The Political Economy of Natural Gas Producer Cooperation: Cartelisation and Market Power

Marcel Dietsch
University College

Thesis submitted in partial fulfilment of the requirements
for the degree of Doctor of Philosophy in International Relations
in the Department of Politics and International Relations at the
University of Oxford

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For my parents
Hartmut and Andrea Dietsch,
my sister Claudia
and my grandparents
Arthur and Ruth Dietsch

Abstract

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In 2001 the Gas Exporting Countries Forum (GECF) was created by some of the world's leading natural gas producing and exporting countries in order to promote their mutual interests through cooperation, in particular with regard to extracting the maximum value from their natural gas exports.

My core research question is: Does cooperation among GECF member countries explain those exporters' market power in highly import-dependent natural gas consuming countries? To determine the influence of the GECF's cooperative actions and policies, I study the GECF's cooperative behaviour and measure the role of (collusive) producer conduct in terms of its contribution to achieving the main GECF objective: attaining gas prices that are measurably above the cost of production and hence help producers earn significant economic rents. I employ a variety of methods from the international relations literature on cooperation and cartelisation, collective action theory and an economic measurement model in three case studies.

I find that cooperation among GECF members partly explains their market power in a number of import-dependent gas markets. This is so despite the GECF's weak degree of institutionalisation. The reasons for the GECF's influence on effective cooperative results are: first, conducive structural conditions in many gas importing markets favouring cartelisation; second, GECF members use methods such as artificial market entry barriers (e.g. long-term term contracts negotiated in a non-transparent way) to secure their market power and third, the GECF faces less severe internal procedural challenges that plague other cartels such as collective action problems, especially cheating.

Cooperation among GECF exporters hence contributes to high(er) prices of natural gas. This causes economic inefficiencies and a transfer of wealth—and political power—from gas consumers to producers. It also hinders climate change mitigation as cleaner-burning gas remains too expensive to replace 'dirty' coal in power generation.

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List of Abbreviations and Acronyms

ADGAS	Abu Dhabi Gas Liquefaction Limited
ADNOC	Abu Dhabi National Oil Company
bcm	billion cubic meters
BOTAS	Turkey's state-owned pipeline gas company
BLNG	Brunei LNG
BTC	Baku-Tbilisi-Ceyhan pipeline
BTE	Baku-Tbilisi-Erzurum Pipeline, Turkey
Btu	British thermal unit
CCGT	Combined-cycle gas turbine, in a gas-fired power station
CIS	Commonwealth of Independent States
CPM	Conduct Parameter Method
CSG	Coal seam gas
DSO	Distribution system operator
EC	European Commission
EGE GAZ	Turkish gas company
EIA	Energy Information Administration (US government)
EMRA	Energy Market Regulatory Authority, Turkey
ENI	Italian oil and gas company
EPSA	Exploration and production sharing agreement
ε	Epsilon, here: elasticity of demand
EU	European Union
FSU	Former Soviet Union
GATT	General Agreement on Tariffs and Trade
GDP	Gross domestic product
GECF	Gas Exporting Countries Forum
GTL	Gas-to-liquids
GSP	Government Selling Price
H	Herfindahl Index of market concentration
HH	Henry Hub
HLG	High-level group, part of the GECF
IEA	International Energy Agency
IGA	Intergovernmental agreement
IHS CERA	Energy consulting firm
IMF	International Monetary Fund
INPEX	Japanese gas company
IO	Industrial organisation
IOC	International oil company
JCC	Japanese Crude Cocktail
JLC	Japanese Liquid Cocktail
JV	Joint venture
KEPCO	Kansai Electric Power Company, Japan
KWh	Kilowatt hour
LNG	Liquefied Natural Gas
LRMC	Long-run marginal cost

LTC	Long-term contract
MC	Marginal cost
MCE	Ministerial Council of Energy, Australia
Mcm	thousand cubic meters
MEB	Market entry barrier
MEG	Maghreb-Europe Gas pipeline, Algeria
METI	Ministry of Economy, Trade, and Industry, Japan
MISC	Malaysia International Shipping Corporation
MITR	Ministry of Industry, Tourism and Resources, Australia
MLNG	Malaysia LNG
mmbtu	million British thermal units
MoU	Memorandum of Understanding
mtoe	million tonnes of oil equivalent
mmt/y	million metric tonnes per year
NBP	National Balancing Point, UK
NEIO	New Empirical Industrial Organization
NG	Natural Gas
NGML	Natural Gas Market Law, Turkey
NIGC	National Iranian Gas Company
NIOC	National Iranian Oil Company
NNPC	National Nigerian Petroleum Company
NWS	North West Shelf gas field in Australia
OECD	Organisation for Economic Cooperation and Development
OPEC	Organization of Petroleum Exporting Countries
PGN	Perusahaan Gas Negara, Indonesia
PSA	Production-sharing agreement
QP	Qatar Petroleum
SPA	Supply and Purchase Agreement
SEZ	Special Economic Zone
SOCAR	Azerbaijan’s state-owned oil and gas company
Tcf	trillion cubic feet
tcm	trillion cubic meters
TEPCO	Tokyo Electric Power Company, Japan
θ	Theta, here: conduct parameter
TSGP	Trans-Saharan Gas Pipeline, Nigeria/Algeria
TSO	Transmission system operator
TWh	Terawatt hour
UAE	United Arab Emirates
UCCI	Upstream Capital Cost Index
UOCI	Upstream Operation Cost Index
VNG	Verbundnetz Gas, Germany
WGI	World Gas Intelligence
WTI	West Texas Intermediate, American oil benchmark price
WTO	World Trade Organisation

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I would like thank my family for all their help, their dedication and generous support throughout my education. This doctoral thesis marks the end of a long period of study and I am very grateful for their patience.

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Marcel Dietsch
Oxford, October 2011

Chapter 1
Introduction & Background

> 'I don't have an interest in competing with Russia, neither does Russia have an interest in competing with me, because both of us will lose in the end.'
> *-- Chakib Khelil, Algeria's Minister for Energy and Mines*
> *Russia Today, 23 December 2008*

1.1. Summary of Thesis Topic

1.1.1. Gas Producer Cooperation and Market Power

In 2001 the Gas Exporting Countries Forum (GECF) was created by some of the world's leading natural gas producing and exporting countries[1] in order to promote their mutual interests through joint action. In particular, GECF member states pursue various forms of cooperation to achieve higher natural gas prices and hence to extract the maximum value from their natural gas exports.[2] The deputy chairman of Russia's Gazprom, Alexander Ryazanov, was quoted as saying about the GECF: "I think that it is in our countries' interests to sell gas at the highest price possible. That is why one has to stick to correct approaches and coordinated policy."[3]

One of the major objectives of the GECF members is to raise gas prices and to maintain high prices through various cooperative actions, which, in addition to overt cooperation, might also include secret collusion. This thesis will examine whether the

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[1] Founding members at the inaugural meeting in 2001 included: Algeria, Brunei, Indonesia, Iran, Malaysia, Nigeria, Oman, Qatar, Russia and Turkmenistan.

[2] Alfred de Montesquiou, "Gas forum tackles how to boost falling prices", *The Associated Press*, 19 April 2010. Accessed on 25 April 2010: http://www.forbes.com/feeds/ap/2010/04/19/business-af-algeria-gas-forum_7526089.html.

[3] Hadi Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making?", *Oxford Institute for Energy Studies Working Papers*, no. NG13, June 2006, p. 36.

GECF's cooperative behaviour is an important factor in explaining gas producing countries' market power in import-dependent gas markets. Market power[4] as evidenced by prices above the producers' production cost is not just a stated objective of GECF producers; it is an empirical reality in many gas-consuming countries that are highly dependent on imports. For example, as Figure 1.1 shows, a significant degree of market power[5] exists in three large, import-dependent gas consuming countries: Germany, Japan and Turkey.[6]

Studying cooperation among GECF members is a difficult task for at least two reasons. First, there is only a limited amount of publicly available information on the mechanics of cooperation within the GECF and on the organisation's institutional properties. Second, representatives from GECF member countries were not available for interviews and specific information on the conversations at GECF meetings could not be obtained. Therefore, an indirect way of studying cooperation was chosen. The *cause-of-effect* approach[7] will be used to "work backwards" from the empirical fact of high prices and market power (which are one of the GECF's stated objectives) to the causes, one of which is hypothesised to be cooperation. To that end, approaches and methods from the

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[4] A formal definition of market power with regard to gas market is given in Machiel Mulder and Gijsbert Zwart, "Market failures and government policies in gas markets", Paper no. 143, *CPB Netherlands Bureau for Economic Policy Analysis*, 23 February 2006, p. 12.:
"This potential to profitably affect prices to levels above costs is called market power." Aside from strategies focused on influencing the price directly, the authors mention a variety of other possible strategies. "Parties having market power may use non-price strategies to increase the influence they can exert on market prices. These strategies usually amount to, one way or another, reducing the size of the market for their product. These strategies may take the form of increasing product diversity, creating switching costs for consumers, erecting barriers to trade through restrictive clauses in supply contracts, or frustrating access to market places by competitors."

[5] Given that gas production and consumption has a long *value chain* with upstream (production), midstream (transportation) and downstream (distribution and consumption) sectors, market power could exist at various and multiple points along the chain. In this thesis, only market power between the upstream producers and the importer, including transportation to the importing countries' border, will be considered. Market power in the importers' domestic markets is an entirely different matter and beyond the scope of the thesis.

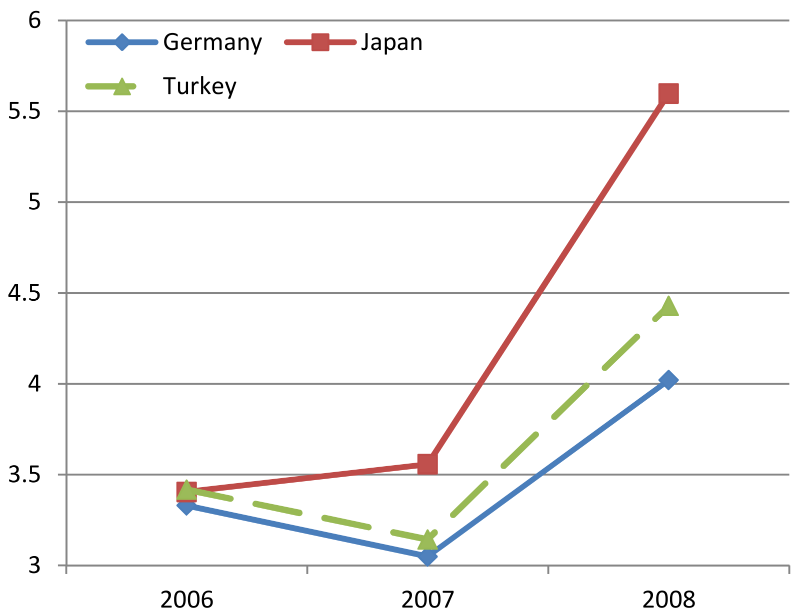
[6] These countries are also the subject of the case studies in this thesis. The case selection will be explained in detail in chapter 3.

[7] James Mahoney and Gary Goertz, "A Tale of Two Cultures: Contrasting Quantitative and Qualitative Research", *Political Analysis*, vol. 14, 2006, p. 230.

international relations literature on cooperation and cartelisation, collective action theory and an economic measurement model will be employed. This measurement model—called the conduct parameter method (CPM)—in particular will be useful for determining the significance of the *cause* ‘cooperation’ on the *effect* ‘market power’.

Specifically, Figure 1.1 shows the average import price for gas at the respective country’s border as a multiple of the (foreign) suppliers’ marginal cost of production, e.g. suppliers to Japan in 2007 managed to achieve prices at a multiple of 3.6 times their marginal cost of production.[8]

Figure 1.1: Mark-up over Marginal Cost (Price as Multiple of MC)[9]



1.1.2. Core Questions

In order to determine the effectiveness and the influence of the GECF’s actions and policies, one must first study the scope and depth of the GECF’s cooperative behaviour in

[8] The average prices and marginal cost figures are used here for the sake of simplicity. As the ensuing analysis in the case study chapters will demonstrate, there are significant price differentials between suppliers that are members of the GECF (higher prices) and those are not members (lower prices).

[9] Chart: author; data: based on data and results from case study chapters 4, 5 and 6.

the gas market and, second, measure the role of such cooperative and collusive conduct in terms of its contribution to the achievement of the main GECF objective: attaining gas prices that are measurably above the cost of production and hence help producers earn significant economic rents. The first research question therefore is:

To what extent does political and economic cooperation[10] *among GECF member countries explain those exporters' market power in highly import-dependent natural gas consuming countries?*

It will be particularly important to evaluate the role of the GECF in this. The institutional properties will be briefly introduced in one of the subsequent sections of this chapter and they will then be discussed in detail in the case studies chapters. It will also be important to distinguish between members of the GECF and non-member countries to determine the influence of the GECF in terms of its cooperative effectiveness. (Most gas-importing countries receive supplies from a range of producers, not just GECF members.[11]) This distinction will be made in the case study chapters and analysed in more general terms in chapter 7. Following the core question above, other important questions are:

If cooperative behaviour is an important explanation for GECF producers' market power, what are the determinants of cooperation and why does it work? Which procedural factors (internal and external) aggravate or alleviate challenges facing GECF members' cartelisation efforts?

The literature on international cooperation, institutionalisation and commodity cartels will be used to contribute to our understanding of collusion and cooperation in

[10] Including both secret collusion and overt cooperation.

[11] The only exceptions are some countries in Eastern Europe, which receive exclusive imports from one GECF member country: Russia. This is not relevant for the purposes of this thesis since the relationship between Russia and those consumers in Eastern Europe is a monopolistic one.

the specific case of gas markets. Exploring this will also contribute to our understanding of cartelisation in commodity markets and international cooperation (both collusive and overtly cooperative) more generally. Hence, another more general core question is:

How does this particular study of the GECF and gas markets contribute to our understanding of cartelisation and cooperation more generally?

1.1.3. Main Argument and Hypotheses

In general, cartels and producer associations in the natural resource sector have one major objective: "Cooperation among producers of any commodity usually aims at creating a higher price that would otherwise have been the case; in other words to [raise] the price above the competitive market price." [12] In the specific case under consideration in this thesis, the GECF has a very similar objective. According to its mission statement, "[t]he GECF was set up with the objective to increase the level of coordination and strengthen the collaboration between member countries."[13] One aim stands out in particular:

- Identify and promote measures and processes necessary to ensure that Member Countries ***derive the most value from their gas resources***.[14]

This is consistent with the Russian representative's statement about the GECF, saying that members should "sell gas at the highest price possible."[15] Before an argument regarding the factor of cooperation in terms of its impact on market power can be

[12] Dag Harald Claes, "What do theories of international regimes contribute to the explanation of cooperation (and failure of cooperation) among oil-producing countries?" *ARENA Working Paper* 12/99, The Research Council of Norway, March 1999, p. 4.
[13] GECF website, Mission of the GECF, http://www.gecforum.org/gecf/web.nsf/web/aboutgecf_mission; accessed on 8 August 2009.
[14] Ibid.
[15] Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making", p. 36.

made, the structural and producer conditions for cooperative, cartel-like conduct must be considered.

The literature on natural resource cartels mentions a variety of **structural factors** that are conducive to cooperative producer conduct. Stephen Krasner stipulates the following conditions: price inelastic demand, high barriers to entry, high market concentration, shared experience among producers, lack of consumer resistance, ability to work with an extended time horizon, and shared values.[16] Karen Mingst lists a range of structural political and economic factors: "1. The supply of the commodity is controlled by the group advocating collusion. 2. The demand for the product is inelastic with respect to price. 3. A small group of countries produces the commodity. […] A background of shared successful experiences in producer regulatory activity is apt to expedite cooperation."[17] Teece et al. mention other conditions that could be relevant, for example members' cost functions and members' discount rates/ requirements—especially when governments determine the rate.[18]

The structural conditions in gas markets are favourable given a high degree of market concentration,[19] which will be measured with the Herfindahl Index in this thesis. The elasticity of demand in highly import-dependent markets is also relatively inelastic[20] hence favouring cartelisation. Natural market entry barriers often exist in the gas sector as a result of major upfront costs for developing gas fields and constructing transportation infrastructure (e.g. pipelines). Finally, a background of shared coopera-

[16] Stephen Krasner, "Oil is the Exception", *Foreign Policy*, no. 14, Spring 1974, p. 72.
[17] Karen Mingst, "Cooperation or Illusion: An Examination of the Intergovernmental Council of Copper Exporting Countries", *International Organization*, vol. 30, no. 2, Spring 1976, p. 265.
[18] David Teece, David Sunding and Elaine Mosakowski, "Natural Resource Cartels", in A.V. Kneese and J.L. Sweeney, eds., *Handbook of natural resource and energy economics*, vol. III, Elsevier Science Publishers, 1993, p. 1132.
[19] See market overview in chapter 2 and case-relevant data in chapters 4, 5 and 6.
[20] Also see chapters 2 and the subsequent case study chapters for detailed discussion of elasticities.

tion partly exists among GECF members since a number of them are also members of the Organisation of Petroleum Exporting Countries (OPEC).[21]

Cooperative producer conduct faces a series of external and internal **procedural issues** as well, according to the cartel literature. Internal challenges may include agreeing on a schedule for production, i.e. allocating production quantities or quotas among members. This is the case in some but not all cartels. For example, OPEC only introduced such quota-based allocation in 1982, almost two decades after its formation. Gas markets are not global and there is no global benchmark price as there is in the oil market. Thus, production management is more regional and occurs on a longer-term basis, i.e. is more about medium-term capacity expansion decisions rather than flexible short-term production quotas.

A second internal challenge in cooperative producer associations is to detect and punish cheating, i.e. non-compliance with the cartel's collective decisions.[22] This issue will be explored in this thesis especially by considering the rigid market structure in gas markets, and how this (structural) condition is likely to reduce incentives to cheat and therefore may alleviate this (procedural) collective action problem often faced by cartels.[23] An external procedural challenge is to predict and discourage non-member production in the cartel's market.[24] Given the long-term nature of the gas market in which production capacity is difficult to manage in the short-term, but crucial to control in the long-term, it will be discussed whether the GECF's policies and actions are effective concerning this important aspect. Not just *natural* market entry barriers can deter poten-

[21] See chapter 7.
[22] Ibid.
[23] The issues of defection and cheating have been studied in particular in global, integrated and liquid markets such as the oil market. Gas markets are structurally different, but the increasing use of liquefied natural gas (LNG) transported by special tankers slowly changes the nature of gas markets in that they become more like the integrated global oil market. In fact, the chief economist of BP, Christoph Ruehl, answered in an expert discussion in 2009 the question "When do we know that the LNG market is truly global?" by saying: "When a global cartel emerges." (I thank Michael Stoppard, gas expert at energy consulting firm IHS CERA for this quote.)
[24] Teece et al., 1993, p. 1131.

tial competitors from entering a market, but also joint policies on additional, *artificial* market entry barriers such as long-term contracts spanning decades, resale restrictions (also called destination clauses[25]) and others.

It was argued in the section on structural conditions that shared cooperative or institutional experiences in the past (such as in OPEC) may expedite cooperation. As Krasner argued: "the greater the level of shared experience among producers, the more aware they will be of their mutual interdependence. Shared experience also makes it more likely that producers will agree on principles that enable them to allocate the burden of market control."[26] That is, another structural factor, prior cooperative experiences by GECF members, may help alleviate especially internal procedural challenges.

My main argument is that cooperation among GECF members partly explains their market power in a number of import-dependent gas markets despite the GECF's weak degree of institutionalisation. A number of tasks will have to be performed to address the core research questions and to advance this main argument in greater detail. First, after briefly presenting the GECF's institutional properties in this chapter, a detailed descriptive account of the GECF's and its members' cooperative policies and actions will be provided in the case study chapters. Second, quantitative methods—to be introduced in this chapter and to be explained in detail in chapter 3—will be used in each case to determine, on the basis of structural factors such as market concentration and the elasticity of gas demand, the extent to which (collusive) producer conduct[27] explains market power, i.e. prices above marginal costs. A similar approach was employed to study cooperative behaviour in the oil market, i.e. "[the] results of cooperation [were]

[25] Such clauses in contracts determine that gas supplies can only be sold to a certain market and the buyer is not allowed to resell supplies.
[26] Krasner, "Oil is the Exception", p. 75.
[27] A non-structural, i.e. procedural factor in the CPM.

judged in terms of the satisfaction of the stated objectives of parties concerned.”[28] The quantitative model—called the Conduct Parameter Method (CPM)—helps identify collusive conduct among producers, but does not include openly cooperative measures such as the GECF members’ collective preservation of *artificial* market entry barriers.[29] These phenomena—the third task—will have to be dealt with in the qualitative discussion of cooperation and collusion. Fourth, the influence of the GECF will be discussed, i.e. whether the hypothesised collusive and cooperative conduct can be attributed to the members of the GECF or not. Fifth, having taken into account and discussed structural factors that favour cartelisation in commodity markets,[30] procedural issues faced by cartels of both an internal (e.g. collective action problems in relation to cheating and defection) and external nature (e.g. keeping non-member production out of the market) will be analysed. Sixth, issues related to the level of institutionalisation of the GECF will be discussed. Finally, the connection between political power and economic rents earned from gas will be examined. Following the core research questions and the main argument, these hypotheses will be tested.

First Hypothesis: Given structural and procedural conditions favouring cartelisation and the GECF members’ determination to protect and increase economic rents earned from gas exports, collusive and openly cooperative producer conduct is expected to be an important explanatory factor for the producers’ market power in consuming markets dominated by GECF suppliers.

Second Hypothesis: Cooperation and its influence in terms of achieving high economic rents are expected to be specific to the GECF member states and not a general phenomenon among all producers.

[28] Zuhayr Mikdashi, „Cooperation among Oil Exporting Countries with Special Reference to Arab Countries: A Political Economy Analysis”, *International Organization*, vol. 28, no. 1, Winter 1974, p. 19.
[29] For details see case study chapters 4 and 5.
[30] For example in the CPM.

Third Hypothesis: The GECF has influence on cooperative outcomes despite a low level of institutionalisation. This is hypothesised to be the case for two reasons. First, it is due to the member countries' political commitment to the cooperative policies (instead of a higher degree of institutionalisation) as it secures economic rents and political power. Second, the GECF unlike other cartels faces less severe internal procedural challenges such as cheating.

Fourth Hypothesis: Cooperative effectiveness of the GECF is expected to be facilitated by a joint background of cooperative and institutional experience in other associations such as OPEC.

Fifth Hypothesis: Cooperation is also hypothesised to be facilitated because GECF members share the objective of short-term revenue maximisation from gas exports, whereas non-GECF suppliers focus on other aims, e.g. long-term revenue maximisation or competitive markets with marginal cost pricing.

Sixth Hypothesis: The regional nature of the relationship between exporting and importing countries and the limitations of fixed infrastructure are expected to produce more effective cooperative outcomes.

Seventh Hypothesis: Cooperation within the GECF works despite the absence of a preponderant player (or hegemon) often needed in cartels to bear a disproportionate share of the various economic and political costs of cooperation. This is hypothesised to be the case due to structural conditions in the gas market that are both conducive to cartelisation and alleviate (procedural) collective action problems at the same time.

1.1.4. Motivations for this Study

There are numerous substantive and also theoretical motivations for conducting research on cartelisation in the gas market with a particular focus on the GECF and its member countries. Substantively, the first contribution will be to offer a better understanding of the GECF as an organisation and of the actions of its members, in particular with regard to the exercise of market power. Cooperation among GECF members will be examined in various ways to determine whether secret collusion and open cooperation play an important role in explaining producers' market power in highly import-dependent gas markets.

This will be a substantive contribution to the literature and it contradicts the conventional argument that the GECF is an ineffective organisation because of its low degree of institutionalisation. This argument was advanced by Hadi Hallouche[31] and others, but these analyses usually stop at the claim that a weak organisation cannot be effective. This study will examine the stated objective of the GECF, look at the outcome (market power) and aim to establish a connection between them in order to assess the cooperative effectiveness of the GECF—which may exist despite the weak degree of institutionalisation.

Such a detailed examination of how and why cooperative behaviour may or may not work will shed light on cartelisation efforts in the specific case of gas markets, which is important for our understanding of one of the most important energy markets in the world. Cartelisation both in general and in the particular case of gas has implications for economic welfare and efficiency and for political power derived from earning large economic rents. Moreover, there is climate change dimension to gas market cartelisation as well.

Economic Welfare and Inefficiency. "Exercise of market power reduces total social welfare compared to perfect competition. [In] the short term, prices that are too high lead to static allocative inefficiency as, from a welfare point of view, too little gas

[31] Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making?", June 2006.

is consumed (*dead-weight loss*). Productive efficiency may be compromised if, as a consequence of distorted price levels, companies invest in techniques and gas production, use of storage and imports that would not be viable under full competition. If, due to reduced competitive pressures, there is too little incentive on parties to innovate, dynamic inefficiency may result. As a result, total welfare is below its optimum."[32] A related argument is about distributive issues between the consumers and the producers. Market power allows producers to earn an economic rent at the expense of consumers, for example a transfer of wealth takes place from the Turkish consumer to Gazprom.

Wealth and Political Power. States that are highly dependent on economic rents earned from their resource endowments prefer high prices as those higher prices generally increase the amount of rent earned. As a Brookings Institution report argues with regard to one specific example (and GECF member country): "In the end, Russia's strength is garnered not from energy production, but rather from the wealth generated by windfall profits from high energy prices."[33] Moreover, the price level of gas affects the economic position and hence the political capabilities of large gas exporters and the way in which they deal with other countries.

For example, Figure 1.2 shows the development of Russia's oil and gas rents since the 1970s. The variations in rents earned have enormously affected Russia's economic and political situation. One can argue that the end of the Soviet Union was (at least in part) precipitated by the drastic fall in oil and gas prices in the early to mid-1980s.[34] With lower amounts of rent earned (because of low prices) and captured by the state (because of botched liberalisation by the Yeltsin government), Russia defaulted on some of its debt in 1998 and had to rely on help by the International Monetary Fund

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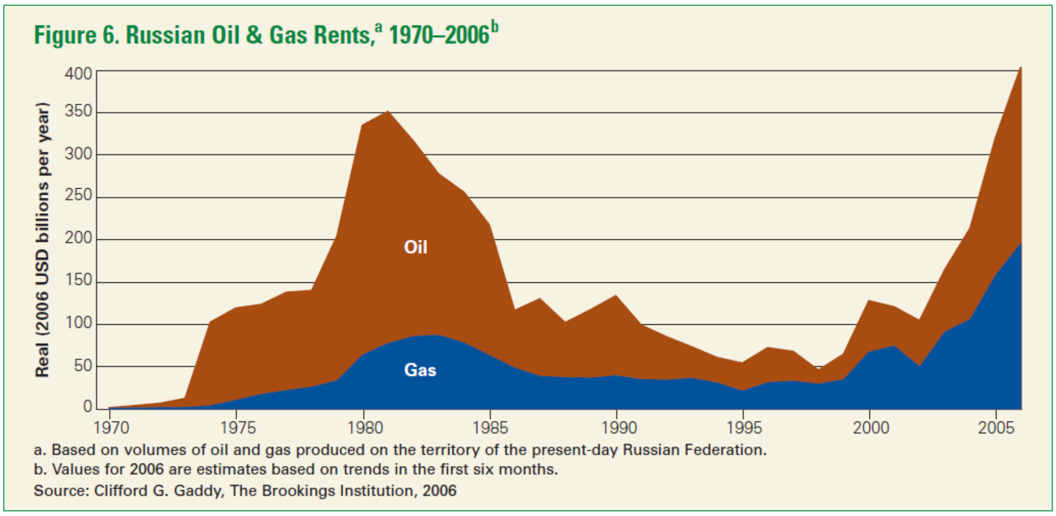
[32] Mulder and Zwart, „Market failures and government policies in gas markets", p. 13.
[33] Unknown Author, "The Russian Federation", *The Brookings Foreign Policy Studies Energy Security Series*, The Brookings Institution, October 2006, p. 4.
[34] I thank my DPhil supervisor Neil MacFarlane for this suggestion.

(IMF). This weakened the Russia's political position vis-à-vis its neighbouring states and globally as well.

Figure 1.2: Russian Oil and Gas Rents[35]



The contrast to 2008 when Russia invaded Georgia could not have been more distinct. Resurgent resource rents since the early 2000s allowed Russia to expand its economic and political muscles.[36] This is especially true because the Russian state started (re-)capturing large parts of the economic rent after Putin became president in 2000 as Figure 1.2 shows.[37] Moreover, the rents have in part been secured by resisting gas market liberalisation efforts in the European Union and elsewhere together with other GECF members. Hence, by driving efforts towards more gas market cartelisation to protect and to continue to earn rents, Russia is not only advancing its economic interests, but also—indirectly—its political power and interests.

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[35] Ibid., p. 8.

[36] Brookings Institution, "The Russian Federation", p. 4.

[37] There is of course a second way of raising economic rents: controlling costs. However, raising prices is easier than containing costs because of structural reasons (inelastic demand) and due to the contribution of political tools such as the GECF. State-run companies, as most GECF member states' gas companies are, tend to be much more inefficient and wasteful leading to high costs (see Figure 2 as well.)

Climate Change Mitigation. The GECF's objective is to raise and maintain already high gas prices in order to secure economic rents earned by producers. The more expensive gas becomes, the less likely it is that power companies will switch from 'dirty' coal-fired power plants to cleaner gas-fired power generation. Given that coal, gas and oil and among the most important sources of power generation, more expensive gas drives its consumers way from the cleanest hydrocarbon source, contributing to increasing carbon emissions. This is particularly true in Germany and Japan, which are scaling down carbon-free nuclear power plants. Especially in those countries nuclear capacity is likely to be replaced by coal and gas, with coal being the cheaper alternative. The more expensive gas remains, the longer it takes for switching from coal to gas to occur.[38] There is a clear link between gas pricing and climate change mitigation and cartelisation efforts among GECF members thwarts efforts to reduce carbon emissions.

Other Substantive Arguments. Given the detailed nature of the case studies, it is expected that the in-depth examinations of German, Japanese and Turkish gas markets may shed light on specific regional issues as well. This may contribute to the regional studies literature on political dynamics between GECF members, non-members and importing countries as well. These 'other' substantive arguments and the preceding three arguments show that studying gas market cartelisation efforts by GECF is important substantively in order to better understand the economic welfare implications of those countries' behaviour, to understand the implications for economic and political power as well as the consequences for climate change.

Theoretical Arguments. In terms of theoretical contributions, this thesis will contribute to our understanding of different forms of international cooperation, including cartelisation among commodity producers, regimes and the importance of (levels of)

[38] Many developed countries have started putting a price on carbon, making the dirtiest fossil fuel source—coal—driving up its price (which still remains below other sources though).

institutionalisation. Moreover, the study of the GECF's cooperative behaviour is expected to show the distinction between secret collusion and overt cooperation in empirical reality, as opposed to just conceptual discussions of various types of cooperative efforts. The (expected) interdependent relationship between such collusive and openly cooperative behaviours will be another contribution to the literature on types of cooperation. Moreover, this thesis seeks to make a contribution to the collective action literature by uncovering evidence regarding cheating and defection in commodity cartels. A final contribution to the literature on market power and cartelisation is expected to be the focus on the understudied issue of 'artificial' market entry barriers (MEB), which, through cooperation, are jointly maintained and hence contribute to producers' pricing power.

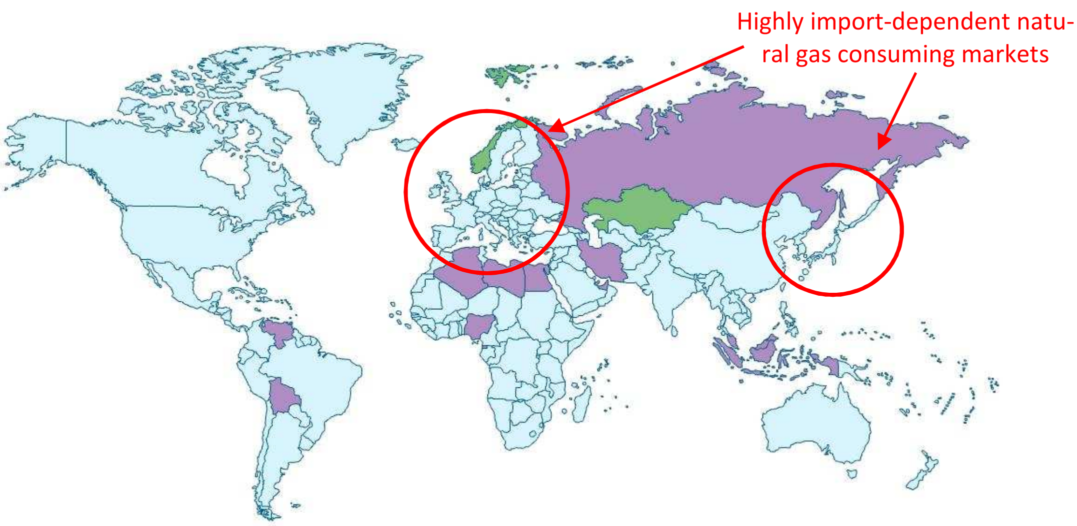
Methodological Arguments. As the literature review shows[39], part of the scholarship on cartelisation focuses on game-theoretic models that model internal procedural challenges such as cheating and defection as prisoners' dilemma-type collective action problems. These models focus on generality over specificity and have been employed successfully to a variety of cartels. Yet, as David Teece et al. in their seminal paper on natural resource cartels argue: "Whether cartels can solve their [internal collective action] problems in principle is not as interesting as the question of whether they can solve their problems in practice."[40] In complex natural gas trade relationships it is crucial to understand through detailed case studies the specifics of the market. Hence abstraction may lead one to overlook important factors. Indeed it is not just a question of whether theory or practice is more "interesting" as Teece et al. argue. With natural gas, highly abstract studies are unlikely to productive.

[39] See chapters 1 and 3.
[40] Teece et al., 1993, p. 1132.

1.2. Gas Producer Cooperation and the GECF

Cooperation among exporters of natural resources has a long history. Many producers tried to control output and prices of diamonds, bauxite, steel and other commodities in international markets.[41] Perhaps the most visible example in the energy sector has been the Organisation of Petroleum Exporting Countries (OPEC).

Figure 1.3: GECF Member Countries and Observers in 2009



Purple: GECF Member Countries; **Green**: GECF Observer Status

Map: Marcel Dietsch with www.indexmundi.com/map/creator.

Today, major gas exporting countries seek to benefit from coordinated production and export policies and higher natural gas prices.[42] In 2001, the Gas Exporting Countries Forum (GECF) was created by Algeria, Brunei, Indonesia, Iran, Malaysia, Nigeria, Oman, Qatar, Russia and Turkmenistan in response to the European Commission's (EC) attempts at deregulation of energy markets. The GECF aims to bring together the world's leading gas producers and exporters in order to promote their mutual

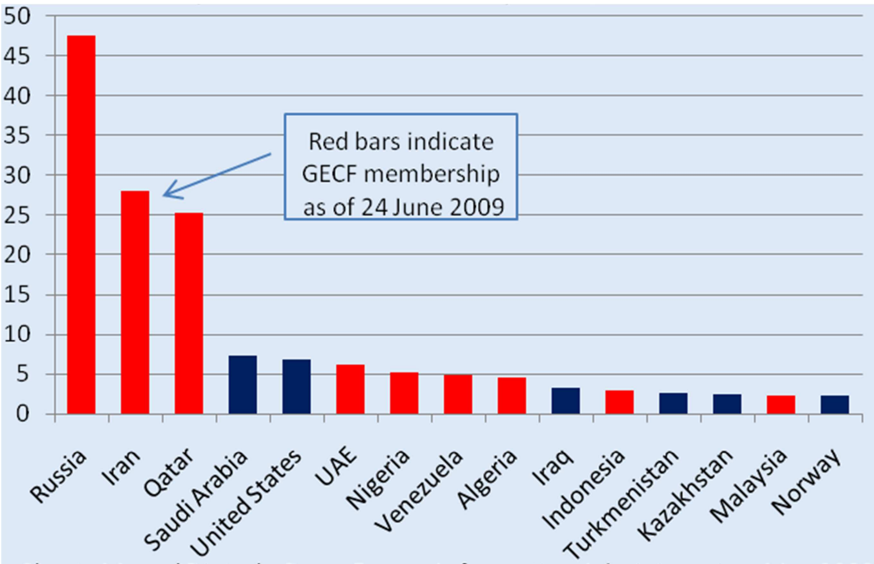
[41] A very good review of the literature on natural resource cartels can be found in: Teece et al., 1993.
[42] de Montesquiou, "Gas forum tackles how to boost falling prices", 2010.

interests and it has evolved from an informal forum to a comprehensive organisation with a charter, a bureaucratic structure and an elected secretary-general. A detailed overview of GECF members and attendants at GECF meetings from 2001 to 2008 can be found in Appendix Table 1.1. Moreover,

Figure 1.4 shows the world's top 15 gas reserve holders and their status regarding GECF membership.

Figure 1.4: World Proved Reserves of Natural Gas[43]

Top 15 Countries as of May 2009; in tcm

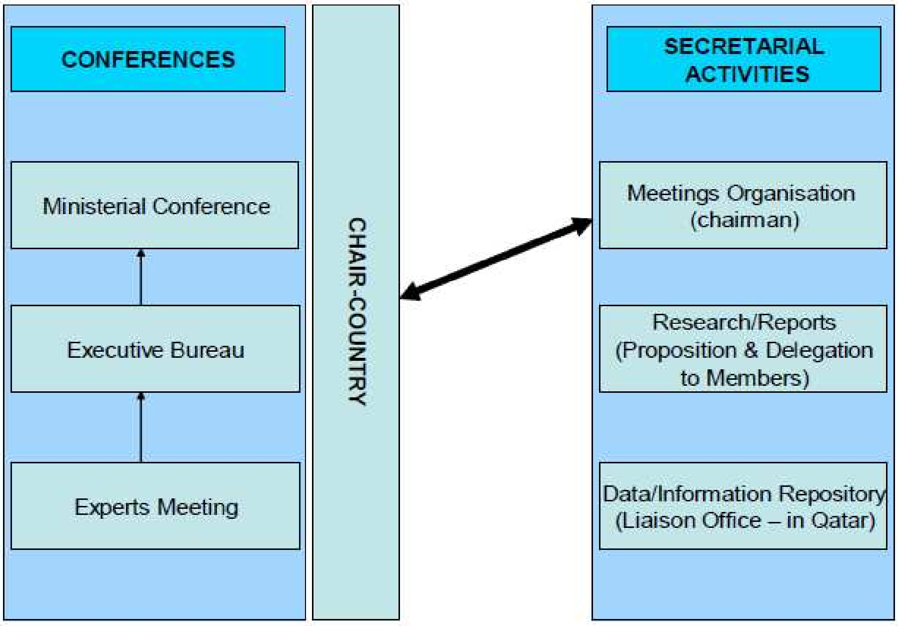


Approximately 73 percent of the world's proved gas reserves are to be found in countries which are members of the Forum.[44] Other major reserve holders that are not part of the GECF are Iraq, Saudi Arabia, Turkmenistan[45] and the United States. The production figures show that between 41 and 42 percent of global natural gas production takes place in GECF countries. A European Commission report shows that mem-

[43] Figure: author; data: Cedigaz database, 2009.
[44] Calculation based on figures in BP Statistical Review of World Energy, 2009.
[45] Turkmenistan was among the founding members in 2001, but subsequently left the GECF.

bers of the Forum together control about 38 percent of the gas pipeline trade and 85 percent of LNG production and exports globally.[46]

Figure 1.5: Pre-2008 Structure of the GECF[47]



The GECF is a venue for both secret collusion and open cooperation. One of the institutional properties of the GECF is to facilitate the exchange of information and data regarding gas markets in order to help producers to coordinate their actions, which contributes to avoiding unnecessary competition in their respective markets. Information exchange may include information on prices, contract terms and quantities concerning producers' secret contracts (traditional collusion). It also, among other things, includes exchange of information regarding current investments and plans for capacity expansions. This is a broader type of cooperation, but has the same objective: managing fu-

[46] A. Georgakaki, B. Kavalov and H. Petric, "Liquefied Natural Gas for Europe: Some Important Issues for Consideration EC report on LNG", JRC Reference Reports, European Commission, July 2009, p. 9.

[47] Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making", p. 22.

ture capacity expansions to avoid creating too much capacity at the same time is, in effect, the same as artificially restricting output to drive up prices. Other issues concerning more open and broader forms of cooperation include pricing mechanisms (e.g. oil-indexation), retaining artificial market entry barriers such as long-term contracts and so forth.

Figure 1.5 shows the pre-2008 organisational structure of the Gas Exporting Countries Forum, i.e. the structure that was in place before the December 2008 ministerial meeting in Moscow.[48] Specifically, it illustrates how various venues within the organisation contribute to discussion and exchanges of information at different levels. The case study chapters will discuss specific cooperative projects and actions that came out of the discussions within the GECF.

The major focus of the analysis is on the years from 2006 to 2008, but as the previous sections have shown, it is useful to take into account potentially relevant events before (going to back to 2001, the year of the GECF's creation) the chosen period of time for a comprehensive understanding. An important practical reason for the specific time frame (2006-2008) in this thesis is that comprehensive data on prices, marginal cost and other necessary inputs into the model are available only during that specific period of time for all three case studies.

[48] Since the period of time being studied in this thesis is 2006 to 2008

> 'People of the same trade seldom meet together, even for merriment and diversion, but the conversation ends in a conspiracy against the public, or in some contrivance to raise prices.'
>
> *-- Adam Smith*
> *An Inquiry into the Nature and Causes of the Wealth of Nations*
> *1776/1976, Book I, Ch. X, Part II, p. 144.*

1.3. Theories and Models

1.3.1. Definitions of Cooperation and Research Question

This research is about one particular type of behaviour by GECF member states: cooperation. Two different aspects will be analysed. First, different types of cooperation—including scope and depth—will be identified. Second, the effectiveness of this cooperative behaviour, i.e. whether it contributes to exporters' market power—will be examined.[49]

A brief definition of cooperation in the international relations context is necessary. (A detailed discussion of relevant IR theory will be provided in Chapter 3.) According to Helen Milner, there is widespread agreement[50] on the definition of cooperation developed by Axelrod and Keohane. They state that "cooperation occurs when actors adjust their behaviour to the actual or anticipated preferences of others."[51] Keohane's more formal definition is:

> Intergovernmental cooperation takes place when the policies actually followed by one government are regarded by its partners as facilitating realisation of their own objectives, as the result of a process of policy coordination.[52]

[49] Dag Claes, *The Politics of Oil-Producer Cooperation*, Westview Press, 2001, p. 5.
[50] Helen Milner, "International Theories of Cooperation among Nations: Strengths and Weaknesses", *World Politics*, no. 44, April 1992, p. 467.
[51] Robert Axelrod and Robert Keohane, "Achieving Cooperation under Anarchy: Strategies and Institutions, " in Kenneth Oye, ed., *Cooperation under Anarchy*, Princeton University Press, 1986, p. 226.
[52] Robert Keohane, *After hegemony: cooperation and discord in the world political economy*, Princeton University Press, 1984, pp. 51-52.

Following this general and rather broad definition of cooperation, which could be summarised as "mutual policy coordination to realise joint gains," a distinction must be made to suit the particular focus of this research. As was alluded to in the section on the GECF, there are two dimensions to cooperation: secret collusion and overt cooperation. Openly cooperative behaviour can be observed as it usually publicised. Most natural resource export cartels have cooperated openly and publicly as it is not illegal for sovereign states to form cartels and national anti-trust authorities, e.g. in gas-importing countries, cannot prevent the national governments of gas-exporting countries from cooperating. When producers get together at GECF meetings, they might not just talk about the management of gas supplies and agree on new initiatives and projects, but they might also engage in conventional collusion. That is, they could exchange secret information on gas pricing and contract terms.[53] Chapter 3 will provide a more detailed discussion of this issue and will show how the methods employed in this thesis—the conduct parameter model (CPM) and the qualitative empirical assessment of factors not included in the CPM—help distinguish between collusion and open cooperation.

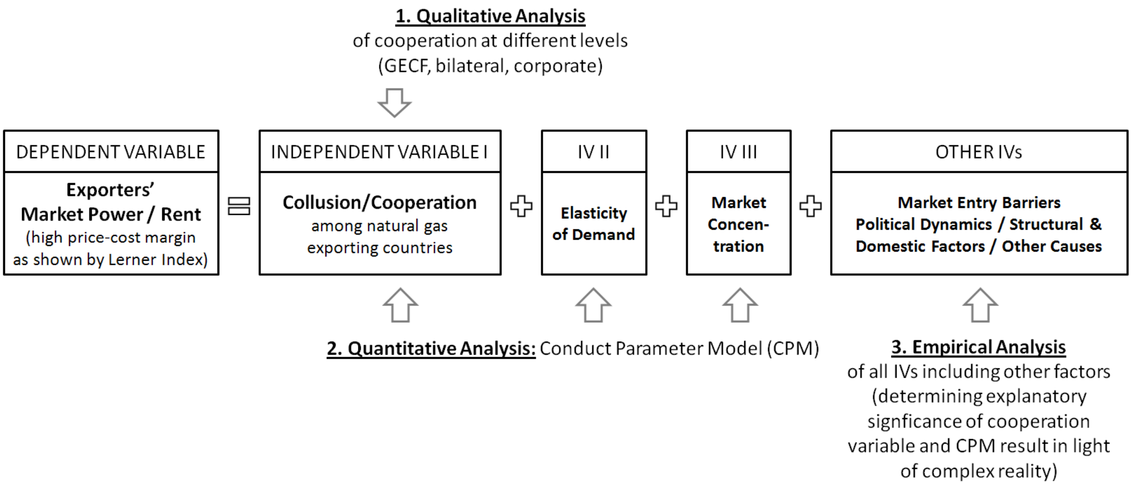
Figure 1.6 shows the whole range of variables that will be studied in each of the case studies, which consisting of three parts: first, a qualitative analysis; second, a quantitative economic study and third, an empirical assessment of all independent variables, especially those that are not accounted for in the quantitative model. The qualitative part of the analysis will investigate cooperative policies and acts (the *study variable*[54]) among two or more natural gas exporters that are GECF members and which have significant market shares in import-dependent gas-consuming markets. The quantitative

[53] Almost all natural gas supply and purchase agreements (SPA) between exporting and importing countries and the respective companies are kept strictly confidential.

[54] In statistical studies the study variable is often the dependent variable since one tries to estimate the average causal effect of an independent variable on the dependent variable (*effect-of-cause* approach). In this thesis, the opposite approach is chosen as will be explained below Figure 6 in this chapter and in more detail in chapter 3. (Also see: Mahoney and Goertz, "A Tale of Two Cultures: Contrasting Quantitative and Qualitative Research", 2006, p. 239.)

analysis will take into account other important (structural) *independent variables*—such as price elasticity of demand and market concentration—to explain the extent to which cooperation is responsible for exporters' market power. Finally, the empirical assessment will put the quantitative results into a broader context by considering further independent variables. This research hence follows the *cause-of-effect* approach, which requires one to consider possible causes (independent variables such as cooperation and others) of an effect (market power).

Figure 1.6: Illustration of Variables and Approaches[55]



1.3.2. Models – International Relations and Economics

The analytical tools and models chosen will be briefly introduced here. A much more detailed description and some background can be found in chapter 3. The political analysis is based on a taxonomy of cooperation which has been developed by the author. The taxonomy is loosely based on the classification of economic cooperation developed by Gorden de Brouwer, Arief Ramayandi and David Turvey.[56] Further inspiration for the classification of cooperative actions was found in Milner's work, in which

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[55] Figure: author.

[56] Gordon de Brouwer, Arief Ramayandi and David Turvey, "Macroeconomic Linkages and Regional Monetary Cooperation: Steps Ahead", *Asian Economic Policy Review*, vol. 1, 2006, p. 285.

she cites different levels of cooperative policies: “[First,] the exchange of information to facilitate tacit policy coordination, [second,] the negotiation of specific policy ‘deals’ on a one-time basis, [third,] the establishment of a set of rules guiding policy choice and [fourth] the surrender of national policy instruments often to form a larger policy community.”[57]

Table 1.1 shows this taxonomy of cooperation among natural gas exporters across different forms and at different levels—including the international, bilateral and corporate level. There are four incremental categories of cooperation listed by column, including discussions, informal and formal cooperation as well as integration. These different types of cooperation take place at three levels: at the international stage, on a bilateral level between national governments and finally at the corporate level.

Table 1.1: Taxonomy of Cooperation among Natural Gas Exporters[58]

	international level	national gov't- bilateral cooperation	corporate level
discussions	discussion of issues within GECF	on bilateral basis between ministries and embassies	among companies
informal cooperation	information and data exchange within GECF	memoranda of understanding (MoU)	memoranda of understanding (MoU)
formal cooperation		side payments in other issue areas	
	joint establishment of market entry barriers (economic and political)		
	joint management of gas production, especially capacity expansion and pricing		
			asset and cargo swaps
integration	institutionalised global cartel constraining state sovereignty		joint Ventures / horizontal and vertical Integration

In each case study a detailed in-depth analysis will be carried out in order to determine the extent to which gas exporting countries that are part of the GECF do in fact cooperate. For example, analytical tools will include comprehensive field research in

[57] Helen Milner, *Interests, Institutions and Information: Domestic Politics and International Relations*, Princeton University Press, 1997, p. 9.
[58] Table: author.

relevant countries in order to gather data on prices and costs, to conduct interviews with diplomats, officials, scholars, energy company executives, journalists and others.

The second analytical tool comes from the economics subfield of *industrial organisation* (IO). Within IO, there is an extensive body of literature on the measurement of market power. The approach used for the purposes of this research is based on a modified version of the Conduct Parameter Method (CPM).[59] The CPM was formalised by Bresnahan[60] in an effort to include firm conduct into analyses of market power. The traditional paradigm linked market structure (e.g. concentration) to market outcomes (e.g. supranatural profits as a result of market power). This causal link turned out to be weak in empirical studies.[61]

Therefore, the CPM takes into account three sources of market power: first, firm conduct (from non-cooperative behaviour to perfect collusion); second, the price elasticity of demand and third, the traditional market concentration measure. This CPM approach was part of an overall effort labelled New Empirical Industrial Organization (NEIO).[62] If one defines market power as the ability of firms to set prices above the competitive level, then one can formalise the conduct parameter method as follows:

$$\theta_t = -\frac{\varepsilon_t L_t}{H_t}$$

[59] Wanwiphang Manachotphong, "Investigating Market Power and Collusion under Demand Change: An Analysis of the UK Milk Market" in *Essays on Applied Industrial Organisation*, DPhil Thesis, University of Oxford, Trinity Term 2009, p. 7.
[60] Timothy Bresnahan, „Empirical Studies of Industries with Market Power" in Schmalensee and Willig, eds., *The Handbook of Industrial Organization*, North-Holland, New York, 1989.
[61] Jeffrey Perloff, Larry Karp and Amos Golan, *Estimating Market Power and Strategies*, Cambridge University Press, 2007, chapter 2.
[62] This NEIO was criticised since some economists estimated simultaneously *conduct* and *marginal cost*, which sometimes led to biased results. Yet, since we use observed or estimated prices, marginal cost, demand elasticity and market concentration and do not estimate two parameters simultaneously, the major criticisms of the NEIO approach do not apply here as will be explained in Chapter 3.

The subscript t stands for time; H_t is the Herfindahl index of market concentration[63] at time t while L_t is the market-wide Lerner Index[64] and θ_t stands for the conduct parameter at t. The conduct parameter θ_t "measures how much output of one [gas producer] matters to the total output of the industry [in a given market]."[65] The conduct parameter can range from zero to 1/H as shown in Table 1.2. A detailed explanation of the Conduct Parameter Model will be provided in chapter 3.

Table 1.2: Spectrum of Possible Conduct Parameter Outcomes[66]

$\theta = 0$	$\theta = 1$	$\theta = 1/H$
Perfect Competition	Non-collusive oligopoly (Cournot)	Perfect Collusion

The conduct parameter method is a measurement model that allows to one estimate the extent to which market power is attributable to cooperative behaviour among producers. Producer conduct is the residual value that can range from perfectly competitive to perfectly collusive with the *non-collusive oligopoly outcome* falling in between. The CPM does not take into account the impact of market entry barriers, whose existence might overstate the conduct parameter result,[67] or buyer concentration, whose existence might understate the degree of producer collusion.[68] These other factors will be taken into account in the subsequent discussion of the CPM outcomes to put the results into perspective.

[63] The Herfindahl Index equals the sum of all firms' squared market shares.
[64] The Lerner Index is a measure of market power and calculates the price-cost-margin, which shows to what extent (if any) a firm is able to charge prices above its marginal cost: L=(P-MC)/P
[65] Manachotphong, 2009, p. 46.
[66] Table: author.
[67] Since the analysis of market power and producer cooperation is static, market entry of new competitors, which might quickly disperse producers' market power, is not accounted for here.
[68] Buyer concentration can offset some of the market power arising producer cooperation. The conduct parameter might therefore understate the degree of producer cooperation.

The strength of the model is that it gives one an estimate of the degree of collusion which is usually otherwise difficult or impossible obtain due to the mostly secret nature of producer collusion. The main objective of the GECF is to extract the maximum value (i.e. economic rent) from natural gas exports, which is why the assumption of profit-maximisation, which is critical to the CPM, can be made.

The CPM was developed for one set of actors (firms) and will be employed in this thesis to study the behaviour another set of actors (states and state-owned firms that are very closely linked in almost all cases). This has been done before on a number of occasions. Various academics have used the CPM or variations of the model before for other sets of actors including states and state-owned and-run companies. For example, Cynthia Lin performed a similar analysis in a study regarding OPEC's market power.[69] Others examined market power in Russia with a similar model[70] assuming that Gazprom and the state (which may be almost the same thing) have the same interest: maximising profits and economic rents. A closely-related firm-level market power model was also used at the state-level (i.e. treating Gazprom and Russia interchangeably) in a World Bank paper.[71] Other studies have done similar analyses of market power at state level, e.g. Mitsuru Igami's examination of market power with the Lerner Index method being employed using data on market shares, cost and prices not at the firm- but the state-level.[72]

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[69] C.-Y. Cynthia Lin, "An Empirical Dynamic Model of OPEC and Non-OPEC", *UC Davis Working Paper*, 11 May 2011. Accessed on 28 June 2011: http://www.des.ucdavis.edu/faculty/Lin/OPEC_paper.pdf

[70] Joris Morbee and Stef Proost, "Russian Market Power on the EU Gas Market: Can Gazprom do the same as in Ukraine?" *Working Paper*, Catholic University of Louvain, 2007. Accessed on 28 June 2011: http://www.tu-dresden.de/wwbwleeg/events/enerday/2007/Paper/MorbeeProost_paper.pdf

[71] David Tarr and Peter Thomson, "The Merits of Dual Pricing of Russian Natural Gas", *The World Economy*, vol. 27, no. 8, August 2004.

[72] Mitsuru Igami, "Oligopoly in International Commodity Markets: The Case of Coffee Beans", *Working Paper*, Forum for Research in Empirical International Trade, 29 July 2010; accessed 28 June 2011: http://www.freit.org/WorkingPapers/Papers/TradePolicyGeneral/FREIT198.pdf

1.4. Review of the Literature on Natural Gas Producer Cooperation

The literature on international cooperation and cartelisation in the commodity sector has mainly focused on OPEC and attempts at cartelisation in other markets such as copper, mercury and so forth. The area of cooperation among natural gas producers, especially credible attempts to create an organisation that provides a venue for cooperation such as the GECF, has been understudied. Studying in detail attempts at (and the effectiveness of) cooperation and cartelisation in gas markets by using empirical data and a range of theoretical and analytical tools from the cooperation and commodity cartel literature will not only enable one to better understand the specific phenomenon of gas market cartelisation and the role of the GECF in this, but may also allow one to infer more general conclusions and lessons from the specific case of gas to other commodity markets.

The literature review will be conducted in two parts. In this chapter, a brief overview of the relatively scarce literature on the GECF and natural gas producer cooperation will be provided. Chapter 3 will present a much more detailed review of the literature on international cooperation, on cartelisation in commodity markets with a particular focus on OPEC and an introduction to the relevant economics literature.

First, there are some general descriptions and analyses of developments in natural gas markets that deal briefly with the gas producer cooperation and the possibility of a cartel. Daniel Yergin mentions in passing that an 'association of some kind among LNG exporters is likely.'[73] Jonathan Stern briefly considers the idea in an overview of the European gas market.[74] The author does not rule out the possibility, but considers successful cartelisation unlikely. Timothy von Ochssee's major study of gas producer

[73] Daniel Yergin and Michael Stoppard, "The Next Prize", *Foreign Affairs*, vol. 82, no. 6, 2003, p. 121.
[74] Jonathan Stern, "The New Security Environment for European Gas: Worsening Geopolitics and Increasing Global Competition for LNG", Paper presented at CESSA Conference, Cambridge, UK, p. 16-17. Accessed on 14 April 2011: http://www.cessa.eu.com/sd_papers/wp/wp4/0401_Stern.pdf.

cooperation from a Russian perspective partly focuses on the GECF and generally provides a very intelligent analysis of the GECF in particular and gas producer cooperation in general.[75] Part of von Ochssee's thesis is focused on possible cooperative behaviour among gas producers in the future and is hence speculative.

There are only very few comprehensive studies on the GECF. Hadi Hallouche, provides an overview of the international gas market and a wide-ranging and very detailed description of the GECF as an organisation pre-2006.[76] The author also includes analyses and predictions on potential influence that the GECF may exercise. The author cites the GECF's institutional weakness as a major argument for the ineffectiveness and hence improbability of cartelisation and the exercise of market power. Hallouche stops at the seemingly obvious claim that a weak organisation cannot be effective. The argument in this thesis will contradict the conventional view that the GECF is an ineffective organisation because of its low degree of institutionalisation. Obindah Wagbara offers a broad and policy-oriented introduction to the available tools a gas cartel could use.[77] Another paper, written by Monika Ehrman, an energy lawyer, provides a purely qualitative general overview with a practical focus.[78] David Wood offers a brief overview of international gas markets and asks to what extent cartelisation could be possible in the LNG market.[79]

While there are many models addressing the issue of market power and its welfare effects in the oil market, hardly any such analyses of the gas market have been con-

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[75] Timothy von Ochssée, "The Dynamics of Gas Supply Coordination in a New World: Cooperation or competition between gas-exporting countries from a Russian perspective", PhD Thesis, University of Groningen, 8 July 2010, p. 125; accessed 2 July 2011: http://dissertations.ub.rug.nl/FILES/faculties/feb/2010/t.a.boon.van.ochssee/14_thesis.pdf.

[76] Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making?", 2006.

[77] Obindah Wagbara, "How would the gas exporting countries forum influence gas trade?", *Energy Policy*, vol. 35, no. 2, 2007.

[78] Monika Ehrman, "Competition Is a Sin: An Evaluation of the Formation and Effects of a Natural Gas OPEC", *Energy Law Journal*, vol. 27, no. 1, 2006.

[79] David Wood, "Could a future gas OPEC shape LNG import plans?", *Oil & Gas Journal*, vol. 105, no. 20, 2007.

ducted. Ruud Egging et al. note the lack of economic studies on market power and cartelisation in natural gas markets.[80] Egging et al. developed a cartel scenario in their global gas model. In that scenario, natural gas exporting countries could earn a supranatural profit (i.e. a transfer from consumers to producers since the market price would exceed long-run marginal cost) of US$150 billion globally per year. In addition to gas consumers being overcharged by US$150 billion annually under the cartel scenario, there would be an efficiency loss (deadweight loss) of about US$30 billion per year.[81] However, that model rests on a vast number of assumptions and predictive data on the future development of natural gas markets. The paper is an interesting contribution and mainly a predictive effort.

However, the more modest approach chosen for this DPhil thesis focusing on historical data and a few detailed case studies is likely to yield more specific and accurate results. Tarr and Thomson follow such an empirical approach in their paper on the pricing of Russian gas.[82] They estimate that Gazprom's market power in its Western European export markets allows the Russian natural gas monopoly to charge its European customers prices that are much higher than its long-run marginal cost (LRMC).[83] They conclude that "Western European consumers would receive the benefit of paying US$5 to 7.5 billion less per year on their present purchases if Gazprom were to lower its export price [to the competitive level]. In the first instance, they could gain an additional US$2.5 billion from the fact that the lower gas prices would allow to switch to more gas consumption."[84]

[80] Ruud Egging, Franziska Holz, Christian von Hirschhausen and Steven A. Gabriel, "Representing GASPEC with the World Gas Model", *The Energy Journal*, International Association for Energy Economics, vol. 30, Special I, 2009, p. 98.
[81] Egging et al., pp. 116-117.
[82] Tarr and Thomson, "The Merits of Dual Pricing of Russian Natural Gas", 2004.
[83] Ibid., p. 1175.
[84] Ibid., p. 1186.

My thesis seeks to expand existing scholarship on the GECF in particular, but also aims to contribute to analyses of other forms of cooperation and cartelisation in other natural resource markets.

1.5. Research Design

1.5.1. Type of Research and Scope of the Study

Stephen van Evera identifies four categories of doctoral dissertations in political science and international relations. They include theory-proposing, theory-testing, theory-applying and literature-assessing theses.[85] My research would predominantly fall in the theory-applying category. Within that category, there are four specific types: policy-evaluative, historical-explanatory, historical-evaluative and predictive dissertations.[86] Mine will principally be a policy-evaluative one in the sense that the policy of cooperation among certain gas exporters will be examined. The main methodological approach is a combination of qualitative and quantitative tools that will be employed in a variety of case studies.

Case Study Methodology. Chapter 3 will give a more detailed explanation of my case study-based approach. In short, I will begin my investigation with specific cases and their outcomes (observed market power) and will then "move backward" towards the causes (e.g. producer cooperation), thereby adopting a *causes-of-effects* approach to explanation.[87] In each case study, I will employ a combination of diverse methods and tools from political science and economics.

The case universe will include highly import-dependent gas-importing countries, which have a relatively limited number of foreign gas suppliers and inelastic demand for natural gas. In other words, the structural conditions in the cases are conducive to

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[85] Stephen Van Evera, *Guide to Methods for Students of Political Science*, Cornell University Press, 1997, p.93.
[86] Ibid.
[87] Mahoney and Goertz, "A Tale of Two Cultures: Contrasting Quantitative and Qualitative Research", 2006, p. 230.

enabling (foreign) gas suppliers to exercise market power and hence the ability to extract economic rents.

It is envisaged to select two cases in which cooperation among GECF members is possible and indeed the stated objective. A third case—the hypothesised ‘negative’ case—will be selected where GECF members cannot cooperate (because the country’s supplier base consists of less than two GECF member countries[88]), but where the other producers could still secretly cooperate (i.e. collude) to achieve market power. If the conduct parameter shows collusive conduct in the first two (‘positive’) cases, but non-cooperative conduct in the ‘negative’ case, one can infer that GECF membership is possible explanatory factor for market power in the positive cases. If the CPM result shows collusive conduct in both the ‘positive’ and the ‘negative’ cases, GECF membership will be insignificant in terms of explaining market power. Hence, the case will be selected on the independent variable “cooperation among GECF members” (possible in the first two cases, but not in the third) to determine the significance of the GECF.

Data and Sources and Methodology. As will be described in chapter 3, the data requirements both for the research and analysis conducted in this thesis will be significant, but manageable. If precise official data is not available, reasonable estimates from reliable sources will be used. If necessary, sensitivity analyses will be carried out. Field research trips to the countries that are subject of my case studies are essential ingredients as well.

[88] At takes at least two GECF members to cooperate with each other.

1.6. Structure of Thesis

This introductory chapter gave a broad overview of my research project starting with the thesis topic, motivations for the research and background information. Moreover, the core research questions, the main analytical frameworks and methodological issues were presented.

Chapter 2 illustrates and analyses in detail the structure of natural gas markets. It will set the stage for the examination of cooperation among natural gas producers and exporters by discussing the fundamental structures of the natural gas trade, including the supply and demand sides as well as modes of transport. Moreover, major regional markets—North America, Europe and Asia Pacific—will be introduced. Finally, basic information on natural gas producer cooperation in particular and an overview of net exporters and the Gas Exporting Countries Forum are to be presented.

Chapter 3 provides a detailed theoretical and methodological background on international cooperation, on cartelisation in commodity markets with a particular focus on OPEC and an introduction to the relevant economics literature. Moreover, a thorough discussion of the case selection will set the stage for the in-depth case studies in the subsequent chapters.

Chapter 4 contains the country case study on Turkey. The first section of this chapter will study the (foreign) supply side of gas producers, from the upstream and midstream part of the gas value chain up to the Turkish border, and the demand side, that is, the domestic part of the midstream component, as well as the different purposes for which gas is used at the downstream end of the chain. The major players on the exporting side will be introduced and various political and economic factors will be described. The case study is to uncover to which extent prices are explained by producer collusion and anti-competitive practices. To that end, the second section of the chapter will analyse existing evidence and patterns of cooperation among Turkey's suppliers. Moreover, to gain a more thorough understanding of all relevant factors that influence pricing and markets one must look at other variables in addition to cooperation and collusion, which will be done in sections three and four. Chapters 5 and 6 will conduct the same type of case studies of two other import-dependent gas markets, Japan and Germany. The process is the same as before in chapter 4.

Chapter 7 compares the quantitative and the qualitative results of the three preceding case studies in order to determine what one can learn from the cases about gas markets and about international cooperation and commodity cartels more generally. The chapter will also emphasise the connection between economic wealth and political power, discuss in depth the significance of the GECF and address the finding that the GECF as an organisation with a weak degree of institutionalisation is still able to achieve effective cooperative outcomes.

Chapter 8 summarises the results of the entire thesis to draw conclusions about the GECF, gas markets in particular and about international cooperation and cartelisation in the natural resource sector more generally. Finally, future areas of research will be suggested and a brief outlook into the possible future of natural gas markets will be offered.

1.7. Appendix

Appendix Table 1.1: GECF Members and Attendance of Meetings, 2001-2008

Tehran 2001	**Algiers** 2002	**Doha** 2003	**Cairo** 2004	**Port of Spain** 2005	**Doha** 2007	**Moscow** 2008
Algeria Brunei Indonesia Iran Malaysia Nigeria Oman Qatar Russia Turkmenistan Norway*	Algeria Bolivia Brunei Egypt Indonesia Iran Libya Malaysia Nigeria Oman Qatar Russia Venezuela	Algeria Brunei Egypt Indonesia Iran Libya Malaysia Nigeria Oman Qatar Russia T&T UAE Venezuela Norway*	Algeria Brunei Egypt Indonesia Iran Libya Malaysia Nigeria Oman Qatar Russia T&T UAE Venezuela Norway*	Algeria Brunei Egypt Eq. Guinea Iran Malaysia Nigeria Qatar Russia T&T UAE Venezuela Norway*	Algeria Bolivia Egypt Indonesia Iran Libya Malaysia Nigeria Qatar Russia T&T UAE Venezuela Norway*	Algeria Bolivia Brunei Egypt Indonesia Iran Libya Malaysia Nigeria Qatar Russia T&T UAE Venezuela Norway* Eq. Guinea*

Source: Hadi Hallouche (2001-2005 meetings)[89]; IHS Global Insight (2007)[90]; Reuters (2008)[91]
* means observer status / in bold: OPEC members[92]

[89] Hallouche, “The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making?”, 2006 , p. 17.
[90] Unknown Author, “Gas Exporters Stop Short of Declaring a Cartel”, *IHS Global Insight*, 10 April 2007.
[91] Katya Golubkova and Dmitry Zhdannikov, “Russia says gas OPEC will not set up output quotas”, *Reuters*, 26 November 2008.
[92] OPEC website, www.opec.org/opec_web/en/about_us/25.htm; accessed on 05.08.2011.

Chapter 2 Introduction to the Natural Gas Trade: Markets and Structures in 2008

This chapter will set the stage for the detailed theory and methodology sections and in particular for the case selection in chapter 3. The first section here shows how natural gas reserves and production are distributed across the world. In addition to the supply side, the overall demand for natural gas and its uses in the household, industrial and electricity generation sectors will be discussed. Moreover, since the core focus of this research is concerned with the international gas trade, a basic introduction to modes of gas transportation will be provided. The second section will discuss in greater detail the three major regional gas markets: North America, Europe and Asia Pacific. The third section offers some basic information on natural gas net exporters, on natural gas producer cooperation in general and the Gas Exporting Countries' Forum (GECF) in particular.

2.1. Fundamentals: Supply, Demand and Modes of Transport

2.1.1. Supply: Reserves and Production

This section aims to give a brief overview of the current distribution of natural gas reserves[1] and production. To consider the reserve distribution is important since it shows where future production can take place. The production figures show the countries which currently dominate their domestic and export markets. Not all gas-rich countries

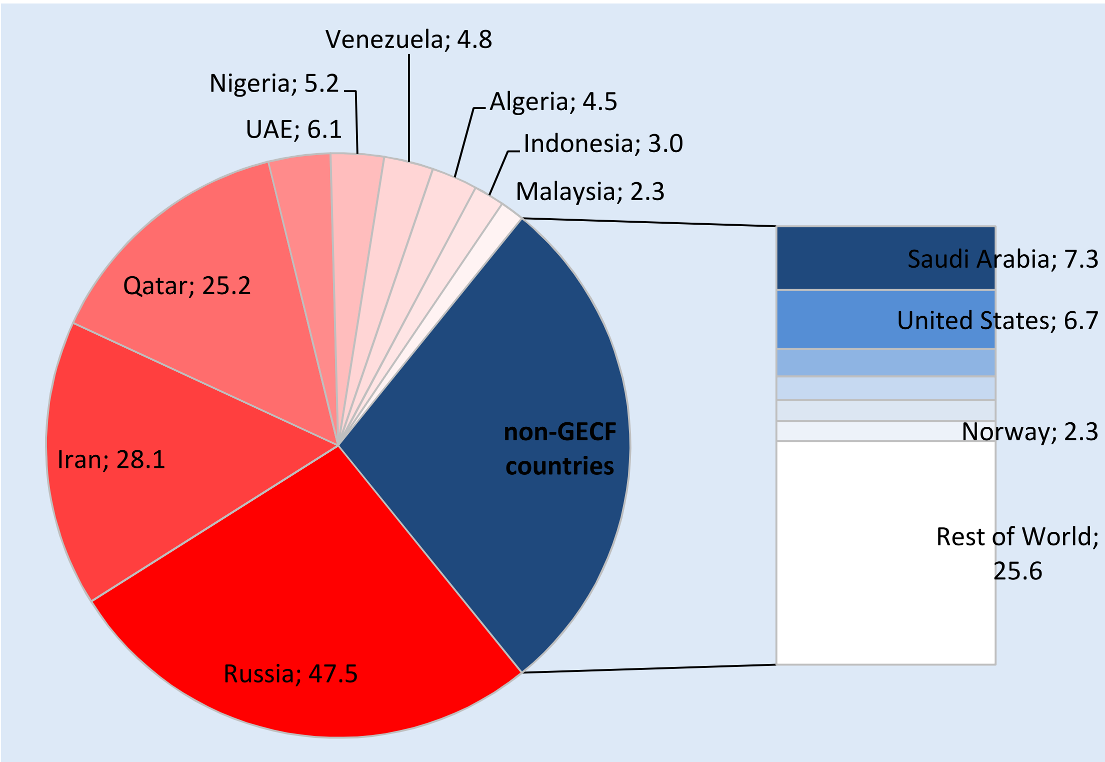
[1] The term 'reserves' refers to the amount of natural gas that is known today and which can be produced from an economic and technological point of view.

are large producers at present, but reserves are an indicator of potential for production expansion in the future.

Around 70 percent of the world's natural gas reserves are located in the former Soviet Republics and the Middle East. Russia, Iran, and Qatar, the top three reserve holders, together held about 57 percent of the world's natural gas reserves at the end of 2008.[2] Nine out of 15 largest reserve holders are members of the Gas Exporting Countries Forum (GECF), which together control 71.6 percent of the world's gas reserves.

Figure 2.1: Natural Gas Reserves: GECF and non-GECF Countries[3]

GECF: shades of red; as of May 2009; in tcm



[2] Unknown Author, "International Energy Outlook 2009", US Energy Information Administration (EIA), United States Department of Energy, chapter 1. Accessed on 2 September 2009: http://www.eia.doe.gov/oiaf/ieo/world.html.

[3] Chart: author; Data: US Energy Information Administration, May 2009.

According to the EIA, global natural gas reserves have mostly trended upward. By the end of 2008, proved gas reserves were estimated at 177 trillion cubic metres (tcm) or 11 percent higher than the estimate for the end of 2007.[4] For 2009, geologists reported the largest increases in natural gas reserves in Iran and the United States with Iran adding approximately 1.22 tcm (or 5 percent) and the US adding 0.76 tcm, a 13 percent year on year improvement.[5]

The EIA further points out in the *2009 International Energy Outlook* that "reserves have remained relatively flat since 2004, despite growing demand for natural gas, implying that, thus far, producers have been able to continue replenishing reserves successfully with new resources over time."[6] This means that the reserves-to-production ratios in some regions—especially in the Middle East and Russia—are relatively favourable. The average global ratio[7] is about 63 years with Europe's and North America's estimates being low, approximately 20 and 11 years respectively,[8] and with higher ratios for Russia (78 years), Africa (79 years) and the Middle East (more than 100 years).[9]

Major reserve holders also tend to be major producers, but vast reserve levels in a gas-rich country are not always matched by similarly enormous production levels—or not yet, that is. Today's production figures show the dominant players in domestic and international markets. Figure 2.1 and Figure 2.2 reveal that the three largest reserve holders are also among the major producers with Russia ranking first, Iran fourth and Qatar eighth. Large producing countries are in some cases also large exporters, such as Russia, Norway, Canada, Algeria and Qatar. In other cases, major producer are only

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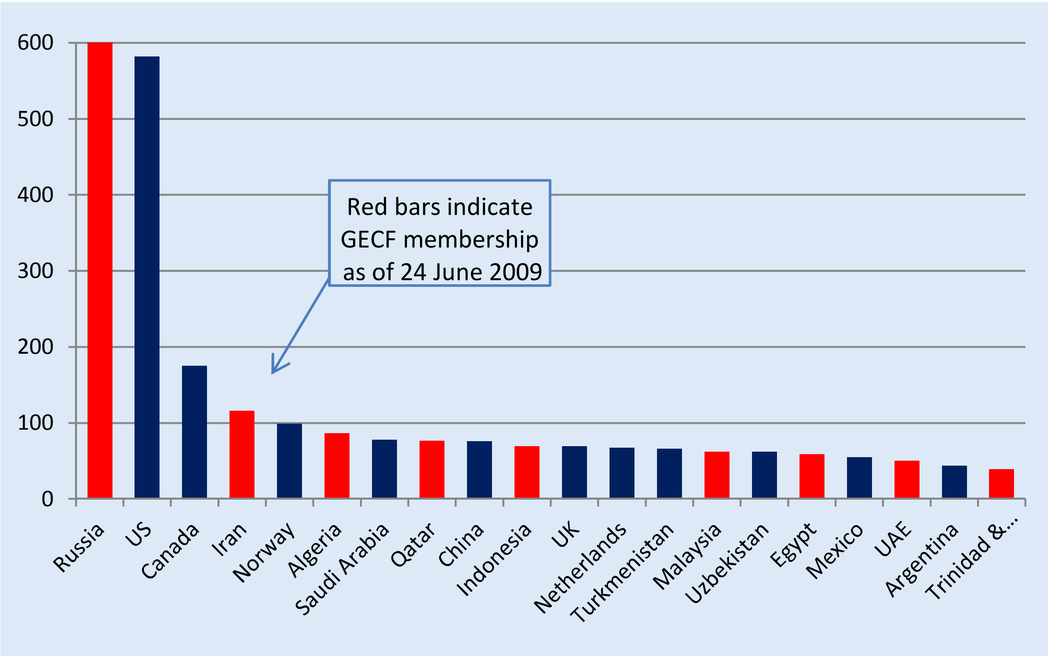
[4] EIA, "International Energy Outlook 2009", chapter 1.
[5] Ibid.
[6] Ibid.
[7] The reserve-to-production ratio shows for how many more years current gas reserves would last at current production levels.
[8] BP Statistical Review of World Energy, June 2009.
[9] EIA, "International Energy Outlook 2009", chapter 1.

minor exporters such as the United States and Iran. (There will be a more detailed analysis of export and imports in sections 2 and 3.) Russia therefore is the world's largest reserve holder, the world's largest producer and also exporter of natural gas. Figure 2.2 also indicates which of the top 20 producing countries are members of the GECF.

Figure 2.2: World Natural Gas Production in 2008[10]

Top 20 Countries; in bcm



These global figures show the distribution and magnitude of natural gas reserves and production. However, since most of the natural gas trade is still regional in nature, this overview does not tell the entire story. A closer look at the major regional markets, including North America, Europe and Asia Pacific, is therefore merited. Section 2 of this chapter provides this analysis and explores the different characteristics of these markets. Having looked at the global supply side figures, the following section examines the demand side in general terms.

[10] Chart: author; data: BP Statistical Review of World Energy, June 2009.

2.1.2. Demand and Types of Use

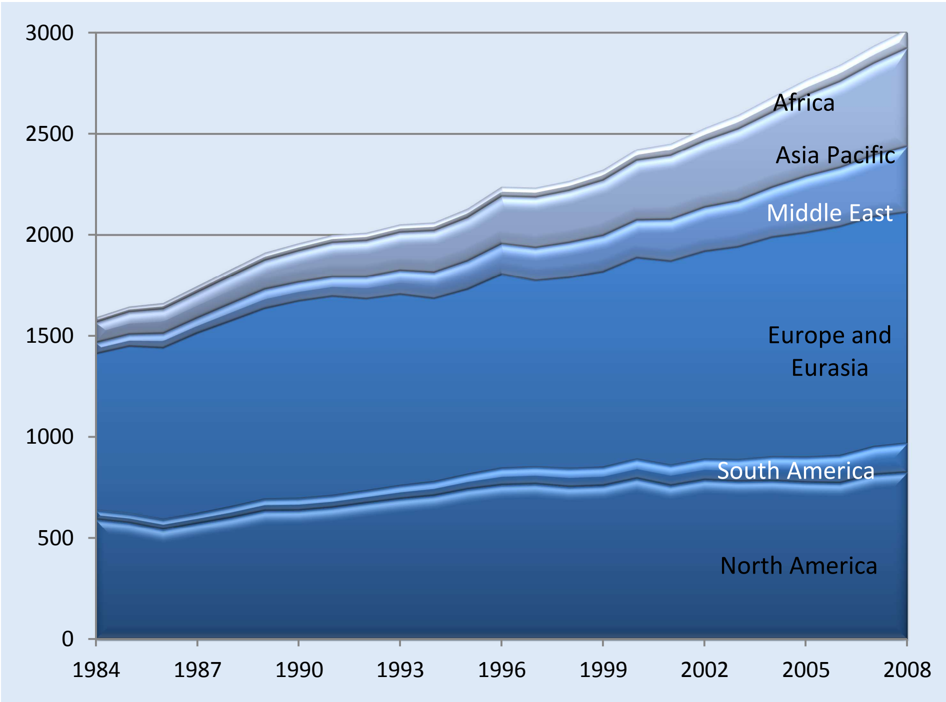
Among various sources of energy—and especially among hydrocarbons—natural gas is often considered a preferred type of fuel due to its desirable properties. Natural gas burns more cleanly than oil and coal, causing almost no local pollution. Moreover, gas emits significantly less CO_2 than the other two hydrocarbon sources. This is considered important as concerns about climate change gain more prominence in energy policy debates. Furthermore, natural gas is much cheaper than most forms of renewable energy.

Since gas is cleaner than most traditional sources of primary energy and cheaper than renewables, it is often considered the most important transition fuel towards a low-carbon energy future in the coming decades. Hence, demand for gas has grown steadily and strongly since the 1980s, as Figure 2.3 demonstrates.

Natural gas can be used for many purposes such as domestic heating and cooking, power generation and in engines and fuel cells. Gas consumption is usually divided into three major categories: household use, power generation and industrial use. In households, consumers use gas mainly for cooking and heating and hence as a substitute for electricity or other liquid and solid fuels.

Using gas for electricity generation has become more and more widespread since emissions of CO_2 and other toxic gases are significantly lower than for oil and in especially coal. Gas-fired power plants are flexible regarding output and provide electricity for industry, households and offices. The industrial sector consumes gas for example in the chemical industry in order to produce fertilisers. In addition to all these various uses, natural gas can serve as a fuel in cars and public transportation systems such as buses. The use of gas in those different sectors varies significantly among countries.

Figure 2.3: Natural Gas Consumption by Region, in bcm[11]



It is important to note for the purposes of this dissertation that gas demand will react differently to price changes depending on the type of consumption. The concept of price elasticity, which will be explored in greater detail in chapter 3, describes consumers' sensitivity to price changes. In brief, economic theory has two important arguments about the price elasticity of demand. First, as prices rise the quantity of gas demanded will fall, holding constant all other factors. Second, consumers' demand for gas (and energy in general) is less price-sensitive than the demand for a large number of other products and services.[12] In the household sector where gas is used for heating and cooking, gas demand tends to be particularly inelastic, meaning that consumers are unlikely to dramatically reduce gas used for heating (especially during winter time) even if prices were to soar. Demand for gas used for power generation is usually more elastic be-

[11] Chart: author; data: BP Statistical Review of World Energy, June 2009.

[12] Mark Bernstein and James Griffin, "Regional Differences in the Price-Elasticity of Demand For Energy", *RAND Technical Report*, Santa Monica, 2005, p. 2.

cause energy companies can switch to coal relatively easily and in some cases to nuclear or renewable energy too. The EIA expects continuing and strong growth of natural gas demand in the coming decades, especially in the electricity generation sector. The EIA's reference case predicts a total increase in natural gas consumption of 1.6 percent per year on average, from 2943 bcm in 2006 to 4330 bcm in 2030.[13]

2.1.3. Modes of Transport

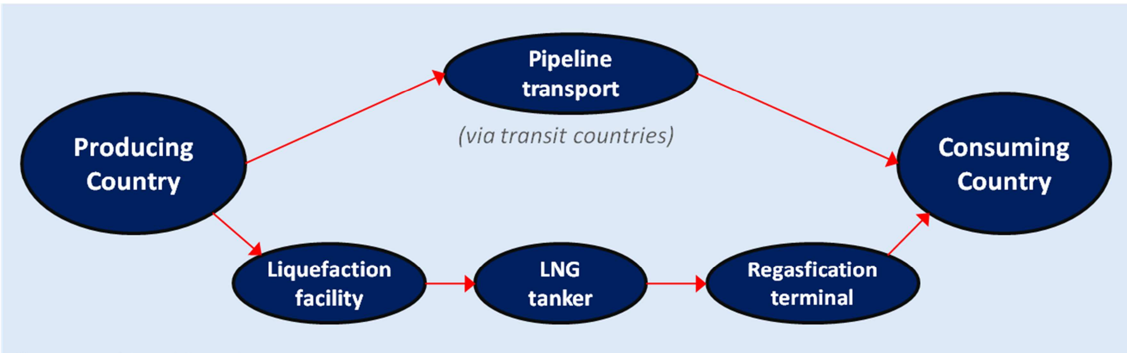
Natural gas can be transported over long distances by two means: either via pipelines or in liquefied form (LNG) by special ships. Almost 90% of today's gas is transported by pipeline, but the LNG market is growing strongly. Since pipelines are fixed, there is little flexibility for suppliers—since customers can only be where the pipeline is—and also perhaps even less flexibility for consuming markets since the supplying gas field is where it is. Pipelines created some mutual dependencies between suppliers and consumers and kept markets largely regional.

When constructing pipelines, economies of scale can hardly be achieved since costs usually rise linearly with the pipe length. Therefore, pipelines are quite capital intensive and require considerable upfront investment. LNG however is generally even more expensive than pipeline gas. Transporting gas as LNG involves three steps as Figure 2.4 shows. First, the liquefaction, which takes place in the producing country, is the most expensive part of the process. In order to ship the LNG, special tankers are needed, which make up about 30 to 40 percent of the costs for transportation.[14] If the gas is not sold under long-term contracts, then the LNG shipment can be received by any consuming that has a regasification terminal. In terms of cost structure, the fixed costs are rela-

[13] EIA, "International Energy Outlook 2009", chapter 1.
[14] Thomas Palm, "The future of LNG in Europe and the potential impact on the market power of the gas suppliers", Master's Thesis, Norwegian School of Economics and Business Administration, May 2007, p. 12. Accessed on 2 September 2009: http://bora.nhh.no/bitstream/2330/1610/1/Palm%20Thomas%202007.pdf.

tively high, but overall LNG transportation costs rise much more slowly with distance in comparison to piped gas. Hence, LNG is comparatively much more expensive to pipeline gas over short distances, but is competitive over longer distances.

Figure 2.4: The Natural Gas Export Chain[15]



More so than other forms of hydrocarbon energy, natural gas is difficult and expensive to transport and store in gaseous form due to its relatively low energy density.[16] The volume of natural gas can be reduced to 1/600 of its gaseous form if it is liquefied (LNG), but as indicated before this process is also very costly. Hence, transportation and storage of gas are relatively more problematic and expensive compared to oil or coal, both of which can easily and cheaply be put on ships or trains. Investments in natural gas pipelines and LNG facilities— including the liquefaction train, the special LNG tankers and the regasification terminals—therefore involve huge amounts of sunk costs.[17] As LNG grows strongly, economies of scale make it relatively more competitive to pipeline gas. Some industry analysts predict that LNG could be the dominant

[15] Illustration: author.
[16] Energy density refers to the mass or volume of an energy store to its stored energy or, put simply, energy contained per unit volume of space.
[17] Sunk costs, as defined in economics, are costs that are irrecoverable once incurred.

form of transport in one to two decades. This would create a global gas market very similar to today's oil market.

2.2. Markets and Trade Relationships: US, Europe and Asia

This section will disaggregate some of the global figures and perspectives presented above. While a general overview is important and the politics and economics of natural gas share some common global characteristics, the markets are still quite regional. Especially for the purposes of this dissertation, a distinction among markets must be made in order to identify the relevant case universe, which is the basis for chapter 3. There are three major regional markets for natural gas: North America, Europe and Asia Pacific. The markets will be introduced in that order.

2.2.1. North America

The natural gas market in North America has two important players. Both Canada and the United States developed their gas markets based on the availability of domestic resources. The international gas trade in North America until the beginning of the 21st century was limited to exports from Canada to the US. In the past few years the United States has begun to import LNG from other sources as well.[18]

North America's gas production is sourced from many small- and medium-sized gas fields, which makes the domestic market more flexible and competitive than other markets that rely on few super-giant fields with very few instead of a multitude of producers. Private energy companies rather than state-run energy monopolies compete in a liberalised and liquid market. This led to a commoditisation of natural gas production and marketing within the US and Canada. Gas is traded at various exchanges and hubs, such as the Henry Hub in Louisiana (spot market) and the New York Mercantile Ex-

[18] Unknown Author, "Putting a Price on Energy: International Pricing Mechanism for Oil and Gas", Energy Charter Secretariat, 2007, p. 12.

change (futures trading).[19] The structure of the market and its competitiveness makes the exercise of market power—either by domestic producers or dominant foreign producers—relatively difficult.

Canada produces much more gas than it consumes. The country is therefore the world's third largest net exporter in 2008. Most of these exports stay within North America and go to the US. While the actual quantities of gas imported from Canada sound large in comparison to traded volumes on other continents, the United States' net gas imports account for only 13% of its gas consumption. This means the US is one of the least dependent gas importers in the world. The share of LNG imports is extremely small when compared to the overall market size.

One other important development emerged in 2009. The Energy Information Administration revised estimates of potential (rather than proved) gas reserves sharply upwards. The US possesses large amounts of unconventional natural gas resources[20] some of which have been produced over the past decades, but most of which were deemed uneconomic until very recently. According to the EIA, "much of the increase in US natural gas reserves results from expanded knowledge and exploration of shale resources."[21] Recent improvements in technologies such as hydraulic cracking make larger amounts of unconventional gas resources economic and hence exploitable. This is a very important change since most reserve estimates in the US predicted that the country would run of exploitable gas by 2020.

[19] Ibid., pp. 12-13.
[20] Mainly shale gas, coal bed gas and methane hydrates
[21] EIA, "International Energy Outlook 2009", chapter 1.

Table 2.1: Characteristics of Regional Gas Markets in Comparison[22]

North America and United Kingdom	Continental Europe and Japan / Korea
1. development based on own resources; no initial dependence on imports	1. high import dependence from the start
2. supply based on small to medium sized gas fields	2. supply based on imports from giant / super giant fields
3. standardised rent taking; development decision by private players	3. rent maximisation of exporting countries; development decision by exporting country
4. demand elasticity from gas-to-power generation	4. limited demand elasticity
5. gas-to-gas competition but price path for gas still tracks oil prices	5. oil prices as reference in price formula

These discoveries may have a significant impact on natural gas producer cooperation. Some say that instead of becoming an importer in the future (because of hitherto expected declines in exploitable US resources), the US could become an exporter once again, provided that enough unconventional gas is available and will be developed. Any gas exporter in the GECF with the intention to take advantage of importers' dependence would prefer that the US remain an importer, not an exporter that can send LNG to import markets in Europe and Asia.

For the purposes of this dissertation, the North American market is not very relevant as an importer (despite a large absolute, but small relative share of imports) for those reasons: there are small gas fields, competitive and liberalised markets, huge domestic production and newly discovered reserves.

[22] Chart: author; adapted from "Putting a Price on Energy", Energy Charter Secretariat, 2007, p. 102.

2.2.2. Europe

The European market, defined as the 27 members of the European Union plus Norway, Switzerland and Turkey, is very different from the North American market in many respects. As Figure 2.1 at the beginning of this chapter shows, there is not a single European country among the 15 largest reserve holders of natural gas. Moreover, Figure 2.2 demonstrates that there are only two EU member states—the Netherlands and the UK—and a third European country, Norway, among the global top 20 gas producers. The reserves of those countries are depleting rapidly at current production levels, which contributes to concerns about future gas supplies and prices in Europe. The global reserves-to-production ratio for gas is about 60 years, but it is much lower for the few remaining European producers (24 years).[23]

Hence, within Europe, the UK and the Netherlands are the only EU members with significant resources and competitive domestic gas markets. Much of the rest of the European Union's gas grid is highly dependent on imports rather than domestic production and on super-giant gas fields rather than the small and medium-size fields to be found in the US. According to a report by the Energy Charter Secretariat, "the find of the super-giant Groningen gas field in the Netherlands in 1961 triggered the development of an import-based gas industry in the then European Community (the Netherlands, Belgium, Luxembourg, Germany, France and Italy) plus Switzerland."[24] More specifically, gas supplied to the EU come largely from eight super giant fields: the Russian fields Yamburg, Urengoy and Medvezhye, and after 2000 also Zapolyarnoye, Groningen in the Netherlands, Hassi R'Mel in Algeria and Troll in Norway.[25]

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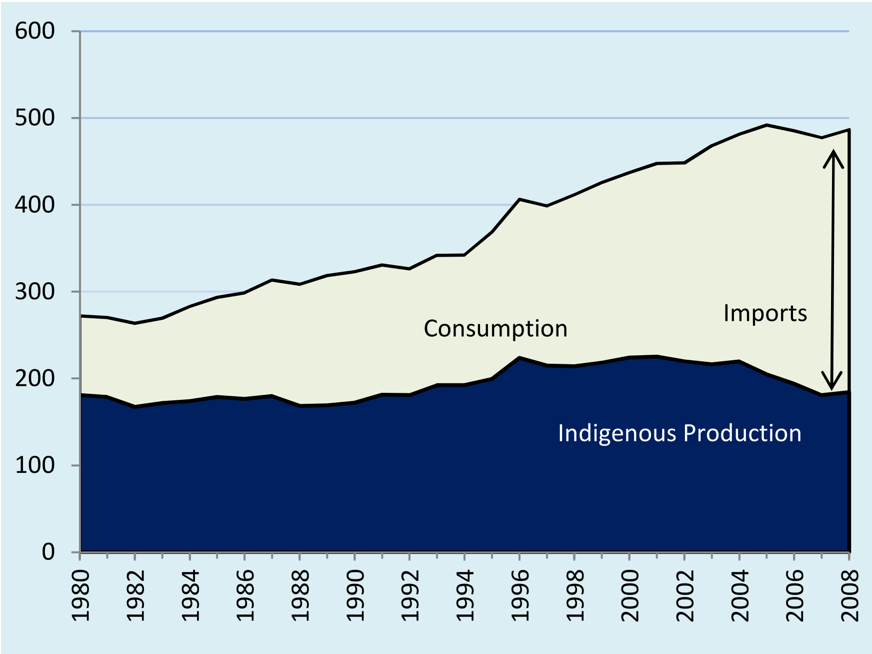
[23] Ruud Egging, Franziska Holz, Christian von Hirschhausen and Steven A. Gabriel, "Representing GASPEC with the World Gas Model", *The Energy Journal*, International Association for Energy Economics, vol. 30, Special I, 2009, p. 98.
[24] Energy Charter Secretariat, "Putting a Price on Energy", p. 23.
[25] Ibid., p. 100.

According to BP energy statistics, total gas production in European Union countries was about 184 bcm, or 6% of the global amount, in 2008.[26] Production levels for individual EU countries in 2008 were as follows: United Kingdom 70 bcm, the Netherlands 68 bcm, Germany 13 bcm, Romania 12 bcm, Denmark 10 bcm, Italy 8 bcm and Poland 4 bcm. Of the total Russian production of 602 bcm about 125 are exported to the EU, while Norway exports 93 of its 99 bcm gas production. Finally, about 35 bcm of Algeria's total production of 87 bcm are exported to the EU.[27] Hence, as the numbers above and Figure 2.5 indicate, the European Union depends for more than half of its consumption on three large gas-exporting countries: Algeria, Norway and Russia.

Figure 2.5: Gas Production and Consumption in EU-27[28]

from 1980 to 2008, in bcm



Import dependence, according to various estimates and forecast, will continue to rise over the next decades. Projections of soaring demand for energy in general and for

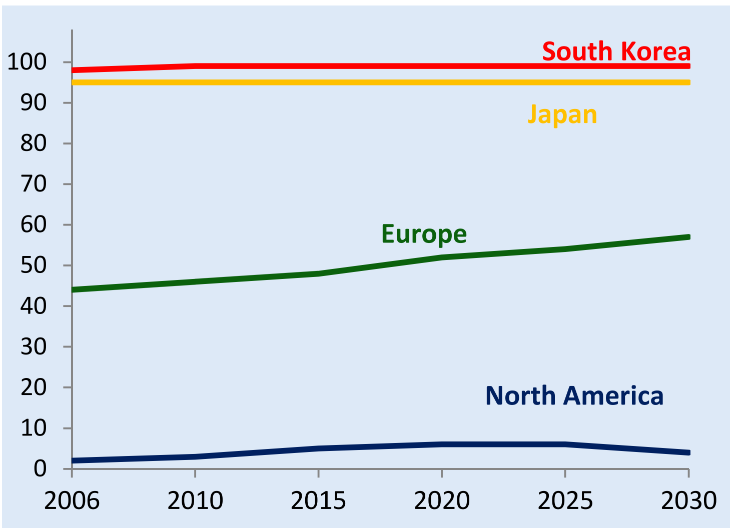
[26] BP Statistical Review of World Energy, June 2009.
[27] Ibid.
[28] Chart: author; data: BP Statistical Review of World Energy, June 2009.

natural gas as a relatively clean transition fuel in particular coupled with declining 'domestic' European reserves make rising import shares virtually inevitable. Neighbouring Russia's reserves on the contrary are ten times as big as the reserves of the EU-27 and Norway combined and five times the reserves of EU-27, Norway and Algeria taken together.[29]

The European Commission predicts in its 'business as usual' scenario that Europe's import dependence will jump from about 57 percent of total EU gas consumption today to 84 percent in 2030. Russia will continue to play a crucial role as an exporter to Europe given that it already supplies about 60 percent of the EU's non-European gas imports.[30] The US Energy Information Administration (which defines the European market slightly differently, i.e. not limited to EU members) also predicts rising import dependence in Europe over the coming decades as can be seen in Figure 2.6.

Figure 2.6: Natural Gas Import Forecasts until 2030[31]

Net Imports as % share of Total Consumption, by Market, 2006-2030



[29] Egging et al., 2009, p. 98.
[30] Joris Morbee and Stef Proost, "Russian Market Power on the EU Gas Market: What if Gazprom is Unreliable?", KULeuven Energy Institute, *Working Paper Series*, 2008, p. 2.
[31] Chart: author; data: EIA, June 2009.

As indicated above, European countries overall consume much more natural gas than they produce. EU-27 consumption of natural gas was 490 bcm or 16 percent of world total consumption. Major European Union consuming countries are the UK with 94 bcm, Germany at 82 bcm, Italy at 78 bcm, France at 44 bcm and both Spain and the Netherlands at 39 bcm.

Natural gas is consumed for three major purposes in Europe: household use, power generation and industrial use. It is important to distinguish between these three different forms of utilisation for two reasons. First, the different uses vary across consuming countries within Europe and elsewhere. For example, the less import-driven and competitive a given gas market is, the more it is likely to use gas for power generation. Import-dependent and uncompetitive gas markets tend to use gas primarily for residential heating and industrial purposes (barring any policies that encourage the utilisation of gas). The second reason follows from the first. Depending on the relative importance of gas in different sectors, a domestic market's demand for gas will tend to be elastic or inelastic. This has implications for the ability and incentive to exercise market power in such markets and is hence a very important factor for the ensuing economic analysis.

Depending on which estimate one chooses and depending on how one defines the European market, about ¼ of Europe's gas consumption is used for power generation.[32] Natural gas is a preferred fuel for power generation especially because the CO_2 emission is much lower compared to coal, which is a traditional solid hydrocarbon fuel used in the electricity sector. While gas is more expensive than coal, the former is becoming comparatively more attractive as costs for carbon emissions associated with burning coal grow.

[32] Palm, 2009, p. 29

While a detailed examination of gas end use is to be carried out in case studies later, two examples are worth mentioning. The UK as a major domestic producer of gas with a competitive market, typically uses gas for power generation on a large scale.[33] Another example is Spain, which is import-dependent, but nonetheless employs natural gas for electricity generation as result of government policies.[34] Gas is also seen as an ideal complement to volatile renewable energy sources for generating electricity. Wind and solar sources can be unsteady to generate base load capacity and gas use can be scaled very flexibly. Hence, countries such as Germany and Spain which traditionally did not rely on gas for power generation are now increasing their shares in that sector.

Table 2.2: Share of Gas Consumption met by Net Imports[35] by Importing Country, in 2008

Country	Consumption/ Net Imports	Country	Consumption/ Net Imports
Europe		**Asia Pacific**	
Finland	100%	Japan	98%
France	100%	Taiwan	94%
Belgium	100%	South Korea	92%
Turkey	100%	Singapore	90%
Switzerland	100%		
Spain	100%	**Others**	
Ireland	100%	Brazil	44%
Portugal	99%	India	26%
Czech Republic	99%	Thailand	23%
Italy	99%	Mexico	19%
Greece	98%	UAE	14%
Slovakia	98%	United States	13%
Hungary	96%	China	6%
Lithuania	95%		
Bulgaria	95%		
Germany	88%		
Austria	85%		
Poland	71%		
Romania	31%		

[33] Ibid., p. 30.
[34] Ibid.
[35] Table & calculations: author; data: Cedigaz database, 2009.

United Kingdom	28%	

There is an import implication as a result of this: gas used for electricity generation can relatively easily be substituted by coal or nuclear power should gas suppliers escalate prices or interrupt supplies. Therefore gas suppliers (especially exporters) looking to derive the maximum economic rent from their resources would prefer not to deliver gas for the purpose of generating power.

Finally, household use of gas for cooking and heating as well as industrial consumption is widespread in continental Europe. Instead of converting natural gas as primary energy source to electricity, the gas is burnt directly for heating and cooking. ‘Direct’ consumption of gas in the household and industry sectors takes up a significant share of Europe’s total gas consumption. The higher the share of ‘direct’ gas use in a given market, the less elastic demand for gas and the more susceptible the market will be for the exercise of market power by energy companies. The reason for this is simple: If a critical mass relies on gas for heating especially during winter time, demand is unlikely to drop much in the face of price hikes. Hence, gas suppliers generally prefer to deliver gas to countries in which household use is dominant. This helps suppliers maximise the economic rent they can extract.

While a more detailed examination of the European market is to follow in later chapters, it seems beneficial to disaggregate the European figures and look at one specific country-by-country comparison. The gap between consumption and production and the resultant need for imports in Europe became evident in Figure 2.5. Yet, statistics show that gas import dependence varies widely across the continent. Table 2.2 presents gas consuming countries and their dependence on non-domestic sources of gas in Europe, Asia and other regions. It is obvious that virtually all of the most dependent countries are located in two regions: Europe and Asia. The share of dependence of the category 'Others' is much lower in comparison, with the highest being Brazil, which itself produces and exports gas.

2.2.3. Asia Pacific

Table 2.3: Reserves, Production and Consumption in Asia-Pacific, in 2008[36]

	Reserves		Production		Consumption	
	tcm	share of world total	bcm	share of world total	bcm	share of world total
Japan	-	-	-	-	93.7	3.1%
China	2.46	1.3%	76.1	2.5%	80.7	2.7%
India	1.09	0.6%	30.6	1.0%	41.4	1.4%
South Korea	-	-	-	-	39.7	1.3%
Indonesia	3.18	1.7%	69.7	2.3%	38.0	1.3%
Pakistan	0.85	0.5%	37.5	1.2%	37.5	1.2%
Thailand	0.30	0.2%	28.9	0.9%	37.4	1.2%
Malaysia	2.39	1.3%	62.5	2.0%	30.7	1.0%
Australia	2.51	1.4%	38.3	1.2%	23.5	0.8%
Bangladesh	0.37	0.2%	17.3	0.6%	17.3	0.6%
Other	0.39	0.2%	14.1	0.5%	13.6	0.4%
Taiwan	-	-	-	-	12.8	0.4%

The situation of natural gas consuming countries in Asia (excluding Russia) is quite varied. There are two relatively mature and established gas consumers without any resources: Japan and South Korea. Hence, both countries are fully dependent on imports, practically all of which come in the form of LNG. Similar to most European states, both markets developed on the basis of imports (not domestic production) from large gas fields in Indonesia, Malaysia and Brunei under large long-term contracts.[37] Moreover, there are China, India, Pakistan and Thailand all of which produce most of their gas domestically and have to import only relatively small quantities at present.

[36] Table: Marcel Dietsch; data: BP Statistical Review of World Energy, 2009.
[37] Energy Charter Secretariat, "Putting a Price on Energy", p. 100.

Yet, it is those countries that are expected to have the strongest growth in consumption (and import) of natural gas over the coming decades.[38]Australia, Indonesia and Malaysia produce natural gas and are net exporters. These countries mainly serve the Asia Pacific market with LNG and are dominant producers in that region, but are at most mid-size producers globally. Indonesia and Malaysia are both members of the GECF.

While dependence on imports is an important issue for both Japan and South Korea, imports are unlike in Europe received as LNG not pipeline gas. In the absence of cooperation among natural gas exporters, this is a distinct advantage compared to Europe's considerable dependence on pipeline gas since both countries can choose whichever LNG supplier they prefer. GECF member states however controlled about 85 percent of worldwide LNG production in 2007.[39] Hence gas producer cooperation is likely to become an energy security issue for importers in Asia Pacific too.

2.3. Fundamentals of Gas Producer and Exporter Cooperation

Following a general introduction to the international gas trade and an overview of major regional markets, this section will present a more detailed description and data concerning natural gas exporting countries, their markets and efforts at closer cooperation. As shown above in Figure 2.1 and Figure 2.2, the list of largest reserve holders is not mirrored by the table of largest producers. And the list of major natural gas net exporters (shown below in Figure 2.7) is somewhat different from the reserve and production charts. The share of exports are an important measure 'of the dominance of countries in

[38] Robert Larsson and Jan Leijonhielm, "Russia's Strategic Commodities: Energy and Metals as Security Levers", *Defence Analysis SE-172 90*, Swedish Defence Research Agency, November 2004.
[39] Unknown Author, "Liquefied Natural Gas for Europe: Some Important Issues for Consideration", EC Joint Research Center, European Commission, July 2009, p. 9.

world markets since the market power of a country is more likely to be related to its share of total internationally traded gas [...] than its share of total [production].'[40]

Moreover, the major reserve holders of today are the likely major producers of the future, depending on the extent to which gas fields can be developed. Furthermore, the major producers of the future will most likely be the largest exporters in the decades to come (depending on their own domestic consumption). Therefore, the ranking of net exporters as shown below must be considered in combination with the reserve figures. A producing country's long-term influence on the gas market does hence depend both on the amount of proved reserves and on the extent to which gas production will be commercially viable.

2.3.1. Major Net Exporters of Natural Gas

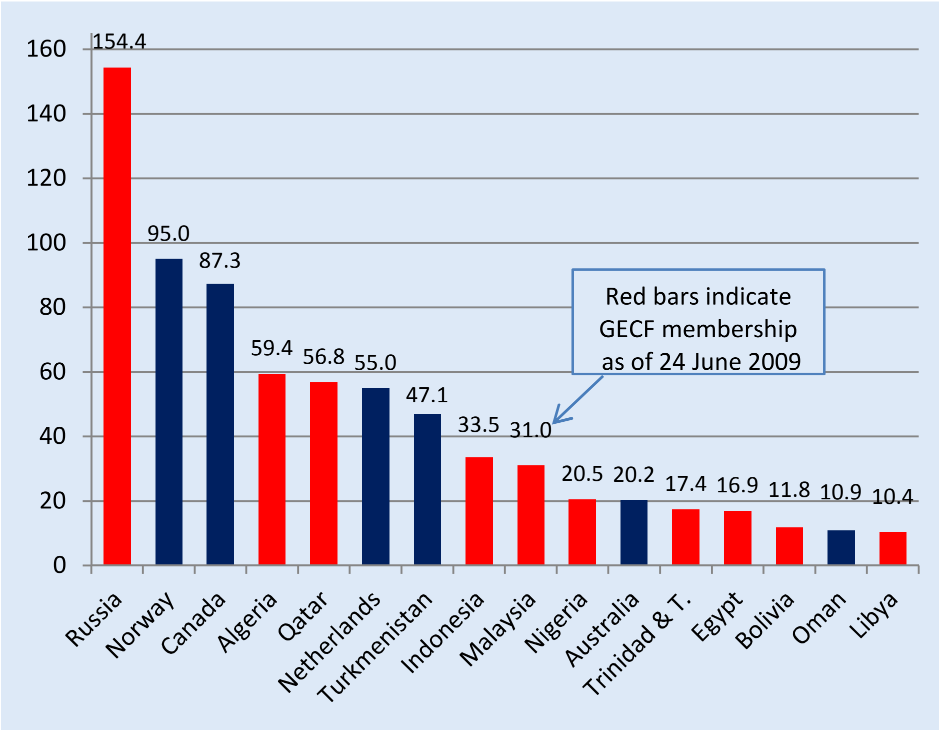
Figure 2.7 shows major natural gas exporters according the quantity of their net exports in 2008. Members of the GECF dominate the ranking. This general overview, however, is not sufficient to understand the gas market structure and the major trade relationships.

It is important to look in detail at the export markets of these countries in order to understand both market concentration and import dependence in consuming countries. Russia, Algeria and Qatar are the three largest net exporters, which are also members of the GECF. Norway and Canada are less interesting for the purposes of this research not only because they not GECF members. These two countries are also less relevant since the former is running out of reserves quite rapidly and is hence likely to disappear from the list of major exporters soon while the latter exports almost exclusively to the United States, where imports constitute only a small share of the market.

[40] Amy Jaffe and Ron Soligo, "Market Structure in the New Gas Economy: Is Cartelization Possible?", PESD Working Paper, Stanford University, May 2004. Accessed on 12 December 2009: http://iis-db.stanford.edu/pubs/20705/Gas_OPEC_final.pdf.

Figure 2.7: Natural Gas Trade: Net Exporters[41]

Net Exports via Pipeline and as LNG in 2008, in bcm



Russia and Algeria are particularly relevant for the analysis of regional cooperation efforts since they both export most of their gas via pipelines. There is little flexibility in the pipeline trade; the customers can only be at some point along the pipe or at its end. This fixed nature of pipeline transport keeps gas markets dominated by pipelines regional. The trade relationships of Russia and Algeria with their exports markets hence are the basis for the 'regional cooperation' case selection in chapter 3.

Table 2.4 shows that Russia is the dominant or quasi-monopolist supplier in eleven European countries (including Turkey), if market dominance is defined as contributing 40 percent or more to a country's gas consumption. Where Russia delivers almost 100 percent of the gas, closer cooperation with other exporters would of course be virtually impossible since there are essentially no other significant suppliers.

[41] Chart: author; data: Cedigaz database, 2009.

Table 2.4: Share of Russian Gas for Importing Countries' Import and Consumption Needs[42]

all via pipeline, for 2008, in bcm

Country	Imports from Russia	Total Net Imports	Import Share	Total Consumption	Consumption Share
Bulgaria	3.10	3.10	100%	3.26	95%
Finland	4.50	4.50	100%	3.95	100%
Lithuania	3.09	3.09	100%	3.24	95%
Slovakia	5.60	5.60	100%	5.73	98%
Greece	2.80	4.14	68%	4.21	67%
Romania	3.50	4.50	78%	14.55	24%
Hungary	8.90	11.50	77%	12.01	74%
Czech Republic	6.60	8.61	77%	8.68	76%
Poland	7.20	9.80	73%	13.90	52%
Turkey	23.55	37.61	63%	36.02	65%
Austria	5.80	8.10	72%	9.48	61%
Germany	36.20	71.96	50%	82.03	44%
Italy	24.50	76.87	32%	77.70	32%
France	8.80	49.25	18%	44.20	20%
Switzerland	0.35	3.19	11%	3.09	11%

Table 2.5 illustrates the extent to which consuming countries in Europe and Asia depend on Algerian natural gas. Algeria by virtue of being a smaller producer, does not dominate her export markets in the same way Russia does. Only Portuguese consumption depends on Algerian gas up to 42 percent. In Spain and Italy the share stands at 36 percent and 33 percent respectively. This does not constitute market dominance as defined above.

Hence, Russia enjoys an influential market position in eleven European consuming countries and Algeria dominates the Portuguese market. Moreover, given that some import-dependent markets receive supplies from Algeria and Russia, a combined market share of 65 percent is achieved in Italy where Russia supplies 32 percent and Algeria

[42] Chart: author; data: Cedigaz database, 2009.

contributes 33 percent to the country's consumption. Another GECF member country, Libya, provides an additional 13 percent of Italy's gas consumption. This brings the total GECF market share in Italy to 78 percent. Russia's dominant position in Greece could be strengthened through cooperation with Algeria, bringing the joint market share up to 84 percent. In the Turkish market, the three GECF members Algeria, Iran and Russia reach a market concentration of 93%. These cases will be particularly interesting for the regional cooperation analysis.

Table 2.5: Share of Algerian Gas for Importing Countries' Import and Consumption Needs[43]

for 2008, in bcm

Country	via Pipeline	via LNG	Imports from Algeria	Total Net Imports	Import Share	Total Consumption	Consumption Share
Portugal	1.93		1.93	4.56	42%	4.59	42%
Spain	8.97	4.90	13.87	39.60	35%	38.97	36%
Italy	24.44	1.56	26.00	76.87	34%	77.70	33%
France		7.60	7.60	36.66	21%	44.20	17%
Greece		0.70	0.70	4.14	17%	4.21	17%
Turkey		4.25	4.25	37.61	11%	36.02	12%
South Korea		0.47	0.47	36.55	1%	39.70	1%
Japan		1.12	1.12	92.13	1%	93.74	1%

The European market is the only major regional gas market which depends on pipeline imports. A number of countries in the Asia-Pacific market are also highly dependent on imports, yet—as mentioned in 2.3—the predominant form of transportation there is LNG. In theory, those countries with regasification terminals, including Japan, South Korea and others, could import gas from any LNG supplier in the world. In that sense the Asia Pacific market is more flexible—depending not only on one or two fixed

[43] Chart: author; data: Cedigaz database, 2009.

pipeline suppliers—and hence less regional. Yet, cooperation among major LNG exporters would have similar effects as regional cooperation strategies by pipeline exporters. Given that almost all LNG exporters are members of the GECF, and having referred to this organisation often, it is necessary to introduce the GECF in greater detail.

2.3.2. The Gas Exporting Countries Forum (GECF)

The Gas Exporting Countries Forum (GECF) was created in 2001 and aims to bring together the world's leading gas producers and exporters in order to promote their mutual interests. There is contradictory information concerning the number of members and observers within the GECF. The GECF's own website lists Algeria, Bolivia, Egypt, Equatorial Guinea, Iran, Libya, Nigeria, Qatar, Russia, Trinidad and Tobago and Venezuela as members. Kazakhstan and Norway have observer status in GECF meetings, according the same website.[44] Since the website appears to be out of date, other reputable sources ought to be consulted. The US Energy Information Administration along with other sources[45] list Brunei, Indonesia, Malaysia and the United Arab Emirates as members as well.[46] In addition to the two observers listed on the GECF website (and mentioned above), it is reported that the Netherlands were granted observer status in 2009.[47]

Appendix Figure 1 shows all GECF member states and countries with observer status on a world map. This map would be quite similar to a map showing the world's

[44] GECF Secretariat, membership section of the website. Accessed on 20 September 2009: http://www.gecforum.org/.

[45] Garry White, "Gas exporters create new group as Putin warns "cheap" prices at an end", *The Daily Telegraph*, 23 December 2008.

[46] Unknown Author, "Gas Exporting Countries Forum: What Is GECF and What Is Its Objective?", in *International Energy Outlook 2009*, US Energy Information Administration, United States Department of Energy, 2009. Accessed on 20 September 2009: http://www.eia.doe.gov/oiaf/ieo/cecf.html.

[47] Unknown Author, "No secretary-general for GECF", *United Press International*, 1 July 2009. Accessed on 20 September 2009: http://www.upi.com/Energy_Resources/2009/07/01/No-secretary-general-for-GECF/UPI-56331246465017/.

largest gas reserve holders. Approximately 73 percent of the world's proved gas reserves are to be found in countries which are members of the Forum.[48] Other major reserve holders that are not part of the GECF are Iraq, Saudi Arabia, Turkmenistan and the United States. The production figures show that between 41 and 42 percent of global natural gas production takes place in GECF countries.[49] A European Commission report shows that members of the Forum together control about 38 percent of the gas pipeline trade and 85 percent of LNG production and exports globally.[50] A perhaps surprising fact is that Iran and Venezuela, two of the GECF's most enthusiastic members, are not (net) exporters of natural gas themselves at present.[51] However, they are major gas producing countries and given the distribution of gas reserves, their production and export capacity is likely to grow significantly.

GECF members have held meetings usually once a year at the ministerial level. The Forum had no formal structure, no membership requirements and fees and no secretariat until late 2008. Yet, the members agreed on the overall objectives of the Forum. First, the GECF works towards measures aimed at maximising the value member countries can derive from their gas reserves. Second, GECF members are to exchange views and information on project development, supply and demand balances, exploration, production and transportation costs, etc.[52] An EIA report points out that the "most significant development for GECF in 2008 was its adoption of a formal charter at its Seventh Ministerial Meeting in Russia in December. [...] The Forum agreed to establish permanent headquarters in Doha, Qatar and adopted a charter formalizing its goals."[53]

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[48] Calculation based on figures in BP Statistical Review of World Energy, 2009.
[49] Ibid.
[50] A. Georgakaki, B. Kavalov and H. Petric, "Liquefied Natural Gas for Europe: Some Important Issues for Consideration EC report on LNG", *JRC Reference Reports*, European Commission, July 2009, p. 9.
[51] Data from BP Statistical Review of World Energy, 2009.
[52] EIA, "Gas Exporting Countries Forum: What Is GECF and What Is Its Objective?", 2009.
[53] Ibid.

Figure 2.8: Gas Importers' Dependence on GECF Suppliers[54]

Share of Net Gas Imports and Consumption coming from GECF Member Countries, 2008

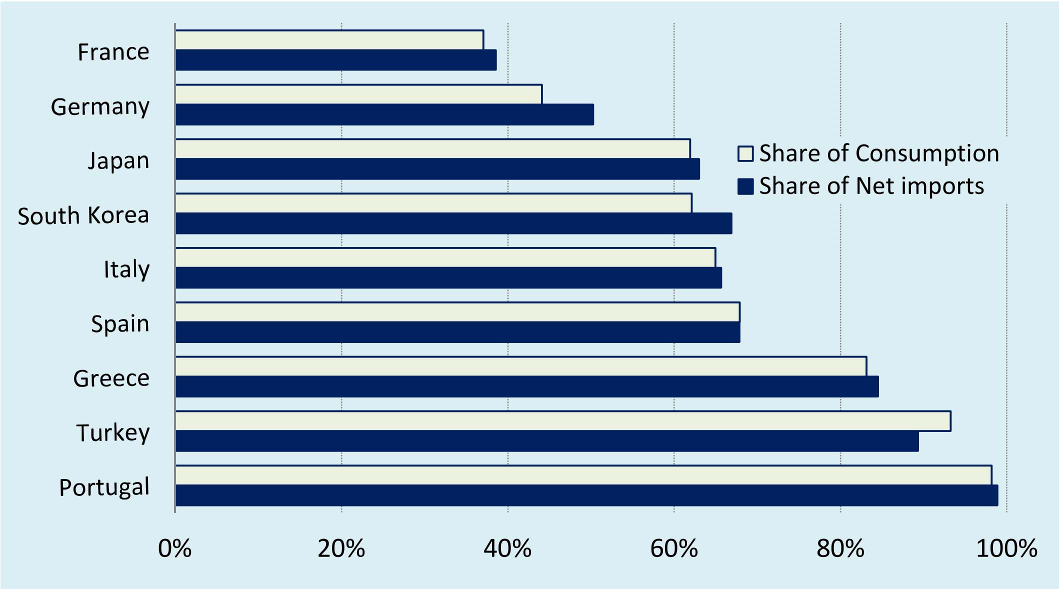


Figure 2.8 shows to what extent major gas consuming countries depend on GECF members for their net imports and consumption. This overview illustrates the GECF's theoretically possible influence in import markets and perhaps overstates the potential market power since this calculation combines both LNG and pipeline transport. As indicated before, Russia and Algeria individually and collectively have large and dominant market shares in some European markets. The GECF's market share in some cases is greater still.

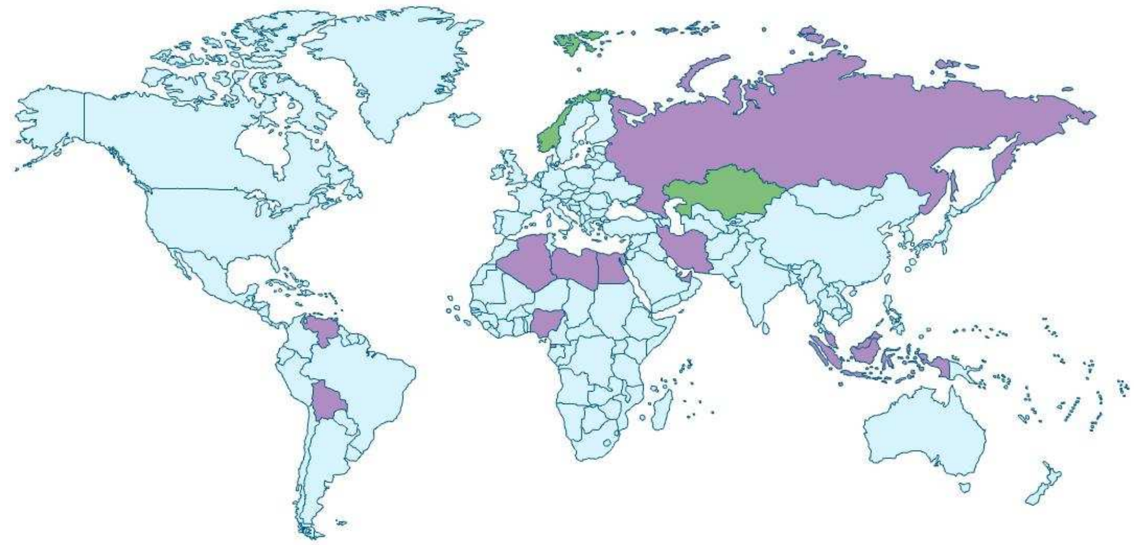
This chapter has set the stage for the examination of cooperation among natural gas producers and exporters. The three preceding sections considered fundamental structures of the natural gas trade, including the supply and demand sides as well as modes of transport. Moreover, major regional markets—North America, Europe and Asia Pacific—were introduced. Finally, basic information on natural gas producer co-

[54] Chart & calculations: author; data: Cedigaz database, 2009.

operation in particular and an overview of net exporters and the Gas Exporting Countries Forum were presented.

2.4. Appendix

Appendix Figure 1: World Map showing GECF Members in 2008[55]



Purple: GECF Member Countries; **Green**: GECF Observer Status

[55] Map: author with www.indexmundi.com/map/creator.

Chapter 3 Theory, Methodology and Research Design

Following the brief introduction to theoretical and methodological issues in chapter 1, this chapter will provide a much more detailed and comprehensive account of the relevant literature. The issues of cartelisation and cooperative producer conduct, especially in the natural resources sector, have been studied extensively by both economists and international relations (IR) scholars. In the IR literature, some studies exclusively focus on cartels such as the ones by Dag Claes,[1] Stephen Krasner,[2] Zuhayr Mikdashi,[3] Karen Mingst,[4] Theodore Moran[5] and Debora Spar.[6] Other works with a focus on international cooperation, e.g. by Robert Keohane[7] and by Helen Milner (in a journal article[8] and a book[9]), also address some issues related to cartelisation. A first-rate introduction to natural resource cartels from an economics perspective can be found in a journal article by David Teece et al.[10]

This chapter will start by surveying the IR literature on cooperation and its relation to the scholarship on cartelisation. The variables *cooperation* and *market power* will then be discussed as well as ways to measure the role of cooperation in terms of explaining market power. Following that, the main method, the conduct parameter model (CPM), will be explained in detail. Finally, the data requirements for the CPM

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1 Claes, *The Politics of Oil-Producer Cooperation*, 2001.
2 Krasner, "Oil is the Exception", 1974.
3 Mikdashi, „Cooperation among Oil Exporting Countries with Special Reference to Arab Countries: A Political Economy Analysis", 1974.
4 Mingst, "Cooperation or Illusion: An Examination of the Intergovernmental Council of Copper Exporting Countries", 1976.
5 Theodore Moran, "Managing an Oligopoly of Would-Be Sovereigns: The Dynamics of Joint Control and Self-Control in the International Oil Industry Past, Present, and Future", *International Organization*, vol. 41, no. 4, Autumn 1987.
6 Debora Spar, *The cooperative edge: the internal politics of international cartels*, Cornell University Press, 1994.
7 Robert Keohane, *After hegemony: cooperation and discord in the world political economy*, Princeton University Press, 1984.
8 Milner, "International Theories of Cooperation among Nations: Strengths and Weaknesses", 1992.
9 Milner, *Interests, Instiutions and Information: Domestic Politics and International Relations*, 1997.
10 Teece et al., 1993), p. 1132.

will be evaluated and further details on the case study method as well as the case selection will be provided.

3.1. Theoretical Approaches and Tools

3.1.1. International Relations Theory and Political Context

The study of energy resources in general and natural gas in particular are topics that fall between the disciplines of political science and economics. International Political Economy (IPE), an important sub-field of International Relations (IR) theory, connects both the political and economic dimensions that are essential to the study of this research subject. Much of the IPE scholarship has focused on topics such as international trade and monetary relations between states.[11] In addition to these issue areas, a political-economy approach appears best suited for the analysis of cooperation among natural gas producing and exporting states. Robert Gilpin offers a comprehensive definition of political economy, which entails:

> ... a set of questions to be examined by means of an eclectic mixture of analytic methods and theoretical perspectives. These questions are generated by the interaction of the state and the market as the embodiment of politics and economics in the modern world. They ask how the state and its associated political processes affect the production and distribution of wealth and, in particular, how political decisions and interests influence the location of economic activities and the distribution of the costs and benefits of these activities.[12]

Specifically, this thesis studies how political and economic decisions influence economic activities. This is important since current analyses of gas-producing states'

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[11] Detlef Sprinz and Yael Wolinsky, “Introduction: Methodology in International Relations Research”, in D. Sprinz and Y. Wolinsky, eds., *Cases, Numbers, Models: International Relations Research Methods*, University of Michigan Press, 2004, p. 8.

[12] Robert Gilpin, *The Political Economy of International Relations*, 1987, p. 9.

behaviour in markets are based mainly on narrowly-focused economic models—mostly employing abstract game theory—that often do not use empirical data nor take into account the broader context. Yet, states as actors in markets operate differently than purely economic entities such as firms. Dag Claes points out in his study on oil-producing states that "the rationale of states is different from the rationale of firms [since] states have a more complex set of interests."[13] One must therefore take into account the political dimension, especially how considerations of political power may motivate cooperative behaviour.

Before presenting details regarding types of cooperation and ways of assessing the extent to which cooperative efforts explain market power, the concept itself within IR theory needs to be discussed. According to Helen Milner, there is widespread agreement[14] on the definition of cooperation developed by Axelrod and Keohane. They state that "cooperation occurs when actors adjust their behaviour to the actual or anticipated preferences of others."[15] This expression summarises Keohane's more formal definition[16] as presented in chapter 1.

Milner argues that it is very difficult to establish an empirical classification of cooperative events.[17] She states: "Establishing the counterfactual may pose great problems: without some process of policy coordination, would the states have behaved differently? [...] Determining the beginning and end of an attempt at cooperation can also

[13] Claes, *The Politics of Oil-Producer Cooperation*, 2001, p. 2.
[14] Milner, "International Theories of Cooperation among Nations: Strengths and Weaknesses", 1992, p. 467.
[15] Axelrod and Keohane, "Achieving Cooperation under Anarchy: Strategies and Institutions," 1986, p. 226.
[16] "Intergovernmental cooperation takes place when the policies actually followed by one government are regarded by its partners as facilitating realisation of their own objectives, as the result of a process of policy coordination."
[17] Milner, "International Theories of Cooperation among Nations: Strengths and Weaknesses", 1992, p. 468.

be problematic. Moreover, it may not be easy to demonstrate that each side adjusted its policies in the expectation of gains."[18]

Keohane argues that cooperation among states should not be viewed independently as disconnected and isolated occurrences. Instead, we should "understand patterns of cooperation in the world political economy. Accordingly, we need to examine actors' expectations about future patterns of interaction, their assumptions about the proper nature of economic arrangements, and the kinds of political activities they regard as legitimate. That is, we need to analyse cooperation within the context of international institutions."[19]

Having introduced some basic theory on cooperation, it is necessary to take a closer look at how this applies to the case of international institutions. A widely used definition describes institutions as "persistent and connected set of rules (formal and informal) that prescribe behavioural roles, constrain activity and shape expectations."[20] The broad concept of international institutions includes three sub-groups as distinguished by Keohane, ranging from informal to formal arrangements. First, *conventions* are "informal institutions with implicit rules and understandings." Second, *regimes* are "institutions with explicit rules agreed upon by governments." Third, *formal intergovernmental organisations*[21] are "purposive entities [...] capable of monitoring activity and reacting to it and are deliberately set up and designed by states."[22]

This definition and the classification of institutions are more specific than the earlier definition of cooperation. Yet, Milner's point about the difficulty of assessing the impact of cooperation applies to institutions as well. Given there is cooperation, it is difficult to establish counterfactuals that allow one to determine what the non-

[18] Ibid.
[19] Keohane, 1984, p. 56.
[20] Keohane, 1984, pp. 3-4.
[21] And transnational nongovernmental organisations.
[22] Keohane, 1984, pp. 3-4.

cooperative outcome would have been. Similarly, a crucial problem in "explaining the implications of a certain institutionalisation (formal or informal) is the counterfactual question what would the actors' behaviour have been without the present institution."[23] For the purposes of studying natural gas markets, a combination of a model from the field of industrial organisation and qualitative, empirical analyses of the political context will help address these issues since the context in which natural gas markets operate is both driven by political and economic forces.

The degree of institutionalisation of an international organisation is often considered to be an important determinant of the cooperative effectiveness of the organisation (see work for example by Richard Herrmann,[24] Peter Gourevitch,[25] Duncan Snidal[26] and Stephen Walt[27]). Milner sees this rather differently. She argues that: "[the] relationship between *policy coordination* and *cooperation* is also important. Analysts often differ over what they mean by these terms as well as over the relationship between them. Policy integration, I argue, is a form of international cooperation; cooperation and coordination refer to the same basic phenomenon."[28] Hence positive cooperative outcomes could also be the result of *policy integration* rather than higher levels of institutionalisation. Successful policy integration is driven by "greater levels of commitment"[29] to joint policies rather than to the international institution.[30] This issue will be explored in greater detail in chapter 7 after the empirical evidence and the analyses have been presented in the case study chapters 4, 5 and 6.

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[23] Claes, *The Politics of Oil-Producer Cooperation*, 2001, p. 139.
[24] Herrmann, "Linking Theory to Evidence in International Relations", 2005, p. 128
[25] Gourevitch, "The Governance Problem in International Relations", 1999, p. 140.
[26] Duncan Snidal, "Coordination vs. Prisoners' Dilemma: Implications for International Cooperation and Regimes", *The American Political Science Review*, vol. 79, no. 4, December 1985, p. 938.
[27] Stephen Walt, "Why alliances endure or collapse", *Survival*, vol 39, no. 1, Spring 1997, p. 166.
[28] Milner, 1997, p. 8.
[29] Ibid., p.9.
[30] Milner cites different levels of cooperative policies (from low to high): "The exchange of information to facilitate tacit policy coordination"; "The negotiation of specific policy 'deals' on a one-time basis"; "The establishment of a set of rules guiding policy choice" and "The surrender of national policy instruments often to form a larger policy community." (all quotes from Milner, 1997, p. 9.)

3.1.2. Cartel Literature

Debora Spar connects the concepts of cooperation and cartelisation in the following way. "As with cooperation in general, cartels emerge from competition. They arise because the competitors realise they can advance their own self-interest by working with each other. Together they can dominate the market and dictate the price that consumers must pay. By refraining from competition, cartel members reap the rewards of greater stability and higher long-term profits."[31] Given significant similarities between the issue of cooperation in political science and the study of cartels,[32] international relations scholars have approached and studied cartels as puzzles of cooperation in two different ways. First, some "translated the phenomenon of cartelisation into an implicit model of international cooperation"[33] drawing on game-theoretic models such as Snidal. Another approach of an inductive nature was used by Spar: "Rather than refer to deductive models of cartel behaviour, I go back to the markets themselves, looking to identify the concrete factors that shaped or constrained the formation of cartels."[34] Such an inductive approach will be used in this thesis as well by conducting detailed, empirical case studies of various gas markets.

Chapter 1 already summarised both important structural and procedural challenges faced by cartels. It was also argued before that the structural conditions in gas markets are favourable due to a high degree of market concentration,[35] which in each case study will be measured with the Herfindahl Index of market concentration. Demand for gas in the two regions under consideration, Europe and Asia,[36] is relatively

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[31] Spar, 1994, p. 2.
[32] Ibid.
[33] Ibid.
[34] Spar, 1994, pp. 2-3.
[35] See market overview in chapter 2 and case-relevant data in chapters 4, 5 and 6.
[36] See chapter 2. Significantly import-dependent markets in which GECF members dominate a large share of supply are to be found in these two regions.

inelastic and therefore conducive to cartelisation. Other structural factors include market entry barriers and a background of shared cooperation among the members of the organisation.

Empirical studies found that other markets, e.g. oil, mercury, uranium and diamonds, "are characterized to a greater or lesser degree by external market environments in which demand elasticities, as well as supply elasticities of non-members are relatively low."[37] However, "success for the cartel seems to depend on a viable internal 'structure' - such as the CSO in the case of diamonds, and a 'club' in the case of uranium - bolstered by governments in all cases. The cartels selected seem to indicate that the external market environment molds the outcomes associated with attempts at cartelization, but that internal structure also matters." However, the need for tight internal governance is softened if the producers are satisfiers, as may be the case with certain OPEC producers."[38]

Hence, internal procedural issues are also considered important. Such internal challenges may include agreeing on a schedule for production, i.e. allocating production quantities or quotas among members. Another internal challenge in cooperative producer associations is to detect and punish cheating, i.e. non-compliance with the cartel's collective decisions. Both structural and procedural issues will be discussed in the cases and in the ensuing comparison of results across cases in chapter 7.

3.1.3. Methodology: Approach and Measurement of the Variables

Measuring cooperative performance in international relations—be it in regimes or in more formal organisations, which can be part of regimes—is fraught with difficulties, some of which are mentioned above. Following the issues Milner pointed out, in-

[37] Teece et al., 1993, p. 1164.
[38] Ibid.

cluding the difficulty of establishing counterfactuals to measure the impact of cooperation and institutions, Gutner and Thompson proposed a new framework to look at the performance of international organisations.[39] Performance, according to their definition and conceptualisation could mean both "performance" in terms of *process* and in terms of *outcome* as shown in Figure 3.1.[40] As the next section on case studies will show, an outcome-based approach is adopted for the purposes of this research. In fact, it is a specific outcome—the existence of market power in gas-importing countries—that I aim to explain by considering various possible causes, with a particular focus on cooperation as one explanatory variable.

Figure 3.1: Process- and Outcome-based Approaches[41]

Case Study Methodology. While the analytical tools used within a case study can be diverse, case study research in international relations and political science as an overall approach belongs to the category of qualitative research. Mahoney and Goertz explain that "a core goal of qualitative research is the explanation of outcomes in individual cases. A central purpose of research is to identify the causes of these specific outcomes for each and every case that falls within the scope of the theory under investigation. By starting with cases and their outcomes and then moving backward toward the

[39] Tamar Gutner and Alexander Thompson, "The politics of IO performance: A framework", *The Review of International Organizations*, vol. 5, no. 3, 2010.
[40] Ibid., p. 229.
[41] Ibid., p. 234

causes, qualitative analysts adopt a 'causes-of-effects' approach to explanation."[42] In comparison with the causes-of-effects approach adopted here, the effects-of-causes approach, which is used in large-N statistical analyses, is primarily concerned with estimating average effects.[43] Specifically, cases of natural gas markets and trade relationships will be selected in which the existence of market power is very likely or indeed a certainty. To what extent this market power can be explained by producer cooperation is the essential task of each case study. The *effect* (or dependent variable) in question is market power and the possible *causes* (independent variables) of this effect – with a particular focus on producer cooperation – will be examined.

The important elements of the case studies will include the following. First, an in-depth qualitative analysis of cooperative behaviour that considers the political context will be conducted. In particular, it will involve a detailed qualitative examination of the independent study variable "cooperation." For example, analytical tools will include comprehensive field research in relevant countries in order to gather data on prices and costs, to conduct interviews with diplomats, officials, scholars, energy company executives, journalists and others. Questions that I will endeavour to answer include (but are not limited to): What does the GECF do as an organisation? What do the GECF members do on a bilateral government-to-government level and on a corporate level? Is there much cooperation and who exactly does the "cooperating"? This will be mainly a descriptive effort.

The *cause of effect* approach requires one to consider other possible causes (independent variables) of the effect. However, econometric analyses to establish precise causality of various factors are not possible because of the small number of observations. Hence, the second part of each case study will employ an economic model from

[42] Mahoney and Goertz, "A Tale of Two Cultures: Contrasting Quantitative and Qualitative Research", 2006, p. 230.
[43] Ibid., pp. 230-231.

the field of Industrial Organisation to measure to what extent producer cooperation explains the existence of market power while also taking into account other possible causes of high market power. That is, I will measure performance of the GECF regime by employing a model from the field of economics.

The study of international relations has a long tradition of using analytical approaches from related disciplines such as law, history and economics. Maliniak and Tierney argue that "a large and growing proportion of the IR literature is 'non-paradigmatic' – that is, theoretically inspired empirical work that does not fit neatly into one of the […] major paradigms."[44] This research project seeks to combine diverse methods from political science and economics as well.

3.1.4. Empirical Description of the Independent Variable: Cooperation

This section will use a descriptive method in order to gather all necessary facts, data and other relevant information. The specific acts of cooperation will be described in each of the case studies while a general overview of the factor cooperation is given here. If one is to study cooperation among natural gas exporters, one must determine what exactly constitutes acts of cooperation within the specific context of natural gas markets and trade relationships. As Milner pointed out, it is difficult to establish an empirical classification of cooperative events.[45] Since there is no widely accepted general taxonomy, a classification according to degrees of cooperation has to be specific to the subject area.

Cooperation can take various forms and span a range of activities. Therefore, a taxonomy of such a variety of cooperative behaviour among natural gas exporters at different levels—including the international, bilateral and corporate level—was presented

[44] Daniel Maliniak and Michael Tierney, "The Study of International Organizations within (American) Political Science", Paper presented at Conference on the Political Economy of International Organizations, Monte Verita, Switzerland, February 2008, p. 7.
[45] Milner, "International Theories of Cooperation among Nations: Strengths and Weaknesses", 1992, p. p. 468.

in chapter 1. The relevant categories of cooperation include discussions, informal and formal cooperation as well as integration, and these different types of cooperation take place at various levels: at the international stage, on a bilateral level between national governments and finally at the corporate level.

While "discussions" may traditionally not be considered cooperative acts, they have the potential to contribute to *mutual policy coordination*[46] and hence are included here as the weakest form of cooperation. Moreover, some explanation might be necessary regarding the distinction between informal and formal cooperation. While formal cooperative action is binding and governed by some kind of contract or treaty, the informal type of cooperation is defined as being non-binding and not governed by such contractual agreements.

Furthermore, as the taxonomy shows, one must look at cooperation in the broadest possible way to capture cooperative acts within the broader regime. Indeed, it may very well turn out that a high degree of institutionalisation of the GECF is not very important, but that cooperation among GECF members works regardless. Moreover, as will become obvious in the case selection towards the end of this chapter, it is envisaged that the results of the analysis will demonstrate significant variation on the independent (study) variable, cooperation. The case selection will provide a more detailed discussion of these issues.

3.1.5. Introducing the Dependent Variable: Market Power

Since it is the stated objective of GECF members to maximise the value of their resources and to advance their economic interests through cooperation, it is necessary to study cooperative behaviour and to assess the extent to which it explains natural gas ex-

[46] Keohane, 1984, pp. 51-52.

porters' market power. The preceding section introduced the concepts of cartelisation and cooperation mainly from a political science perspective. This section will present the economic theory approach to cooperation among producers and exporters. Moreover, while the description of cooperative policies, intentions and acts is very useful, the problems surrounding the measurement of cooperative performance in IR remains.

The conduct parameter model (CPM) allows one to analyse both cooperative behaviour itself and to quantitatively estimate its effectiveness as well. Such estimates are useful and indeed necessary given that it is very difficult to obtain solid empirical evidence confirming that the producers in fact do cooperate. Estimates obtained from economic modelling also allow one to take into account not just explicit, but also anticiapatory and tacit cooperation between producers. Linking both IR and economic approaches is expected to be fruitful for the purposes of this research. This section will now introduce in detail the dependent variable—market power—and it will show how the CPM can help establish reliable estimates of how much cooperation explains the existence of this market power, taking into account other important factors.

The study of market power is an important subject the field of Industrial Organisation (IO).[47] Economic theory shows that under competition, markets generally[48] tend to allocate resources in such a way that overall *social welfare* (that is the combined economic benefit to both producers and consumers, called *producer surplus* and *consumer surplus*) is maximised. Competition, over time, will eliminate *supranatural profits,* i.e. the difference between the market price and a firm's long-run cost of production. More-

[47] There is an extensive body of literature on market power and cartelisation. Basic intermediate theory can be found in: Dennis Carlton and Jeffrey Perloff, *Modern Industrial Organization,* 4th edition, Addison Wesley (2004), chapters 3, 4, 5, 6 and 8.

Cento Veljanovski, "The Economics of Cartels", *Finnish Competition Law Yearbook*, 2006.

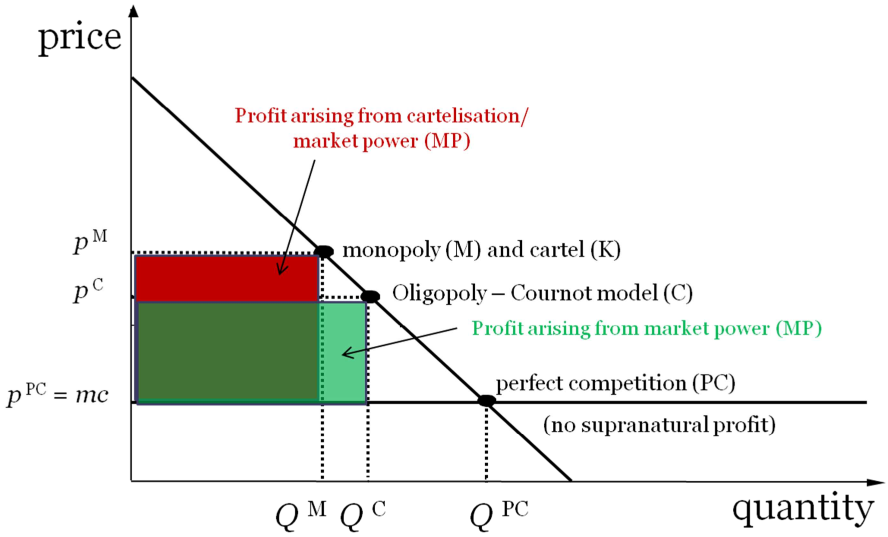
Advanced theory and empirical applications can be found in:

Jeffrey Perloff, Larry Karp and Amos Golan, *Estimating Market Power and Strategies*, Cambridge University Press (2007), chapters 1, 2 and 3.

[48] There are exceptions: market failure occurs when certain goods or services are mispriced by the market mechanism and hence will be either overprovided or underprovided. One possible remedy is regulation.

over, under competition, no single firm will be influential enough to have an effect on the market price. If, however, a firm or a group of firms have market power, they are not *price takers* but instead *price makers*.

Figure 3.2: Schematic Illustration of Competitive, Oligopoly and Monopoly/Cartel Outcomes[49]



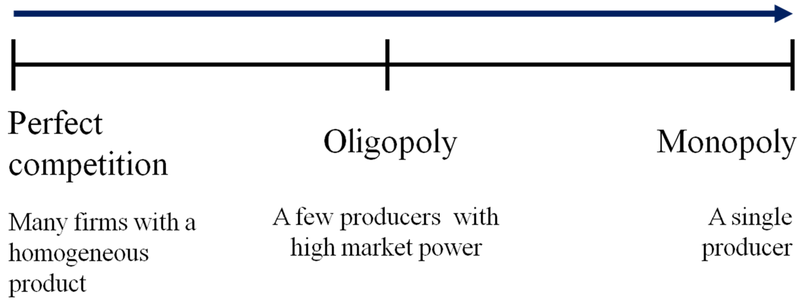
However, the welfare effects of oligopolies are more complicated since one must take strategic interaction among firms into account. In a market with only a few actors, firms' output and pricing decisions are interdependent. Figure 3.2 represents very schematically the underlying concept. As one moves along the diagonal curve from competition[50] to oligopoly[51] to monopoly/cartel,[52] one can see that more producer cooperation leads to lower output at higher prices.

Market power is the ability of a single company or a group of companies to increase and sustain a price that is measurably above the competitive market price. Such market power can arise from at least three major sources, which will be discussed in detail in the next section. One of those sources is anti-competitive collusion (i.e. a form of

[49] Figure: author.
[50] With many firms.
[51] With a few non-collusive firms in the market.
[52] With one firm (a monopolist) or a group of firms (a cartel) acting as a quasi-monopoly.

cooperation).[53] All else being equal, an increase in cooperation among producers will increase firms' market power. With prices above long-run marginal cost, this reduces overall social welfare since the exercise of market power creates economic inefficiencies called *deadweight losses*. The exercise of market power also increases the *producer surplus* at the expense of consumers, i.e. a transfer of wealth from consumers to producers takes place.[54]

Figure 3.3: Market Power of Firms[55]



Collusion and cartels are therefore illegal in most countries with highly developed markets and sophisticated legal and institutional infrastructure. Whenever producers are caught jointly fixing prices or restricting output (to raise prices), they will be severely fined. However, market power exercised by states and state-owned companies in export markets ultimately cannot be prohibited by national anti-trust authorities in importing countries.

The Organisation of Petroleum Exporting Countries (OPEC), one of the most visible international cartels, made changes to the way in which it influences the global oil market in the early 1980s in response to a decision by the GATT, the predecessor of

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[53] Wanwiphang Manachotphong, "Investigating Market Power and Collusion under Demand Change: An Analysis of the UK Milk Market" in *Essays on Applied Industrial Organisation*, DPhil Thesis, University of Oxford, Trinity Term 2009, p. 7.
[54] Carlton and Perloff, 2004, p. 91. and pp. 95-96.
[55] Illustration: author.

the World Trade Organisation (WTO).[56] The ruling prohibited joint price-setting in international trade and hence OPEC changed its mechanism to exercise market power to manipulating production quotas. Instead of agreeing to jointly set prices, a very similar effect of higher prices could be achieved by reducing output together. Despite these international regulatory efforts, and unlike in a domestic context, there is no effective and comprehensive legal or regulatory recourse to the exercise of market power in export markets.

The competitive market model—in which market power cannot exist—rests on a variety of assumptions, including: a large number of buyers and sellers, the absence of market entry barriers, perfect information, no transaction costs, profit maximisation as firms' foremost objective and homogenous products. The economic analysis in this thesis will employ this model and consider the results as an ideal type. Some of the assumptions will be relaxed in the ensuing comprehensive case study research. However, three assumptions need further explanation at this point.

First, the assumption of firms as profit-maximisers is somewhat problematic since (partly) state-owned and -run natural gas companies are the subjects of this investigation. If a government and a company are closely intertwined, the principal economic activity does not necessarily seek to maximise shareholder value in the way a private company would do. The company's principal objective may be to maximise the state's or the government's benefit rather than company profits. Or the company's leadership—often a small group of individuals with good contacts in the government—may seek to maximise their own short-run personal gain rather than invest in the long-term profitability of the company. Ultimately, the assumption of standard profit-maximisation is defensible in this case for three reasons. First, if a government, partly or completely,

[56] At the time the WTO was called the General Agreement on Tariffs and Trade (GATT).

owns the national natural gas company, the state is a shareholder whose profits would be maximised under the standard assumption. And, second, the government collects taxes—hence tax revenue is linked to company performance. Finally, some national gas companies such as Gazprom have to heavily subsidise natural gas consumption in their domestic market by accepting comparatively low prices. However, those companies still tend to be profit-maximisers in export markets in which they charge the highest possible price—often a multiple of the artificially low domestic price—to extract as much value as possible.

Second, while the profit-maximisation principle is justifiable, two other assumptions need to be put into perspective to better reflect the market structure in highly import-dependent gas markets. The number of sellers tends to be very low, hence favouring oligopoly models rather than those presuming perfect competition. Closely linked is the issue of market entry. Under perfect competition there are no barriers to entry, but in oligopolistic markets such barriers are usually high. Therefore, while the opposing market models of *perfect competition* and *monopoly/cartel outcomes* are theoretical ideal types, an oligopoly more accurately reflects natural gas trade relationships between major exporters and importers. Furthermore, oligopolistic markets with entry barriers favour the existence and exercise of market power. More relevant details will be provided in the ensuing introduction to the specific model, the Conduct Parameter Method (CPM), employed in this research.

The welfare implications of market power and anti-competitive market structures were mentioned briefly before. While relatively simple to estimate under the assumptions of both perfect competition and monopoly, the welfare effects of oligopolies are more complicated since once must take strategic interaction among firms into account. In a market with only a few actors, firms' output and pricing decisions are interdependent.

3.1.6. Measuring Market Power and Collusion in Natural Gas Markets

There is an extensive body of literature on the measurement of market power. The approach used for the purposes of this research is based on a modified version of the Conduct Parameter Method (CPM).[57] The CPM was formalised by Bresnahan[58] in an effort to include firm conduct into analyses of market power. The traditional paradigm linked market structure (e.g. concentration) to market outcomes (e.g. supranatural profits as a result of market power). This causal link turned out to be weak in empirical studies.[59]

Therefore, the CPM includes firm conduct—from perfect competition to perfect collusion—and the price elasticity of demand in addition to the traditional market concentration measure. This approach was part of an overall effort labelled New Empirical Industrial Organization (NEIO). This NEIO was criticised since some economists estimated simultaneously *conduct* and *marginal cost*, which sometimes led to biased results.[60] Yet, since we use observed or estimated prices, marginal cost, demand elasticity and market concentration and do not estimate two parameters simultaneously, the major criticisms of the NEIO approach do not apply here.

The CPM takes into account three sources of market power: inelastic demand, high market concentration and collusion. If one defines market power as the ability of

[57] Manachotphong, "Investigating Market Power and Collusion under Demand Change: An Analysis of the UK Milk Market" , 2009, p. 7.
[58] Timothy Bresnahan, "Empirical Studies of Industries with Market Power" in *The Handbook of Industrial Organization,* Schmalensee and Willig (eds.), New York, North-Holland, 1989.
[59] Perloff et al., 2007, chapter 2.
[60] Manachotphong, "Investigating Market Power and Collusion under Demand Change: An Analysis of the UK Milk Market", p. 9.

firms to set prices above the competitive level, then one can formalise conduct parameter method as follows: The Lerner Index is defined in expression 3.1a and relates to market characteristics as shown in 3.1b:

$$L_t = \sum_i s_{it} \frac{P_t - MC_{it}}{P_t} \tag{3.1a}$$

$$L_t = -\frac{H_t \theta_t}{\varepsilon_t} \tag{3.1b}$$

Subscript *i* denotes a gas producing firm and *t* denotes time, L_t is the industry-wide Lerner Index adjusted by demand elasticity, s_{it} is a producer's share in the gas market, P_t stands for price, MC_{it} is the marginal cost, H_t denotes the Herfindahl index of market concentration and ε_t is the price elasticity of demand for natural gas in a given import market. The conduct parameter (sometimes also called *coefficient of cooperation*) is symbolised by θ_t.[61]

The simple Lerner Index is a measure of market power. It calculates the price-cost-margin and shows to what extent (if any) a firm is able to charge prices above its marginal cost: L=(P-MC)/P. If $L = 0$ indicates that price equals marginal cost and the firm enjoys no market power. $L = 1$ can only be achieved by a monopolist which enjoys a very high degree of market power. Lerner Index estimates in oligopolistic market structures such as in natural gas markets lie within this closed set [0,1]. N.B. this is true of the simple Lerner Index, but the Lerner Index employed in the CPM above is slightly modified so that results will not necessarily lie within [0,1] as will become evident later. The Herfindahl Index equals the sum of all firms' squared market shares and is easily formalised as shown below, where x_i is a firm's output and X is the total market output, so that *s* denotes the market share of firm *i*.:

[61] The formula is based on Manachotphong, 2009, pp. 7-8.

$$H = \sum_{i=1}^{n} \left(\frac{x_i}{X}\right)^2 = \sum_{i=1}^{n} s_i^2 \tag{3.2}$$

Expressions 3.1a and 3.1b show that market power, i.e. firms' ability to charge prices above marginal cost, comes from three sources: first, a high concentration in the respective market **H**; second, inelastic demand **ε** and finally, a high degree of cooperation among firms **θ**. To measure this coefficient of cooperation **θ** one must gather the following data: market shares in order to assess concentration, elasticity of demand estimates and marginal cost figures.[62]

Before the CPM formula employed here will be explained in greater details, a few words of caution are in order. First, the CPM "is built upon a static conjectural variations framework, e.g. Bertrand/perfect competition, Cournot oligopoly and monopoly."[63] These are one-period frameworks in the field of industrial organisation with different assumptions as to how firms interact. In the Bertrand model, firms set prices rather than output. Another assumption is that firms face no capacity constraints. The outcome of the Bertrand model is the same as under competition where price equals marginal cost.[64] The Cournot model often assumes that companies produce a homogeneous product at constant marginal cost. Firms in the Cournot framework will base their decisions on output rather than price after they have considered the possible reaction of rival firms. It is a non-cooperative oligopoly outcome. Prices and output levels will fall between the competitive and monopoly outcomes as illustrated in Figure 3.2.[65] A monopolist (or a group of firms that cooperates perfectly) will maximise profits where marginal cost equals marginal revenue. Since a monopolist faces a different marginal revenue curve than firms in a competitive market, the output will be even lower than under the

[62] Ibid., p. 8.
[63] Ibid., p. 10.
[64] Veljanovski, 2006, p. 16.
[65] Ibid.

Cournot framework while the price level will be even higher.[66] Since it is impossible to ascertain the actual decision rules of firms, i.e. which game they play in an oligopoly situation, these well-studied models are a solid basis for measuring market power.

A second caveat is that the CPM does not include every possible factor that may influence market power. For example, market entry barriers could be a reason for firms' supranatural profits.[67] Manachotphong cites a case study which suggests that "the conduct parameter understates collusion if the threat of entry by [new] suppliers is not accounted for."[68] This is something to bear in mind with regard to gas markets and it is a factor that will be studied subsequently in the empirical analysis of factors not considered in the model. While new pipeline gas suppliers may not enter a market easily, those consuming countries which possess LNG regasification terminals could receive some flexible, uncontracted LNG shipments from new suppliers relatively easily. While this possibility of LNG supplies may understate collusion among producers, the opposite may be true if there is concentration not just among suppliers, but also among buyers. These issues will of course also be addressed in the contextual analysis following the economic calculations in each case study.

A full derivation of the CPM model is to be found in the appendix of this chapter. The formula at which we arrive is the following:

$$\theta_t = -\frac{\varepsilon_t L_t}{H_t}$$

Here, subscript *t* (as before) stands for time. Hence H_t is the Herfindahl index of market concentration at time *t* while L_t and θ_t are the market-wide Lerner Index and the conduct parameter at *t*. The conduct parameter $\theta_t = \partial Q_t / \partial q_{it}$, as defined by Manachot-

[66] Carlton and Perloff, 2004, chapter 4.
[67] Manachotphong, "Investigating Market Power and Collusion under Demand Change: An Analysis of the UK Milk Market", 2009, p. 10.
[68] Ibid., p. 44.

phong, “measures how much output of one [gas producer] matters to the total output of the industry [in a given market].”[69] The conduct parameter can range from zero to 1/H.

Spectrum of Possible Conduct Parameter Outcomes

θ = 0	θ = 1	θ = 1/H
Perfect Competition	Non-collusive oligopoly (Cournot)	Perfect Collusion

A conduct parameter of zero ($\theta_t = 0 = \partial Q_t/\partial q_{it}$) implies that an output change by one gas suppliers does not affect the total output in a market. If a firm changes its output and the total output of the industry changes by exactly the same amount, then $\theta_t = 1 = \partial Q_t/\partial q_{it}$. This is the Cournot oligopoly outcome without cooperation.[70] Lastly, what would happen if there were perfect collusion among producers?

“An *x* percent increase in [a firm *i*’s market share] q_{it} would result in an *x* percent increase in the industry’s quantity [Q_t].”[71] One can therefore conclude that producers have achieved perfect collusion if the conduct parameter equals θ = 1/H.

$$L_t = -\sum_i s_{it}^2 \times \frac{1}{\varepsilon_t} \times \frac{\partial Q_t}{\partial q_{it}}$$

$$= -\sum_i \underbrace{s_{it} \times \frac{1}{\varepsilon_t}}_{1} \times \underbrace{\frac{\partial Q_t}{\partial q_{it}} \times \frac{q_{it}}{Q_t}}_{1}$$

[69] Ibid., p. 46.
[70] Ibid.
[71] Ibid.

$$L = -\frac{1}{\varepsilon_t} \rightarrow in\ \theta_t = -\frac{\varepsilon_t L_t}{H_t} = 1/H_t$$

This analysis—whether and to what extent collusion explains market power—has been completed, the economic welfare implications will be considered. Prices above marginal cost imply both an economic efficiency (deadweight loss) and an economic rent that accrues to producers at the expense of consumers. Both will be discussed in the relevant case study chapters and chapter 7.

3.1.7. Data Requirements for CPM

The data requirements for the Conduct Parameter Method are considerable. Natural gas import prices and quantities in the importing market are necessary. Furthermore, estimates of the price elasticity of natural gas demand in the importing country will be needed. Moreover, the CPM analysis requires data or estimates of gas producers' long-run marginal cost (LRMC). Price and marginal cost data allow one to calculate the price-cost margin or Lerner Index. Quantities of gas consumed are essential for the analysis of market shares and the Herfindahl Index of market concentration. Finally, the price elasticity of gas demand is the third important variable.

The idea is to obtain reasonable estimates from reliable sources in cases where precise, official data is not available. It is, after all, better to be approximately right instead of being "wrong with infinite precision."[72] In cases of approximate estimates, sensitivity analyses will be carried out.

Prices. Prices for each case study are available from various sources. The International Energy Agency (IEA) publishes pricing data in "Energy Prices & Taxes" quarterly in addition to maintaining a database on natural gas prices. The magazine World

[72] Nassim Taleb, *The Black Swan: The Impact of the highly Improbable*, Random House, 2007, p. 74.

Gas Intelligence (WGI) and the consulting firm *Platts* also regularly publish data on natural gas prices. Furthermore, the German Ministry of the Economy publishes monthly gas price data (*Monatliche Erdgasbilanz*) for Europe. Moreover, the gas industry database Cedigaz provides detailed pricing data. Finally, some academic papers and press reports on natural gas contracts and prices may – if appropriate care is taken – be useful. The appropriate sources will be consulted for each case study.

Quantities. Market shares of natural gas producers in import-dependent countries can be calculated on the basis of widely available data from the annual BP World Energy Statistics and the Cedigaz database. The market shares based on the 2008 figures have already been calculated in Chapter 2.

Data on marginal cost—the cost a firm incurs for producing an additional unit—is notoriously difficult to obtain. Often, firms themselves only have a rather vague estimate of their own products' marginal cost. Those who do not have access to firms' internal data, face an even more delicate task concerning the estimation of marginal cost. Yet, there are a variety of MC estimates for natural gas production, e.g. concerning Russia. A World Bank paper included the following cost components:

Estimating Long Run Marginal Cost for Pipeline-Delivered Natural Gas
The following components make up the calculation of the undiscounted long run marginal cost of natural gas:

1. Exploration costs (if applicable – depends on whether production comes from existing proven reserves or not).
2. Upstream development costs. (Development costs are estimated in the range of …$ to …$ per tcm.)
3. Transmission costs. This includes transportation in the upstream and midstream sectors up to the exporting countries' border. The long run marginal cost associated with trunk transmission gas lines is estimated at about $.../tcm per 100 km.
4. Distribution costs. These costs only occur the producing country's domes-

tic market and are not applicable here.

Source: Adapted from Tarr and Thomson.[73]

The appropriate long-run marginal cost is in most cases composed of production and transportation cost. Including the transportation cost up to the importing countries' borders is preferable since it enables one to better compare market power estimates across cases. For example, Tarr and Thomson estimated Gazprom's average long-run marginal cost in 2003 to be $35 to $40 per tcm.[74]

Similar analyses will have to be carried out for other producing countries and firms, such as Sonatrach of Algeria, the National Oil Cooperation of Libya and the National Iranian Gas Export Company and others. The above figures for Gazprom Export are still fundamentally valid, but one needs to account for overall changes in production cost. The energy consulting firm Cambridge Energy Research Associates (now called IHS CERA) publishes two natural gas production cost indicators called the Upstream Operating Cost Index (UOCI) and the Upstream Capital Cost Index (UCCI). Hence, instead of creating a completely new marginal cost estimate for Gazprom, the 2003 World Bank figures can be updated by applying one of those two indicators to account for cost inflation in the subsequent years.

Some economic models for exhaustible natural resources maintain that a *depletion cost* component ought to be part of the accurate long-run marginal cost estimate.[75] This would take into account the fact that non-renewable natural resources can only be produced once and therefore producers face a trade-off as to whether to produce a given unit of the resource today or in the future. However, "the size of the *depletion premi-*

[73] Tarr and Thomson , 2004 , p. 1181.
Tarr and Thomson do not include transmission costs between the Russian border and the importing country's border. This will be added for the purpose of this analysis.
[74] Ibid.
[75] Ibid., p. 1180.

um[76] is inversely related to the size of the reserves. Since more than 80 years of reserves remain and there are prospects for new discoveries, the depletion premium would be close to zero in the case of Russia."[77] Tarr and Thomson add that "empirical research has cast doubt on whether a depletion cost should be added to the LRMC, since it has shown that real prices of exhaustible resources (or the value of a unit of the remaining resource) have not persistently increased over the past 125 years. The empirical evidence has shown that new discoveries and technological progress have significantly mitigated the effects of finite availability of nonrenewable resources on their scarcity for production and consumption activities."[78]

Elasticity of natural gas demand. Apart from the market concentration and the Lerner Index, the conduct parameter method requires data on a product's price elasticity. "Economic theory says that as energy prices rise, the quantity of energy demanded will fall, holding all other factors constant. Economic theory also suggests that consumers' demand for energy is less sensitive to price changes than the demand for many other commodities. Economists define consumers' sensitivity to price changes as a measure of price elasticity."[79] One can calculate the price elasticity of demand as follows:

$$\varepsilon_D = \frac{\%\Delta\, Q}{\%\Delta\, P}$$

where $\%\Delta\, Q$ is the percentage change in quantity of natural gas demanded and $\%\Delta\, P$ is the percentage change in the natural gas price. Since ε_D is a ratio of two percentages, it is not expressed as a specific unit of measure. There are two major types of

[76] Often also called 'user cost' or 'scarcity rent' in the literature on resource economics.
[77] Tarr and Thomson, 2004, p. 1181.
[78] Tarr and Thomson, 2004, footnote no. 16, p. 1180.
[79] Mark Bernstein and James Griffin, "Regional Differences in the Price-Elasticity of Demand For Energy", *RAND Technical Report*, Santa Monica, 2005, p. 2.

demand elasticities: inelastic and elastic. Inelastic demand ranges within absolute values of 0 and 1 while the elastic range starts at absolute values greater than 1. Moreover, a distinction is often made between short-run elasticity (defined as demand response period of one year or less) and long-run elasticity that typically includes a range from one to ten years.[80] Elasticity estimates for each case study will be discussed in the relevant chapters.

3.2. Case Selection

Table 3.1: Share of Gas Consumption met by Net Imports[81]

by Importing Country, in 2008

Country	Consumption/ Net Imports	Country	Consumption/ Net Imports
Europe		**Asia Pacific**	
Finland	100%	**Japan**	98%
France	100%	Taiwan	94%
Belgium	100%	**South Korea**	92%
Turkey	100%	Singapore	90%
Switzerland	100%		
Spain	100%	**Others**	
Ireland	100%	Brazil	44%
Portugal	99%	India	26%
Czech Republic	99%	Thailand	23%
Italy	99%	Mexico	19%
Greece	98%	UAE	14%
Slovakia	98%	United States	13%
Hungary	96%	China	6%
Lithuania	95%		
Bulgaria	95%	**Countries highlighted bold: Large GECF market shares**	
Germany	88%		
Austria	85%		
Poland	71%		
Romania	31%		
United Kingdom	28%		

[80] Douglas Bohi, *Analyzing demand behavior: a study of energy elasticities*, Johns Hopkins University Press, Baltimore, 1981, p. 159.
[81] Table & calculations: author; data: Cedigaz database, 2009.

Having discussed a wide variety of theoretical and methodological issues, the final major step is to select cases of natural gas producer cooperation. Mahoney and Goertz point out that “qualitative researchers usually start their research by selecting cases where the outcome of interest occurs (these cases are often called ‘positive’ cases).” This is not unusual, they continue, since “[the] research goal is the explanation of particular outcomes.”[82]

The first step of the process—before cases can be selected—is to define the case universe according to Brady and Collier.[83] The case universe of ‘positive’ cases includes all possible instances of the subject under investigation. For the purpose of this research, that will include highly import-dependent gas-importing countries, which have a relatively limited number of foreign gas suppliers and inelastic demand for natural gas.[84] In other words, the structural conditions in the cases are conducive to enabling (foreign) gas suppliers to exercise market power and hence the ability to extract economic rents. Table 2.2 shows the dependence on gas imports of all major gas-consuming countries.

The situation of the exporters is illustrated below in Figure 2.7. The case universe includes all trade relationships in which exporters shown in Figure 2.7 have large market shares in the importing markets listed in Table 2.2.

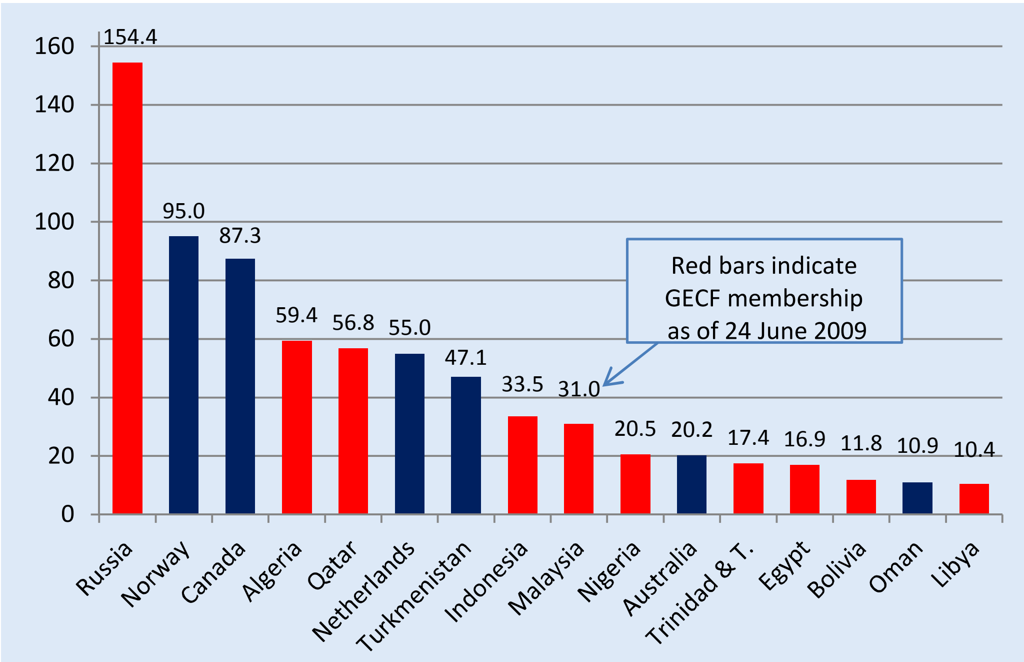
Selecting particular cases from this case universe is the second important step.[85] One must perform two tasks here. First, two ‘positive’ cases need to be selected in

[82] Mahoney and Goertz, “A Tale of Two Cultures: Contrasting Quantitative and Qualitative Research”, 2006, p. 239.
[83] H.E. Brady and D. Collier, *Rethinking Social Inquiry: Diverse Tools, Shared Standards*, Rowman and Littlefield, New York, 2004, p.107.
[84] As Table 1 in Chapter 2 showed, demand is relatively inelastic in both European and East Asian gas consuming markets. These two regions also are the most import-dependent ones too as Table 1 in this chapter shows.
[85] Brady and Collier, 2004, p. 112.

which cooperation among GECF members is possible and indeed the stated objective.[86] This is important, because, as argued before, if one wishes to "explain certain outcomes, it is natural to choose cases that exhibit those outcomes."[87]

Figure 3.4: Natural Gas Trade: Net Exporters[88]

Net Exports via Pipeline and as LNG in 2008, in bcm



Second, in order to corroborate evidence that cooperation is in fact an important factor explaining the existence of market power, researchers ought to choose one or more "*negative* cases to test their theories" as well.[89] The hypothesised 'negative' case will focus on a gas-importing country in which GECF members cannot cooperate,[90] but where the other producers could still secretly cooperate (i.e. collude) to achieve market

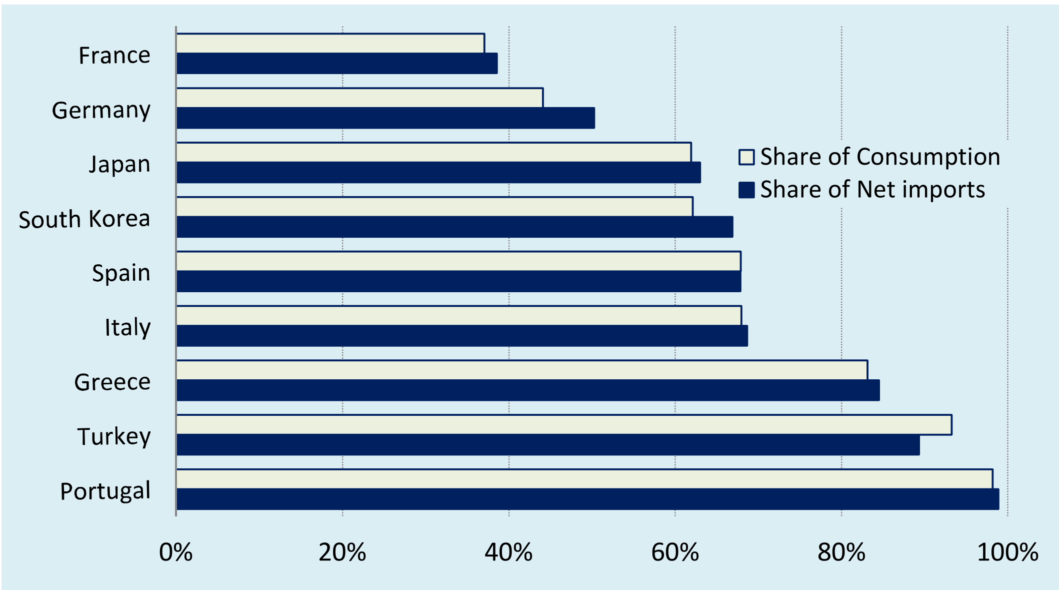
[86] Two cases will be used in order to test whether cooperation among GECF members is an explanation for market power in more than just one instance.
[87] Mahoney and Goertz, "A Tale of Two Cultures: Contrasting Quantitative and Qualitative Research", 2006, p. 239.
[88] Chart: author; data: Cedigaz database, 2009.
[89] Ibid.
[90] Because the country's supplier base consists of less than two GECF member countries.

power. Should the CPM results show collusive conduct in the first two ('positive') cases, but non-cooperative conduct in the 'negative' case, one can infer that GECF membership is possible explanatory factor for market power in the positive cases. If the conduct parameter shows collusive conduct in both the 'positive' and the 'negative' cases, GECF membership will be insignificant in terms of explaining market power. The case selection matrix in Figure 3.6 illustrates this point.

The *positive* cases will be drawn from Figure 3.5, which shows those gas-consuming markets that receive a significant share of their imports from GECF member countries. One can only attempt to measure whether GECF exporters achieve market power through their stated objective of cooperation in those trade relationship in which GECF exporters actually aim to cooperate. The selected cases are Turkey for the European market and Japan as the East Asian case.[91]

Figure 3.5: Gas Importers' Dependence on GECF Suppliers[92]

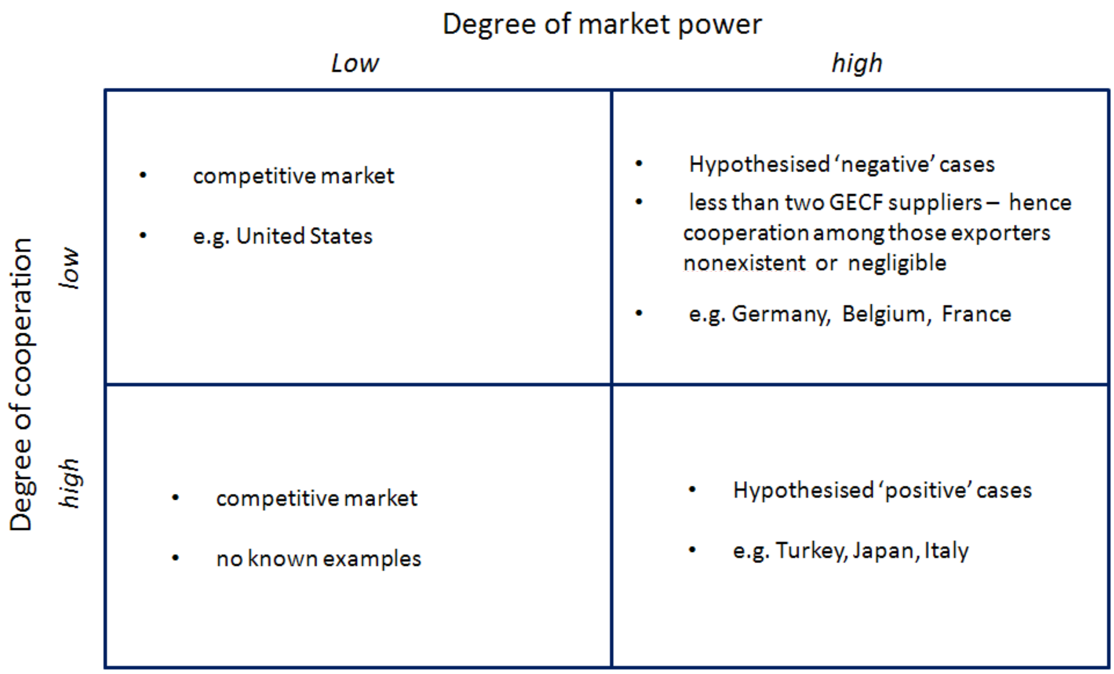
Share of Net Gas Imports and Consumption coming from GECF Member Countries, 2008



[91] Europe and East Asia is where most import-dependent gas consuming countries happen to be.
[92] Chart & calculations: author; data: Cedigaz database, 2009.

The *negative* case could be any gas consuming country, in which market power is expected to be prevalent, but in which GECF suppliers do not and cannot cooperate. The relevant 'negative' case here is Germany, which is to be found is Figure 3.5 as well. There is a significant degree of dependence on gas imports from a single GECF supplier: Russia. Given the lack of other significant GECF suppliers in the German market, cooperation among those exporting countries cannot take place. Yet, given the existence of market power, there have to be credible explanations other than GECF-driven producer cooperation. Hence, the cases will be selected on the independent variable "cooperation among GECF members" (possible in the first two cases, but not in the third) to determine the significance of the GECF.

Figure 3.6: Case Selection Matrix[93]



Two final observations concerning this case selection are necessary. First, while import dependence is an important energy policy issue in many Eastern European coun-

[93] Figure: author.

tries and while there are concerns about Russia's political and market power in these countries, they are not relevant cases for this research. Russia's gas export monopoly Gazprom dominates natural gas markets in Eastern European countries. If one supplier has close to 100 percent market share, cooperation is not possible since that supplier is already the quasi (or actual) monopolist.

Second, the case selection carried out here is based on states rather than other units of analysis. While it is fashionable to criticise the state-centric nature of the IR literature, the approach taken seems appropriate for two reasons. The first reason is that the respective state and the relevant organisation exporting natural gas are closely linked. While one might mean Sonatrach, Gazprom and Qatar Petroleum, one might as well refer to Algeria, Russia and Qatar instead since the national government and those companies are often intricately linked and state-owned as will be shown in the detailed empirical description in the relevant case study chapters. Using *Sonatrach* and *Algeria* interchangeably is therefore not necessarily evidence for inappropriate state-centricity, but instead shows merely a pragmatic approach to semantics. This of course cannot be an excuse for vague definitions and analyses, which brings me to the second reason. While the case selection was carried out on the basis of states, the actual research and analysis will be much more detailed and diverse, including studies of the corporate level, the national government level and international organisations. Hence, potential criticism of a state-centric analysis is not justified.

This chapter concludes all preparations for the case study research. Chapter 1 provided a general introduction to the subject matter. Chapter 2 gave an overview of natural gas reserves, production, trade and transportation including many relevant statistics. Chapter 3 provided a detailed theoretical and methodological background as well as the case selection that set the stage for the in-depth case studies in the subsequent chapters.

3.3. Appendix

Derivation of the Conduct Parameter Model

The conduct parameter model is based on the follow formula (introduced as expression 3.1. in the chapter). This expression needs some further explanation.

$$L_t = \sum_i s_{it} \frac{P_t - MC_{it}}{P_t} = -\frac{H_t \theta_t}{\varepsilon_t}$$

First, one needs to derive the equation and we will then solve for $\boldsymbol{\theta}$. Based on Manachotphong's work, we assume – as stated before – that firms are profit-maximisers.[94] That means they will sell at the point where marginal costs equals marginal revenue. Under competition, price equals marginal revenue, hence firms maximise their profit where price equals marginal cost.

$$\max_{q_{it}} \pi_{it} = (P_t(Q_t) - MC_{it})q_{it} \tag{3.3}$$

Here, subscript *i* stands for gas producing firm and *t* is time, π_{it} is for gas firm *i*'s profit at *t*. Being a function of Q_t, the total market quantity, P_t stands for the average price for natural gas in a given market. The marginal cost of gas producer *i* at time *t* is denoted by MC_{it} while quantity of gas delivered by gas company *i* at *t* is symbolised by q_{it}. Therefore:

$$0 = P_t + \left(q_{it} \frac{\partial P_t}{\partial Q_t} \frac{\partial Q_t}{\partial q_{it}}\right) - MC_{it}$$

$$\frac{P_t - MC_{it}}{P_t} = -q_{it} \times \frac{\partial P_t}{\partial Q_t} \times \frac{\partial Q_t}{\partial q_{it}} \times \frac{1}{P_t} \times \frac{Q_t}{Q_t} \tag{3.4}$$

[94] Manachotphong, "Investigating Market Power and Collusion under Demand Change: An Analysis of the UK Milk Market", 2009.

$$\frac{P_t - MC_{it}}{P_t} = -\underbrace{\frac{\partial P_t}{\partial Q_t} \times \frac{Q_t}{P_t}}_{-1/\varepsilon_t} \times \frac{\partial Q_t}{\partial q_{it}} \times \underbrace{\frac{q_{it}}{Q_t}}_{s_{it}}$$

The term on the left-hand side is the Lerner Index, which was introduced earlier. The term on the right-hand side ε_t is the elasticity of gas demand at *t* and s_{it} is the market share of gas firm *i* at time *t*.

$$\sum_i s_{it} \frac{P_t - MC_{it}}{P_t} = -\sum_i s_{it} \times \frac{1}{\varepsilon_t} \times \frac{\partial Q_t}{\partial q_{it}} \times s_{it}$$

$$L_t = -\underbrace{\textstyle\sum_i s_{it}^2}_{H_t} \times \frac{1}{\varepsilon_t} \times \underbrace{\frac{\partial Q_t}{\partial q_{it}}}_{\theta_t} \tag{3.5}$$

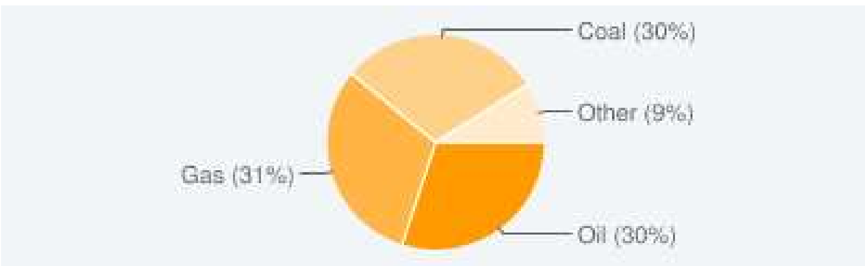
$$L_t = -\frac{H_t \theta_t}{\varepsilon_t} \qquad solving\ for\ \ \theta_t: \qquad \theta_t = -\frac{\varepsilon_t L_t}{H_t}$$

Chapter 4
Case Study: The Turkish Gas Market and its Suppliers

4.1. Introduction and Background

Turkey is one of the most interesting and relevant case studies of market power and the effects of producer collusion and cooperation on prices. It has a negligible amount of domestic gas resources and—among highly import-dependent countries—it is one of the larger markets as the case selection in chapter 3 showed. As Figure 4.1 shows, natural gas has become one of the most important fuels and input into power generation in Turkey since its consumption—and hence imports from the Soviet Union—first started in mid-1980s.

Figure 4.1: Total Primary Energy Supply (2008)[1]



*other: nuclear, hydro, geothermal, solar, combustible and renewable waste

Moreover, Turkey's natural gas market is also interesting from a geographic perspective and due to its prominent role in geopolitical debates on transit options for Middle Eastern, Caspian and Russian gas for deliveries to Europe. Turkey is surrounded by, and in the vicinity of, nearly all major natural gas reserve holders and many of the top producers in the world. Moreover, unlike gas consumers in Western Europe and

[1] IEA Natural Gas Information 2010, IV.335.

North America, Turkey is also close to a large number of gas-producing countries with most attractive economics of gas production, i.e. lowest cost structures. What is more, the distances between those producers and the Turkish border are comparatively short, which also keeps down another important part of the import price: transportation cost. Finally, another fortunate factor is Turkey's long coastline and hence access to both the Black Sea and the Mediterranean, which enables the country to diversify its sources of gas and other forms of energy even more. Given this array of favourable circumstances, which many other highly import-dependent gas consuming countries lack, Turkey could have built (and still has the potential to build) a natural gas market with many diverse and competing sources of low-cost supply. Evidently, as this case study in this chapter will show this has not happened. Turkish import prices presented in Table 4.6 are some of the highest import-dependent countries face globally.

The first section of this chapter will examine the (foreign) supply side—the up-stream and midstream part of the gas value chain up to the Turkish border—and the demand side, i.e. the domestic part of the midstream component, as well as the different purposes for which gas is used at the downstream end of the chain. The major players on the exporting side will be introduced and various political and economic factors will be described. The focus of this case study is to uncover to which extent prices are explained by producer collusion and anti-competitive practices. The second section will hence analyse existing evidence and patterns of cooperation among Turkey's suppliers. However, to fully grasp the influences on pricing and markets one must look at various other factors apart from cooperation and collusion, which will be done in section three and four.

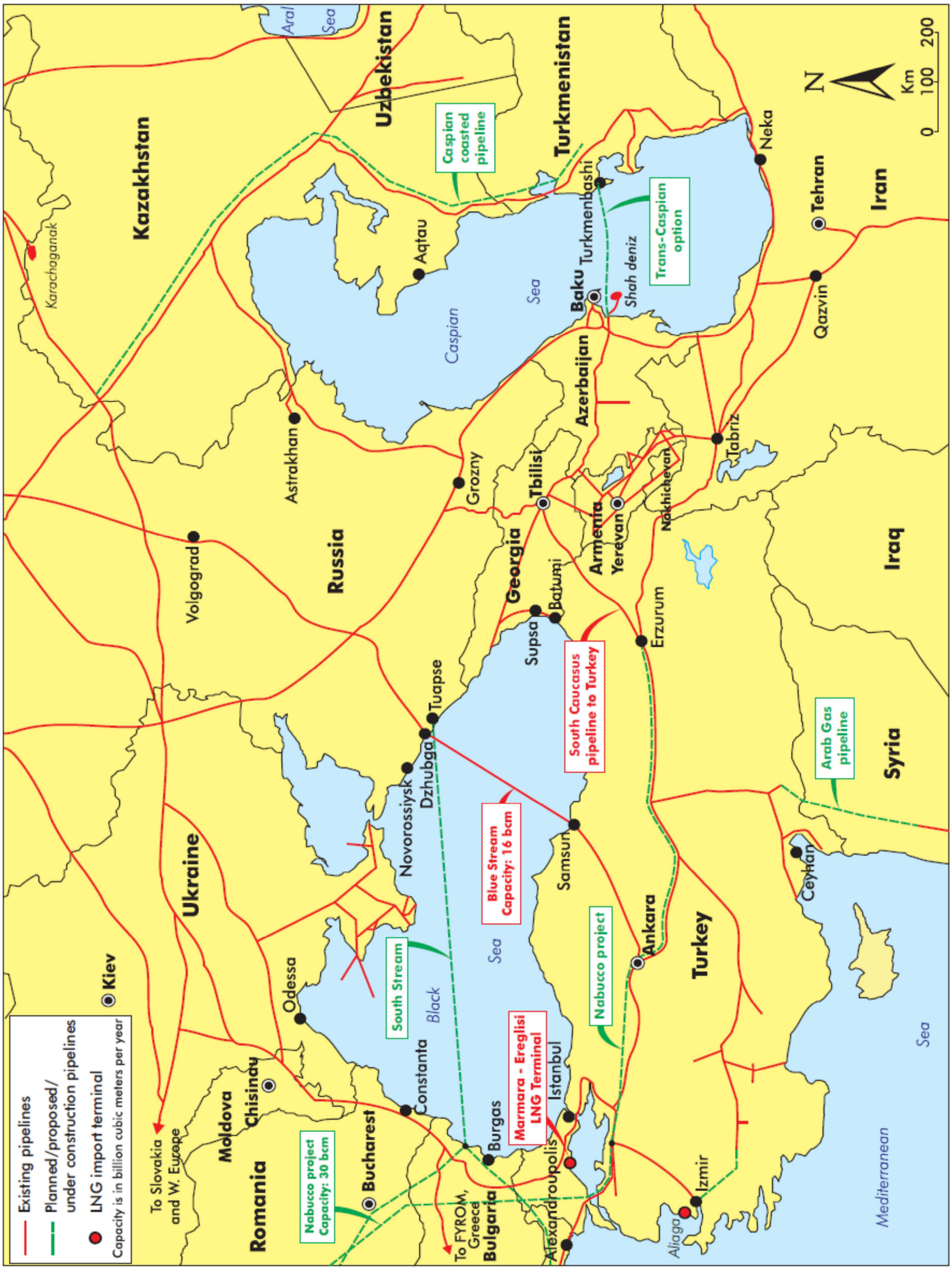


Figure 4.2: Natural Gas Pipeline Network in the Black Sea Region

Source: IEA Natural Gas Information 2010, IV.6

4.1.1. History and Overview of Turkey's Sources of Natural Gas Supply

Since there has been virtually no domestic production in Turkey, one must examine the foreign producers and the importing arrangements Turkey has in place in order to understand the supply side. Figure 4.2 shows the geographical context in which Turkish natural gas trade relationships take place.

In 1984, the Turkish government signed an intergovernmental agreement (IGA), which has been the dominant form of negotiating long-term natural gas agreements, with the Soviet Union. Two years later, the first long-term sale and purchase agreement of 25 years was signed between Boru Hatlari ile Petrol Tasima AS (BOTAS), Turkey's state-owned pipeline company and the Russians. The total annual volume of gas delivered to Turkey from the Soviet Union in 1993, six years after the commencement of operations, reached about 6 bcm.[2] After the fall of the Soviet Union, the successor of the Ministry of Gas Industry of the Soviet Union, Gazprom, continued to expand gas deliveries to Turkey. In 1997 Gazprom and BOTAS agreed to increase gas supplies by 8 bcm per year starting the following year as can be seen in Table 4.1. That gas would also be delivered via the conventional West line.[3] Given strongly increasing demand for gas, Turkey and Russia also made a second agreement in 1997: a 25-year contract to deliver additional volumes of up to 16 bcm per annum through a new pipeline, to be constructed on the seabed of the Black Sea.[4] For this pipeline, known as Bluestream, a joint venture was established by Gazprom and ENI, the Italian gas company.

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[2] Tamer Çetin, "Institutional Change in the Turkish Energy Markets", in T. Çetin, F. Yilmaz, eds., *Understanding the Process of Economic Change in Turkey*, Nova Science Publishers, 2010, p. 302.
[3] Via Ukraine, Moldova and Bulgaria, see Figure 2.
[4] Bilge Hacisalihoglu, "Turkey's natural gas policy", *Energy Policy*, no. 36, 2008, p. 1870.

Table 4.1: Natural Gas Sale and Purchase Agreements, 1986-2009[5]

Agreements	Volume (bcm/year)	Date of Signature	Duration (Years)
Russian Fed. (Westward)	6	14 February 1986	25
Algeria (LNG)	4	14 April 1988	20
Nigeria (LNG)	1.2	9 November 1995	22
Iran	10	8 August 1996	25
Russian Fed. (Black Sea)	16	15 December 1997	25
Russian Fed. (Westward)	8	18 February 1998	23
Turkmenistan*	16	21 May 1999	30
Azerbaijan	6.6	12 March 2001	15

*not operational

"In August 1996, Turkey signed a 25-year natural gas sale and purchase agreement with the Islamic Republic of Iran […]."[6] The supply of gas was supposed to start at 3 bcm annually to reach 10 bcm a decade later. The first volumes of gas between the National Iranian Gas Export Company and BOTAS starting flowing in December 2001.[7] As can be seen in Table 4.1, Turkey and Turkmenistan signed a long-term contract in 1999 to bring a significant amount from Turkmenistan's huge gas fields to the Turkish market. As of the time of writing (2011), this agreement is still not operational, mainly due to unresolved border disputes between Turkmenistan and Azerbaijan in the Caspian Sea. Moreover, Gazprom has snapped up significant volumes from Turkmenistan, which are sold through the Gazprom pipeline network rather than going directly from Turkmenistan to other countries. This has taken further quantities of non-Russian

[5] Graph: author; data: BOTAS Petroleum Pipeline Company, "Natural Gas Sale and Purchase Agreements, 1986-2009". Accessed on 21 April 2011: www.botas.gov.tr.
[6] Çetin, "Institutional Change in the Turkish Energy Markets", p. 302.
[7] Ibid.

supply to Turkey and Europe off the market.[8] Finally, an agreement with Azerbaijan was signed in 2001 to supply 6.6 bcm annually to Turkey. SOCAR, the Azeri state-owned oil & gas company, started delivering gas from the giant Shah Deniz offshore field in the Caspian to Turkey in 2007.

4.1.2. Natural Gas Infrastructure:

International Gas Pipelines and LNG Terminals

- The **Romania-Bulgaria-Turkey Pipeline** has a capacity of 17.85 bcm per year.[9] The pipeline (sometimes referred to "Westward pipeline") carried some of the first gas from Russia to Turkey, in particular to the Istanbul and north-western region of the country. It is identified in Figure 4.2 as the red line coming from Russia via Ukraine, Moldova, Romania and Bulgaria.

- The **Tabriz–Ankara Pipeline** connects Iranian gas fields around Tabriz with the Turkish capital. It was commissioned in 2001, is approximately 2577 kilometres long and can carry up to 14bcm annually.[10] It can be identified on the map as the solid red line running from Tabriz via Erzurum to Ankara.

- The **Mavi Akim Pipeline** (also known as Blue Stream) has a total capacity of 31 bcm per year but has been operated well below that volume since it was commissioned in 2003.[11] It connects Dzhubga in Russia with the Turkish port city Samsun via a subsea pipeline on the floor of the Black Sea as can be seen in Figure 4.2. A second pipeline, Blue Stream II, may be developed right next to the existing one in the coming years.

[8] China now also receives gas from Turkmenistan, but for domestic consumption rather than for (higher priced) resale in Turkey or in Western European markets.
[9] Unknown Author, "Turkey Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 10 April 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=TU.
[10] Ibid.
[11] Ibid.

- The **Baku-Tbilisi-Erzurum Pipeline** (BTE and sometimes called South Caucasus Pipeline, as in Figure 4.2) is the most recent addition to Turkey's pipeline infrastructure after its completion in 2006 it started delivering gas in 2007. Its capacity is close to 30bcm annually and it is sourced from Azerbaijan's giant offshore Shah Deniz I field.[12] Due to political conflicts and disagreements with Armenia, Turkey and Azerbaijan decided to take a detour and build the pipeline via Georgia rather than the more direct route via Armenia.

- **LNG Terminals:** Turkey's state pipeline company BOTAS has been operating the LNG Regasification Terminal at Marmara Ereğlisi since the late 1980s when it started importing LNG from Algeria. The terminal is next to a combined-cycle gas turbine (CCGT) power plant that is also belongs to BOTAS.[13] A second regasification terminal, owned and operated by EGE GAZ, a private company, is located near the industrial city of Izmir and started operating in 2006.[14] Both terminals are shown in ure 4.2 as red dots.

Table 4.1 showed the agreements signed between Turkey and her various suppliers. All agreements reach taken together about 67.8 bcm annually according to data from BOTAS. This by a long way exceeds Turkey's actual consumption of 36.6 bcm in 2008 for example.[15] (A detailed break-down of production and consumption can be found in Appendix Table 4.2 of this chapter.) Table 4.2 shows actual import quantities from 2007 to 2009, broken down by country of origin and mode of transport. As mentioned, the agreement with Turkmenistan is not operational, which explains up to 16 bcm of the gap. However, supplies from almost every other supplier – except for Algeria and Nigeria are also well below their full capacity. A simple explanations for this is

[12] Ibid.
[13] Unknown Author, "The Global Liquefied Natural Gas Market: Status and Outlook", *EIA Analysis Paper*, December 2003. Accessed on 10 April 2011: http://www.eia.doe.gov/oiaf/analysispaper/global/importers.html.
[14] EGE GAZ A.S., Corporate website. Accessed 5 May 2011: http://www.egegaz.com.tr/en/about.aspx.
[15] IEA "Natural Gas Information 2010", p. 336.

that Turkey, expecting even stronger domestic demand, signed up for too much contracted gas and now does not need the full amount.

Table 4.2: Natural gas imports by country of origin[16]

by pipeline (left) and by LNG (right)

	2007	2008	2009e
	Million cubic metres		
Belgium	-	-	-
Canada	-	-	-
Denmark	-	-	-
France	-	-	-
Germany	-	-	-
Italy	-	-	-
Mexico	-	-	-
Netherlands	-	-	-
Norway	-	-	-
United Kingdom	-	-	-
United States	-	-	-
Other	-	-	-
OECD	**-**	**-**	**-**
Algeria	-	-	-
Azerbaijan	1 258	4 580	4 960
Islamic Republic of Iran	6 054	4 113	5 254
Russian Federation	22 752	22 962	19 474
Other Former Soviet Union	-	-	-
Total non-OECD	**30 064**	**31 655**	**29 688**
Non-specified/other	-	-	-
Total imports	**30 064**	**31 655**	**29 688**

	2007	2008	2009e
	Million cubic metres		
Australia	-	-	-
United States	-	-	-
Other	-	-	-
OECD	**-**	**-**	**-**
Algeria	4 205	4 148	4 487
Brunei	-	-	-
Egypt	-	-	-
Equatorial Guinea	-	-	-
Indonesia	-	-	-
Libyan Arab Jamahiriya	-	-	-
Malaysia	-	-	-
Nigeria	1 396	1 017	903
Oman	-	-	-
Qatar	-	-	-
Trinidad and Tobago	-	-	-
United Arab Emirates	-	-	-
Yemen	-	-	-
Total non-OECD	**5 601**	**5 165**	**5 390**
Non-specified/other	167	333	698
Total imports	**5 768**	**5 498**	**6 088**

4.1.3. Organisation of the Domestic Sector

As is common in many gas-importing countries, the state has traditionally played an important role in negotiating trade agreements as well as running state-owned importing, transmission and distribution companies. Such intergovernmental agreements between the exporting countries' governments and Ankara have shaped the conditions for the natural gas trade relationships of the past decades. While the overall framework for trading gas was agreed by governments in such IGAs (and hence inherently political), the specific sale and purchase agreements between BOTAS and, e.g. Gazprom, have never been purely commercial enterprises either. This is not least be-

[16] IEA, "Natural Gas Information 2010", p. 338.

cause both BOTAS and every supplying country's gas company are state-owned (and state-run) enterprises.

Ownership and operation of gas transmission system: Transportation up to the Turkish border is principally the responsibility of the exporter. Once gas reaches the border, it is fed into BOTAS' high pressure transmission pipeline system. "BOTAS has enjoyed its monopoly rights on transmission as well since 1987. As a transmission company, BOTAS makes transportation contracts with importers, wholesalers, producers and exporters. It also enters into delivery contracts with producers, free consumers, storage companies, and other transmission companies."[17] Appendix Figure 2 of this chapter provides a map of the domestic gas pipeline system.

Distribution: BOTAS delivers gas through its transmission system throughout Turkey. BOTAS until recently had monopoly rights not only in the transmission but also largely in the distribution system, which consists of local low-pressure pipelines. In accordance with the Natural Gas Market Law (NGML) of May 2001, the newly created Energy Market Regulatory Authority (EMRA) is now issuing licenses for regional natural gas distribution. As of April 2009, there were 66 distribution companies and more than 50 city centres and 60 provinces in Turkey received natural gas.[18]

Regulatory framework: "Within the framework of the Natural Gas Market Law enacted in May 2001, BOTAS's monopoly rights were abolished on natural gas imports, wholesales and distribution, and EMRA was established."[19] The NGML envisages unbundling of the whole spectrum of the natural gas business: import, export, wholesale, production, distribution, transmission and storage of natural gas Law.[20] BO-

[17] Çetin, "Institutional Change in the Turkish Energy Markets", p. 300.
[18] IEA Natural Gas Information, 2010, p. VI.60.
[19] Ibid.
[20] As Çetin (2010), p. 302. explains: "The main purpose of the new law is to 'establish a legal framework for developing a fair, transparent and competitive natural gas market by separating market activities and unbundling the BOTAS's monopolistic structure in the market', to reduce state role in the market,

TAS's vertical value chain is also supposed to separated and the NGML mandates the privatisation of almost all business units. As of 2010, this is true rather *de jure* than *de facto*. There was widespread agreement among the experts interviewed for the purposes of this research in September 2010 that the liberalisation and the privatisation of the gas market – although very ambitious in terms of the laws passed – has hardly been put into practice in the nine years after the NGML was passed in 2001.[21] Apart from "Shell becoming the distributor of some volume imported from Russia"[22] in 2007 and a privately-operated LNG regasification terminal in Izmir the market is still very much dominated by BOTAS.

and to prepare the ground for the integration to the EU natural gas market by harmonizing regulations. In this context, NGML was an initial stage to introduce competition to the market and to unbundle vertically the market."

[21] Interviews with Dr Filiz Katman, Dr Levent Ozgul, Professor Mustafa Aydin, Dr Tuncay Babali and a US goverrment official in Ankara. The full names, job titles and affiliations of the interviewees can be found in the references.

[22] EIA, "Turkey Country Analysis Brief", 2011.

4.1.4. Consumption of Natural Gas

Turkey is one of the fastest-growing natural gas markets in the world. Essentially all of this strong demand growth is met by equally rapidly growing imports. Table 4.3 illustrates this extraordinary demand growth. In 1987 only 0.5 bcm were consumed annually. Twenty years later, demand had risen to more than 67 times of the initial consumption figure. That is an average annual growth of more than 23 percent. “Turkey began to use natural gas only for electricity production in 1987. In 1988, natural gas began to be used for residential and commercial purposes in Ankara, and continued, respectively with Istanbul and Bursa in 1992, and then Eskisehir and Izmit in 1996.”[23]

Table 4.3: Natural Gas Demand by Sector in Mcm, 1987-2007[24]

Years	Electricity	Fertilizer	Households	Industry	Total
1987	522	–	–	–	522
1988	1,034	152	0	–	1,186
1989	2,759	382	7	5	3,153
1990	2,599	501	50	222	3,373
1991	2,908	485	190	547	4,132
1992	2,633	652	375	861	4,521
1993	2,595	797	549	1,011	4,952
1994	3,037	612	647	955	5,251
1995	3,857	732	1,014	1,190	6,793
1996	4,174	830	1,526	1,376	7,906
1997	5,019	761	2,041	1,899	9,721
1998	5,491	493	2,247	2,041	10,271
1999	7,950	144	2,429	1,858	12,382
2000	9,733	113	2,806	1,914	14,566
2001	10,994	121	2,849	2,063	16,027
2002	11,631	496	2,973	2,277	17,378
2003	13,513	469	3,944	3,012	20,938
2004	13,226	528	4,463	3,892	22,108
2005	15,435	594	5,843	4,993	26,865
2006	16,642	157	7,259	6,435	30,493
2007	19,658	–	7,836	7,569	35,064

[23] Mustafa Balat, “Energy consumption and economic growth in Turkey during the past two decades”, *Energy Policy*, no. 36, 2008, p. 123.
[24] Erkan Erdogdu, “A review of Turkish natural gas distribution market“, *Renewable and Sustainable Energy Reviews*, vol. 14, issue 2, February 2010, Pages 807.

Table 4.3 also shows that natural gas in Turkey is mainly used in power generation (about 56 percent of the total consumption in 2007) and in households for heating purposes (around 22 percent in 2007) as well as in industry (around 22 percent in 2007). Consumption growth is predicted to remain very strong since new gas-fired power plants and soaring electricity demand are likely to drive up gas consumption.[25]

Table 4.4 offers an overview of competing sources of natural gas in power generation. It demonstrates that natural gas is the most important fuel burnt to generate electricity, followed by hydroelectric generation (around a quarter of the total input) and coal (lignite and hard coal provide approximately another quarter of the input). Oil-fired power generation has gone out of fashion and provides less than five percent of the total input into power generation along with other sources. Understanding the composition of the market both in terms of the sectors in which gas is burnt as well as competing fuels especially in power generation is important for the ensuing analysis.

Table 4.4: Share of Energy Sources in Turkish electricity generation in 2005[26]

Source	Energy (TWh)[a]	Percentage
Natural gas	70.8	43.8
Hydroelectric	39.7	24.6
Lignite	30.0	18.6
Hard coal	13.0	8.0
Oil	5.8	3.6
Other	2.2	1.4

[a] TWh: terawatt-hours.

[25] EIA, “Turkey Country Analysis Brief”, 2011.
[26] Hacisalihoglu, “Turkey’s natural gas policy”, p. 1869.

4.1.5. Turkey's Main Suppliers - Algeria

Algeria held approximately 4.5 trillion cubic metres (tcm) of natural gas reserves in 2009, according to the BP Review of Energy.[27] That figure corresponds to about 2.4 percent of all gas reserves worldwide and makes Algeria the 8th largest reserve-holder globally. According to the EIA, the "largest gas field is Hassi R'Mel, discovered in 1956 and holding proven reserves of about 85 Tcf [=2.41 tcm]. Hassi R'Mel accounts for about a quarter of Algeria's total dry natural gas production. The remainder of Algeria's natural gas reserves come from associated and non-associated fields[28] in the south and southeast regions of the country."[29]

Overall production in 2009 amounted to 81.4 bcm, which constitute 2.4 percent of the overall global natural gas production.[30] This makes Algeria the sixth-largest natural gas producer in the world. Approximately 32 percent of Algeria's gas production is consumed domestically while the remaining volumes are exported with the majority of the exports going to European countries and North America.[31]

State-owned Sonatrach dominates natural gas production and wholesale distribution in Algeria, while state-owned Sonelgaz controls retail distribution. Algeria has increasingly allowed greater foreign investment in the sector, and foreign gas producers, including BHP-Billiton, BP, Eni, Repsol, Statoil and Total, have entered into numerous partnership agreements with Sonatrach. There are also plans to allow foreign participation in the retail natural gas sector.

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[27] BP Statistical Review of World Energy, 2010.
[28] That is, reservoirs in which only gas, but not oil, occurs – such fields are also known as non-associated fields.
[29] Unknown Author, "Algeria Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 3 April 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=AG.
[30] BP Statistical Review of World Energy, 2010.
[31] EIA, "Algeria Country Analysis Brief", 2011.

In terms of transport infrastructure, Algeria heavily relies both on pipeline transport, mostly to Spain and Italy as well as liquefaction of natural gas. In fact, Algeria is a pioneer in developing LNG shipments and was the first producer to sell cargoes in 1964. According to the EIA, two thirds of the country's exports are transported via the Trans-Mediterranean pipeline to Italy via Sicily and via the Maghreb-Europe Gas pipeline (MEG) to Cordoba in Spain. The remaining one third of exports is shipped as liquefied natural gas on tankers. As the world fourth largest LNG exporter in the world as of 2006, Algeria is an important supplier to Turkey and other countries in Europe.[32] Algeria is also an active and particularly forceful member of the GECF and as such of interest as one of Turkey's GECF suppliers in this case study.

4.1.6. Turkey's Main Suppliers - Azerbaijan

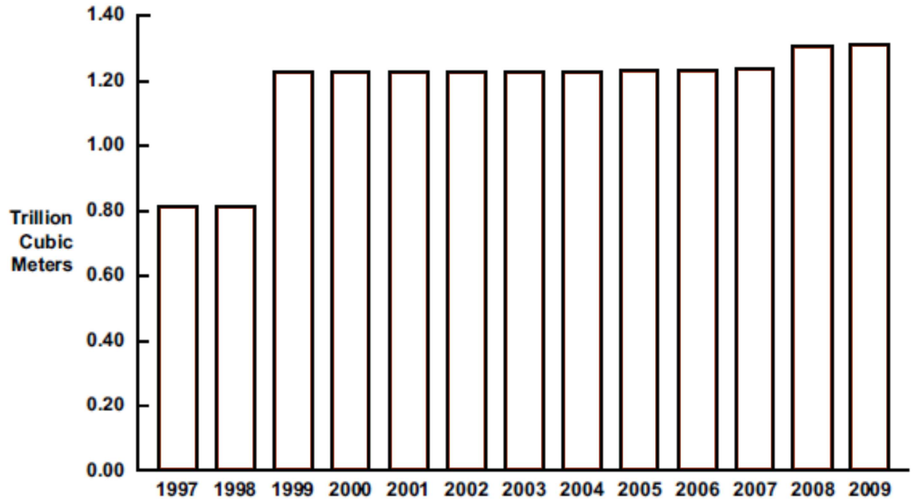
According to IHS CERA, Azerbaijan's gas reserves at the end of 2008 amounted to 3.5 trillion cubic meters (tcm), with 1.2 tcm alone at the Shah Deniz field.[33] In contrast, the figures given in the BP Review of Energy contain a narrower estimate of gas resources of approximately 1.31 tcm in 2009 (or 0.7 percent of the world total).[34] While there are differences in terms of measuring the reserve base, one development is clear and observable in Figure 4.3, and that is the steady growth of known reserves in Azerbaijan since the late 1990s.

This development has made Azerbaijan one of the leading players in the Caspian region, propelling its production to 14.8 bcm in 2009. These figures are expected to grow strongly as the giant offshore field, Shah Deniz, continues to be developed. In the past few decades, it was mainly Russia and Turkmenistan that supplied gas to Azerbai-

[32] Ibid.
[33] IHS CERA Private Report, 2010.
[34] BP Statistical Review of World Energy, 2010.

jan. Between 2004 and 2008 Azerbaijan's gas production approximately tripled as domestic consumption increased only marginally. This strongly increased gas production has made Azerbaijan an exporter for the first since the 1970s.[35]

Figure 4.3: Natural Gas Reserve Growth in Azerbaijan, 1997-2009[36]



In terms of sector organisation, "Azerigaz, a SOCAR[37] subsidiary, is responsible for natural gas processing, transport, distribution, and storage, mainly in the domestic market. Azneft, another SOCAR subsidiary, is responsible for exploration, development and production from the older onshore and offshore natural gas fields owned directly by SOCAR. AIOC is the largest foreign joint venture in association with SOCAR, and is involved in the development of the ACG oil and gas fields and the Shah Deniz gas field." [38] Moreover, unlike Algeria, Iran, Nigeria and Russia, Azerbaijan is the only supplier to Turkey, which is not part of the Gas Exporting Countries Forum.[39]

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[35] Stanislav Pritchin, "Azerbaijan's New Gas Strategy", *Turkish Policy Quaterly*, vol. 9, no. 2, Summer 2010, p. 127.

[36] Data: BP Statistical Review of Energy, 2010.

[37] State Oil Company of Azerbaijan Republic

[38] Unknown Author, "Azerbaijan Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 7 April 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=AJ.

[39] Azerbaijan was not gas exporting country when the GECF was founded in 2001. It is also safe to say that Russia has never been in favour of expanding membership to Azerbaijan (or to Turkmenistan)

4.1.7. Turkey's Main Suppliers - Iran

Iran is credited with possessing an estimated 29.61 trillion cubic metres (tcm) in 2009, according to the BP Review of Energy.[40] It hence controls 15.8 percent of all world gas reserves and is second only to Russia. Most of Iran's gas reserves are non-associated gas fields which are situated in southern Iran and in the Persian Gulf. Some of the most important fields are: South and North Pars, Kish, and Kangan-Nar.[41] Given Iran's difficult political situation and the existing international sanctions regime, many of the fields have not been developed mainly because advanced technology and expertise usually brought in by international oil companies (IOCs) is lacking.

According to the US Energy Information Administration (EIA), consumption was actually slightly higher than production in 2008, making the second largest holder of gas reserves a net importing country. "Both production and consumption have grown rapidly over the past 20 years, and natural gas is often used for re-injection into mature oilfields in Iran. […] Iran's natural gas exports will be minimal due to rising domestic demand even with future expansion and production from the massive South Pars project. In 2008, roughly 70 percent of Iranian natural gas was marketed production, approximately 16 percent was for enhanced oil recovery gas re-injection, and shrinkage, loss, and flaring accounted for about 14 percent. As with the oil industry, natural gas prices in Iran are heavily subsidised by the government."[42] Domestic consumption of natural gas in Iran is predicted to grow approximately 7 percent per year.

As is common in major natural gas exporting countries, state-owned and state-run hydrocarbon companies—in the case of Iran the National Iranian Gas Company

given Russia's practice of buying up Azeri gas to resell it more expensively through Gazprom's pipeline system.

[40] BP Statistical Review of World Energy, 2010.

[41] Unknown Author, "Iran Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 9 April 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=IR.

[42] Ibid.

(NIGC) and the National Iranian Oil Company (NIOC)—are in charge of natural gas production, the infrastructure, transmission and distribution. What is more, Iran offers unattractive conditions for partnerships with IOCs, that is, service agreements rather than more common production sharing agreements (PSAs). Hence, according to the EIA, Repsol, Shell, Total and other IOCs have divested from the country's natural gas sector.

As pointed out in the previous section, Iran is one of Turkey's important suppliers of natural gas via the Tabriz–Ankara Pipeline, which started operating in 2001. According to the IEA, Iran supplied only 6 bcm[43] of the contracted 10 bcm in 2007 to Turkey.

[43] IEA, "Natural Gas Information 2010", p. 338.

Figure 4.4: Map of Iranian Oil and Gas Fields and Infrastructure[44]

The contracted levels have not been fulfilled because of both Turkish domestic reasons as well as Iranian issues. Turkey contracted almost twice as much gas as it needed in the 2006-2008 period. But an equally important reason is that Iran actually could not deliver more because of its own strong domestic demand growth.

As the map presented in Figure 4.4 demonstrates, most of Iran's gas reserves are in the southern part of the country and in Iran's Special Economic Zone (SEZ) in the Persian Gulf while most of the consuming takes places in the populous northern part. Iran therefore has to import gas from its northern neighbour Turkmenistan to satisfy domestic demand. Despite being a net importer at the moment, Iran could be one of the

[44] Source: US Department of Energy.

most important gas exporting countries in the future because of its huge reserve base. Hence the country has been a very vocal and active member of the GECF, expressing a strong interest in "defending their economic interests" with regard to gas exports.

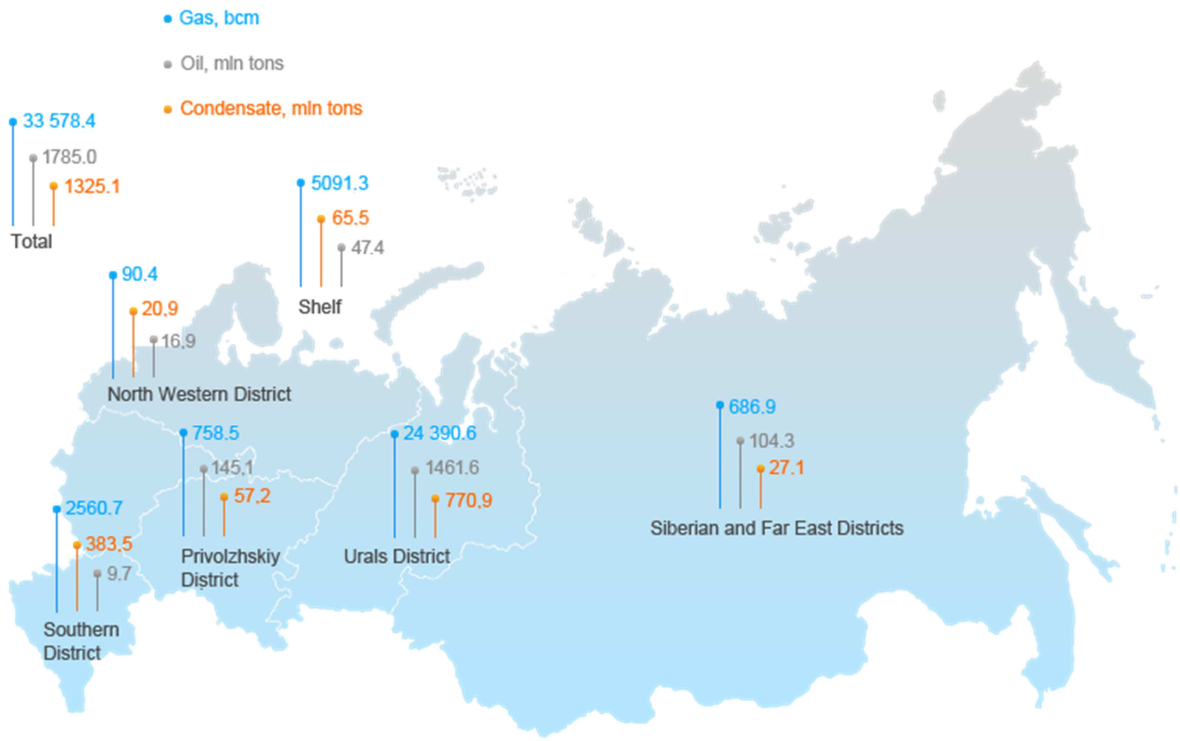
4.1.8. Turkey's Main Suppliers - Russia

Russia is by far the largest holder of natural gas reserves in the world. Until 2009, Russia was also the largest producer of gas in the world. According to the BP Review of Energy, Russia held 44.38 trillion cubic metres (tcm) of gas reserves, which corresponds to 23.7 percent of all gas reserves worldwide. Russia produced 527 bcm of gas in 2009 or 17.6 precent of the overall global production.[45]

According to the EIA, the "the largest concentration of production is located in Siberia, where about 95 percent of Russia's natural gas is produced. Some of the most prolific fields in this area include Yamburg, Urengoy, and Medvezh'ye, all of which are licensed to Gazprom, Russia's state-run natural gas exploration and production company. These three fields have seen output declines in recent years. In response, the company launched the Yamal Megaproject in late 2008. Additionally, the Zapolyarnoye field, commissioned in 2001, is expected to offset some of the declines of Gazprom's big three fields."[46]

[45] BP Statistical Review of World Energy, 2010.
[46] Unknown Author, "Russia Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 10 April 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=RS.

Figure 4.5: Distribution of Explored Hydrocarbon Reserves in the Russian Federation[47]



Except for some independent producers of oil and gas, such as Lukoil and Novatek, state-run Gazprom dominates Russia's gas market, especially in the upstream sector. It controls 90 percent of the overall gas production and in excess of 65 percent of Russia's reserves. Moreover, Gazprom is the owner and operator of the network of high-pressure inter-regional gas pipelines in Russia and it is also the sole owner of gas storage capacity.[48] As the EIA points out, Gazprom is the quasi-monopolist in the domestic market in addition to holding the legal monopoly on exports from Russia.[49] Gazprom and its various subsidiaries also control and manage all exports from Russia to Turkey.

[47] Source: Gazprom website, www.gazprom.com/production/reserves/. Accessed on 27 April 2011.
[48] Ruediger Ahrend and William Tompson , "Unnatural Monopoly: The Endless Wait for Gas Sector Reform in Russia", *Europe-Asia Studies*, vol. 57, no. 6, September 2005, p. 802.
[49] Ibid.

As described earlier, Russia's exports to Turkey commenced in the late 1980s via the Trans-Balkan gas pipeline. Gazprom corporate website states that until 2003, its gas could only be transported to Turkey via Ukraine, Moldova, Romania and Bulgaria, which incurred considerable transit fees. Hence, the Blue Stream pipeline allowed Gazprom's subsidiary, Gazprom Export to deliver additional volumes of gas to BOTAS directly via the subsea pipeline through the Black Sea from 2003 onwards.[50] Russia is also one of the leading members of the GECF.

4.1.9. Turkey's Smaller Supplier - Nigeria

Given Nigeria's small share in the Turkish gas market, this overview will be briefer than that of the other more significant suppliers. Nigeria possesses an estimated 5.25 trillion cubic metres (tcm) in 2009, according to the BP Review of Energy.[51] It hence controls 2.8 percent of all world gas reserves and is the largest reserve holder in Africa as well as being the 8th largest one globally. The country produced about 35 bcm in 2008 – this only includes marketed gas, as the EIA points out, but not gas used for re-injection in oil reservoirs for enhanced recovery. The country consumed 12 bcm in 2008, which left around two-thirds of the production for exports, venting, or flaring.[52] "The majority of the natural gas reserves are located in the Niger Delta and the sector is also impacted by the security issues affecting the oil industry. Projects are often delayed or shut-in as a result of sabotage, bunkering and general insecurity."[53]

Nigeria exports her gas both via pipeline and LNG. While exporting via pipeline to various places in Africa is a relatively recent phenomenon, Nigeria has been a major LNG exporter for over decade. In 2009, as the EIA reports, Nigeria exported around

[50] Gazprom website. http://www.gazpromexport.ru/en/partners/turkey/
[51] BP Statistical Review of World Energy, 2010.
[52] Unknown Author, "Nigeria Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 15 April 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=NI.
[53] Ibid.

[14 bcm] of gas in liquefied form. Most of this LNG went to Europe, including Turkey.[54] Nigeria is a member of the GECF.

[54] Ibid.

4.2. Cooperative Efforts and Actions

This section will describe and discuss instances of cooperation among natural gas exporting countries that supplied gas to Turkey during the period from 2001 (when the GECF was founded) to 2008.[55] Publicly available reports and data on relevant cooperative policies, actions and efforts will be presented and summarised. Moreover, insights and data obtained from expert interviews in Turkey during September 2010 will also be used to shed light on cooperative acts among Turkey's gas suppliers.

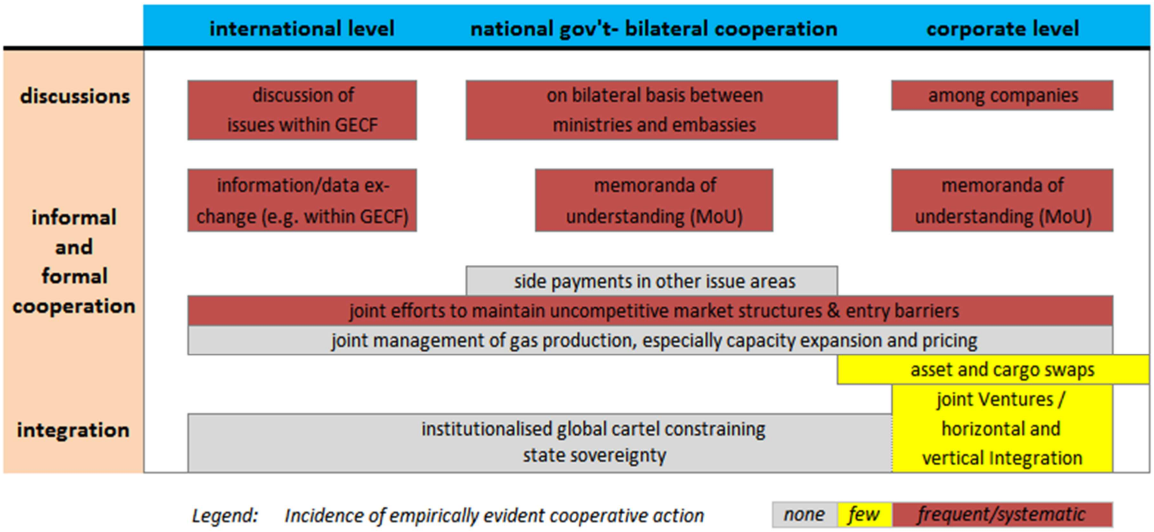
The main focus here will be to consider a broad range of mutual policy coordination to realise joint gains on an international level, the bilateral government-to-government level and at the corporate level of the countries' individual oil and gas companies. Most of the time, evidence for the actual implementation of cooperative efforts is not available, which is why section three of this chapter will employ an economic model to estimate the effectiveness of cooperation on the desired outcome, i.e. joint gains for producers, which in particular means preserving or extending producers' market power.

An important distinction is necessary at this stage. Economists often understand collusive or cooperative action by producers in very narrow terms. That is, producing companies will discuss explicit collusion by aiming to fix a product's price or to determine quantities to be sold (both of which should lead to higher revenues and most likely profits too). Alternatively, economists will study tacit collusion, where a producer might engage in price leadership and others follow that lead. The result can be very similar to explicit collusion and is hence problematic. Here, a much broader range of collusive and cooperative action aimed at retaining or expanding market power will be considered,

[55] As was pointed out in 1.11, the data-driven economic analysis in section 3 will take into account the situation from 2006 to 2008, but the description of cooperative events presented here will start before the mentioned time frame

including efforts to maintain uncompetitive market structures and entry barriers, attempts at horizontal and vertical integration and other measures. The taxonomy of cooperation (Figure 4.6) was introduced in chapter 1 and is specified here to reflect the results for the Turkish gas market. These results are discussed in detail below.

Figure 4.6: Cooperation among Natural Gas Exporters - Turkey[56]



4.2.1. Discussions

The first type of cooperation is discussions between producers take place at various levels. These discussions can have a serious impact despite their informal nature. Discussions at the **international level** take place among producers mainly at the ministerial meetings of the GECF, which usually take place at least annually. Discussions may also take place in other fora, such as the International Energy Forum or on the fringes of OPEC meetings since a number of GECF members are also members of OPEC (though not Russia, the most important GECF member in many respects). The most serious and impactful discussions are likely to take place at GECF meetings though, since the pur-

[56] Source: author.

pose of the Forum and the meetings is to protect members' economic interests by extracting the maximum value from their gas exports.

GECF meetings have taken place throughout the period of time under investigation in this thesis. Table 4.5 shows the participants of these meetings and highlights Turkey's suppliers, all of which attended all meetings during the period of time in question.

Table 4.5: GECF Ministerial Meetings, 2001-2008, Turkey's suppliers in bold

Tehran 2001	**Algiers** 2002	**Doha** 2003	**Cairo** 2004	**Port of Spain** 2005	**Doha** 2007	**Moscow** 2008
Algeria Brunei Indonesia **Iran** Malaysia **Nigeria** Oman Qatar **Russia** Turkmenistan Norway*	**Algeria** Bolivia Brunei Egypt Indonesia **Iran** Libya Malaysia **Nigeria** Oman Qatar **Russia** Venezuela	**Algeria** Brunei Egypt Indonesia **Iran** Libya Malaysia **Nigeria** Oman Qatar **Russia** T&T UAE Venezuela Norway*	**Algeria** Brunei Egypt Indonesia **Iran** Libya Malaysia **Nigeria** Oman Qatar **Russia** T&T UAE Venezuela Norway*	**Algeria** Brunei Egypt Eq. Guinea **Iran** Malaysia **Nigeria** Qatar **Russia** T&T UAE Venezuela Norway*	**Algeria** Bolivia Egypt Indonesia **Iran** Libya Malaysia **Nigeria** Qatar **Russia** T&T UAE Venezuela Norway*	**Algeria** Bolivia Brunei Egypt Indonesia **Iran** Libya Malaysia **Nigeria** Qatar **Russia** T&T UAE Venezuela Norway* Eq. Guinea*
Source: Hadi Hallouche (2001-2005 meetings)[57]; IHS Global Insight (2007 meeting)[58]; Reuters (2008 meeting)[59] * indicates observer status						

In those meetings, the relevant members had ample opportunities to discuss their objectives and strategies among each other. It is perhaps useful to recall the GECF's mission, which comprises the following relevant points in relation to the exchange of

[57] Hadi Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making?", *Oxford Institute for Energy Studies Working Papers*, no. NG13, June 2006, p. 17.
[58] Unknown Author, "Gas Exporters Stop Short of Declaring a Cartel", *IHS Global Insight*, 10 April 2007.
[59] Katya Golubkova and Dmitry Zhdannikov, "Russia says gas OPEC will not set up output quotas", *Reuters*, 26 November 2008.

information:

- “Identify and promote measures and processes necessary to ensure that Member Countries derive the most value from their gas resources.
- Promote common policies for access to capital and financial resources and transparency among member countries in the exchange of capital, financial data, and know-how.
- Exchange information on investment opportunities in member countries.”[60]

GECF meetings also afford the opportunity for producer countries’ representatives to hold **bilateral government-to-government** talks on the fringes of those meetings. Moreover, frequent state visits by heads of government and visits by cabinet ministers among Turkey’s supplying countries have occurred on a very frequent basis between 2001 and 2008 as well. The issue of energy in general and natural gas in particular have almost always been on the agendas of those meetings. As the next section on informal and formal cooperation will demonstrate in greater detail, a number of specific agreements such as memoranda of understanding (MoU) have come out of these talks.

> Algerian President Bouteflika said that gas exporters should ‘coordinate’ their energy policies. Concerning the GECF, he argued that the major players in the international gas markets ‘should coordinate their activities even more.’ Moreover, he argued that the GECF should ‘play a more active role’ in these cooperative efforts.[61]
>
> [Russian energy minister Sergei] Shmatko said at the time that he would encourage members [of the GECF] to avoid competition between various forms of gas and restore stability to world gas markets.[62]

Finally, on a **corporate level**, discussions and exchanges of information take place as well. Some of the producers jointly own and operate upstream and midstream

[60] GECF website, Mission of the GECF. Accessed on 18 May 2011: http://www.gecforum.org/gecf/web.nsf/web/aboutgecf_mission.
[61] Unknown Author, “Algerian leader meets Putin as gas OPEC plan gains ground”, *Thomson Financial News Super Focus*, 19 February 2008. Accessed on Nexis UK on 25 April 2011.
[62] Unknown Author, “Russia, Algeria say committed to longterm, oillinked gas sales”, *Platts Commodity News*, 7 October 2010.

projects. For example, Nigeria and Algeria "continue to discuss the possibility of constructing the Trans-Saharan Gas Pipeline (TSGP). The 2,500-mile pipeline would carry natural gas from oil fields in Nigeria's Delta region to Algeria's Beni Saf export terminal on the Mediterranean." [63] Nigeria's NNPC and Algeria's Sonatrach signed an MoU in 2009 to continue with the development of this joint project. In addition to this example of a joint midstream project, there are a variety of upstream joint ventures under consideration as well. For example, "'Gazprom is talking about co-operating across the whole spectrum of Nigeria's gas industry,' said a senior Nigerian energy industry official."[64] Additional examples will be provided in the section on "integration."

4.2.2. Informal and Formal Cooperation

This section will discuss cooperative actions by GECF member countries at the international, bilateral and corporate levels. At **the international level**, several specific policies were created. The most formal one is the Forum's High-Level Group (HLG) on pricing, which was established at the 6th ministerial meeting of the GECF on 9 April 2007 in Doha. The HLG's purpose is to "to develop a common methodology on the formation of gas export prices and to conduct research on consumer markets."[65] Members of the HLG are deputy ministers or departmental directors from the GECF member countries' governments.[66] Members emphasised "the need for expanded coopera-

[63] EIA, "Nigeria Country Analysis Brief", 2011.
[64] Dino Mahtani and Matthew Green, "Gazprom Nigeria move bodes ill for the West", *Financial Times*, 6 January 2008.
[65] Robert Pritchard, "Recent Developments: April 2007", *Resources Law International*, April 2007. Accessed on 17 May 2011: http://resourceslaw.net/documents/ResourcesLawGECFMeetingApr07.pdf.
[66] Ibid.

tion"[67]within the Forum and considered the creation of the HLG an important steps towards closer cooperation.

Some, especially Rafael Ramirez from Venezuela, were quite frank concerning the GECF's specific objective of extracting more value from gas production and exports by seeking higher prices.[68] He also said that "we hope that this Gas Exporting Countries Forum will evolve toward a superior level by focusing not solely on technical aspects but also in the coordination of policies."[69] Algeria's minister for energy and mining Khelil added: "There will be more coordination in the future. We will create a team to see how we can move toward more coordination in this, particularly on the issue of price."[70] The 2007 meeting in Doha was the first time GECF treated the issue of gas pricing and pricing mechanisms in a formal way. However, recognising the importance of pricing formulas as an indirect price-setting tool, the issue had been debated before.

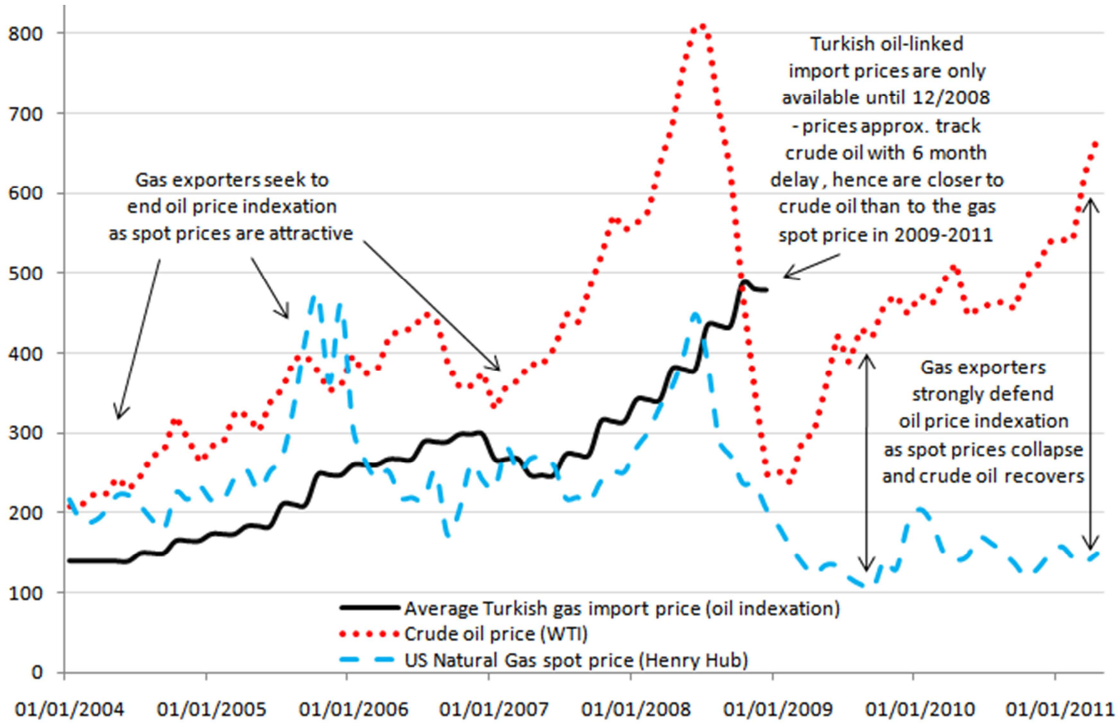
Natural gas supplied to Turkey is priced in the follow way. The price of gas is indexed to those of close substitutes such as petroleum products (heating oil and fuel oil). By selling gas at a price just below the closest substitute, producers are able to extract the maximum rent from their sales. (The price is hence not determined by the supply and demand fundamentals of the gas market, but by the price of oil – and therefore, indirectly, by the supply and demand balance of the oil market.) An alternative type of price formation is to trade gas at so-called hubs,[71] where gas-to-gas (and not gas-to-oil) competition takes place and hence the fundamentals of the gas market determine the price. The price for immediate delivery at trading hubs is called 'spot price'. This distinction is important to understand how producers change (or wish to change) their pre-

[67] Kate Dourian, Geoff King and Anna Shiryaevskaya, "Gas OPEC cartel not in the cards for now; Russia to chair high-level panel; expanded cooperation focus of forum", *Platts Oilgram News*, 10 April 2007. Accessed via Nexis UK on 24 April 2011.
[68] Ibid.
[69] Ibid.
[70] Ibid.
[71] Such as Henry Hub (HH) in Louisiana or the National Balancing Point (NBP) in the UK.

ferred way of pricing from oil-indexation to spot-pricing or vice versa depending on market conditions.

Figure 4.7: Oil-linked Natural Gas Import Prices v Crude Oil and Gas Spot Prices[72]

All converted to US$ per tcm, 2004 to 2011 (Turkish imports only up to 12/2008)



If producers wish to maximise the economic rent they derive from their gas sales, they would prefer to sell gas at spot prices if spot prices are strong and oil-indexed gas prices are weak (because of a weak oil price). They would prefer the opposite—and current practice in the Turkish market—that is, to sell gas on the basis of oil-linked gas prices if spot prices are weak and oil prices are high.

Figure 4.7 shows the average Turkish gas import price (weighted by each supplier's market share), the crude oil spot price (West Texas Intermediate, WTI) and the American natural gas spot price for delivery at Henry Hub. Consistent with the rent-

[72] Chart: author; Data: BOTAS, 2010 and Federal Reserve Bank of St. Louis, Economic Data: http://research.stlouisfed.org.

seeking behaviour described above, producers have sought to abolish oil-indexation to raise prices of their gas exports between 2003 and 2007 and subsequently, between 2009 and 2011 they sought to maintain high prices by vigorously defending oil-indexation of gas prices as is pointed out in Figure 4.7.

Against Oil Indexation: In 2003 and 2004 it was widely reported that "the Egyptian delegation has also discussed proposing potential avenues for a move away from indexation of gas contracts to oil prices."[73] More specifically, "Egypt proposed abolishing oil linkage and adopting a single, fixed gas price, agreed on by all forum members."[74] Forum members said in 2007 that "a primary GECF objective remains to move gas pricing away from oil indexation."[75] A move away from oil indexation might be understood as an attempt to move towards a more competitive market in which pricing is determined by the actual supply and demand fundamentals of the gas market, but as the Egyptian statement shows, the objective is to fortify anti-competitive market structures and to maintain high prices and hence rents. One of the leading voices within the GECF, Algeria's Chakib Khelil, argued at the 2007 meeting in Doha that gas prices should be delinked from oil prices to achieve a higher price for gas.[76] He added: that "prices up to now have been indexed to oil; the world has changed […]. Now we have solar power, wind power, bioethanol, nuclear energy, all of that is connected to gas. Gas now is not competing with fuel oil."[77] Moreover, he argued: "We don't have a balance between gas demand and supply, we have more demand...and that is not reflected in the gas price."[78] Indeed some exporters, e.g. Algeria, chose to implement the strategy of

[73] Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making?", p. 15.
[74] Unknown Author, "Pricing to Dominate Dialogue at Gas Exporters Forum in Trinidad", *Natural Gas Week*, 25 April 2005. Accessed via Nexis UK on 17 May 2011.
[75] Unknown Author, "'Gas OPEC' May Have Real Clout After All", *Petroleum Intelligence Weekly,* 6 August 2007. Accessed via Nexis UK on 22 April 2011.
[76] Dourian et al., "Gas OPEC' cartel not in the cards for now; Russia to chair high-level panel; expanded cooperation focus of forum", 2007.
[77] Ibid.
[78] Ibid.

abandoning long-term contracts with oil-linked pricing formulae in favour of short-term, spot-priced sales in 2008. As energy consulting firm IHS CERA put it: "[Algeria] did not "renew any of its long-term contracts [in 2008] almost at the peak of global LNG spot prices […] but instead opt[ed] for shorter period deals in order to cash in."[79]

In Favour of Oil Indexation: In late 2008, both crude oil and natural gas spot prices collapsed as a result of the financial and economic crisis. However, oil prices (and hence oil-indexed gas prices) recovered quickly while natural gas spot prices especially in the US remained depressed, chiefly because of huge amounts of additional domestic supplies from shale gas production became available. Hence, gas producers which had called for and implemented the abolishment of oil-indexed gas contracts suddenly strongly advocated the reintroduction and continuation of the traditional practice. IHS Global Insight reports that "Algeria appears to be realigning its gas supply strategy away from spot gas markets and specifically championing oil indexation in LNG contracts."[80] In negotiations, Algeria "insists on retaining oil-indexation."[81]

Not just Algeria, but also other GECF members, which supply the Turkish market, defended linking gas prices to the price of oil. For example, "Russia's state Gazprom [… has] tenaciously stuck to oil-product indexation […]", it was reported in 2009.[82] Importantly, suppliers did not just defend oil-indexation individually vis-à-vis the importing countries, but also jointly, such as Russia and Algeria in a 2010 memorandum of understanding on gas pricing: "They also reaffirmed their commitment to long-term take-or-pay gas contracts linked to oil prices.

[79] Samuel Ciszuk, "Algerian LNG Output Plummets on Feedgas, Marketing Problems", *IHS Global Insight*, 11 October 2010.
[80] Kash Burchett, "Spain Seeks Cheaper Gas from Algeria", *IHS Global Insight*, 1 November 2010.
[81] Unknown Author, "Last Days for Algeria's Aging LNG Trains?", *World Gas Intelligence*, 30 March 2011. Accessed via Nexis UK, 15 May 2011.
[82] Unknown Author, "Oil Link In Gas Pricing Past Its Sell-By Date", *Petroleum Intelligence Weekly*, 2 November 2009. Accessed via Nexis UK on 22 April 2011.

The agreements were signed by Algerian oil minister Youcef Yousfi and Russian energy minister Sergei Shmatko, who was part of a large delegation accompanying Russia's president, Dmitri Medvedev, to the North African state in early October. The two sides agreed that the existing format of long-term, take-or-pay contracts, using oil product prices with a minimum annual purchase quantity, was here to stay. ‘It is the sacred cow,’ said Miller.”[83]

Moreover, Qatar, which does not deliver LNG to the Turkish market, but is a leading member of the GECF was reported as having “been vocal recently on behalf of oil indexation, not wishing to see the certainty offered by such terms eroded, or allow cheap spot prices to undercut pricier long-term supply deals.[84] They key point is that this practice is most effective if it is implemented jointly and cooperatively, including by GECF members such as Qatar, which do not export to the Turkish market. It does not constitute price-fixing in the narrow traditional sense, but this type of joint action with regard to determining the pricing formula has a very similar effect of raising prices or maintaining high prices (above their competitive level). It is therefore an indirect price-management tool that works if it is applied by a large number of market participants.

At the **bilateral and corporate levels of cooperation**, there are two major areas in which Turkey’s suppliers pursue mutual policy coordination to maintain their market power and hence economic rent. The first is concerned with Turkey’s uncompetitive, internal gas market structure. The exporters have an interest in maintaining uncompetitive, inflexible and inherently political procedures and hence resist the gas market liber-

[83] Nadia Rodova and Lies Sahar, “Algeria, Russia rekindle links”, *International Gas Report*, Platts, 11 October 2010.

[84] Unknown Author, “Qatar pins its LNG hopes on the East”, *Petroleum Economist*, January 2011. Accessed via Nexis UK on 22 April 2011.

alisation laws the Turkish government passed in 2001.[85] Such structures are more easily exploited given the absence of other Turkish domestic firms, which would have to seek more competitively priced gas in order to take away market share from the dominant firm BOTAS. Moreover, given that BOTAS is government-owned and has a close relationship with the political elite, it is easier for exporters to strike political deals. That, of course, would be much less feasible if there were many smaller, competing firms. Yet, the Natural Gas Market Law (NGML) of 2001 seeks to create exactly that: a more diverse and competitive market. To that end, BOTAS has been required by law to relinquish market shares in the Turkish market ("gas release programme") and also not to sign any new contracts with foreign suppliers until its market share is below 20 percent in 2009. Specifically, BOTAS was mandated to sell 10% (or more) of its supply contracts with Gazprom and other suppliers annually.[86] That is the de jure situation, but de facto almost nothing has been implemented in the nine years after the NGML was passed.[87] In part, this has been due to BOTAS' reluctance to change. Yet, another significant factor in this has been strong opposition on the part of the GECF exporting countries.

Reuters reported in early 2005 that "Russia and Iran are refusing to accept the sale of import and wholesale contracts by state-owned natural gas company BOTAS. As part of BOTAS' gas-release plan, the company must transfer contracts worth 64% of consumption to the private sector. This is equal to contracts of over 16 Bcm per year from Russia and Iran, as well as LNG consignments from Algeria and Nigeria. However, Russian and Iranian officials have said that they refuse to deal

[85] One of the events that prompted the creation of the GECF in 2001 was the European Commission's gas and electricity market liberalisation and privatisation legislation, which GECF members have sought to prevent and stall ever since.

[86] Unknown Author, "Turkey's gas release programme may finally be under way", *European Gas Markets - The HEREN Report*, 19 December 2005. Accessed via Nexis UK on 2 May 2011.

[87] Interview with Dr. Tuncay Babali, Energy Expert, Turkish Ministry of Foreign Affairs, Ankara, September 2010.

with the private market. Russia and Iran's refusal to transfer the contracts effectively blocks liberalisation proceedings."[88] This is an additional example of joint policy by producers to resist changing market structures towards a more competitive approach that would reduce suppliers' market power and hence rents.

Throughout 2005 and afterwards Turkey's suppliers such as Nigeria's NNPC, Algeria's Sonatrach and Iran's NIOC have continued to oppose the liberalisation plans in Turkey. Only one player changed its strategy in one particular case: Gazprom. The Russian monopoly in late 2005 agreed to release 4 bcm a year of gas supply, but only because the quantities would go to from BOTAS to Bosphorus Gaz, a distributor in Turkey partly owned by Gazprom.[89] At the time, Gazprom through its affiliate ZMB, owned 40 percent of Bosphorus Gaz. Subsequently, Gazprom increased its share in the company to 51 percent and later to 70 percent.[90] This vertical downstream integration has been an opportunistic, one-off departure from cooperation with other exporters that does not seem to represent a shift in Gazprom's overall policy.

At the **bilateral and corporate levels** of cooperation, there are a series of bilateral memoranda of understanding (MoU) that were signed between Algeria, Iran, Nigeria and Russia. The first MoU was agreed upon between Russia's Gazprom and Algeria's Sonatrach in 2006. The Russian news agency Interfax described the content of the memorandum in rather general terms:

> The memorandum envisions the possibility of exchanging assets in the exploration and extraction sphere, the creation of joint ventures, participation in tenders to explore and extract oil and gas, information exchanges about projects, including projects related to liquefied natural gas (LNG), the opti-

[88] Stephanie Berger, "Russia and Iran Conest Turkish Gas Privatisation Plans", *World Markets Analysis*, World Markets Research Centre, 24 March 2005. Accessed via Nexis UK on 2 May 2011.
[89] Unknown Author, "Turkey's gas release programme may finally be under way", 2005.
[90] Unknown Author, "What the Russian papers say", *Ria Novosti*, 19 August 2009. Accessed on 13 November 2010: http://en.rian.ru/papers/20090819/155858877.html.

> mization of gas supplies to the market, research activities, professional training and an increase in the qualification of employees at the two companies.[91]

Gazprom's corporate website provides further details on the formalised, cooperative relationship with Sonatrach by stating that cooperation is supposed to be intensified in the following areas: "geological exploration, production, transportation, gas transmission and distribution systems development, asset swaps, oil and natural gas processing and marketing in Algeria, Russia and third countries."[92] Two years after the original MoU, Russia and Algeria re-iterated and specified their commitment to cooperation in 2008 to work together on "specific marketing and production projects [which are] to be implemented jointly."[93] The Gazprom's Deputy chief executive office Alexander Medvedev declared that such projects will "include swaps of pipeline gas for LNG as well as LNG for LNG, and projects to produce gas in Algeria, Russia and third countries."[94] The next subsection on "integration" as the most solid form of cooperation will demonstrate that some of these MoU actually led to specific projects being put into practice jointly.

Nigeria, one of Turkey's suppliers of LNG, also made formal agreements to co-operate and to enter in joint ventures with Sonatrach and Gazprom. In 2008, the NNPC and Gazprom agreed to "to produce gas in Nigeria and participate in the construction of the Trans-Sahara gas pipeline that could become a major source of gas supplies to Europe."[95] Moreover, Nigeria has also talked to Algeria regarding the joint construction of the so-called Trans-Saharan Gas Pipeline, which would connect Nigeria's gas fields

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[91] Unknown Author, "Russia's Gazprom, Algeria's Sonatrach Sign MoU on Cooperation", *Interfax in English*, August 4, 2006.

[92] Unknown Author, "Algeria Strategy / Cooperation" Gazprom corporate website, accessed 10 May 2011: http://www.gazprom.com/production/projects/deposits/algeria/.

[93] Unknown Author, "Gazprom, Sonatrach agree specific projects for cooperation", *Russia & CIS Business & Financial Daily*, 18 June 2008. Accessed via Nexis UK on 22 April 2011.

[94] Ibid.

[95] Nina Poussenkova, "Rethinking Russia : The Global Expansion of Russia's Energy Giants", *Columbia SIPA Journal of International Affairs*, vol. 63, no. 2, Spring/Summer 2010. Accessed on 10 May 2011: http://jia.sipa.columbia.edu/global-expansion-russia%E2%80%99s-energy-giants.

with LNG export terminals in Algeria.[96] The talks culminated in the signing of a MoU in 2009 (i.e. after the period under consideration here), in which Sonatrach and the NNPC expressed their determination to proceed with the $US12bn midstream project.[97]

Russia and Iran have also been intensifying their long-standing cooperation, especially in the energy sector. This cooperation between Gazprom and the NIOC has also been formalised in an MoU in 2008.[98] Despite international sanctions against Iran, Gazprom has worked together with the country even before the formation of the GECF. For example, "has been involved [in Iran's South Pars field] since 1997."[99]

Apart from these broader types of cooperation, hard empirical evidence of narrowly-defined price-fixing among Turkey's gas suppliers is scarce. Since negotiations on gas sale and purchase agreements between BOTAS and its suppliers are all conducted in secret, producers would be even more careful about keeping their price-fixing collusion secret as well. The expert interviews conducted in Ankara and Istanbul showed that there were many suspicions and indications of price-fixing, but no hard evidence to support this. Dr Cenk Pala, a former senior negotiator at BOTAS, stated that: "Of course, when we negotiated with Gazprom, we were almost certain that they pick up the phone to talk to other suppliers such as Sonatrach about the specific terms and prices. We always ended up getting very similar terms and prices from all of those [GECF] suppliers, so I'm sure that they regularly talk."[100]

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[96] EIA, "Nigeria Country Analysis Brief", 2011.
[97] Ibid.
[98] Julia Nazarova, "Friendship with a future competitor", *RBC Daily*, 17 March 2009. Accessed on 4 April 2011: http://www.rbcdaily.ru/2009/03/17/tek/406265.
[99] Poussenkova, "The global expansion of Russia's energy giants", pp. 118-119.
[100] Expert Interview, Dr Cenk Pala, Chief Executive, E.ON Ruhrgas Turkey, Ankara, September 2010.

4.2.3. Integration

This section deals with the strongest form of cooperation: integration. At the state- and international levels that would involve a cartel organisation that constrains the sovereign decision-making of its member states. While there is no such institutionalised global cartel that constrains the state sovereignty of GECF members countries (as shown in Figure 4.6), other kinds of integration have taken place mostly at the corporate level. These efforts to create not only joint policies, but also integrated organisations in the form of joint ventures (JVs) are sometimes preceded by MoU, in particular those which were mentioned in the previous section. Other JVs have been or are in the process of being established without prior bilateral agreements at the national government level. It should be pointed out that the majority of the JVs mentioned here have been put into practice towards the end or after the period of time under consideration and hence are less relevant than the cooperative practices discussed earlier in this chapter.

Gazprom/ Sonatrach. Following the memorandum of understanding in 2006 and its renewal in 2008, the first representative office of Gazprom was opened in Algeria in June of 2008, according to the firm's corporate website.[101] Observers explained that the purpose of the office is to build and maintain a working relationship with Sonatrach in all areas of potential cooperation, especially in order to create joint operations with Sonatrach in all regional gas market (North America, Europe and Asia). Moreover, the office will oversee all of Gazprom's operations across the African continent.[102] Following the establishment of Gazprom's official liaison office in Algeria, it was announced later in 2008 that the first upstream joint venture would go ahead.

[101] Unknown Author, "Algeria Strategy / Cooperation" Gazprom corporate website. Accessed on 10 May 2011: http://www.gazprom.com/production/projects/deposits/algeria/.

[102] Unknown Author, "Gazprom Opens Office in Algeria", *Nefte Compass*, 19 June 2008. Accessed via Nexis UK on 22 April 2011.

> In December 2008 Gazprom EP International (Gazprom's wholly owned subsidiary) was announced the winner of the hydrocarbon exploration and development tender for the onshore El Assel area. Gazprom EP International is the operator of said project in partnership with Sonatrach. Gazprom and Sonatrach hold a 49 percent and a 51 percent stake in the project respectively.[103]

The Russian and the Algerian firms also announced in 2008 that they will not stop at the borders of their own countries with their cooperative joint ventures but that they plan "joint acquisition[s] of energy assets in third countries" said Gazprom Deputy CEO Alexander Medvedev.[104]

Gazprom/ NNPC/ Sonatrach. Not only Algeria and Russia have been driving forces of cooperation and integration. Nigeria has also been in favour upstream and midstream integration. According to Gazprom, "A Nigerian delegation in talks with Gazprom has suggested that the Russian company take part in laying a gas pipeline across the Sahara. The project would run from Africa across the desert and the Mediterranean Sea into Europe […]."[105] Moreover, a memorandum of understanding was signed by the NNPC and Sonatrach in 2009 to jointly construct the Trans-Sahara Pipeline.[106]

Gazprom/ NIOC. As was pointed out before, Russia's Gazprom has played an important role in the development of one of the largest gas fields in the world—Iran's South Pars gas field off the coast of Iran—since the late 1990s.[107] In particular the Russian firm worked together with the National Iranian Oil Company project development

[103] Ibid.
[104] Unknown Author, "Gazprom, Sonatrach mull acquisition of energy assets in third countries", *Russia & CIS Business and Financial Newswire*, 16 June 2008. Accessed via Factiva on 5 April 2011.
[105] Unknown Author, "Nigeria offers Russian gas company a stake in Sahara pipeline project", *BBC Monitoring Former Soviet Union*, 7 June 2008. Accessed via Nexis UK on 22 April 2011.
[106] EIA Nigeria Country Analysis Brief, 2010.
[107] Unknown Author, "Iran, Russia Urged for Expansion of Energy Ties", *Moj News Agency*, 9 April 2011. Accessed via Factiva on 20 April 2011.

and operation of the second and third stages deposits of the South Pars."[108] Levent Ozgul of BOTAS added: "Because of the American and European sanction on Iran and the pressure that is being put on us [Turkey in general and BOTAS in particular] to comply, we adopt a wait and see approach with regard to investments in, and trade with, Iran. In contrast, Russia is not willing to forgo revenues from trade with Iran and continues to invest there despite the economic sanctions."[109]

The preceding sections have looked at cooperative efforts and actions, from discussions to exchanges of information, to informal and formal cooperation to integration of activities among GECF member countries that supply the Turkish market. The analysis relied mostly on publicly available data and reports in addition to information gathered in expert interviews in Turkey. Despite all cited evidence that broadly defined cooperation takes place and that such cooperation to maintain and expand producers' market power has an effect, cooperation as a causal explanation for market power can be better determined not by just looking at the process, but at the outcome (existence of market power) and to work backwards to possible causes. By studying various causal variables, one can more convincingly establish that producer cooperation and collusion do play an important role in explaining market power in the Turkish gas market. The quantitative analysis in the next section aims to do that.

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[108] Julia Nazarova, "Friendship with a future competitor", *RBC Daily*, 17 March 2009. Accessed on 4 April 2011: http://www.rbcdaily.ru/2009/03/17/tek/406265.

[109] Expert Interview, Levent Ozgul, Head of BOTAS Gas Master Plan Commission, Ankara, September 2010.

4.3. Quantitative Analysis: The Conduct Parameter Model

Section 3 seeks to establish whether the exporting countries that supply the Turkish market enjoy a significant amount of market power there. Subsequently, the conduct parameter model will be explained and employed to calculate to what extent collusive conduct explains the producers' market power.

4.3.1. Establishing the Existence of Market Power – Lerner Index

Market power is generally understood to be the ability to raise and maintain prices above the competitive level, where marginal revenue (i.e. price) equals marginal cost. Firms that enjoy market power are not price takers, but price makers. In the Turkish market, the fact that five different producers charge five different prices[110] for a homogeneous product such as natural gas is evidence that firms have some pricing power.[111] To be more precise, the Lerner Index of market power allows one to estimate the degree of market power if data on prices, on firm's marginal costs and market shares are available.

Average import prices. Table 4.6 shows the average price of imported gas BOTAS paid to its various suppliers. The calculations of the annual average prices are based on BOTAS' monthly price time series obtained during the research visit to Turkey in September 2010. Gazprom has four separate (but similar) contracts with BOTAS hence the average of all four contracts was used.

[110] Prices are not simply different price of transportation cost differentials.
[111] In a competitive market, every firm faces the same price – the one set by the market.

Table 4.6: Gas Import Prices and Market Shares in Turkey, by country of origin[112]

	Price[113] US$/Mcm	**Market share**[114] (by gas volume)	**Market share** (sales in US$)
		Russia	
2004	144.75	64.4%	62.6%
2005	202.25	65.4%	64.3%
2006	283.25	63.7%	64.3%
2007	287.25	62.3%	64.4%
2008	476.25	61.8%	71.7%
		Iran	
2004	146.00	15.8%	15.5%
2005	202.00	16.2%	15.9%
2006	287.00	18.5%	18.9%
2007	292.00	18.0%	18.9%
2008	458.00	11.1%	12.4%
		Azerbaijan	
2007	112.15	3.5%	1.4%
2008	105.00	12.3%	3.2%
		Algeria	
2004	162.00	15.2%	16.6%
2005	220.00	14.1%	15.1%
2006	264.00	13.6%	12.8%
2007	270.00	11.7%	11.4%
2008	372.00	11.2%	10.1%
		Nigeria	
2004	170.00	4.7%	5.3%
2005	212.00	3.8%	3.9%
2006	265.00	3.6%	3.4%
2007	265.00	4.1%	3.9%
2008	393.00	2.7%	2.6%

Market share. There are two ways to calculate a firm's market share in a given market, by sales volume (here in bcm) or by revenue (in US$). For the purposes of this model it is preferable to use sales revenues as the basis for market share since the focus is on prices and value rather than just physical trade quantities. The difference between the two is marginal, however, as Table 4.6 demonstrates. With that, two of the three essential data inputs for the Lerner Index have been provided.

[112] Table: author; source: BOTAS, 2010.
[113] Average import price paid by BOTAS.
[114] The market shares may not always add up to exactly 100 percent and the difference is explained by varying, small quantities of domestic production, (re-)exports, stock changes and spot LNG cargoes.

$$L_t = \sum_i s_{it} \frac{P_t - MC_{it}}{P_t}$$ [115]

Marginal cost. The third input is marginal cost (MC). Since producers' marginal costs are notoriously difficult to determine, one must rely on estimates. Fortunately, a number of marginal cost estimates for all of Turkey's suppliers do exist. A World Bank paper in 2003 estimated for Gazprom: "[…] that the LRMC for natural gas is in the range of US$35 to $US40/[Mcm]. Estimates of LRMC are subject to a margin of error, but this estimate is consistent with Gazprom's own estimate that a domestic price equivalent to $US35/[Mcm] is required if existing production levels are to be maintained."[116] In this thesis the most conservative estimate—the upper end of the spectrum of US$40—will be used. Estimates for Algeria, Iran and Nigeria come from the model, which was developed in 2006 and is presented in Figure 4.8. The central estimate, e.g. US$0.60 per mmbtu for Algeria, will be used. The conversion factor for mmbtu to thousand cubic metres (Mcm) is 35.3. Hence the marginal cost estimate for e.g. Algeria will be US$0.60*35.3 = US$21.18 for 2006.

The marginal cost estimate for Azerbaijan comes from the energy consulting firm IHS CERA. This particular valuation is for the Shah Deniz field (Phase I) which became operational in 2007 and from which Turkey receives its gas. They calculate the upstream cost to be US$35.20 in 2007.[117] Having gathered these estimates for all five suppliers to the Turkish market, two further issues need to be considered.

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[115] The Lerner Index was reproduced from chapter 3. *P* stands for price, *MC* for marginal cost and *s* for market share, *t* for unit of time (year) and *i* for firm.

[116] David Tarr and Peter Thomson, "The Merits of Dual Pricing of Russian Natural Gas", *The World Economy* , vol. 27, no. 8, September 2004, p. 1181.

[117] IHS CERA Private Report, 2010.

Figure 4.8: Range of production costs for selected gas producing regions[118]

(in US$/mmbtu)

Country	Production costs	
	Lowest	Highest
Algeria	0.40	0.80
Australia	0.60	1.00
Canada	0.70	1.20
Indonesia	0.50	1.00
Iran	0.35	0.70
Netherlands	0.20	1.40
Nigeria	0.60	1.20
Norway (North Sea)	0.80	1.40
Norway (Barents Sea)	1.20	1.70
Qatar	0.35	0.60
Russia (Western Siberia)	0.40	1.20
Russia (Barents Sea)	1.00	1.30
Russia (Sakhalin)	0.80	1.30
UK	1.20	1.60
USA (Gulf and onshore)	0.70	1.70
Venezuela	0.60	1.00

First, MC data were generated at different times (in 2003, 2006 and 2007), hence one must adjust for changes in cost over time to make the figures comparable and to arrive at estimates for the relevant period of time under consideration. To that end, the IHS CERA Upstream Capital Cost Index (UCCI) will be used.[119] (An additional index, the Upstream Operating Cost Index, UOCI, also exists, but the UCCI seems more appropriate given that long-run marginal costs are more affected by large-scale capital expenditure rather than short-term operating expenditure.) The figures from the various papers and sources cited can be found in Table 4.7. The required upstream marginal cost figures for the conduct parameter model were then calculated from the quoted estimated by adjusting them with the UCCI.

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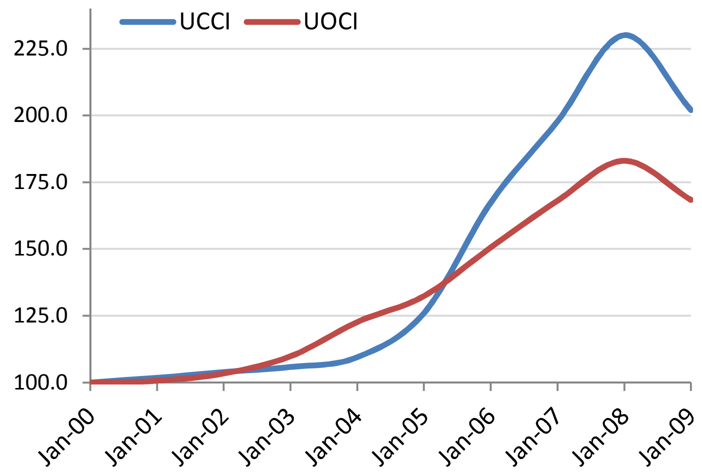
[118] Andreas Seeliger, *Entwicklung des weltweiten Erdgasangebots bis 2030: Eine modellgestuetzte Prognose*, Oldenburg Verlag, 2006, Munich, pp. 52-56. Cited in: Stefan Lochner and David Bothe, “The development of natural gas supply costs to Europe, the United States and Japan in a globalizing gas market—Model-based analysis until 2030”, *Energy Policy*, no. 37, 2009, p. 1521.

[119] I should like to thank Michael Stoppard, Managing Director, Global Gas at CERA for the suggestion.

Figure 4.9: CERA's Upstream Cost Indicators 2000 to 2008[120]



For example, applying the UCCI to the 2003 World Bank marginal cost estimate for Russia, one arrives at a marginal cost of approximately US$ 83 in 2008. Leonid Grigoriev and Maria Belova use the range of US$ 80-90 for 2008 in their paper, so the estimate used here is broadly in line with other studies.[121]

The second issue is transportation cost, which has been added to Table 4.7. In addition to the upstream production cost (i.e. getting the gas out of the ground), the cost of transportation from the exporting countries' borders to the Turkish border will be added. Tarr and Thomson calculate Gazprom's transportation cost for bringing gas to the German border ("European border price") to be $US26.90 in 2003.[122] Although the distance to the Turkish border is shorter (for the Westward pipeline and for Blue Stream) a conservative estimate of US$30 per Mcm will be used. Since the distance is to Iran is very short and there are no other countries in between (and hence no transit fees), a transportation cost estimate of $US20 will be used. Given the short distance, this again is a very conservative estimate. Azerbaijan is the third pipeline gas supplier.

[120] Chart: author; Data: http://www.ihsindexes.com.
[121] Leonid Grigoriev and Maria Belova, "EU-Russia gas relations", *Pan-European Institute Electronic Publications*, Turku School of Economics, Finland, August 2009, p. 77. Accessed on 14 May 2009: www.tse.fi/FI/yksikot/erillislaitokset/pei/Documents/Julkaisut/Liuhto%200809%20web.pdf.
[122] Tarr and Thomson, "The Merits of Dual Pricing of Russian Natural Gas", p. 1177.

CERA estimate US$ 8.60 per Mcm for pipeline capital and operating expenditure and US$ 10.90 for transit fees charged by Georgia, bringing the total transportation cost up to US$ 19.50.[123]

Turkey's two LNG suppliers, Algeria and Nigeria, have different transportation costs. Gas needs to be liquefied, shipped on special tankers and regasified to enter the Turkish transmission and distribution system. Massol and Tchung-Ming estimate for Algeria is US$ 15.89 for upstream and liquefaction and US$ 22.40 for shipping,[124] hence a total cost of US$ 38.29 per Mcm for 2001. As discussed before, the upstream cost (excluding liquefaction) used in this thesis is between US$21.18 and US$27.88 (see Table 4.7). A common estimate for liquefaction, shipping and regasification is around US$2 per mmbtu (=US$ 70.60 per Mcm) and will be employed here, bringing the total cost, e.g. for 2006, to US$ 91.78 – a higher estimate than the one used by Massol and Tchung-Ming (partly because of cost inflation between 2001 and 2006 and also because a more conservative seems sensible in order not to potentially overstate the degree of market power). Nigeria as Turkey's second LNG supplier has a longer shipping distance than Algeria. Hence, a higher transportation cost figure of US$ 2.50 per mmbtu (=US$ 88.25 per Mcm) will be used for Nigeria.

Table 4.7 shows the upstream and transportation cost estimates, including the total figure. These numbers are broadly consistent with other estimates such as Joris Morbee and Stef Proost's study[125] on the MC of Russian natural gas and Massol and Tchung-Ming's study[126] of a wide range of LNG exporters.

[123] IHS CERA Private Report, 2010.
[124] Olivier Massol and Stéphane Tchung-Ming, "Cooperation among liquefied natural gas suppliers: Is rationalization the sole objective?", *Energy Economics*, no. 32, 2010, p. 944.
[125] Morbee and Proost, "Russian Market Power on the EU Gas Market: What if Gazprom is Unreliable?", p. 33.
[126] Massol and Tchung-Ming, "Cooperation among liquefied natural gas suppliers: Is rationalization the sole objective?", p. 944.

Table 4.7: Marginal Cost of Production and Transportation Cost to the Turkish border[127]

in US$/Mcm

	Upstream cost	Transportation cost	Total cost
		Russia	
2003	**40.00**	30.00	**70.00**
2004	41.07	30.00	**71.07**
2005	45.49	30.00	**75.49**
2006	59.61	30.00	**89.61**
2007	71.27	30.00	**101.27**
2008	83.31	30.00	**113.31**
		Iran	
2006	**18.53**	20.00	**38.53**
2007	20.87	20.00	**40.87**
2008	24.40	20.00	**44.40**
		Azerbaijan	
2007	**35.20**	19.50	**54.70**
2008	39.33	19.50	**58.83**
		Algeria	
2006	**21.18**	70.60	**91.78**
2007	23.85	70.60	**94.45**
2008	27.88	70.60	**98.48**
		Nigeria	
2006	**31.77**	88.25	**120.02**
2007	35.78	88.25	**124.03**
2008	41.83	88.25	**130.08**

Having presented all relevant data for the calculation of the Lerner Index, ble 4.8 shows the results for the period of time under consideration. The overall Lerner Index is the sum of each individual supplier's Lerner Indices, weighted by each supplier's market share. A Lerner Index of zero would indicate a perfectly competitive market in which producers are not able to charge prices above their marginal cost of production. A Lerner Index of 1 would indicate a monopoly or a cartel which manages to co-operate/collude perfectly. The results for the Turkish market for 2006 to 2008, which

[127] Table: author; Sources: Detailed and comprehensives references are to be found in section 3.1, subsection *marginal cost*.

are between 0.68 and 0.76 as Table 4.8 illustrates, point to a very high degree of market power.

Table 4.8: Lerner Index for Turkish natural gas market, 2006-2008[128]

	Russia	Iran	Azerbaijan	Algeria	Nigeria	Total
2006	0.44	0.16		0.08	0.02	**0.70**
2007	0.42	0.16	0.01	0.07	0.02	**0.68**
2008	0.55	0.11	0.01	0.07	0.02	**0.76**

The literature on industrial organisation originally explained a high degree of market power by looking at the market structure, in particular market concentration. The higher the concentration among suppliers, the more market power producers could exercise. That link turned out to have weak empirical support. The conduct parameter model (CPM) was built on the basis of new insights about market power: inelastic demand can give producers pricing power too and hence can sometimes be an even more powerful explanation for price levels above marginal cost than market concentration. The CPM takes into account both factors, which allows one to estimate to what extent producer collusion—the third factor—explains market power, taking into account the other two explanatory variables mentioned before. The next section will present the results of the conduct parameter model for the Turkish market from 2006 to 2008.

4.3.2. Explaining Producers' Market Power – The Role of Cooperation

Having shown the Lerner Index results as well as basic data on market concentration, two steps need to be taken before the CPM result can be calculated. First, the basic data on market shares needs to be translated into the appropriate measure of market concentration. The Herfindahl Index (H) will be used. The Herfindahl Index for each year is

[128] Table: author.

simply calculated by adding the squared market shares of each supplier to the Turkish market (see Table 4.9).

Table 4.9: Market shares & Herfindahl Index (H)[129]

	2006	2007	2008
Russia	64.3%	64.4%	71.7%
Iran	18.9%	18.9%	12.4%
Azerbaijan		1.4%	3.2%
Algeria	12.8%	11.4%	10.1%
Nigeria	3.4%	3.9%	2.6%
H	**0.466**	**0.465**	**0.542**

The second step is concerned with the price elasticity of demand **ε** and since the conduct parameter result is very sensitive to the level of **ε**, a comprehensive review of the literature and careful analysis of the available elasticity data is required. There is a wide range of elasticity figures for natural gas consumption. They are usually split into short-run and long-term estimates (long-term often meaning 1 year and beyond). Since producers' collusive efforts to maximise economic rents have both a short-term and a longer-term dimension,[130] an elasticity estimate that lies between the generally inelastic short-run figure and the less inelastic longer-run one will be used. David Tarr and Peter Thomson of the World Bank note in a paper:

> The amount of the decline in Russian consumption of natural gas following a price decrease depends on the elasticity of demand. There have been estimates of the price and income elasticities of demand for natural gas by various authors, including Joskow and Baughman for 48 U.S. States, Beierlin, Dunn and McConnor for nine U.S. states, Estrada and Fugleberg for France and West Germany, Hsing for the states in the United States, Liu for regions and sectors of the United States, and Chaudry for Pakistan. These estimates

[129] Table: author.
[130] Raising prices too much in the short-run might eventually create a correspondingly significant quantity reaction since demand is more elastic in the long-run.

> and others have been surveyed by Al-Sahlawi and earlier by Taylor. Regarding the price elasticities of demand, the studies typically find that short run price elasticities are inelastic but the long run elasticities are elastic. From the survey of Al-Sahlawi, the various studies of short run price elasticities of demand range from -0.07 to -0.63, with a modal estimate of about -0.25. Long-run price elasticities of demand range from -0.56 to -4.6 with a modal estimate of about -2.3.[131]

Within this broad range of elasticity data, a long-run price elasticity of demand estimate employed here is -0.93 – a figure used by Joris Morbee and Stef Proost in their study on Russian market power and its impact on the consumption in Europe.[132] Carol Dahl surveyed 15 studies that estimated long-run price elasticities for natural gas demand and the average of all those estimates was -0.99,[133] which is comparable to the estimate of -0.93 used here. This figure means that Turkish gas demand is taken to be somewhat inelastic since it is closer to -1 than to 0 and it is not smaller than -1, which would imply more elastic demand.

While this figure seems appropriate, there are some conflicting arguments about energy demand in emerging markets in general and about Turkey's natural gas demand in particular. The first argument is that emerging market energy demand is generally more inelastic (suggesting a figure between 0 and -1, and possibly more inelastic than -0.93) because in poorer countries people tend to depend on important inputs like energy for their most basic needs such as heating. In contrast, in richer countries a large part of the economy and energy consumption is directed towards many non-essential purposes. Moreover, richer countries usually are more flexible in terms of switching fuels if needed. Therefore, the argument goes, demand is more elastic in developed countries and

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131 Tarr and Thomson, "The Merits of Dual Pricing of Russian Natural Gas", pp. 1189-90.
132 Morbee and Proost, "Russian Market Power on the EU Gas Market: What if Gazprom is Unreliable?", p. 2.
133 Carol Dahl, "A Survey of Energy Demand Elasticities in Support of the Development of the NEMS", *Paper prepared for United States Department of Energy*, Contract De-AP01-93EI23499, 1994.

less elastic in emerging markets. According to this line of thinking, a more inelastic estimate than the one employed here would be appropriate for the Turkish market.

The second argument is about the empirical reality in Turkey and it paints a completely different picture. Various reasons suggest that elasticity of demand for gas in Turkey might be more elastic than usually assumed for emerging markets. One reason is the large-scale use of gas in power generation. For example, in 2007 the share of gas consumption used for electricity generation was at 56%, while the amounts of gas burnt in the household and industrial sectors stood at approximately 22% each.[134] A relatively high share of gas used for power generation is usually characteristic of developed countries and implies a more elastic demand for gas since fuel-switching to other sources of primary energy such as coal, oil and hydroelectric power is possible. Since, somewhat untypically, Turkey features a high share of gas used in power generation, the elasticity estimate should be less inelastic and more similar to that of rich countries. Another reason is this: Even in the household sector fuel-switching seems to take place, which again points to more elastic demand. One of the experts interviewed in Istanbul for this thesis described that old-fashioned fuel switching in the household heating sector occurs regularly – born out of desperation due to high gas prices especially during winter time. In particular, gas consumers who at elevated price levels (no longer) can afford to heat with gas will turn on their indoor coal furnaces again.[135] This also suggests that gas demand in Turkey might not be as inelastic as is usually assumed. Furthermore, one expert interviewed in Ankara argued that that the elasticity in one sector, namely power generation, might actually be positive (i.e. demand rises rather than falls after a price hike), which contradicts economic theory for normal goods.[136] This sug-

[134] Erdogdu, “A review of Turkish natural gas distribution market”, p. 807.
[135] Expert Interview, Dr Filiz Katman, Istanbul Aydin University, Istanbul, September 2010.
[136] Expert Interview, Dr Cenk Pala and Dr Necmi Odyakmaz.

gests that if demand is not inelastic at all, then market structure and producer cooperation must be even more important in terms of explaining the existence of market power.

Because of these conflicting views—from arguments that can be made for fairly inelastic demand to arguments that are put forward for elastic demand—an established estimate from the literature of -0.93, which lies in between, will be used. Moreover, a sensitivity analysis will be carried out, testing whether the results change substantially if the elasticity of demand is assumed to be 25 percent below or 25 percent above the figure employed here. This sensitivity analysis, shown in

Table 4.10, hence uses not only -0.93 to perform the calculations, but also -0.74 (more inelastic) and -1.16 (more elastic). Moreover, the lower end of the spectrum, -0.74 is also very close to an estimate used by Olga Golovina, Ger Klaassen and Alexander Roehrl in one of their simulations for the Turkish gas market.[137] Having presented and discussed all necessary data inputs into the Conduct Parameter Model (formula reproduced from earlier chapters right below),

Table 4.10 and Figure 4.10 show the results of the model.

$$\theta_t = -\frac{\varepsilon_t L_t}{H_t}$$

[137] Olga Golovina, Ger Klaassen and Alexander Roehrl, “An Economic Model of International Gas Pipeline Routings to the Turkish Market: Numerical results for an uncertain future”, *Interim Report IR-02-33*, International Institute for Applied Systems Analysis, July 2002.

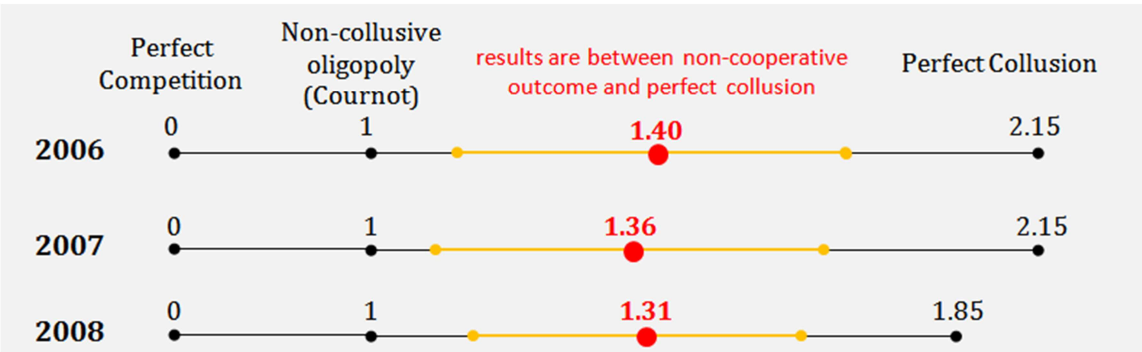
Table 4.10: Results from Conduct Parameter Model[138]

	Results			Spectrum of Possible Outcomes		
	Conduct Parameter θ			Perfect Comp.	Non-coop. oligopoly	Perfect collusion
2006	1.05	**1.40**	1.75	0	1	2.15
2007	1.02	**1.36**	1.70	0	1	2.15
2008	0.98	**1.31**	1.64	0	1	1.85
Elasticity ε	-0.70	**-0.93**	-1.16	θ = 0	θ = 1	θ = 1/H

Sensitivity analysis of ε: -25% and +25% of estimate

Taking into account elasticity of demand and market concentration the CPM results for 2006, 2007 and 2008 show that collusion is a credible explanation for part of the difference between marginal costs and Turkish import prices. The result for every year is between the non-cooperative oligopoly solution (=1) and the respective result for perfect collusion (=1/H), which suggests that cooperation is an important explanation for producers' market power in Turkey. The sensitivity analysis shows that even if the elasticity of demand is assumed to be 25 percent below or 25 percent above -0.93, the result is still in the same range (between the non-cooperative and the perfectly cooperative outcomes).

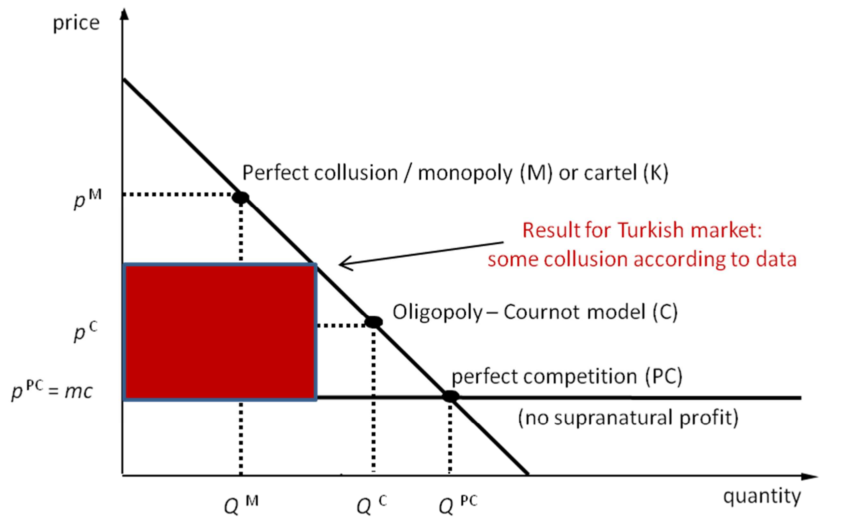
Figure 4.10: Spectrum of Possible and Actual Conduct Parameter Outcomes[139]



[138] Table: author.
[139] Figure: author.

What is the significance of these results in the wider context? As has been shown before in this chapter, there have been instances of cooperative efforts, policies and actions among Turkey's gas suppliers. Furthermore the model confirms that producer conduct (here cooperation instead of competition) is an important explanatory variable. However, the model rests on a variety of assumptions and does not take into account other factors such as market entry barriers (which might overstate the conduct parameter outcomes in terms of ascribing too much significant to cooperative behaviour) and concentration on the buying side (which might understate the conduct parameter outcome). Hence these results need to be put into perspective. Other factors might be important too. For example political and strategic objectives between Turkey and its suppliers might lead the Turkish government to accept less favourable conditions in one area (e.g. gas supplies) in exchange for other political agreements. Moreover, a whole range of domestic issues including the role of BOTAS might be significant as well, e.g. errors in gas market policy design and implementation, corruption and so forth. A qualitative assessment of the results—the fourth part of this chapter—will address these questions in greater detail.

Figure 4.11: Schematic illustration of CPM result[140]



To finalise this section, a brief comment on the welfare implications of producer cooperation in the Turkish gas market will be provided. Figure 4.11 schematically shows the conduct parameter outcome and the blue box illustrates the economic rent earned by producers by charging prices above marginal costs. All statements that can be made regarding this will remain schematic because any specific welfare calculations would require much more complex modelling that is beyond the scope of this thesis.[141]

4.4. Qualitative Assessment of the Results

4.4.1. Cooperation and the Issue of GECF Membership

It is obvious that cooperation among those countries that export natural gas to Turkey, and which are part of the GECF, does play an important role when one considers the question of market power and pricing of natural gas. The descriptive part of this chapter

[140] Figure: author.

[141] Calculating economic rents would require one to estimate a change in quantity demanded in response to price changes. Lower prices—at the oligopoly level and at the competitive price (=marginal cost) level—generally imply higher quantities consumed. To model those would be extremely complex and using the observed quantities with conjectured price levels in order to calculate revenues and rents will neither be correct nor marginally useful.

showed exporters' cooperative policies, efforts and actions at the corporate, at the bilateral government-to-government and at the international GECF levels. The data and calculations of the conduct parameter model in section 3 confirm that if one considers other important factors which influence pricing, such as market structure and the price elasticity of demand, cooperation is one valid explanation for the market power producers enjoy in the Turkish market. This conclusion holds true when a sensitivity analysis is conducted in which some variables were changed substantially in order to determine whether the conclusion remains the same even if one's estimates are somewhat inaccurate.

What is clear is that market concentration and inelastic demand alone are unsatisfactory explanations for market power, but in light of the fact that the conduct parameter model is not perfect, one must ask how important cooperation as an explanation for the large price-cost margin is. The CPM does not consider market entry barriers, the impact of buyer concentration, bad policy, political interference and motives, corruption and other possible explanations. One reason is that such factors are extremely hard to quantify and hence cannot be included in the model.

To address this limitation, this section will perform two duties. First, the significance of cooperation as such will be considered, e.g. by looking at suppliers which are not GECF members. Second, other possible causes will be considered in detail to determine their impact on market power in the Turkish market.[142] Such contextual qualitative analysis will be a useful complement to the quantitative analysis performed before.

Having compared import prices to the marginal cost of production of the suppliers in order to determine whether cooperation might explain part of the mark-up over the competitive level, it is also instructive to compare the prices charged by different

[142] A third test is to look at a case where there is some market power, but where cooperation among GECF members is not possible (i.e. less than two GECF export significant quantities to that market). Case study 3 in chapter 6 will do exactly that.

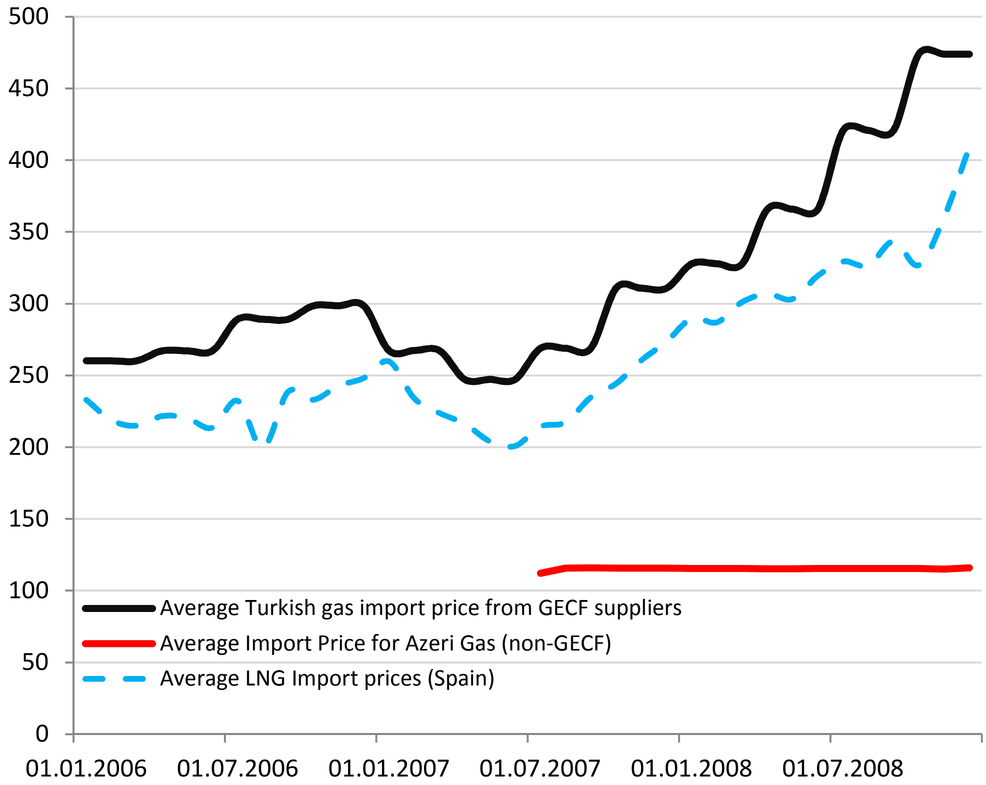
suppliers. This could be especially fruitful since one supplier, Azerbaijan, is not part of the GECF.

Figure 4.12 shows three prices: the average price of GECF suppliers, the import price charged by the only non-GECF supplier and the import price for LNG sold under long-term contracts to Spain. (Spanish import prices for LNG are the most suitable comparison to Turkey since both are highly import-dependent major gas markets and both are also located in southern Europe, which means the transportation costs are comparable.) The difference between the average GECF-supplier prices and the two alternatives is striking, but another fact is equally striking. Going back to Table 4.6, which showed a more detailed breakdown of Turkey's import prices, one finds that the prices charged by GECF suppliers tend to be in the same region while only Azerbaijan is a distinct outlier. In addition to the fact that collusion plays a role in explaining market power, one can now also state with confidence that collusion is specific to the GECF members (as they achieve higher prices) and does not involve non-GECF suppliers.

Figure 4.12: Import Prices for Gas from GECF vs Non-GECF Countries[143]

All converted to US$ per Mcm, 2006 to 2008 (Azeri imports started in 2007)

[143] Chart: author; Data: BOTAS, 2010 and IEA Energy Prices and Taxes, 2009.



Moreover, one of the experts interviewed for the thesis also argued: “There are two LNG terminals in Turkey, one owned and operated by BOTAS on the Marmara Sea near Istanbul. The other one is which is privately owned by EGE Gas and close to industrial facilities near Izmir. EGE Gaz is now printing money with this LNG terminal because they agreed the contracts when prices were high and now they buy their LNG extremely cheaply from the spot market. If you can get a permit for a privately-operated LNG terminal in Turkey, you can run this very profitably under current market conditions.”[144] Some competitive suppliers such as Azerbaijan and suppliers of spot LNG cargoes can easily undercut dominant and collusive producers, but this happens only on a very small scale in Turkey as BOTAS is committed in long-term contracts (LTC). Producers jointly defend these LTCs, which, as the subsequent analysis will show, is also contributes to their market power.

[144] Expert Interview, Dr Cenk Pala, Chief Executive, E.ON Ruhrgas Turkey, Ankara, September 2010.

It is sometimes argued that it is the oil price that determines natural gas prices in places such as Turkey and not producers' market power and collusion. Figure 4.12 clearly demonstrates that such arguments are not very sophisticated and are the result of an incomplete understanding of gas prices in certain markets like Turkey. Oil-indexation in the pricing formula determines the fluctuation of Turkey's gas import prices, but not the absolute levels at which they fluctuate. Instead, negotiations between Turkey's suppliers and BOTAS determine these levels. Figure 4.12 shows the fluctuation of the average import price from GECF member states (and this is largely driven by price changes of a basket of oil products), but it also shows that the only non-member, Azerbaijan, is – as pointed out before – the outlier, despite the fact that Azeri supplies are also indexed to the price of oil products. Hence, the argument that oil-linked gas prices are high because of high oil prices is correct, but misses the point, since the absolute level at which prices fluctuate rather than the fluctuation itself is important. That is why, moreover, the role of OPEC is not particularly relevant here since not the movement of prices is the important argument, but the level at which the movement takes place. (Some have argued that OPEC – through oil indexation – determines the price of gas indirectly and collusion among gas exporters is not especially relevant.[145])

Cooperation among producers does matter. Having employed a variety of methods and having carefully analysed the data, one can be confident that collusive and openly cooperative conduct is an important explanation for the price-cost margin the Turkish natural gas market. Collusion here is not limited to narrowly-defined traditional price fixing in the way that other cartels such as OPEC have operated. The broadly conceived analysis of cooperative actions in the descriptive part showed this.

[145] Expert Interview, Dr Levent Ozgul, Head of Gas Master Plan Commission, BOTAS, Ankara, September 2010.

The outcome of the conduct parameter model suggests that cooperation does play a role in explaining elevated prices. This, however, could also include non-GECF suppliers. If this were true, it could mean that non-GECF member states also collude and the impact of GECF membership could not be determined with confidence. Yet, the evidence concerning price differentials between members and the only non-member (Azerbaijan) confirms the hypothesis: Azerbaijan charges significantly lower prices than those countries within the GECF. Hence high prices and GECF membership are evidently connected. That shows that cooperation as evidenced in the CPM results is not a general producer phenomenon, but is specific to the GECF member states.

Moreover, Azerbaijan's much cheaper supplies[146] to Turkey as well as Turkmenistan's low-cost export potential[147] pose a clear competitive threat to the market power and economic rents earned by GECF suppliers. Given the GECF's objective of "protecting their economic interests" by raising and maintaining high gas prices, one might expect these dominant suppliers to defend their market power if possible. A careful analysis of the literature and relevant reports shows that both Russia and Iran have been actively trying to curb Turkey's alternative (and more competitive) supplies of natural gas.

Specifically, Russia, which until a few years ago was a gas supplier to Azerbaijan, now buys volumes from the country after Azerbaijan emerged as an exporter (and hence competitor) in 2007. Clearly, the prices offered by Russia are "clearly attractive enough to give the Azeris and the consortium ample grounds for serious consideration.[148] Subsequently, two analysts noted:

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[146] Compared to Algeria's, Iran's, Nigeria's and Russia's suppliers.
[147] As a reminder, there is an existing gas sale and purchase agreement between Turkey and Turkmenistan, which has not become operational so far.
[148] Unknown Author, "Azerbaijan's Turkish, Russian Troubles", *World Gas Intelligence*, 1 October 2008. Accessed via Nexis UK on 2 May 2011.

> In the medium term Russia can become a remarkable consumer for Azerbaijani gas. On 14 October 2009, Russia's Energy Company, Gazprom, and SOCAR signed a contract to supply Azerbaijan's gas to the Russian North Caucasus from the beginning of 2010. The agreement is very flexible and specifies only the minimum amount of supplies, which is a mere 0.5 bcm per year. Partners expect that Russia will buy as much gas as Azerbaijan can sell.[149]
>
> Supplies from Azerbaijan to Turkey depend on the price negotiations, Russia offered higher prices to the Azeri government, which has already become highly sensitive to developments between Turkey and Armenia. [150]

The Russian government has undertaken similar steps concerning another potential supplier to the Turkish market, Turkmenistan. While BOTAS' agreement with Turkmenistan has not become operational due to a whole host of reasons, including border disputes between Azerbaijan and Turkmenistan about their borders in the Caspian Sea that prevent a pipeline being built through the Caspain, Russia's meddling is one of those reasons. Gazprom has secured gas supplies from Turkmenistan, which it pumps through its own network and resells it mostly to Europe at a much higher price. An observer describes the deal:

> Russia's April, 2003 gas deal with Turkmenistan, a pivotal move in Putin's grand design to secure for Russia a leading place in what would be an analogue of OPEC's cartel for natural gas, exemplifies the process as it pertains as well to Central Asia. The firm chosen to move gas from Turkmenistan to Russia and Ukraine is Eural Trans Gas, a firm chartered in a Hungarian village named Csadba and headed, through an intricate maze of shell companies, by one of Russia's most notorious organized crime lords, Semyon Mogilevich. Eural Trans Gas stood to make from $US320 million to $US1 billion on this deal, which clearly raises the most disturbing implications.[151]

The view that Russia successfully reduces Turkey's alternatives to obtain natural gas from non-Russian and non-GECF sources was also expressed by Dr Filiz Katman in

[149] Pritchin, "Azerbaijan's New Gas Strategy", pp. 125-126.
[150] Mert Bilgin, "Turkey's Energy Strategy: What difference does it make to become an energy transit corridor, hub or center?", *UNISCI Discussion Papers*, no. 23, May 2010, p. 122.
[151] Stephen Blank, "The Putin Succession and its Implications for Russian Politics", *Policy Paper*, Institute for Security & Development Policy, Stockholm, February 2008, p. 28.

an expert interview in Istanbul: Incremental competitive alternatives to current supplies are difficult to secure because Gazprom locks up resources in places such as Azerbaijan and Turkmenistan.[152] Dr Katman also pointed out various academic papers on Turkish energy issues and natural gas policy in the wider region. One of those papers indicated that not only Russia, but also Iran is actively trying to secure volumes from Azerbaijan. As the paper notes:

> On 13 January 2010, SOCAR and the National Iranian Gas Export Company signed a contract regarding Azerbaijan supplying gas to Iran. The head of the Centre for Oil Studies, Ilham Shaban, said that in 2010, when the old gas pipeline is repaired, its capacity would become 1.5 bcm per year. Furthermore, Iran and Azerbaijan have agreed to construct a new pipeline with five bcm capacity. Collaboration with Iran is very important for Azerbaijan because it initiates a constructive mode of cooperation with this important neighbor. Additionally, Iranian Oil Industries Engineering and Construction has a 10 percent share in "Shah Deniz 1" project.[153]

Both Russia and Iran, the world's number one and number two holders of natural gas reserves, are clearly not concerned about an impending shortage of natural gas, but instead seem to pursue this strategy of locking up resources in non-GECF countries for the reasons stated before: to protect their market power and hence economic rents. Azerbaijan and Turkmenistan both are not members of the GECF. The most efficient way of preserving economic rents and market power in lucrative markets such as Turkey is to take alternatives off the market. This behaviour aims to address the external procedural challenge faced by the GECF: keeping out actual and potential non-member production.[154]

[152] Expert Interview, Dr Filiz Katman, Director, Energy Research Institute, Istanbul Aydin University, September 2010.
[153] Pritchin, "Azerbaijan's New Gas Strategy", p. 126.
[154] This is one of the major challenges faced by the GECF mentioned in chapter 1 under procedural conditions enabling cooperative effectiveness.

4.4.2. Market Power and Economic Rent: Other Explanatory Factors

The conduct parameter model calculations showed that in each year between 2006 and 2008 price levels were not only far above the marginal cost level, but also above the non-cooperative oligopoly level. An outcome between the non-cooperative level and perfect collusion indicates that there is a small number of firms—an oligopoly—which engage in cooperation and manage to charge elevated prices.

On the basis of the simple CPM, it is impossible to ascribe a specific US$ amount to cooperation and other formal factors that are part of the model, such as the elasticity of demand, as well as factors that are not part of the model. Such other factors will be discussed qualitatively in this section to shed some light on additional and more sophisticated (possible) explanations of market power.

To illustrate the size of the mark-up over marginal cost and over the non-cooperative outcome, Figure 4.13 *schematically* shows the actual average price charged by Turkey's gas suppliers and the average marginal cost of all producers.[155] The non-cooperative oligopoly outcome is an approximation and shows that the mark-up over this price level is still very considerable. There are quite a few additional possible explanatory factors of market power, hence it is useful to picture the extensive size of the mark-ups before moving on to describe these various other factors.

The conduct parameter model takes into account three major explanations of market power: market concentration, the elasticity of demand and producer conduct. Yet, other factors may play an equally or even more important role in explaining market power. As was pointed out in chapter 3, the role of buyer concentration and market entry barriers are not part of the model and could lead to an understatement or overstate-

[155] Both prices and marginal costs are weighted by the market share of each supplier.

ment of the role of cooperation among producers in the model results. These two and other possible factors will be discussed here.

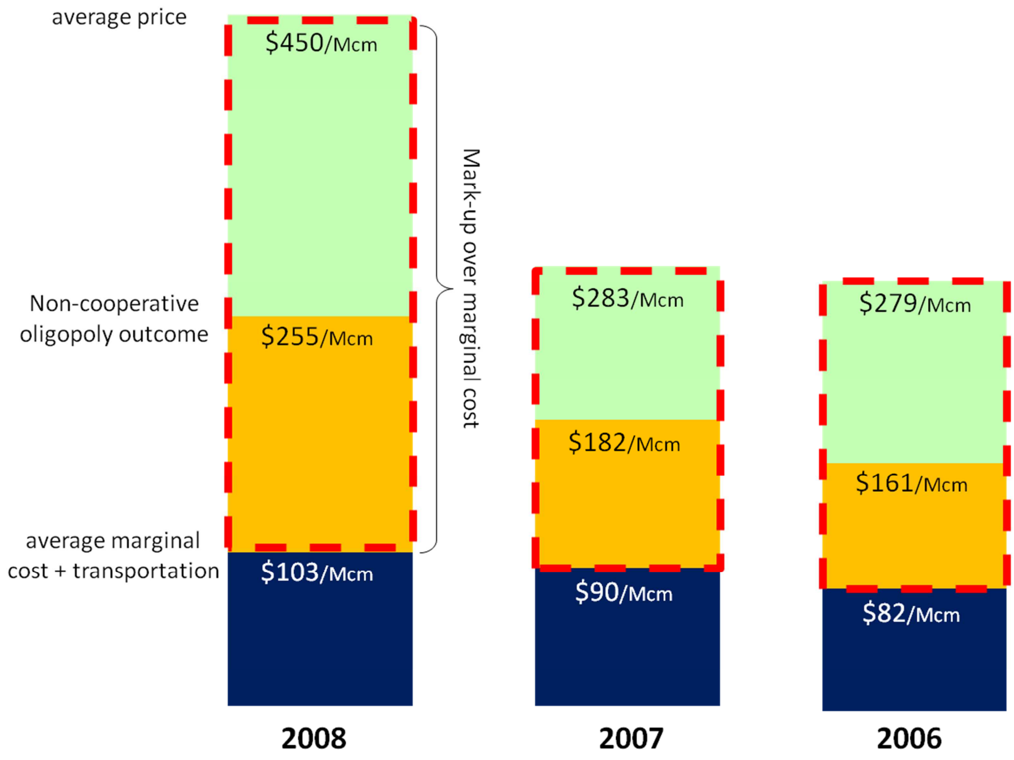

Figure 4.13: Schematic Illustration of Economic Rent earned by Exporters[156]

Buyer concentration. If consumers of a good or service are numerous, but the number of producers is small, producers, because of their small number and the possibility to collude easily, are in a better bargaining position and hence are likely to enjoy market power. If the number of consumers is small too, this may be different. Buyer concentration is not part of the CPM, but the reality in Turkey is that BOTAS still dominates more than 90 percent of the market. Despite privatisation and liberalisation efforts, the Turkish gas importing market remains highly concentrated. It is this buyer concentration that might give Turkey a better bargaining situation than is assumed in the

[156] Figure: author.

model. This would mean that the CPM result—located between non-cooperative oligopoly and perfect collusion—could be even closer to the perfectly collusive outcome.

Most experts interviewed for this thesis agreed that BOTAS' dominant role was an obstacle to a more competitive market in Turkey, partly because BOTAS is not interested in change, which would essentially entail losing market share. BOTAS also has no interest in bringing more transparency to the negotiation process with the suppliers nor does it have an incentive to actively look for more competitively priced gas from other sources since it does not face much competition at home.[157] Contrary to this widely held position, Dr Levent Ozgul from BOTAS pointed out in the interview that unbundling BOTAS and privatising the market sounds good in theory, but it is not sensible in practice. The reality, he pointed out, is that Turkey has to deal with national oil and gas companies such as Gazprom, Sonatrach, SOCAR and so forth which are mostly controlled by totalitarian governments. Dr Ozgul therefore advocates a strong BOTAS that will enable Turkey to negotiate eye to eye with those state-run suppliers in a way smaller private companies could not.[158]

> In theory it might be a good idea to unbundle and to privatise BOTAS in order to create more competition and a more market-based approach. In practice, BOTAS deals mainly not with the competitive and market-driven BPs and Chevrons, but with totalitarian governments that surround Turkey. Therefore a strong, integrated and at least partly state-owned BOTAS is needed to secure a strong position in negotiations.[159]

However, Turkey pays some of the highest prices for gas despite being surrounded by countries holding some of the world's largest gas reserves. This should give Turkey a choice of suppliers and should keep transportation costs low. The fact that

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[157] For example: Expert Interview, Dr Tuncay Babali.
[158] Expert Interview, Dr Levent Ozgul.
[159] Expert Interview, Levent Ozgul, Head of Gas Master Plan Commission, BOTAS, Ankara, September 2010.

prices are high despite this is evidence that if buyer concentration in fact strengthens the country's bargaining position, it has not generated favourable results so far.

Market entry barriers. Contrary to buyer concentration, market entry barriers could lead to an overstatement of the conduct parameter. If there are high barriers to entry for potential market participants, collusive producer conduct may not be as important an explanation as the model suggests. It is true that natural gas production and transportation faces such high barriers. Yet, one must distinguish between natural market entry barriers and others which may be established or sustained with anti-competitive motivation. Natural barriers are high upfront costs for developing natural gas fields and for building long-distance pipelines and LNG tankers. These certainly exist for alternative suppliers[160] though not in all cases. For example, were Iraq to export gas to Turkey, it could produce the gas from fields close to the Turkish border for around US$15 per Mcm, much lower than even low-cost suppliers such as Russia.[161] Moreover, incremental volumes from Iran would not face high entry barriers either since many Iranian gas fields need to be scaled up, but do not need to be developed from scratch. A pipeline also exists, which carries small volumes to Turkey. Hence, the natural entry barriers exist, but they are not as severe as they could be. Hence these barriers may not overstate the CPM much.

There is a second type of market entry barrier as well: artificial ones put up to keep the market uncompetitive. A competitive market, among other things, needs transparency, flexibility and prices that reflect supply and demand. Yet, in the Turkish natural gas market—and in many others in Europe and East Asia—this is not the case. One entry barrier is the wide-spread use of long-term contracts. Suppliers insist on those

[160] Turkey's existing suppliers, apart from Azerbaijan, source gas from relatively old fields, where high upfront costs have largely been amortised over years and decades. That is in part why their marginal costs are relatively low.

[161] Expert Interview, Dr Cenk Pala. He cited a feasibility study conducted by Shell in Northern Iraq.

contracts in order to commit the consumer for up to 30 years, hence shutting out potential rivals for decades. Energy expert Filiz Katman pointed out in the expert interview conducted with her that Turkey is overcommitted having signed agreements to take delivery of gas almost twice the actual consumption. These and long-term inflexible contracts prevent major adjustments and market entry of competitors.[162] Producers defend this practice jointly and hence Turkey cannot source gas through more flexible short-term contracts.

Connected to the issue of long-term contracts with upstream suppliers is the problem of stranded costs. These are costs that were "incurred within the previous market structure [and] that cannot be economically recovered within a competitive natural gas market structure."[163] Stranded costs include high-price long-term contracts that need to be fulfilled until their expiry.[164] "Stranded costs create uncertainty for new investors and risk stifling competition. [Regulators in Turkey have to] mitigate and accurately measure stranded costs […] to provide for their recovery in a way that is 'fair' and does not impede efficient entry or the emergence of competition. Prospects for competition among upstream players are poor for the immediate future unless there is new entry from new sources. However, new entry may exacerbate the problem of stranded costs, since excess supply of gas [in long-term contracts] is already expected to be substantial. However, on the other hand, by delaying the import/upstream competition with the import ban provision in the NGML, Turkish policy makers bind themselves and Turkish consumers with the high prices in those contracts."[165] Hence the issue of long-term contracts is both problematic because all (GECF) producers refuse to move to more flexi-

[162] Expert Interview, Dr. Filiz Katman.
[163] M. Oğuzcan Bülbül, "Liberalization of the Turkish Gas Market", *Rekabet Dergisi*, vol. 11, no. 1, 2010, p. 21.
[164] Other examples include: over staffing, especially payments for redundancies resulting from transfer of operations from BOTAS to the private sector and for pension liabilities.
[165] Bülbül, "Liberalization of the Turkish Gas Market", p. 21.

ble, short-term contracts—thereby keeping out competition—but it is also a regulatory challenge for the government in Turkey because of stranded costs. A more detailed treatment of Turkish domestic policy design and implementation is to follow in the next subsection. Finally, another artificial barrier to market entry is worth mentioning: the practice of conducting negotiations on natural gas sale and purchase agreements in secret and keeping the contract terms secret too. This lack of transparency makes it difficult for competitors to enter the Turkish market.

Section 2 described various cooperative efforts and actions among GECF suppliers to the Turkish market, including the use of the gas pricing mechanism (oil indexation) to sustain producers' market power. Some of the artificial entry barriers mentioned here also contribute and sustain producers' market power. In fact, there is a positive feedback loop—an interdependence—between artificial entry barriers and producer cooperation. All producers insist on secret negotiations and on locking customers into two or three decade-long contracts. These barriers make it easier to keep out competition and less competition makes it easier to cooperate (on matters of price and contract terms).

Hence, some *natural* market entry barriers may to an extent overstate the conduct parameter result. However, *artificial* market entry barriers that are the result of (openly) cooperative action should not be understood as potential overstatement of the CPM, but instead they should be considered part of the CPM result. Given the prevalence of these artificial entry barriers, it could well be that their existence even understates the CPM figure in terms of actual cooperative conduct.[166]

Policy issues. The major policy document of the past decade was the 2001 Natural Gas Market Law, which incidentally was passed in the same as the GECF was estab-

[166] Accounting for both secret collusion and overt cooperation.

lished. In line with EU efforts to liberalise and integrate the European gas markets, Turkey passed an even more aggressive law. Yet, while the law itself was very ambitious, the implementation of it left much to be desired:

> The 2001 gas market law was very aggressive, but it has hardly been implemented. BOTAS was supposed to transfer at least 50% of its contracts to the private sector by 2009, but so far less than 10% of gas volumes are now provided by private firms. Moreover, BOTAS is not allowed to sign new contracts with suppliers from abroad, but in fact they still do. Such is the reality of Turkish politics.[167]

The gas release programme that required BOTAS to relinquish volumes has hence not been properly implemented. One issue was that BOTAS' competitors were quite small firms with which Gazprom, Sonatrach et al did not want to do business (presumably mainly because these smaller firms would have eroded the exporters' market power over time by looking for the most competitive source of gas). A more effective policy design could have been to privatise BOTAS and divide it into four to five smaller firms. That way, contracts with GECF suppliers, which are eager to protect their market power, would not have had to be changed. Hence, in terms of policy, both the design of the NGML and its implementation were problematic. This could also be an additional explanation for the existence of market power.

Political factors. Political factors are treated separately from policy issues here. Given the existence of a state-run and state-owned pipeline firm such as BOTAS, one would expect some degree of politicisation that influences market prices and might explain departures from competitive conditions. In addition to this fact, there are other factors at play too. For example, while the gas sale and purchase agreements between BOTAS and its suppliers such as Gazprom are negotiated on a company-to-company basis,

[167] Expert Interview with Ms Berris Ekinci, Head of Energy Department, Turkish Ministry of Foreign Affairs (MFA) and Dr. Tuncay Babali, senior diplomat, Turkish MFA and former fellow at Harvard's Weatherhead Center for International Affairs (2009-2010), Ankara, September 2010.

an intergovernmental agreement (IGA) usually precedes this. Hence governments and their political agendas are not only involved indirectly through state-run companies, but also more directly in the basic IGAs agreed upon before the commercial negotiations begin. While specific examples of quid pro quo deals in which the Turkish governments accepts less favourable conditions in their natural gas negotiations with their suppliers in exchange for other political or strategic benefits are hard to come by, the political element might be another factor that explains why gas is not priced as competitively as it could be.

Politics also plays a role in two other ways. As one expert argued, the retail natural gas prices in Turkey are politicised, especially ahead of elections. "The prime minister and the ruling party will often lower end-user prices of gas and electricity, which are mainly very high because of high import costs."[168] The loss imposed on BOTAS by such actions is of course ultimately borne by all citizens through their taxes. Moreover, politics matters in yet another way. International relations professor Mustafa Aydin pointed out that the search for alternative sources of gas is hindered by America's political influence. "Iran has the world's second largest gas reserves and could deliver much larger quantities to Turkey than it does at the moment. Yet, Iran's supplies are kept to a minimum because of US political influence and sanctions. Sanctions on Iran left infrastructure and fields underdeveloped so that additional volumes couldn't be supplied at the moment even if the Americans allowed it."[169] This argument has some merit, but the fact that Iran has been one of the most vocal GECF suppliers aiming to raise prices, makes it seem unlikely that Iran would be the supplier most likely to provide additional volumes under more competitive conditions.

[168] Expert Interview, Dr. Necdet Pamir, former TPAO executive, Ankara, September 2010.
[169] Expert Interview, Professor Mustafa Aydin, Kadir Has University, September 2010.

Corruption. A recurrent theme in the expert interviews conducted in Turkey in September 2010 was corruption. Almost every expert agrees that corruption does play a big role in Turkish politics and also in the energy market and business. Dr Pala argued: "Erdogan supports market-oriented reforms, but most often he favours those private companies that are close to him and his party, such as Calik Holdings." Professor Aydin added that when it comes to the construction of pipelines for both gas and oil, Calik Holdings seems to be the government's preferred company. "Mr Calik, the owner of the holding company maintains close ties to the government and employs the son-in-law of Prime Minister Erdogan as the chief executive of his company."[170] Moreover, Vladimir Socor argued that "Blue Stream One's exorbitant construction costs translated into onerously high prices to Turkish gas consumers. Elements in the Turkish government at that time colluded with Gazprom in this project, but the subsequent investigations did not run their full course."[171]

Infrastructure/Storage. The lack of gas storage facilities in Turkey are another possible reason for the existence of market power.[172] If gas consuming countries do not have sufficient storage facilities, they are particularly susceptible to suppliers' pricing power since they have no cushion in a time of crisis suppliers can get away with charging much higher prices. Tamer Cetin explains:

> Natural gas demand in Turkey is seasonally volatile and depends on imports. Supplier countries can put ceilings on imports for economic and political reasons. For example, Ukraine and Iran cut gas exports to Turkey in 2006. In January 2007 and now in January 2008, Iran reduced the supply of natural gas two more times. Iran always defends the cut in supply on the basis of technical problems and a heavy winter. Nonetheless, political reasons also had some role in Iran's behaviour. […] [Moreover, during] the crisis with

170 Expert Interview, Mustafa Aydin.
171 Vladimir Socor, "Gazprom, Turkey Revive and Reconfigure Blue Stream Two", 11 August 2009. Accessed on 10 October 2010: http://economie.moldova.org/news/gazprom-turkey-revive-and-reconfigure-blue-stream-two-203210-eng.html.
172 Expert Interview, US Government official, Ankara, September 2010.

> Russia, Ukraine consumed domestically some of the gas it is needed to transport to Turkey. This unexpected supply shortage gave signals about the vulnerability of the market structure and raised questions about the sustainability of the current system.[173]

This section has considered alternative explanations for the existence of the considerable difference between prices and marginal cost of gas in Turkey. While certain factors such as buyer concentration might understate the CPM result, others such as the existence of market entry barriers might overstate it. It seems that policy, political and other factors including corruption in Turkey and the absence of sufficient storage facilities may also in part explain producers' pricing power. Nevertheless, after careful consideration of these other possible factors cooperation remains a viable major explanation for the price-cost margin though perhaps not quite to the extent that the conduct parameter model suggests.

[173] Çetin, "Institutional Change in the Turkish Energy Markets", pp. 203-205.

4.5. Consequences of Market Power and Conclusion

The preceding analysis has shown that the significant degree of market power in the Turkish gas market is to a considerable extent not only explained by the highly concentrated market structure, by somewhat inelastic demand, but also by cooperation among major natural gas exporters to Turkey, especially those that are members of the GECF. This market power is also perpetuated by producers' insistence on uncompetitive practices and artificial market entry barriers. High prices and significant amounts of economic rent earned by suppliers, chiefly Russia as it is the biggest one, have a range of detrimental implications for Turkey in the energy, political and economic spheres. These implications will be explained in detail below.

Energy Security. First of all, energy security not only comprises security issues related to the physical access of energy supplies. Much attention has been devoted to the physical access side of the argument and other studies[174] have also looked at the recent resurgence of energy nationalism, which creates vulnerabilities for all gas consuming countries. Yet, for highly import-dependent gas importing consuming countries in Europe and Asia—Turkey in particular—pricing vulnerability has been a permanent feature. That is why producers' market and pricing power should not only be understood in narrow terms, but also in terms of broader energy security issues. While there are many definitions for energy security, the most basic one is the reliable and affordable access to energy. If access to energy becomes unaffordable for many—and this is a relevant problem in a developing country such as Turkey—then pricing is an energy security issue as well.

[174] Nana de Graaff, "A Global Energy Network? The expansion and integration of non-triad national oil companies ", *Global Networks* vol. 11, no. 2, 2011, p. 262.

Welfare Implications. Uncompetitive gas prices are problematic in Turkey for many reasons. As a report by the Turkish government notes:

> Around 58 percent of electricity production is dependent on imported resources including other imported fuels besides natural gas. That much dependence on natural gas almost all of which is imported and large part of that dependence being on a single country constitutes a significant supply security risk besides that being the main reason behind the persistent electricity price increases seen in last two years.[175]

Overreliance on a few colluding suppliers leads to high prices and economic rents earned by those suppliers at the expense of the Turkish economy and consumers. Figure 4.14 compares the OECD average of power and natural gas prices to prices in Turkey. The poorest OECD country hence faces prices far above average despite the fact that it is surrounded by a wider range of gas-rich countries (with low production costs) than any other country within the OECD.

Figure 4.14: Power and Gas Prices for Industrial Consumption: Turkey v OECD average[176]

		2004	2005	2006	2007	2008
Electricity (¢/Kwh)	**Turkey**	10.0	10.6	10.0	10.9	13.9
	Average of OECD	7.3	7.8	8.6	9.4	-
Natural Gas ($/10^7 Kcal)	**Turkey**	230.3	304.5	352.7	440.8	572.9
	Average of OECD	253.7	320.2	335.4	338.5	432.1

No doubt, these high end-user prices are partly explained by the monopoly position of BOTAS. Economists call this situation double marginalisation where consumers

[175] Unknown Author, "2010 Annual Programme", Republic of Turkey - Undersecretariat of State Planning Organization, 2010, p. 113.
[176] IEA Energy Prices and Taxes, 2010.

face two monopolies,[177] one at the upstream end and one on the downstream end of the chain (BOTAS). Yet, in most comparable gas consuming countries there are only a limited number of downstream firms that also possess market power. Hence the difference between Turkey's end-user prices shown in Figure 4.14 and the OECD average is not principally due to double marginalisation and BOTAS' dominant role.

In fact BOTAS itself has faced immense difficulties because of inflexible long-term contracts with Gazprom et al and because of high prices:

> Turkey's BOTAS raised natural gas prices by between 5.4% and 5.8% yesterday in a bid to ease its financial difficulties, according to Reuters. The gas-price rises amount to a cumulative 30% so far this year and are likely to push up electricity prices and in turn boost inflation. […] The move follows earlier reports that BOTAS is close to bankruptcy after being squeezed by high-priced take-or-pay contracts with Russia's Gazprom, regulated end-user prices, and debts of around 9 billion Turkish lira (US$6 billion) run up by Elektrik Uretim Anonim Sirket, which operates the majority of Turkey's 13,300MW of gas-fired generating capacity. […] BOTAS last raised natural gas prices 6.8% in August 2006, but has since kept prices steady despite rising costs because of soaring oil prices.[178]

Furthermore, IHS CERA reported in 2007 that an investigation into gas import contracts between BOTAS and Gazprom was conducted. The 1998 contract concluded that Turkey had "overpaid for supplies by up to US$233m" – on just one of the three contracts BOTAS has with Gazprom. The investigation also criticised the long-term contracts with Gazprom that "lock [Turkey] into buying far more gas than it needed." Turkey's former energy ministers Recai Kutan and Cumhur Ersumer are now being scrutinised for their role in concluding the contract and also for possible corruption.[179]

[177] Or a group of colluding upstream suppliers.
[178] Sally Bogle, "BOTAS Hikes Turkish End-User Gas Prices to Ease Financial Problems", *IHS Global Insight*, 2 November 2006. Accessed via Nexis UK on 2 May 2011.
[179] Sally Bogle, "BOTAS's 1998 Gas Contract with Gazprom Probed; Sale of Ankara Gas Distributor Cleared", *IHS Global Insight*, 27 November 2007. Accessed via Nexis UK on 2 May 2011.

High gas prices in Turkey are not just a matter of economic welfare, but also a welfare issue at a more basic level. One expert reported that due to high prices especially during winter time many citizens who can no longer afford gas prices to heat their houses, switch to the use of indoor coal furnaces that are extremely dirty not only because burning coal indoor is a health risk by itself, but also because Turkish coal is much more dirty in terms of generating local pollution and toxic emissions than coal from other countries.[180]

Macroeconomic Issue. High and fast-rising gas prices contribute to Turkey's inflation problems, which at 10.4 percent in 2008 are already very considerable given the country's strong economic growth. Gas prices exacerbate inflationary problems. Moreover, high gas prices make energy-intensive production more expensive, hence hurting Turkey's competitiveness. Finally, as Roubini Global Economics (RGE) note, Turkey's enduring current account deficit is caused by structural trade issues, in particular Turkey's reliance on expensive imported energy.[181]

Political Implications. Turkey's heavy dependence on foreign sources of energy is a fact and a detrimental one at that. Yet, because of extremely limited conventional sources of oil and gas, this import dependence is likely to continue. This dependence, the concentrated market structure and producer collusion taken together weaken Turkey's political position especially vis-à-vis its dominant suppliers of gas. A more diversified and competitive market approach would reduce reliance on big suppliers, increasing the Turkey's bargaining power and it would also reduce the enormous cost imposed by the current system.

The current Turkish approach of government-influenced negotiations with the country's gas suppliers is not without irony. By sometimes making concessions in the

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180 Expert Interview, Dr Filiz Katman.

181 Mary Stokes and David Rogovic, "RGE's Wednesday Note: Mind the (Current Account) Gap", Roubini Global Economics *Wednesday Note*, 25 August 2010.

issue area of natural gas (i.e. accepting less favourable terms and prices or more control for Gazprom and others in Turkey's domestic distribution market) in order to achieve other strategic goals, Turkey weakens its position in the long-run by becoming ever more dependent on those suppliers. What may look like a strategic, political success for Turkey in the short-term (in exchange for compromises in the natural gas negotiations), may in the long-run weaken the country's overall position.

To conclude this case study on the role of cooperative conduct and market power in the Turkish natural gas market, one can summarise the following findings. Cooperation among Turkey's natural gas suppliers is both a clearly stated objective and there is a wide range of publicly available evidence that cooperative efforts, policies and actions have taken place after the GECF's formation. Section two provided a descriptive account of these efforts at the international, at the bilateral and at the company-to-company levels. The weaker forms of cooperation tend to take place at the international level, e.g. in GECF meetings. The stronger types of cooperation have taken place at the national government and corporate levels. Despite weak levels of institutionalisation, I find evidence that cooperation and collusion among GECF members is effective. This finding is at odds with the international relations literature that presumes higher levels of cooperation tend to lead to more effective cooperation outcomes. This finding, especially if corroborated in the other case studies, will be discussed in chapter 7. Hard evidence of (collusive) price-fixing is of course essentially impossible to obtain, which is why the conduct parameter model and empirical data were very helpful in estimating the conduct of producers, which was collusive in the period of time under investigation (2006 to 2008). The subsequent qualitative analysis showed that there might be some other factors that are not part of the model and which might lead to an over- or underestimation of the cooperative nature of the producers' conduct. On balance, these factors do not change the overall result that Turkey's producers collude. The model outcome was greater than the non-cooperative oligopoly outcome, but lower than the perfectly collusive outcome, suggesting that cooperation is an important explanation for market power. More evidence for the effect of collusive conduct on gas prices can be found by considering the only supplier of gas to the Turkish market that is not part of the GECF, Azerbaijan. The import price of gas from Azerbaijan was 60 to 70 percent lower than the average price charged by members of the GECF. This evidence of a significant price differential between members and the only non-member of the GECF confirms the hypothesis that high prices and GECF membership are evidently connected. Cooperation and collusion as evidenced in the CPM results are therefore not general producer phenomena, but are specific to the GECF member states.

4.6. Appendix

Appendix Table 4.1: Natural gas cost of extraction and transportation[182]

Unit costs used in that study ($/1000m^3)*.

	Gas extraction and liquefaction costs C_i ($/1000m^3) *	Unit shipping costs T_{ij} for LNG ($/1000m^3)						
		Europe						
		Belgium	France	Greece	Italy	Portugal	Spain	Turkey
Trinidad and Tobago	21.19	44.89	43.59	57.23	48.6	40.47	40.61	61.62
Oman	14.13	62.32	46.77	31.21	45.49	50.31	47.67	30.82
Qatar	10.59	65.65	50.34	35.88	49.07	56.86	51.47	35.49
UAE	12.36	65.54	49.95	35.35	48.67	56.75	50.94	34.97
Algeria	15.89	23.69	13.59	18.15	14.08	15.18	11.09	22.4
Egypt	21.19	38.47	22.99	15.11	22.32	29.84	23.48	15.67
Equatorial Guinea	17.66	49.69	46.04	59.46	47.83	41	40.48	60.19
Libya	17.66	33.8	19.57	19.79	18.55	25.21	19.55	20.27
Nigeria	17.66	49.06	45.41	54.4	47.2	40.37	39.85	55.14
Brunei	14.19	81	65.21	50.43	63.92	72.09	65.54	50.04
Indonesia	8.97	94.13	78.16	63.31	76.91	85.15	78.54	62.91
Malaysia	35.47	91.36	75.32	60.31	74.01	82.32	75.66	59.91

Sources: * OME (2001) and calculations by the authors based on various sources (DTI, 2005; GIIGNL, 2008)[1].

182 Massol and Tchung-Ming, "Cooperation among liquefied natural gas suppliers: Is rationalization the sole objective?", p. 944.

Appendix Figure 2: Domestic Natural Gas Pipeline Network in Turkey

Source: IEA Natural Gas Information 2010, IV.61

Appendix Table 4.2: Natural gas supply and consumption in Turkey

Million cubic metres

	1973	1978	1980	1990	2006	2007	2008	2009e
Indigenous production	-	-	-	**212**	**905**	**893**	**1 017**	**715**
+ From other sources	-	-	-	-	-	-	-	-
+ Imports	-	-	-	3 257	30 219	35 832	37 153	35 776
- Exports	-	-	-	-	-	31	435	708
+ Stock changes	-	-	-	- 1	59	- 95	- 1 090	- 717
- Statistical difference	-	-	-	-	-	-	-	-
Total consumption	-	-	-	**3 468**	**31 183**	**36 599**	**36 645**	**35 066**
Transformation	-	-	-	**2 585**	**15 961**	**19 019**	**20 062**	..
Main activity electricity	-	-	-	2 585	13 056	15 730	16 523	..
Autoproducers electricity	-	-	-	-	886	1 032	1 195	..
Main activity CHP plants	-	-	-	-	920	1 121	1 062	..
Autoproducers of CHP	-	-	-	-	1 099	1 136	1 282	..
Main activity heat plants	-	-	-	-	-	-	-	..
Autoproducers heat plants	-	-	-	-	-	-	-	..
Gas works	-	-	-	-	-	-	-	..
Gas to liquids	-	-	-	-	-	-	-	..
Other transformation	-	-	-	-	-	-	-	..
Energy industry own use	-	-	-	**20**	**126**	**644**	**534**	..
Coal mines	-	-	-	-	-	-	-	..
Oil and gas extraction	-	-	-	20	-	-	-	..
Gas inputs to oil refineries	-	-	-	-	81	598	487	..
Coke ovens	-	-	-	-	-	-	-	..
Gas works	-	-	-	-	-	-	-	..
Other energy	-	-	-	-	45	46	47	..
Losses	-	-	-	-	**25**	**25**	**68**	..
Final consumption	-	-	-	**863**	**15 071**	**16 911**	**15 981**	..
Industry	-	-	-	**600**	**4 007**	**4 473**	**3 858**	..
Iron and steel	-	-	-	10	710	822	784	..
Chemical	-	-	-	320	1 002	1 089	738	..
Non-ferrous metals	-	-	-	-	553	588	118	..
Non-metallic minerals	-	-	-	221	623	676	990	..
Transport equipment	-	-	-	3	43	33	48	..
Machinery	-	-	-	7	26	30	154	..
Mining and quarrying	-	-	-	-	-	-	-	..
Food and tobacco	-	-	-	-	180	257	184	..
Pulp, paper and printing	-	-	-	10	62	65	137	..
Wood and wood products	-	-	-	-	-	-	-	..
Construction	-	-	-	-	-	-	-	..
Textiles and leather	-	-	-	28	220	268	109	..
Non-specified	-	-	-	1	588	645	596	..
Transport	-	-	-	-	**139**	**201**	**221**	..
Road	-	-	-	-	4	11	31	..
Pipelines	-	-	-	-	135	190	190	..
Non-specified	-	-	-	-	-	-	-	..
Other	-	-	-	**49**	**10 767**	**11 993**	**11 586**	..
Commerce and public	-	-	-	-	3 344	3 689	3 707	..
Residential	-	-	-	49	7 423	8 304	7 879	..
Agriculture (incl. fishing)	-	-	-	-	-	-	-	..
Non-specified	-	-	-	-	-	-	-	..
Non-energy use (industry)	-	-	-	**214**	**158**	**244**	**316**	..
Petrochemical feedstocks	-	-	-	214	158	244	316	..
Other	-	-	-	-	-	-	-	..

Totals may not add up due to rounding.
Source: Annual Gas Statistics.

Source: IEA "Natural Gas Information 2010", p. 336.

Marcel Dietsch
DPhil Student, University of Oxford
September 2010

<u>Issues and Questions for Expert Interview – Ankara and Istanbul, Turkey</u>

I hope to have a wide-ranging conversation with you about the following issues and questions:

Turkey's energy market in general and natural gas in particular

- Relationships between the suppliers (Algeria, Azerbaijan, Iran, Nigeria, Russia and Turkmenistan)
  - and BOTAS and between the exporting countries and Turkey more generally
    - Economic dimension
    - Political dimension
    - Important issues in these economic and political relationships between the exporters and Turkey
- Competition in Turkish energy /gas markets
  - Level of competition in the domestic natural gas market and other markets (electricity)
- In terms of public policies/energy policy, has there been a strong drive towards liberalisation of gas and electricity markets?

- <u>Issue of producer cooperation</u>

  - Important in Turkish policy debate?
  - **Mitigating factors:**
    - I look at producer cooperation in the gas market. Such cooperation on the supply side, might (in part) be offset by <u>buyer concentration</u> or cooperation in the Turkish market. Do you consider BOTAS' position as the dominant importer as being favourable?
    - the drive for alternative supplies of gas:
      - other pipeline suppliers (Azerbaijan/Iraq)?
      - more LNG?
      - more domestic production?
    - Market entry barriers – remove?
- Current economic and political issues in Turkey related to energy market?
  - Economic policy
  - Other domestic policy
  - Foreign policy

List of Experts Interviewed in Turkey
between 6 September 2010 and 17 September 2010

Istanbul

Dr Filiz Katman, Director, Energy Research Institute, Istanbul Aydin University.

Professor Mustafa Aydin, Rector and International Relations expert, Kadir Has University

Mr Alain Terraillon, Head of Turkey Office, European Investment Bank.

Ankara

Dr Cenk Pala, General Manager, E.ON Ruhrgas Doğalgaz A.Ş. (Turkey)

Dr Necmi Odyakmaz, Board Member, E.ON Ruhrgas Doğalgaz A.Ş. (Turkey)

Ms Berris Ekinci, Head of Energy Department, Turkish Ministry of Foreign Affairs (MFA)

Dr. Tuncay Babali, senior diplomat, Turkish MFA and former fellow at Harvard's Weatherhead Center for International Affairs (2009-2010)

Mr Levent Ozgul, Head of Gas Masterplan Commission, Strategy Department, BOTAS

US government official, American Embassy in Ankara

Mr Pars Kutay, AB Consulting

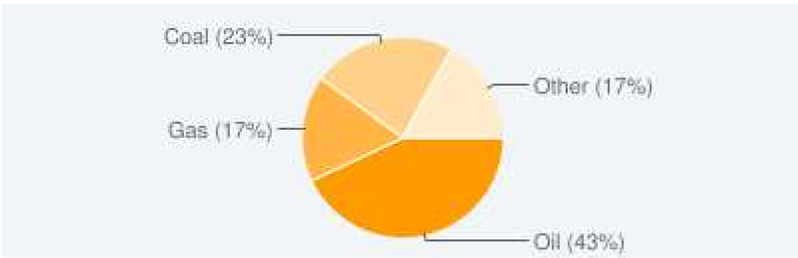
Dr Necdet Pamir, former executive, TPAO.

Chapter 5
Case Study: The Japanese Gas Market and its Suppliers

5.1. Introduction and Background

The second case study is concerned with the Japanese gas market. It is another very interesting case and in some ways different to Turkey, yet essentially comparable in most respects. Japan is a resource-poor country and produces only very small amounts of gas domestically. In East Asia it is the largest consumer of gas and it is almost fully dependent on imports. Figure 5.1 shows Japan's total primary energy supply in 2008. Natural gas is the third most important source of energy in the country.

Figure 5.1: Total Primary Energy Supply (2008)[1]



*other: nuclear, hydro, geothermal, solar, combustible and renewable waste

While major gas producers such as Indonesia and Malaysia are reasonably close, Japan's geographical location is difficult in terms of transportation for at least two reasons. First, no pipeline connections to Japan exist since there are hardly any sources[2] of gas close enough to make pipeline transportation feasible. Hence Japan must rely on LNG shipments, which tend to be more expensive than piped gas. Second, apart from Malaysia and Indonesia, most other suppliers of gas (Australia, Middle Eastern coun-

[1] IEA Natural Gas Information 2010.
[2] With one exception: Russia' Sakhalin fields in the North Pacific.

tries, North America) are located many thousands of miles away, which also means that transportation costs will be higher.

Given different modes of transportation—LNG in the case of Japan and mostly pipelines in the case of Turkey and Germany—is it sensible to compare these country case studies? Comparing piped gas sold through long-term contracts with LNG sold on the spot market might indeed be difficult; however the contractual and pricing arrangements are remarkably similar in the cases under consideration. LNG sold to Japan is also sold through long-term contracts spanning 15 to 30 years. The original justification for those long-term contracts was that huge upfront costs for developing gas fields and for constructing pipelines and LNG facilities needed to be recovered overtime. Unless the buyer committed to long-term contracts which guaranteed reliable capital recovery, producers would not build the facilities. Therefore, the contractual arrangements for pipeline gas and LNG are fairly similar and hence comparable in most highly import-dependent countries.[3]

Despite higher transportation cost, LNG has an advantage over pipeline transportation. A pipeline is immobile piece of infrastructure, which often crosses various transit countries that are situated between the supplier and the importer. This sometimes creates political and sovereignty issues between the importing, transit and supplying countries. Since LNG tankers generally use international waters, this mode of transportation tends to be less political. But does Japan benefit from a (potentially) more commercial relationship with its suppliers (evidenced e.g. by competitive and not political prices) as a result of using LNG tankers and not pipelines? This is one of the questions that will be addressed in this chapter. A first glance at the data indicates a significant degree of producer market power. The main task will be to identify the degree to which

[3] And the original justification for those structures today is equally questionable in both cases as will be argued later.

this market power is explained by cooperation among Japan's gas suppliers, many of which are GECF members.

This introductory section will provide some background information on the Japanese gas market and other related domestic issues. It will also introduce in some detail the most important suppliers of LNG to the Japanese market. The second section will consider evidence of cooperation among the suppliers at the corporate, at the bilateral and at the international levels. Section three will use available empirical data to run the conduct parameter model, which allows one to estimate by how much the price-cost margin is explained by producer collusion, taking into account the price elasticity of demand for gas and market concentration. Finally, other possible factors in addition to those used in the model will be discussed in section four.

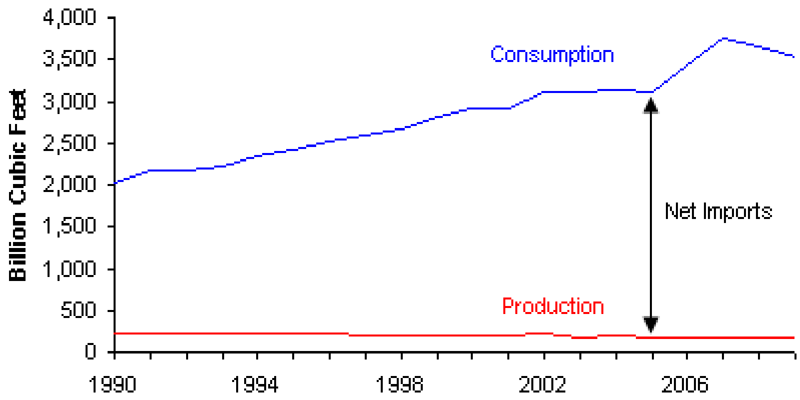
5.1.1. Overview of Japan's Sources of Natural Gas Supply

Japan's domestic gas reserves are so small on a global scale that they are not even included in the BP Statistical Review of World Energy. Reliable information comes from *The Oil and Gas Journal*, according to whose data Japan possessed about 20.9 bcm of proved reserves in 2011. The reserves were previously estimated to be twice as large in 2007.[4] Since Japan consumes close to 100 bcm a year, the reserves—if they could all be produced in one year—would barely cover one-fifth of the total annual demand. The yearly production is hence very small: "Japan produced 181 Bcf [= 5.1 bcm] of natural gas in 2009. Japan's largest natural gas field is the Minami-Nagaoka on the western coast of Honshu, which produces about 50 percent of Japan's domestic gas. Discovered by Inpex in 1979, field exploration and development are still ongoing. The gas produced is transported via an 808-mile pipeline network that stretches across the

[4] Unknown Author, "Japan Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 19 May 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=JA.

region surrounding the Tokyo metropolitan area."[5] Figure 5.2 illustrates how strongly growing demand and declining production lead to ever higher import quantities.

Figure 5.2: Japan's Gas Production and Consumption, 1990-2009[6]



Consequently, LNG imports have played a dominant in role in the Japanese electricity and gas markets since the late 1960s. "Japan began importing LNG from Alaska in 1969, making it a pioneer in the global LNG trade. Due to environmental concerns, the Japanese government has encouraged natural gas consumption in the country and Japan accounted for about 36 percent of global LNG imports in 2009."[7] Tokyo Electric Power Company (TEPCO) and Tokyo Gas, a gas distribution company, started importing LNG in 1969 and soon added additional capacities in 1972 by importing LNG from Brunei through a 20-year long-term contract.[8] Unlike in Turkey, individual power and gas companies negotiate with foreign suppliers.

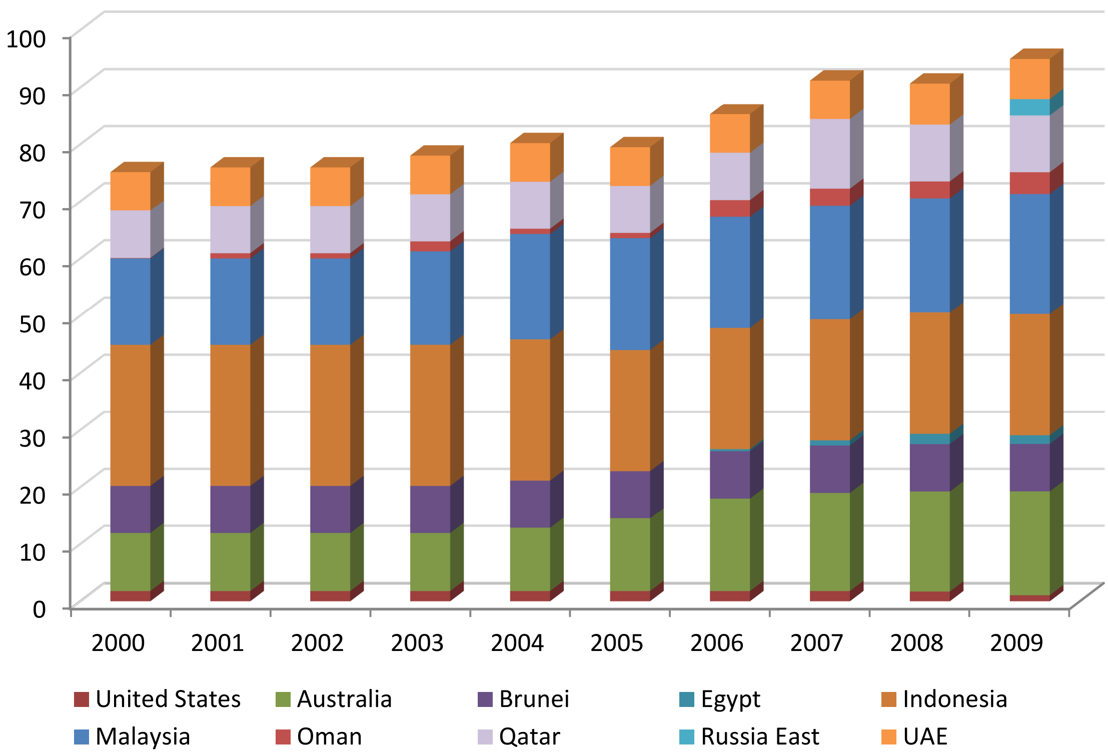
Many of the subsequent supply and purchase agreements are with Middle Eastern and Southeast Asian countries, especially Malaysia and Indonesia. Indonesia had been Japan's largest supplier for decades, but as a result of soaring demand in Indone-

[5] Ibid.
[6] Ibid.
[7] Ibid.
[8] Akira Miyamoto, Chikako Ishiguro and Takashi Yamada, "Irrational LNG Pricing Impedes Development of Asian Natural Gas Markets: A Perspective on Market Value", Unpublished Working Paper obtained at Interview with Mr Miyamoto, Osaka Gas, October 2010, pp. 2-3.

sia, the country has allocated more of its production to its domestic market rather than to exports.[9]

Figure 5.3: Contracted LNG Demand for Japan[10]

2000-2009, in bcm



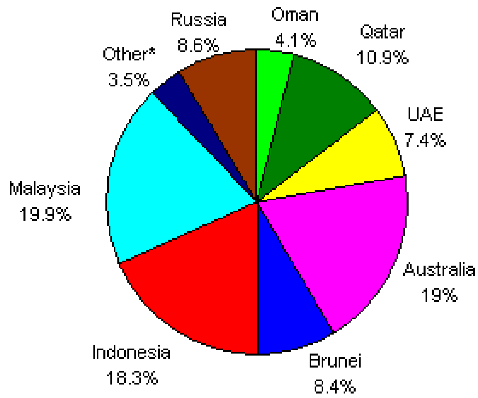
In terms of contracted volumes, as illustrated in Figure 5.3, Indonesia's market share has fallen both in absolute and in relative terms. The contracted volumes also show that Australia's role has become much more important between 2000 and 2009. The contracted volumes have some flexibility and can be adjusted upwards or downwards depending on changes in demand. In comparison to the Turkey case study which showed that BOTAS had signed agreements for around twice the amount of actual gas consumed, Japan's contracted volumes are more in line with actual demand as can be seen if one compares Figure 5.3 and Table 5.1.

[9] EIA, "Japan Country Analysis Brief", 2011.
[10] Chart: author; data: kindly provided by Osaka Gas, June 2011.

Table 5.1: Natural gas imports (LNG) by country of origin[11]

Figure 5.4: LNG imports by source, 2010 Source: EIA

	2007	2008
	Million cubic metres	
Australia	16 543	17 044
United States	1 086	979
Other	85	87
OECD	**17 714**	**18 110**
Algeria	1 327	688
Brunei	9 297	8 554
Egypt	2 278	1 777
Equatorial Guinea	785	1 644
Indonesia	19 047	19 529
Libyan Arab Jamahiriya	-	-
Malaysia	18 553	18 675
Nigeria	1 428	2 548
Oman	5 179	4 290
Qatar	11 380	11 333
Trinidad and Tobago	839	474
United Arab Emirates	7 800	7 769
Yemen	-	-
Total non-OECD	**77 913**	**77 281**
Non-specified/other	-	-
Total imports	**95 627**	**95 391**



In terms of actual (as opposed to contracted) volumes supplied, Table 5.1 and Figure 5.4 show that Japan had three large suppliers in the past few years—Australia, Indonesia and Malaysia—with market shares around 18 to 20 percent and three other significant producers—Brunei, Qatar and the United Arab Emirates (UAE)—with market shares between 7 and 10 percent. (Russia only became a supplier in 2009, i.e. after the period of study in this thesis.) In addition to LNG sourced through long-term contracts, Japan often buys smaller quantities of gas on the spot market as well. More information concerning the evolution of pricing mechanisms and a comprehensive description of the contracts between Japan and its major suppliers will be provided later in this section.

[11] IEA “Natural Gas Information 2010”, p. 208.

5.1.2. Organisation of the Domestic Sector and Consumption

There are over 200 private or local government gas utilities in Japan. These utilities, which used to enjoy regional monopoly status, own and operate 40 LNG regasification terminals.[12] "The majority of LNG terminals are located in the main population centers of Tokyo, Osaka, and Nagoya, near major urban and manufacturing hubs, and are owned by local power companies, either alone or in partnership with gas companies. These same companies own much of Japan's LNG tanker fleet." [13] The gas transmission system is rather fragmented, both in terms of ownership and geography. The regional utilities own their respective parts of the transmission pipeline network and geographically, as Figure 5.5 shows, there are regionally separate networks instead of a nationally integrated one.[14] The reasons for this are diverse: Japan is quite mountainous, making it difficult to build an extensive network across the country. There are also other land-use issues, including high cost, which would make a comprehensive grid expensive.[15] However, the most important reason is the lack of incentive for incumbents to build such a grid since it would only invite (additional) competition to their region.

The small amounts of gas production in Japan are carried out by Inpex and Japex. These upstream companies also take part in gas exploration and production projects outside Japan. Inpex and Japex were formed when the Japan National Oil Compa-

[12] IEA Natural Gas Information 2010, p. VI.34.
[13] EIA, "Japan Country Analysis Brief", 2011.
[14] IEA Natural Gas Information 2010, p. VI.34.
[15] Expert Interview, Tetsuo Morikawa, Institute for Energy Economics Japan (IEEJ), Tokyo, September 2010.

ny was broken up.[16] Given the small scale of upstream production, most of the natural gas sector in Japan is focused on importing LNG, transmission and distribution.

In 2007, 28 percent of Japan's natural gas consumption occurred in the commercial and residential sector, mainly for heating buildings.[17] Gas for these purposes is distributed by retail natural gas companies such as Osaka Gas, Tokyo Gas and Toho Gas, which at 75 percent retail market share, are the largest suppliers of city gas.[18] The gas market in Japan, according to the IEA,

> used to be highly fragmented, characterised by regional monopolies within geographical concession areas, but the market is now changing rapidly. The revised *Gas Utility Law* provides for third-party access to LNG terminals and pipelines, and for competition in supplying those customers who use in excess of 100 000 cubic metres of gas per year. Competition between incumbent city-based utilities and new entrants is developing, causing prices to fall and margins to drop to very low levels.[19]

These reforms were put into practice in 1995 and 1999.[20] City gas companies hence face more competition today, especially from power generation companies, which benefit from a broader and often cheaper set of inputs, including nuclear power.

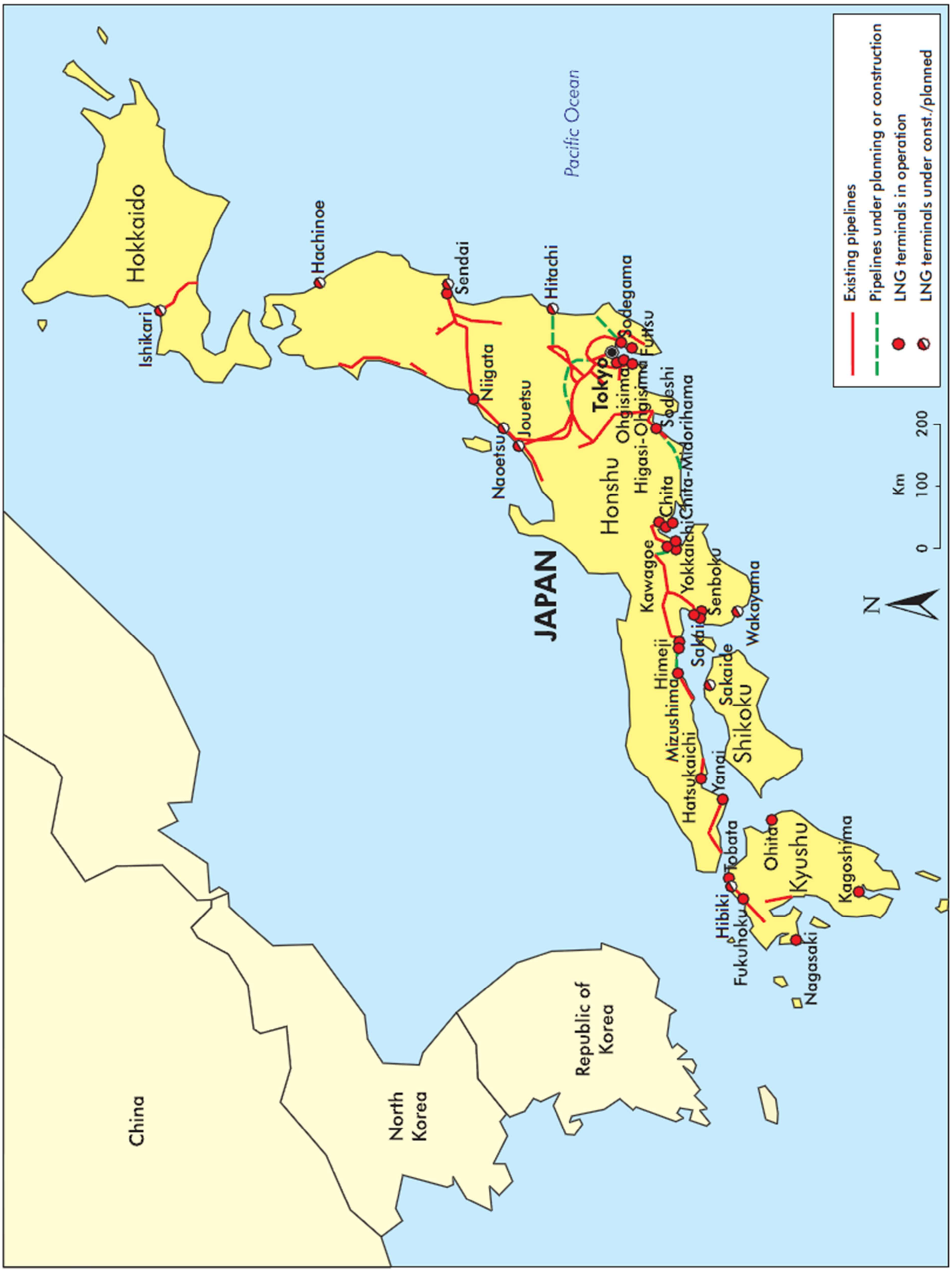
To put consumption figures into perspective, two other major areas need to be explained. Industrial use of natural gas, e.g. using gas as a feedstock for petrochemical production, made up 9% of the total annual consumption in 2007.[21] It is the power generation sector, however, that is by far the largest consumer of natural gas in Japan. According to IEA figures, around 60 percent of the total annual consumption in 2007 went

[16] EIA, "Japan Country Analysis Brief", 2011.
[17] Data: IEA Natural Gas Information 2010, p. VI.206.
[18] EIA, "Japan Country Analysis Brief", 2011.
[19] Ibid.
[20] IEA World Energy Outlook 2009, p. 521.
[21] Data: IEA Natural Gas Information 2010, p. VI.206.

into electricity generation. This sector, according to the EIA, has been "one of the main drivers of growth in natural gas demand in Japan."[22]

[22] EIA, "Japan Country Analysis Brief", 2011.

Figure 5.5: Map of Japanese LNG and domestic Pipeline Infrastructure[23]



[23] IEA Natural Gas Information 2010, p. VI.35.

Table 5.2: Trends in the Share of Energy Sources for Power Generation[24]

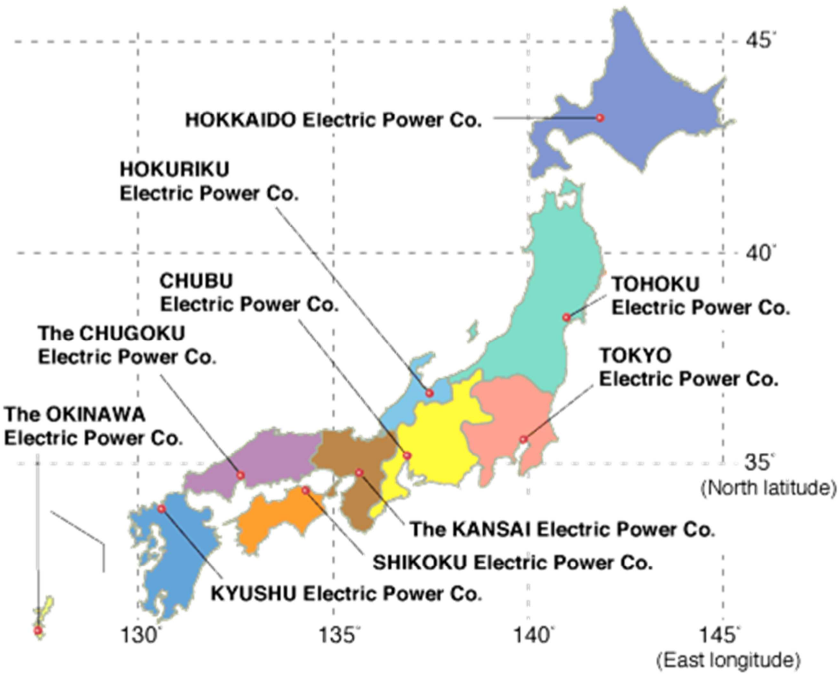
Energy source		FY1973[a]	FY1990	FY2005
Hydro		15.2	11.9	8.4
Thermal	Coal	6.2	9.7	25.7
	LNG	2.0	22.2	23.8
	Oil, etc.	**74.7**	**28.6**	**10.9**
	Total	82.9	60.8	60.7
Nuclear		1.9	27.3	31.0
Renewables		0	0	0.6

Table 5.2 shows that while electricity generation is the most important destination for imported LNG in Japan, gas in the power generation sector is an important source compared to other types of primary energy input (with close to 24 percent in 2005), but coal is similarly important while nuclear is more dominant still. Crucially for this analysis and to understand gas pricing mechanisms, the share of oil, which traditionally competed with gas in the power sector, has declined dramatically from three-quarters in 1973 to around 11 percent in 2005.

Figure 5.6 shows the regional fragmentation of the power market with Tokyo Electric Power Company (TEPCO), Chubu Electric Power Company and Kansai Electric Power Company (KEPCO) being the three most important players. Due to the liberalisation of the gas and power markets, city gas companies such as Tokyo Gas compete with power generation companies in the same region, e.g. with TEPCO. However, power companies still do not compete with each other across regions.[25]

[24] Miyamoto et al., 2010.
[25] Expert Interview, Akira Miyamoto, Osaka Gas, Osaka, October 2010.

Figure 5.6: Electric Power Company Service Areas[26]



5.1.3. A Short History of Gas Pricing in Japan

When Japan started importing LNG in the late 1960s from the United States, fixed prices on the basis of actual project costs were used and no market-oriented price adjustment mechanism was envisaged.[27] Specifically, the "LNG deal entered […] took the form of long-term 15-year contract [with a fixed price of] US$ 0.52 per mmbtu." Other long-term contracts for LNG cargoes were agreed upon in the early 1970s and US$0.48 per mmbtu was charged in the case of the contract between TEPCO and Brunei. Since LNG competes with fuel oil in power generation, both prices were generally preferred to be in the same range (in terms of calorific equivalence). Hence when oil price soared in 1973 as a result of the Arab oil embargo, the price of LNG was also raised.[28]

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[26] Federation of Electric Power Companies. Further details, including maps showing the distribution of existing power plants, are available from http://www.fepc.or.jp/english/
[27] IEA World Energy Outlook 2009, p. 520.
[28] Miyamoto et al., 2010.

Energy expert Akira Miyamoto at Osaka Gas argued that: "the first oil crisis precipitated a transformation of the global energy market, and it was during this period that the key projects to supply Japan were negotiated, such as the Indonesian 1973 contract. Even within OPEC, which had begun to dominate the oil market, there was discussion of the export price of natural gas as well, and this subsequently had some impact on LNG prices. In 1977, Abu Dhabi and Indonesia commenced LNG exports to Japan. While a fixed price approach was initially employed for the Abu Dhabi project, a price formula that linked to crude oil prices was employed for the 1973 contract with Indonesia." The general idea of oil-indexation, which had been employed in Europe since the late 1960s, had also arrived in East Asia. The formula employed "the average of the export prices (government selling price; GSP) of main Indonesian-produced crude oil as the reference, and incorporated an inflation rate of 3% per annum as a variable factor in addition to crude."[29]

The principle of indexing gas prices to those of either crude oil (as in Japan) or to crude oil products such as fuel oil (mostly in Europe) became more widespread after the Iranian Revolution and the oil shock it caused in 1979 and afterwards. The concept of "oil-parity pricing"[30] became the dominant mechanism for new contracts in the early 1980s and Japanese customers and their suppliers changed existing fixed-priced contracts to oil-indexation (e.g. for Abu Dhabi LNG). Hence surging oil prices also led to surging LNG prices.[31] There were slight variations in the mechanism, e.g. Malaysia referenced their gas delivery prices to Japan's average crude oil import price (the Japanese Crude Cocktail, JCC) while Indonesia preferred linking their LNG prices to the government selling price (GSP) of Indonesian crude oil.[32]

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[29] Ibid.
[30] IEA World Energy Outlook 2009, p. 520.
[31] Miyamoto et al., 2010.
[32] Ibid.

This approach allowed producers to capture both the upswing in oil price as well as the concomitant rise in LNG prices. Yet, in 1986 when crude oil prices collapsed, producers became less enthusiastic about selling LNG at oil-linked prices. Crashing LNG prices made it difficult to recover the costs for the relatively new LNG liquefaction projects, hence a more stable pricing mechanism was negotiated: the price of LNG was set “equal to 80% to 90% of the weighted-average price of crude oils imported into Japan [the JCC], plus a constant amount.”[33]

Another principle for pricing LNG delivered to Japan—the so-called “S-Curve”—was developed in the late 1980s and has been dominant since the early 1990s. “The purpose of the S-curve formula is to reduce the risk of lower oil prices to sellers and the risk of high oil prices to buyers by reducing the slope of the pricing formula when oil prices go above or below a certain range. Given that it was adopted when the market entered a period of cheap oil, however, it was clearly initially introduced for ‘the helping hand’ for sellers.”[34] The S-curve will be described in greater detail and as a means of retaining market power in section 2 of this chapter.

More recently, especially during the oil price rally between 2005 and 2008 some producers wanted to return to full oil price parity since the S-curve not only protects the producers with a floor price, but also limits the upside as it did in recent years.[35] Producers’ changing positions on the S-curve and oil-parity pricing especially over the past decade will also be examined in the subsequent sections.

[33] IEA World Energy Outlook 2009, p. 520.
[34] Miyamoto et al., 2010.
[35] IEA World Energy Outlook 2009, p. 520.

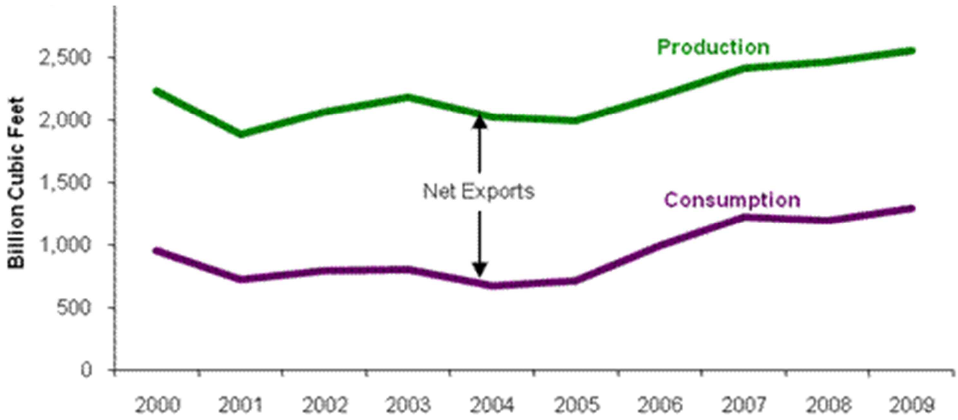
5.1.4. Japan's Main Suppliers - Indonesia

Indonesia has been the largest supplier to the Japanese market for decades, though this lead is shrinking considerably. In 2008 Indonesia was still the largest suppliers, closely followed by Malaysia and Australia. The suppliers will be introduced in this and the following subsections sorted by volume. Indonesia held approximately 3.18 trillion cubic metres (tcm) of natural gas reserves in 2008, according to the BP Review of Energy.[36] That figures corresponds to about 1.7 percent of all gas reserves worldwide and makes the country the largest reserve-holder in Asia-Pacific and the thirteenth largest one globally. An IEA report points out that "at current levels of production, these would sustain production for another 39 years. According to the Indonesian government, more than 70% of the country's natural gas reserves are located offshore, with the largest found off Natuna Island, East Kalimantan, South Sumatra and West Papua (or Irian Jaya). Sizeable reserves were discovered in 2006 and 2007, after new exploration and development licences were issued."[37]

Indonesia's natural gas production reached 70 bcm in 2008, according to the BP Review of Energy.[38] "Production has grown at an average annual rate of about 1.5 percent over the previous two decades, and Indonesia's 2009 gas production was the eleventh-highest in the world."[39] Figure 5.7 shows that a significant portion of the country's production is exported, though strongly growing domestic demand is putting pressure on the government to use more of its gas production at home.

[36] BP Statistical Review of World Energy, 2010.
[37] IEA World Energy Outlook 2009, pp. 589-590.
[38] BP Statistical Review of World Energy, 2010.
[39] Unknown Author, "Indonesia Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 19 May 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=ID.

Figure 5.7: Indonesia's Gas Production and Consumption, 2000-2009[40]



The natural gas sector is regulated by BPMigas and the state-owned PT Pertamina today plays only a minor role in the upstream sector, producing about 15 percent of the country's natural gas. Moreover, the EIA Indonesia country analysis brief states: "International oil companies such as Total, ConocoPhillips, and ExxonMobil dominate the upstream gas sector, while natural gas transmission and distribution activities are carried out by the state-owned utility Perusahaan Gas Negara (PGN)."[41]

Indonesia is one of the most significant exporters of natural gas, that is, LNG in the world. As the sixth largest exporter of gas globally, Indonesia exports most of its gas to Japan (about 65 percent) and to other destinations in East and Southeast Asia.[42] During the period of time studied for the purposes of this thesis, two liquefaction terminals for LNG exports were operational. Another one went online in 2009 with more to follow in the middle of this decade as Figure 5.8 shows. According to the EIA, Indonesia was the third-largest LNG exporter globally in 2009.

[40] IEA World Energy Outlook 2009, pp. 589-590.
[41] EIA, "Indonesia Country Analysis Brief", 2011.
[42] Ibid.

Figure 5.8: Liquefaction Capacity in Indonesia[43]

	Location	Capacity (Bcf/y)	Commercial Operations
Operational			
Arun	Aceh	102	1978
Bontang	East Kalimantan	1101	1977
Tangguh	Papua	370	2009
Planned			
Donggi-Senoro	Sulawasi	102	2014
Masela	Arafura Sea, Maluku Province	122	2016+

From the two main production and liquefaction centres at Arun in Aceh and Bontag, Indonesia currently supplies 12 percent of total global LNG.[44] Despite new sources coming online in the next few years, "LNG exports have been a politically charged topic in Indonesia, due to the perception of LNG exports removing much-needed gas from the domestic market. The expected growth in gas demand, in addition to the currently unmet demand, has led the government to pursue policies for securing domestic supplies for the local market."[45] One result is that the contracted volumes between Japan and Indonesia shown in Figure 5.3 have declined considerably over the past decade in relative terms and they are expected to decline in absolute terms over the next few years as well.

In terms of specific supply and purchase agreements between Indonesia and Japanese importers, Figure 5.9 shows all those that are currently operational, but not the initial ones made in the 1970s. The overview illustrates that it is often a consortium of buyers that negotiate the agreements with the producing counterparts.

43 EIA, "Indonesia Country Analysis Brief", 2011.
44 IEA World Energy Outlook 2009, pp. 589-590.
45 EIA, "Indonesia Country Analysis Brief", 2011.

Figure 5.9: Japan's Supply and Purchase Agreements with Indonesia[46]

buyer	delivery terms	contract volume (mmt/y)	contract duration
Bontang			
Chubu Electric (2.15), Kansai Electric (2.57), Kyushu Electric (1.56), Toho Gas (0.25), Osaka Gas (1.30), Nippon Steel (0.62)	ex-ship	8.45	2000-2009
Chubu Electric (1.70), Kansai Electric (0.91), Toho Gas (0.57), Osaka Gas (0.44)	FOB	3.62	1981-2011
Tokyo Gas (0.92), Osaka Gas (1.27) Toho Gas (0.12)	FOB	2.31	1994-2013
Osaka Gas (0.10), Hiroshima Gas (0.21) Nippon Gas (0.08)	CIF	0.39	1996-2015
Arun			
Tokyo Electric (0.13), Tohoku Electric (0.83)	FOB	0.96	2005-2009

Finally, Indonesia was part of the GECF from the beginning. The country's representatives attended the founding meeting in 2001 and all meetings afterwards until and including 2008 (except for one meeting in 2005).

5.1.5. Japan's Main Suppliers - Malaysia

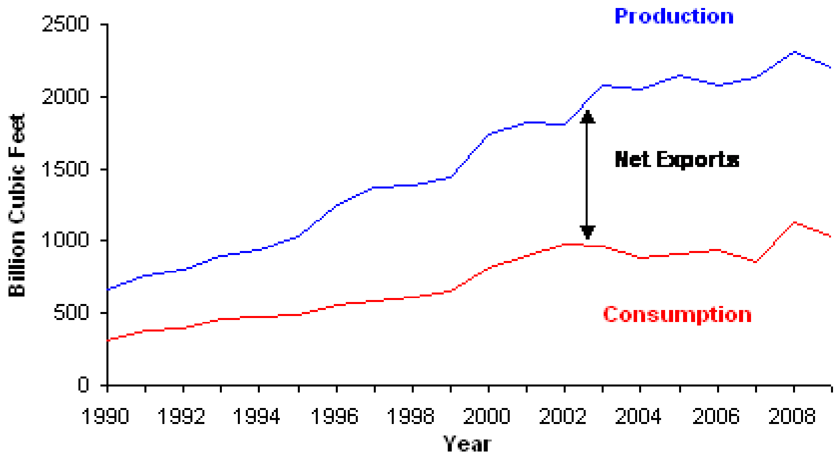
Malaysia traditionally has been one of the major suppliers to the Japanese market. In 2008, the country was the second-largest supplier after Indonesia and just ahead of Australia. Malaysia held approximately 2.38 trillion cubic metres (tcm) of natural gas reserves in 2008, according to the BP Review of Energy.[47] This figure corresponds to about 1.3 percent of all gas reserves worldwide and makes the country the third-largest reserve-holder in Asia-Pacific and the fifteenth largest one globally. According to the IEA, "about 50% [of Malaysia's natural gas reserves] are located offshore Sarawak,

[46] Unknown Author, "Fostering LNG Trade: Role of the Energy Charter", Energy Charter Secretariat, 2008, p. 166.
[47] BP Statistical Review of World Energy, 2010.

41% offshore the east coast of Peninsular Malaysia and 9% offshore Sabah. Most of the country's undiscovered gas resources are in offshore areas."[48]

Malaysia's natural gas production reached 65 bcm in 2008, according to the BP Review of Energy.[49] This is an increase of around 22 percent since 2000.[50] Production has risen continuously over the past two decades, but equally, "domestic natural gas consumption has also increased steadily, reaching 1.0 Tcf [= 28 bcm] in 2009." Figure 5.10 shows this development of growing production and similarly growing consumption. More than half of the country's production is exported at present.

Figure 5.10: Malaysia's Gas Production and Consumption, 1990-2009[51]



Petronas, Malaysia's state-owned petroleum company, dominates both the oil and gas sectors. "The company has a monopoly on all upstream natural gas developments, and also plays a leading role in downstream activities and the LNG trade. Most natural gas production comes from production sharing agreements operated by foreign companies in conjunction with Petronas."[52]

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48 IEA World Energy Outlook 2009, pp. 607-609.
49 BP Statistical Review of World Energy, 2010.
50 IEA World Energy Outlook 2009, pp. 607-609.
51 Unknown Author, "Malaysia Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 19 May 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=MY.
52 Ibid.

Malaysia was the second-largest LNG exporter in 2008, according to data from the BP Statistical Review of Energy[53] and it accounted for 12 percent of LNG exports globally with the main destinations for Malaysian LNG being Japan, South Korea and Taiwan.[54] "LNG is primarily transported by Malaysia International Shipping Corporation (MISC), which owns and operates 27 LNG tankers, the single largest LNG tanker fleet in the world by volume of LNG carried. MISC is 62-percent owned by Petronas."[55]

Figure 5.11: Supply and Purchase Agreements with Malaysia[56]

MLNG 1 and MLNG 2

buyer	delivery terms	contract volume (mmt/y)	contract duration
Tokyo Electric (4.80), Tokyo Gas (2.60)	ex-ship / FOB	7.40	2003-2018
Seibu Gas	ex-ship	0.36	1993-2013
	ex-ship	0.39	2013-2028
Chubu Electric	ex-ship	0.54	2011-2031
Toho Gas	ex-ship	0.52	2011-2031
Kansai Electric, Tokyo Gas (0.80), Toho Gas, Osaka Gas (0.60)	ex-ship	2.10	1995-2015
Tohoku Electric	ex-ship	0.50	1996-2016
Shizuoka Gas (Joint cargos with Tokyo Gas)	ex-ship	0.45	1996-2016
Sendai City Gas	ex-ship	0.15	1997-2007
MLNG 3			
Tohoku Electric	-	0.90	2005-2025
Tokyo Gas (0.34), Toho Gas (1.14), Osaka Gas (0.12)	Ex-ship / FOB	1.60	2004-2024
Osaka Gas	ex-ship	0.92	2009-2024
Japex	-	0.48	2003-2023

Supply and purchase agreements between Japan and Malaysia are presented in Figure 5.11. What is interesting in comparison to supply and purchase agreements with

[53] BP Statistical Review of World Energy, 2009.
[54] EIA, "Malaysia Country Analysis Brief", 2011.
[55] Ibid.
[56] Unknown Author, "Fostering LNG Trade: Role of the Energy Charter", Energy Charter Secretariat, 2008, pp. 166-167.

Indonesia is that these are struck between Petronas and mostly individual buyers in Japan rather than larger consortia as is the case with Indonesian suppliers. This means that the annual contract volumes tend to be smaller in comparison. It is also obvious that supply contracts have been made lasting well into the 2020s and even 2030s, which is another striking difference to Indonesia.

To conclude this brief overview of Malaysia and its LNG trade relationship with Japan, a final point must be mentioned. Malaysia was a founding member of the Gas Exporting Countries Forum. The country's representatives attended all GECF meeting from 2001 until and including 2008 without exception.

5.1.6. Japan's Main Suppliers - Australia

Australia's gas exports to the Japanese market have grown very strongly over the past decade. The country was the third-largest supplier in 2008 after Indonesia and Malaysia. Australia held about 3.1 trillion cubic metres (tcm) of natural gas reserves in 2008, according to the BP Review of Energy.[57] That means Australia holds about 1.7 percent of the world's gas reserves and makes the country the twelfth-largest reserve-holder globally.[58]

Earlier estimates of Australia's reserves were much lower. As the EIA points out: "The upgrade is largely a result of increased exploration and development of its unconventional as well as conventional gas sources. It has been reported that unconventional gas deposits, i.e., coal seam and shale gas deposits, have become an increasingly larger component of gas reserves due to technological advances."[59]

[57] BP Statistical Review of World Energy, 2010.
[58] Unknown Author, "Australia Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 19 May 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=AS.
[59] Ibid.

Australia's production of natural gas reached 38.3 bcm in 2008, according to the BP Review of Energy.[60] This is an increase of around 23 percent since 2000. Production is expected to grow even more strongly in the coming years as large new projects will come online. "Queensland and New South Wales are the main sources for coal seam gas (CSG), which accounted for 13 percent of gas production in 2009, while conventional gas is largely located in the Carnarvon Basin offshore North Western Australia."[61]

Figure 5.12: Australia's Gas Production and Consumption, 1990-2009[62]

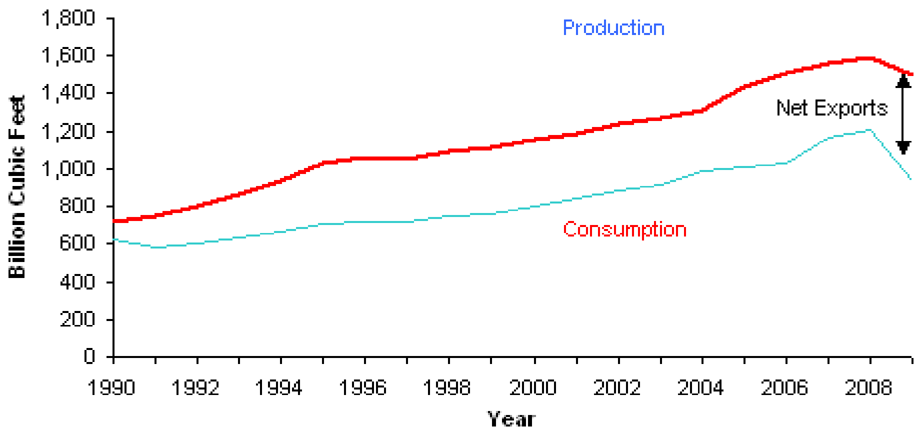


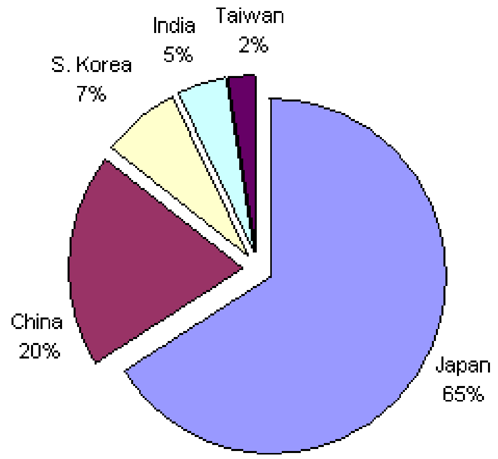
Figure 5.12 shows that much of Australia's gas production has traditionally been consumed domestically. The recent drop in consumption (mainly because of the economic crisis) increased the share of exports, but this share is expected to widen in any case due to strongly growing production.

Unlike most gas producing (and indeed consuming) countries in Asia-Pacific, "the Australian government has no ownership stake in the domestic natural gas industry. The industry is regulated by the Ministry of Industry, Tourism and Resources (MITR) and the Ministerial Council of Energy (MCE). The MCE functions as the director of

[60] BP Statistical Review of World Energy, 2010.
[61] EIA, "Australia Country Analysis Brief", 2011.
[62] EIA, "Malaysia Country Analysis Brief", 2011.

natural gas policy. Major domestic and foreign players operating in Australia include Santos, Woodside, Chevron, ConocoPhillips, ExxonMobil, Origin Energy, BG Group, Apache, INPEX, Total, and Shell."[63]

Figure 5.13: Australian LNG Exports in 2009[64]



Because of the long distances between Australia and its potential markets, all natural gas for exports is converted in to LNG instead of transported by pipelines. According to EIA figures, Australia's LNG exports grew by 48 percent since 2000 and in 2009, the country exported 24 bcm of LNG. As Figure 5.13 shows, Japan is the main destination of Australian LNG cargos, with China, South Korea, India and Taiwan receiving much smaller quantities. Most of the gas produced in the past 20 years came from two sources in northern Australia: the Northwest Shelf and Darwin. Most of this LNG goes to Japan.

The initial supply and purchase agreements between Australia and Japan were negotiated by large Japanese consortia as the 1989 contract from the NWS venture shows. Subsequently, and similar to agreements with Malaysia, individual Japanese util-

[63] EIA, "Australia Country Analysis Brief", 2011.
[64] Ibid.

ities have tended to strike deals with producers in Australia. Finally, Australia is not a member of the GECF and has not taken part in any meeting of the Forum.

Figure 5.14: Supply and Purchase Agreements with Australia[65]

NWS (North West Shelf)

buyer	delivery terms	contract volume (mmt/y)	contract duration
Tokyo Electric (1.18), Chubu Electric (1.05), Kansai Electric (1.13), Chugoku Electric (1.11), Kyushu Electric (1.05), Tokyo Gas (0.79), Osaka Gas (0.79), Toho Gas (0.23)	ex-ship	7.33	1989-2009
Tokyo Gas (1.07), Toho Gas (0.30)	FOB	1.37	2004-2029
Osaka Gas	FOB	1.00	2004-2034
Tohoku Electric	FOB ('05-'10) ex-ship ('10-'20)	0.40 0.90 0.40	2005-2010 2010-2018 2018-2020
Kyushu Electric	-	0.50 0.73	2004-2026 2009-2017
Kansai Electric	ex-ship ex-ship ex-ship	0.50 0.93 0.40	2009-2014 2015-2023 2009-2017
Chubu Electric	-	0.60 0.50	2009-2024 2009-2016
Shizuoka Gas	-	0.14	2005-2029
Chugoku Electric (HoA)	-	max. 1.40	2009-2021
Tokyo Gas (HoA)	ex-ship	0.53	2009-2017
Osaka Gas (HoA)	ex-ship	0.50	2009-2015
Tokyo Electric (HoA)	ex-ship	0.30	2009-2017
Toho Gas (HoA)	ex-ship	0.76	2009-2019

Darwin

Tokyo Electric (2.00), Tokyo Gas (1.00)	FOB	3.00	2006-2022

Gorgon

Tokyo Gas	FOB	1.20	2010-2035
Chubu Electric (HoA)	FOB	1.50	2010-2035
Osaka Gas	FOB	1.50	2010-2035

Pluto

Tokyo Gas	ex-ship	1.5–1.75	2010-2025
Kansai Electric	ex-ship	1.75–2.00	2010-2025

65 Unknown Author, "Fostering LNG Trade: Role of the Energy Charter", pp. 165-166.

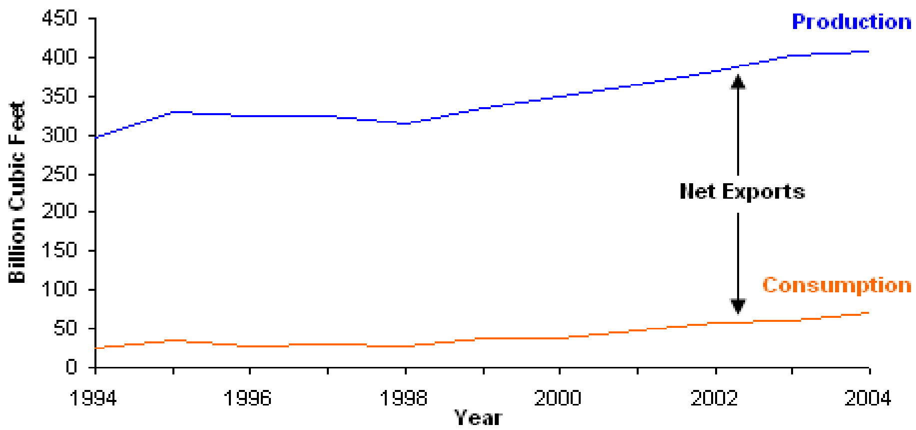
5.1.7. Japan's Main Suppliers - Brunei

Brunei is a tiny state, but owing to its advantageous location, is a very significant producer of natural gas in Asia-Pacific and the fourth-largest supplier to the Japanese market in 2008. Brunei held about 350 bcm of natural gas reserves in 2008, according to the BP Review of Energy.[66] The country hence holds about 0.2 percent of the world's gas reserves.[67] "Most of the economy's oil and gas fields are considered mature. Intensive exploitation of oil resources for over 75 years and of natural gas resources for over 35 years has required the industry to change recovery techniques. At current production rates, the 2007 proven oil and gas reserves are expected to be depleted within 20 and 30 years, respectively."[68]

Brunei's production of natural gas reached 12.2 bcm in 2008, according to the BP Review of Energy.[69] This is an increase of around 8 percent since 2000. Since the gas fields are fairly mature, significant increases in production cannot be expected in the future. Figure 5.15 shows production and consumption data up to 2004. The production figures have been almost flat since then as 12.2 bcm in 2008 correspond to 430 bcf, i.e. very close to the production level shown for 2003-2004 in the chart. What is clear is that Brunei mainly produces for exports rather than for local consumption, which very small given a population of only around 400,000.

[66] BP Statistical Review of World Energy, 2010.
[67] Ibid.
[68] Unknown Author, *APEC Energy Overview 2009*, Asia-Pacific Energy Research Centre, pp. 12-16.
[69] BP Statistical Review of World Energy, 2010.

Figure 5.15: Brunei's Natural Gas Production and Consumption, 1994-2004[70]



Brunei's gas production is dominated by its government. Given the lack of technological expertise when gas was first produced on a large scale in the 1970, Brunei entered into joint ventures with Western and Japanese companies. Gas production and liquefaction for exports are conducted by Brunei LNG (BLNG), which is a joint venture between Brunei's government, Mitsubishi and Shell. The government holds and ownership stake of 50 percent and while Mitsubishi and Shell hold 25 percent each.

BLNG is sourced from Brunei Shell Petroleum, the major production company, which is also a joint venture between the government and Shell. Moreover, in 1999 BLNG also started obtaining natural gas from offshore fields run by the French firm TOTAL.[71] "In 2000, the Brunei Natural Gas Policy (Production and Utilisation) was introduced. The policy aimed to maintain gas production at 2000 rates in order to adequately satisfy export obligations. It aimed to open new areas for exploration and development, and encourage increased exploration by new and existing operators. Under the

[70] Unknown Author, "Brunei Country Analysis Brief", United States Energy Information Administration (EIA). Graph retrieved on 9 June 2011: http://www.marcon.com/marcon2c.cfm?SectionListsID=93&PageID=369.
[71] Unknown Author, "Brunei Country Analysis Brief", United States Energy Information Administration (EIA). Information retrieved on 9 June 2011: http://www.marcon.com/marcon2c.cfm?SectionListsID=93&PageID=369.

policy, priority is always given to domestic utilisation of gas, especially for electricity generation."[72]

Figure 5.16: Supply and Purchase Agreements with Brunei[73]

Brunei LNG

buyer	delivery terms	contract volume (mmt/y)	contract duration
Tokyo Electric (4.03), Tokyo Gas (1.24), Osaka Gas (0.80)	ex-ship	6.07	1993-2013

Given its location, Brunei exports all of its gas as LNG. Major destinations are Japan and South Korea.[74] While Mitsubishi has been part of the early development of Brunei's gas fields and liquefaction plants since the 1970, there is only one large supply and purchase agreement operational between Brunei LNG and Japan, specifically one power generation company, TEPCO, and two city gas companies (Tokyo and Osaka Gas) as Figure 5.16 demonstrates. Finally, Brunei is a member of the GECF and attended the founding meeting in 2001 and all meetings until and including the one in Moscow in 2008 (with the exception of the 2007 Doha meeting).

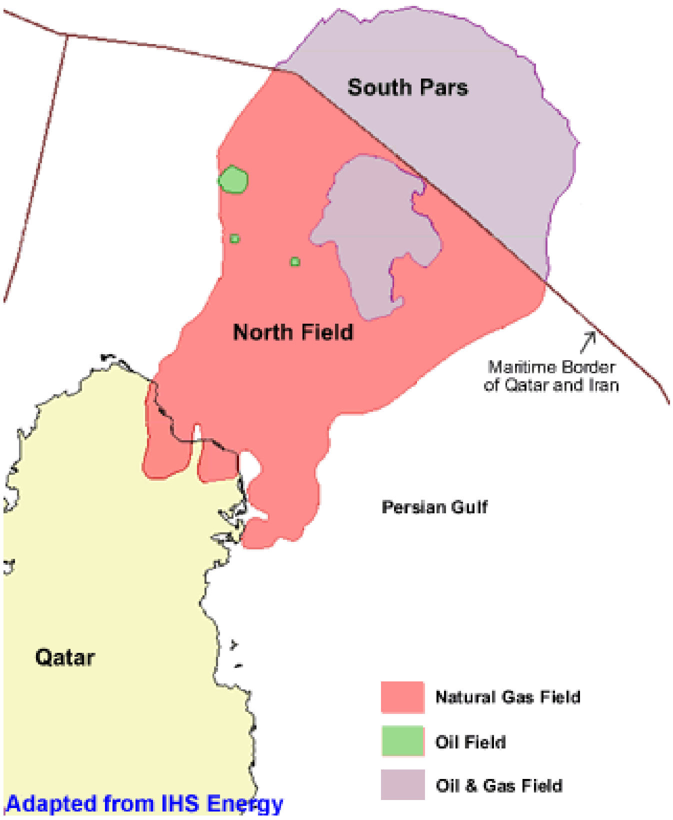
5.1.8. Japan's Main Suppliers - Qatar

Qatar was the fifth-largest supplier of gas to the Japanese market in 2008 and is the largest exporter of LNG globally. Qatar held about 25.4 trillion cubic metres (tcm) of natural gas reserves in 2008, according to the BP Review of Energy.[75] That makes Qatar the third-largest reserve-holder in the world after Russia and Iran. The country

[72] Unknown Author, *APEC Energy Overview 2009*, pp. 12-16.
[73] Unknown Author, "Fostering LNG Trade: Role of the Energy Charter", p. 166.
[74] Ibid.
[75] BP Statistical Review of World Energy, 2010.

holds about 13.7 percent of the world's gas reserves.[76] "The majority of Qatar's natural gas is located in the massive offshore North Field, which spans an area roughly equivalent to Qatar itself. Part of the world's largest non-associated natural gas field, the North Field is a geological extension of Iran's South Pars field, which holds an additional 450 Tcf [= 12.75 tcm] of recoverable natural gas reserves."[77] Figure 5.17 shows Qatari oil and gas fields in the Persian Gulf.

Figure 5.17: Map of Qatar's North Field in the Persian Gulf[78]

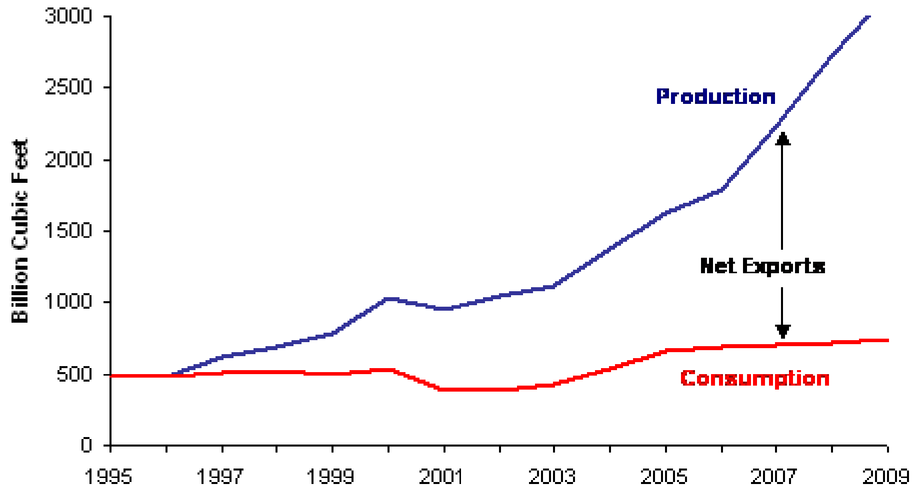


Given the size of its reserves, Qatar's production potential is enormous and production keeps growing strongly. The production of natural gas reached 77 bcm in 2008,

[76] Unknown Author, "Qatar Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 19 May 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=QA.
[77] Ibid.
[78] Ibid.

according to the BP Review of Energy.[79] This is an increase of around 225 percent since 2000. The EIA points out that, "although the increase in natural gas production fuels the growing natural gas requirements of domestic industry and its gas-to-liquids (GTL) projects, the bulk of this increase is going towards LNG exports. Qatar's natural gas consumption in 2009 was approximately 745 Bcf [= 21.2 bcm]."[80] Figure 5.18 illustrates the strong growth of production and quantities available for export.

Figure 5.18: Qatar's Natural Gas Production and Consumption, 1995-2009[81]



The state-owned company Qatar Petroleum (QP) and its subsidiaries dominate both the oil and gas sectors from the upstream to the downstream part of the value chain. Yet, Qatar's policy-makers past and present have been keen to involve international oil companies (IOCs) in their oil and gas production since those companies traditionally possessed advanced technology and know-how. Given the enormous size of gas production and liquefaction plants in Qatar, joint ventures with IOCs have also provided additional access to capital to develop these huge projects. Preferred project partners are

[79] BP Statistical Review of World Energy, 2010.
[80] EIA, "Qatar Country Analysis Brief", 2011.
[81] Ibid.

ExxonMobil, Shell and Total, but in these joint ventures QP and its subsidiaries such as Qatargas and Ras Laffan always hold the majority stakes of at least 65 percent.[82]

Figure 5.19: Supply and Purchase Agreements with Qatar[83]

Qatar Gas

buyer	delivery terms	contract volume (mmt/y)	contract duration
Chubu Electric	-	4.00	1997-2022
Tokyo Gas	ex-ship	0.35	1997-2021
Osaka Gas	ex-ship	0.35	1997-2021
Tohoku Electric Power	-	0.52	1999-2022
Tokyo Electric Power	-	0.20	1999-2021
Chugoku Electric Power	-	0.12	1999-2022
Kansai Electric Power	-	0.29	1999-2022
Toho Gas	-	0.17	2000-2022

Qatar's rise from exporting no LNG at all before 1997 to becoming the largest exporter in the world only a decade later has been meteoric. While Qatar transports about 28 percent[84] of its exports via pipeline to neighbouring countries in the Gulf such as UAE and Oman, the huge majority is exported as LNG to Japan, South Korea and India and to various European destinations, mainly Belgium, the UK and Spain.

Figure 5.19 shows the supply and purchase agreements between Qatar and various Japanese importers, most of which are power generation companies. All contracts are long-terms contracts with durations of 20 years or more. Finally, Qatar was a founding member of the GECF in 2001. Country representatives have taken part in every meeting of the Forum so far and as the world's largest LNG exporter, Qatar is keen to promote the GECF agenda especially with regarding to maintaining favourable pricing

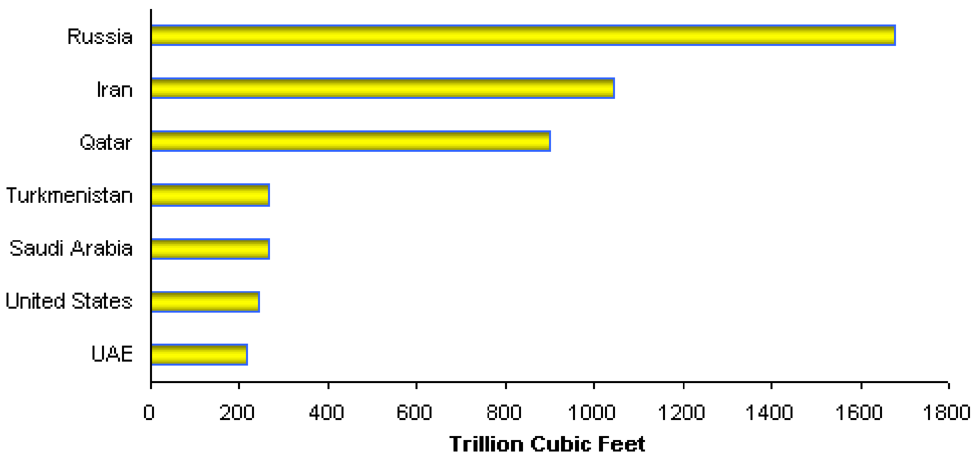
[82] Ibid.
[83] Unknown Author, "Fostering LNG Trade: Role of the Energy Charter", p. 168.
[84] BP Statistical Review of World Energy, 2010.

mechanisms. Moreover, Qatar's capital, Doha, is host to the GECF's official bureaucracy and its secretary-general.

5.1.9. Japan's Main Suppliers – United Arab Emirates (UAE)

The UAE were the sixth-largest supplier of gas to the Japanese market in 2008. The Emirates held about 6.4 trillion cubic metres (tcm) of natural gas reserves in 2008, according to the BP Review of Energy.[85] That makes UAE the seventh-largest reserve-holder of gas in the world according to the EIA[86] with about 3.5 percent of gas reserves globally.

Figure 5.20: Top Gas Reserve-Holders, 2010[87]

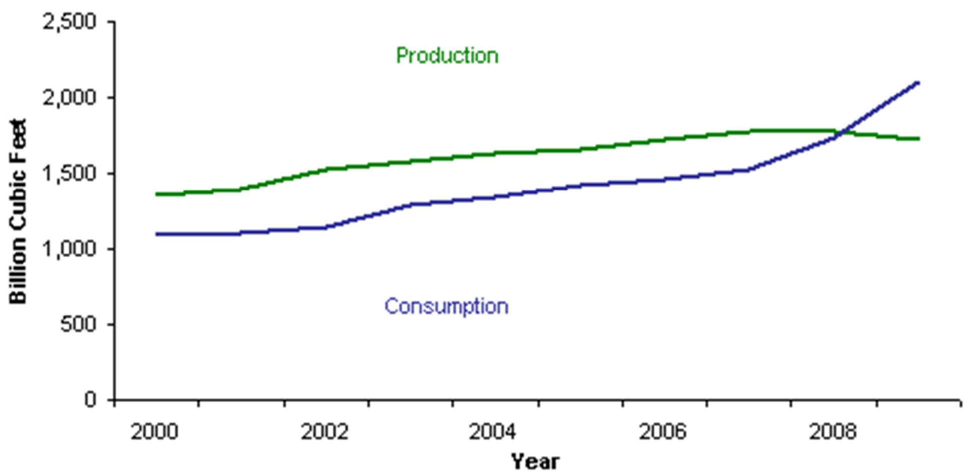


"The majority of these reserves are located in Abu Dhabi, with marginal amounts found in Sharjah, Dubai and Ras al-Khaimah."[88] Figure 5.20 shows the United Arab Emirates as one of the top seven reserve-holders globally. In 2008, production of natural gas reached 50.2 bcm, according to the BP Review of Energy.[89] This is an in-

[85] BP Statistical Review of World Energy, 2010.
[86] Unknown Author, "UAE Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 19 May 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=TC.
[87] Ibid.
[88] Ibid.
[89] BP Statistical Review of World Energy, 2010.

crease of more than 30 percent since 2000. Despite the country's considerable reserves, domestic consumption exceeds production as Figure 5.21 shows. The EIA explains: "Domestic demand for electricity continues to rise, spurred by subsidies. Most electricity generated in the UAE uses natural gas as a feedstock, causing the government to look for ever increasing volumes to compensate for increased demand from economic expansion and high population growth. The reliance upon natural gas for injection into mature oil fields further compounds the strain on natural gas supplies. Despite the UAE's large natural gas reserves, capital costs and high sulfur content present major impediments to development."

Figure 5.21: UAE Natural Gas Production and Consumption, 2000-2009[90]



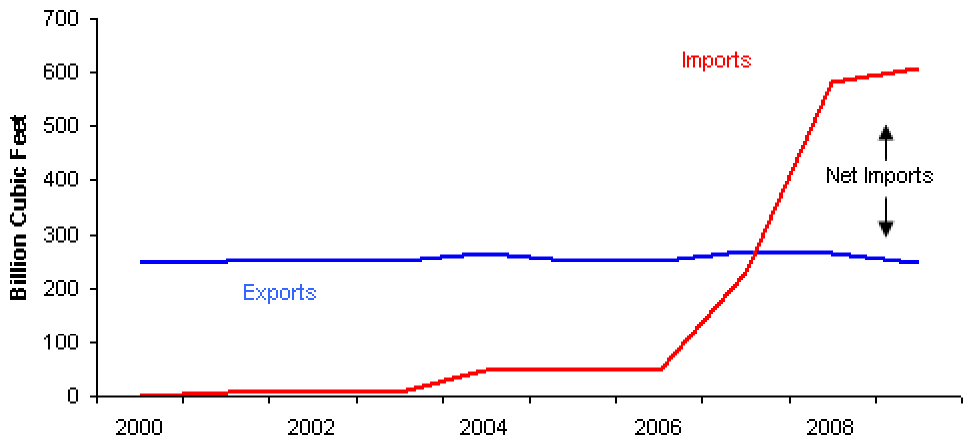
Oil and gas policy in the Emirates is determined by the Supreme Petroleum Council of the Abu Dhabi National Oil Company (ADNOC), which, according to the EIA, operates "14 subsidiaries which participate at every level of the oil and natural gas

[90] EIA, "UAE Country Analysis Brief", 2011.

sectors." The relevant subsidiary for natural gas exports is the Abu Dhabi Gas Liquefaction Limited (ADGAS).[91]

Furthermore, not only does UAE now consume more domestically than it produces, but it also exports significant amounts of gas, mostly to Japan, making it the eleventh-largest LNG exporter in 2009, according to BP's energy statistics.[92] The deficit between consumption and exports on the one hand and production on the other is mainly covered by imports from Qatar. Figure 5.22 shows the soaring imports over the past decade, which is closely correlated to the strong economic growth of two of UAE's emirates, Abu Dhabi and Dubai.

Figure 5.22: UAE Natural Gas Trade Balance, 2000-2009[93]



Virtually all of the exports shown in Figure 5.22 went to Japan. In 2009, UAE exported around 6.75 bcm[94] to Japan. This is slightly above the annual contracted quantity agreed between ADGAS and TEPCO. That quantity is shown in Figure 5.23: 4.30 mmt/y (million metric tonnes per year, also mmt/a) are around 6 bcm. Finally, the Unit-

[91] Ibid.
[92] BP Statistical Review of World Energy, 2010.
[93] EIA, "UAE Country Analysis Brief", 2011.
[94] 6.75 bcm = 238 bcf, the unit used in Figure 23.

ed Arab Emirates are part of the GECF, but did not attend the first two meetings in 2001 and 2002. From 2003 onwards, UAE was represented at every meeting.

Figure 5.23: Supply and Purchase Agreements with UAE[95]

ADGAS Gas

buyer	delivery terms	contract volume (mmt/y)	contract duration
Tokyo Electric	ex-ship	4.30	1994-2019

5.1.10. Japan's Main Suppliers – Oman

Oman in 2008 was Japan's seventh-largest supplier of natural gas. The country held about 1 trillion cubic metres (tcm) of natural gas reserves in 2008, according to the BP Review of Energy.[96] With 0.5 percent of all global gas reserves in 2008, Oman is number 26 in a ranking of 55 natural gas reserve-holders listed in the BP statistics. The EIA notes: "Due to increased domestic consumption, gas reinjection use,[97] and export obligations, Oman requires increasing volumes of natural gas. The Ministry of Oil has announced plans to reassess natural gas reserves, seeking to increase reserves by a trillion cubic feet [= 28.3 bcm] per year for the next 20 years, through programs akin to the enhanced oil recovery (EOR) techniques being implemented in the oil sector."[98]

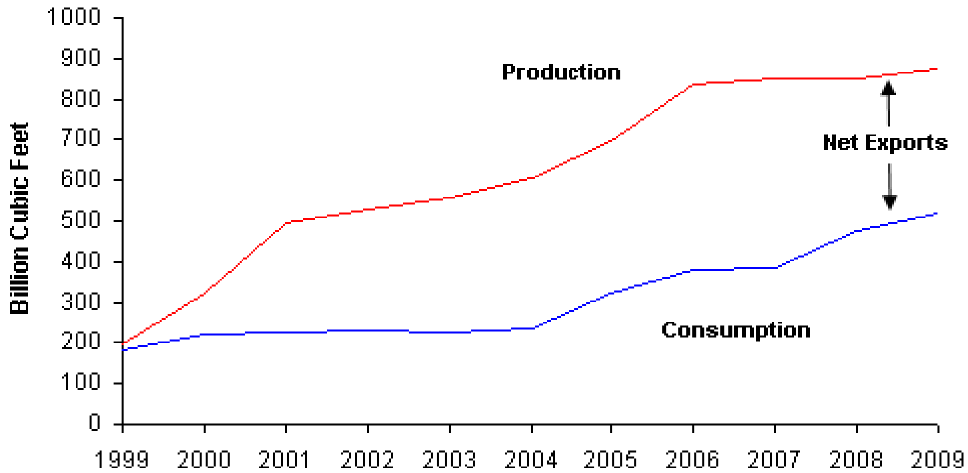
In 2008, Oman's production of natural gas reached 24.1 bcm, according to the BP Review of Energy.[99] This is a 2.8 fold increase since 2000. Figure 5.24 illustrates

[95] Unknown Author, "Fostering LNG Trade: Role of the Energy Charter", p. 169.
[96] BP Statistical Review of World Energy, 2010.
[97] Into Oman's oil fields to enhance production.
[98] Unknown Author, "Oman Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 19 May 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=MU.
[99] BP Statistical Review of World Energy, 2010.

strongly growing consumption since the mid-2000s and production that has started to level off around the same time.

The government's Petroleum Development Oman (PDO) dominates the natural gas sector of Oman. "The government enlists foreign companies in new exploration and production projects, requiring the sophisticated technology and expertise of the private sector. Developing gas projects with foreign firms such as Occidental, BP, and Petronas will determine Oman's future production. […] The Oman Liquefied Natural Gas Company (OLNGC), owned by a consortium including the government and Shell, operates all LNG activities in the sultanate."[100]

Figure 5.24: Oman's Natural Gas Production and Consumption, 1999-2009[101]



There are two major LNG projects to export Omani gas, Oman LNG and Qalhat LNG. In 2009 Oman exported around 11.5 bcm from these two sites with most exports going to South Korea, Japan and Spain.[102] "Aside from the majority stake held by the government of Oman (51 percent), shareholders of Oman LNG include Shell (30 per-

[100] Ibid.
[101] EIA, "Oman Country Analysis Brief", 2011.
[102] BP Statistical Review of World Energy, 2010.

cent), Total (5.54 percent), Korea LNG (5 percent), with Partex and other Japanese investors comprising the rest."[103] Figure 5.25 shows the supply and purchase contracts between Oman and Japan. Most of these deals were struck relatively recently, i.e. after 2000. Finally, Oman was a founding member of the GECF and attended meetings from 2001 until and including 2004.

Figure 5.25: Supply and Purchase Agreements with Oman[104]

Oman LNG

buyer	delivery terms	contract volume (mmt/y)	contract duration
Osaka Gas	FOB	0.66	2000-2025
Itochu	FOB	0.70	2006-2026
Qalhat LNG			
Osaka Gas	FOB	0.80	2009-2026
Tokyo Electric	FOB	0.80	2006-2021

5.1.11. Japan's Smaller Suppliers

The survey of major suppliers to the Japanese market has shown similarities and differences between those exporting countries. The seven largest suppliers delivered 92.4 percent of the total volume bought by Japanese importers in 2008.[105] The remaining 7.6 percent were obtained from two suppliers with which Japan has supply and purchase agreements: the United States (from Alaska) and Egypt. According to the agreement both countries were contracted to supply slightly less than 2 percent each to Japan in 2008[106], however the actual quantities supplied are: 2 percent for Egypt and 1 percent

[103] EIA, "Oman Country Analysis Brief", 2011.
[104] Unknown Author, "Fostering LNG Trade: Role of the Energy Charter", p. 166.
[105] Calculation: author; data: IEA "Natural Gas Information 2010", p. 208.
[106] See Figure 3 for contracted volumes.

for the US.[107] The United States is not part of the GECF and opposes the formation an organisation aimed at maintaining or raising natural gas prices by favouring cooperation over competition. Egypt on the other hand is a vocal member of the Gas Exporting Forum and attended all meetings except for the first one in 2001.

Apart from these small-scale contracted supplies, Japan imports some LNG cargoes purchased on the spot market as well. In 2008, Japan bought 0.7 bcm from Algeria, 1.6 bcm from Equatorial Guinea, 2.5 bcm from Nigeria and 0.5 bcm from Trinidad and Tobago, which together make up around 5.5 percent of Japan's overall imports. Two of these countries, Algeria and Nigeria, are both keen members of the GECF, having attended all meetings of the Forum since its creation in 2001. Equatorial Guinea only took part in the 2005 meeting in Port of Spain (and returned as an observer in 2008) while Trinidad and Tobago has taken part in all meetings except for the first two in 2001 and 2002.

Although the quantities supplied via short-term contracts and the spot market are small, they make a difference at the margin. If spot cargoes were sold more cheaply than those obtained through long-term contracts, this could whittle down producers' market power significantly. This in fact has happened in the Atlantic LNG market in the past few years, but not in the Asia Pacific market, where spot cargoes often fetch much higher prices than even the long-term contract-based LNG deliveries. For that reason, GECF membership and cooperative efforts of the small-scale supplier need to be examined as well.

[107] See Table 1 for actual quantities supplied.

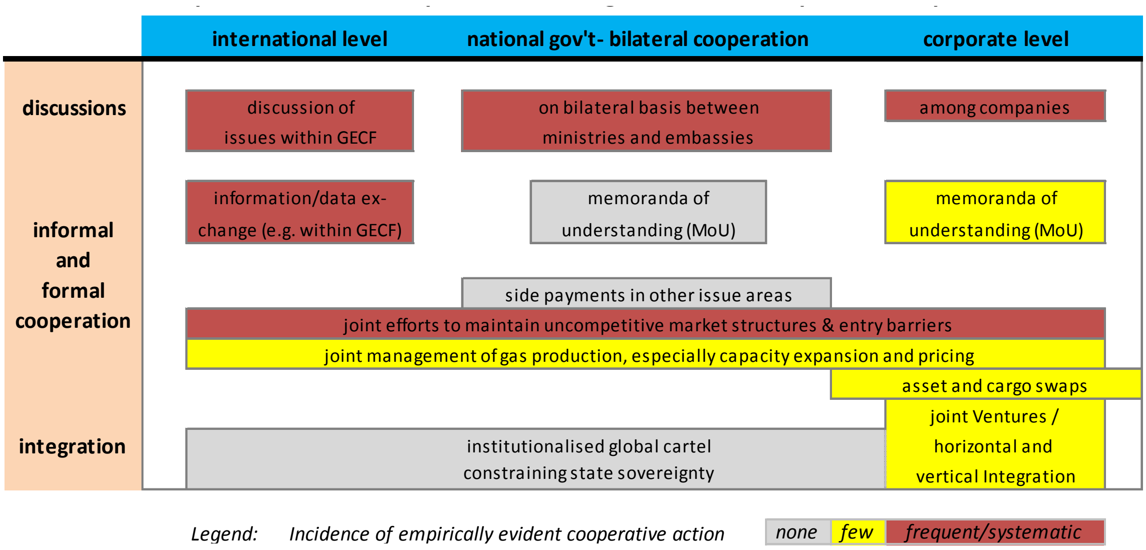
5.2. Cooperative Efforts and Actions

This section aims to summarise and discuss instances of cooperation among natural gas exporting countries that supplied LNG to Japan during the period from the GECF's creation in 2001 to 2008.[108] As in the Turkey case study, publicly available reports and data on relevant cooperative policies, actions and efforts will be presented and summarised. Moreover, insights and data obtained from expert interviews in Japan during September and October 2010 will also be used to shed light on cooperative efforts among the LNG suppliers of Japan.

As before, to better understand whether and to what extent cooperation explains market power in the Japanese gas market, a broad range of mutual policy coordination to realise joint gains on an international (multilateral) level, the bilateral government-to-government level and the corporate level of the countries' individual oil and gas companies will be considered. Generally, hard evidence for actual collusion is not available, which is why section three of this chapter employs an economic model to estimate the effectiveness of cooperation on the desired outcome, i.e. joint gains for producers, which in particular means maintaining or extending producers' market power. A broad range of cooperative policies and actions will be studied, including efforts to maintain uncompetitive market structures and entry barriers, attempts at horizontal and vertical integration and other measures. A taxonomy of cooperation was introduced in chapter 1 and is specified here to reflect the results for the Japanese gas market. Figure 5.26 shows these results, which are discussed in greater detail below.

[108] The data-driven economic analysis in section 3 will take into account the situation from 2006 to 2008, but the description of cooperative events presented here will start before the mentioned time frame

Figure 5.26: Cooperation among Natural Gas Exporters - Japan[109]



5.2.1. Discussions

As Figure 5.26 shows, discussions between producers—the first and prevalent type of cooperation in the Japan case study—take place at various levels. While discussions are the most “shallow” type of cooperation, they can have a serious impact despite this and despite their informal nature. All three levels will be the considered.

First, discussions at the **international level** take place among producers mainly at the ministerial meetings of the Gas Exporting Countries Forum, which usually take place at least once a yearly. While GECF meetings are not the only venue for discussions,[110] the Forum is the most focal place where discussions about joint goals—protecting members’ economic interesting by extracting the maximum value from their gas exports—take place. Between 2001, the year of the GECF’s creation, and 2008 seven meetings of the Gas Exporting Countries Forum took place. Table 5.3 shows the participants of these meetings and highlights Japan’s suppliers, which attended all or at least most meetings during the period of time under consideration.

[109] Source: author.

[110] Some of the producing countries may also meet each other at gatherings of the International Energy Forum or OPEC

Table 5.3: GECF Ministerial Meetings, 2001-2008, Japan's suppliers in bold

Tehran 2001	**Algiers** 2002	**Doha** 2003	**Cairo** 2004	**Port of Spain** 2005	**Doha** 2007	**Moscow** 2008
Algeria **Brunei** **Indonesia** Iran **Malaysia** **Nigeria** **Oman** **Qatar** Russia Turkmenistan Norway*	**Algeria** Bolivia **Brunei** **Egypt** **Indonesia** Iran Libya **Malaysia** **Nigeria** **Oman** **Qatar** Russia Venezuela	**Algeria** **Brunei** **Egypt** **Indonesia** Iran **Libya** **Malaysia** **Nigeria** **Oman** **Qatar** Russia **T&T** **UAE** Venezuela Norway*	**Algeria** **Brunei** **Egypt** **Indonesia** Iran Libya **Malaysia** **Nigeria** **Oman** **Qatar** Russia **T&T** **UAE** Venezuela Norway*	**Algeria** **Brunei** **Egypt** **Eq. Guinea** Iran **Malaysia** **Nigeria** **Qatar** Russia **T&T** **UAE** Venezuela Norway*	**Algeria** Bolivia **Egypt** **Indonesia** Iran Libya **Malaysia** **Nigeria** **Qatar** Russia **T&T** **UAE** Venezuela Norway*	**Algeria** Bolivia **Brunei** **Egypt** **Indonesia** Iran Libya **Malaysia** **Nigeria** **Qatar** Russia **T&T** **UAE** Venezuela Norway* Eq. Guinea*
Source: Hadi Hallouche (2001-2005 meetings)[111]; IHS Global Insight (2007)[112]; Reuters (2008)[113] * means observer status						

What is immediately obvious from the table is that the majority of GECF member countries are suppliers of LNG to the Japanese market. A higher number of players generally makes successful cooperation more challenging,[114] hence regular exchanges at ministerial meetings of the Forum are necessary. At the first meeting in 2001, the following relevant objectives were laid out: "(i) to foster the concept of mutuality of interests by favouring dialogue between producers, between producers and consumers and between governments and energy-related industries [and] (ii) to provide a platform to promote study and exchange of views."[115] Two years later Qatar's energy minister, Abdullah Bin Hamad Al-Attiyah, specified the aims by stating:

> […] therefore one of this Forum's objectives is to work on *marketing gas export projects as a group*. We shouldn't consider each other just as competition. We also appreciate the need to support the Gas Exporting Countries Forum as it

[111] Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making", p. 17.
[112] Unknown Author, "Gas Exporters Stop Short of Declaring a Cartel", IHS Global Insight, 10 April 2007.
[113] Golubkova and Zhdannikov, "Russia says gas OPEC will not set up output quotas", 2008.
[114] See chapter 1 for sources regarding structural conditions favouring cartelisation.
[115] Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making", p. 12.

> gives the opportunity to work together as producers and exporters so that we can develop our business and *exchange views and technology*.[116]

Japan's suppliers of gas are geographically more dispersed than Turkey's suppliers. Hence, the GECF may be a more important venue for those LNG suppliers since they do not come from the same region and hence may interact less in other issue areas than do Turkey's suppliers that are relatively proximate.

Moreover, GECF meetings also allow producer countries' representatives to hold **bilateral government-to-government** talks on the fringes of those meetings. Finally, given that some of the GECF countries' gas companies operate joint ventures, which will be described in the section on "integration," discussions and exchanges of information also take place on the **corporate level**.

5.2.2. Informal and Formal Cooperation

This section will describe instances of both formal and informal cooperation actions among member countries of the GECF at the international, bilateral and corporate levels. At **the international level**, there is the GECF's High-Level Group (HLG) on gas pricing. The purpose of the HLG is to "to develop a common methodology on the formation of gas export prices and to conduct research on consumer markets."[117] The Group emphasised "the need for expanded cooperation"[118] within the GECF while Algerian energy Khelil said: "We will create a team to see how we can move toward more coordination in this, particularly on the issue of price."[119]

[116] Ibid., p. 14.
[117] Robert Pritchard, "Recent Developments: April 2007", 2007.
[118] Dourian et al., "Gas OPEC' cartel not in the cards for now; Russia to chair high-level panel; expanded cooperation focus of forum", 2007.
[119] Ibid.

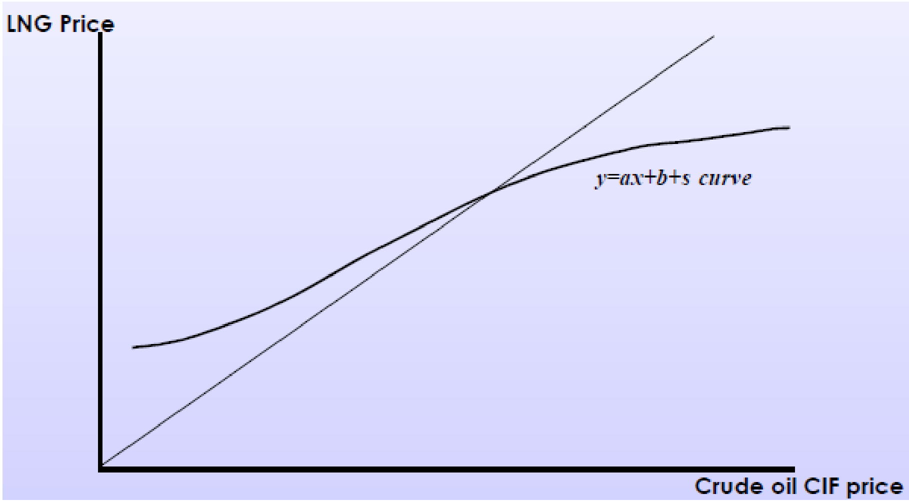
One way to achieve such cooperation is to exchange information and data about the production, pricing and marketing of natural gas. Knowing which projects will come online allows producers to manage supply in the medium-term though in an admittedly crude way. Exchanging information regarding terms and prices of secret long-term contracts also allows producers to avoid undercutting each other. Before the formation of the HLG on pricing, these issues were discussed at the meeting in 2005. Algeria's Khelil argued that 'we don't have to create another OPEC for gas, but I think we need to allow companies and gas producing countries to share information to optimize our infrastructure and to allow us to do swaps… for example, we want to do swaps with Trinidad and Tobago and Spain and we need to share information to do that.'[120]

Even earlier, at the 2002 meeting in Algiers and Osaka, cooperation with regard to data exchange was agreed upon. Specifically, Iran was commissioned to create a database of gas projects and contracts terms and conditions of all GECF members. Moreover, "there was a study on new gas utilisations and associated costs, especially those related to LNG (which is relevant form of transportation to the Japanese market), to be undertaken by Qatar."[121]

Other types of informal and formal cooperation that span all levels—the international, national and corporate ones—include using the pricing mechanism and other anti-competitive measures such as destination clauses and market entry barriers such as long-term contracts to preserve and expand producers' market power. Section 1.3 provided a brief introduction to the pricing mechanisms used for LNG exports to Japan over the past few decades.

[120] Ibid., p. 47.
[121] Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making", p. 13.

Figure 5.27: The S-Curve Illustrated[122]



The S-curve is the dominant formula at the moment and has been used since the late 1980s. LNG sold to Japan is indexed to crude oil,[123] i.e. rising oil prices mean higher gas prices and vice versa, but the relationship is not linear since S-curve reduces “the sensitivity of the LNG price to oil-price movements outside certain oil price limits. This shielded suppliers in periods of unusually low oil prices and buyers in periods of extraordinarily high oil prices.”[124] Figure 5.27 illustrates this S-shaped relationship in comparison to the straight linear line.

Existing contracts from the late 1980s onwards were adapted and the S-curve was also introduced for new LNG projects in Australia and Qatar. “From the time when crude oil prices plunged in the mid-1980s to around 2000 (barring the exceptional circumstances at the time of the Gulf War in 1991), [oil] prices remained low at less than

[122] Koji Morita, “Falling Prices and Increasing Flexibility of Supply: Risk Redistribution Creates Contract Diversity”, Presentation, The Institute of Energy Economics, Japan, April 2003.
The relationship between crude oil and LNG prices is described in the generic function y=a*x+b+s-curve where b represents the constant factor that remains regardless of oil price variations, a*x determines the underlying linear slope of the curve (i.e. how steep the curve will be) and the s-curve term “softens” the sensitivity of LNG prices to the crude oil price above and below certain levels.

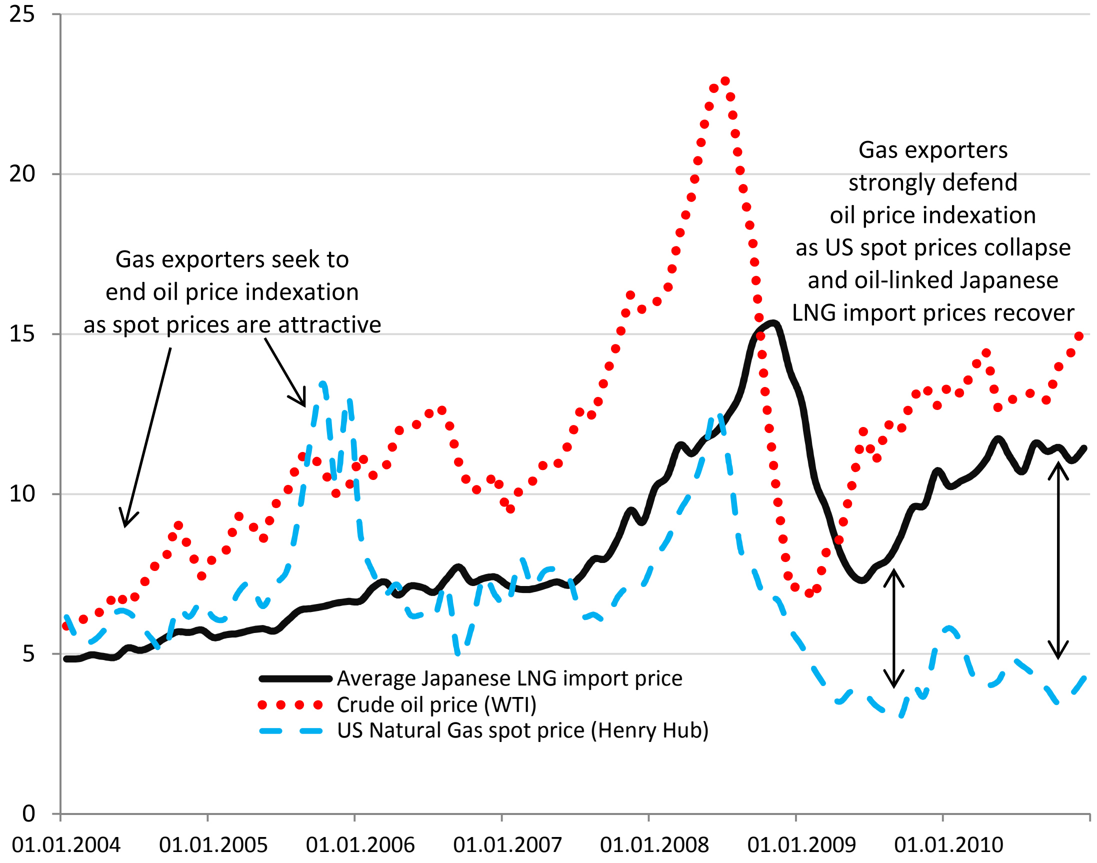
[123] The original rationale for this is that LNG used to compete with fuel oil in power plants. This justification is obsolete today since the lion’s share of primary energy going to power generation aside from gas are coal and nuclear.

[124] IEA World Energy Outlook 2009, p. 520.

$US20/bbl. Consequently, LNG prices were comparatively higher than the price of the crude oil during this period. This may be ascribed to the effect of both the constant terms ["b" in Figure 5.28Figure 5.27] and the S-curves of the formula."[125]

Figure 5.28: Oil-Linked LNG Import Prices, Crude Oil and US Natural Gas Spot Prices[126]

All converted to US$ per mmbtu, 2004 to 2010



After 2000, producers that supply LNG to Japan have changed their preferences with regard to pricing in an opportunistic, rent-maximising way multiple times. Mostly in favour of retaining oil-indexation and the S-curve, they also sometimes called for an end to oil-indexation (when the spot price of gas was attractive) or for a change to the S-

[125] Miyamoto et al., 2010.
[126] Chart & Calculations: author ; Data: IEA Energy Statistics, 2011.

curve when oil price were extraordinarily high, i.e. lifting the ceiling that flattens rises in the LNG price as the crude oil price rises.

Figure 5.28 illustrates producers' preferences since 2004. At some points the spot price of gas was higher than the average Japanese import price (and sometimes even than the crude oil price) before 2005. Given more attractive spot prices, "Egypt [at the second GECF meeting in Algeria in 2002] submitted proposals to de-link gas prices from crude oil prices, something the Egyptian government itself has attempted to do domestically, and to set up a committee to study the potential of fixing a special tariff on gas sales."[127] Moreover, when spot prices peaked in 2005 while oil-indexed gas prices for LNG cargoes to Japan remained low producers demanded "a fair [presumably meaning higher] price for liquefied natural gas"[128] at the fifth GECF meeting in Trinidad and Tobago in 2005.

When oil prices surged in 2006 and afterwards (with the exception of a brief economic crisis-induced slump between late 2008 and mid-2009), producers were particularly adamant about oil-indexation, especially because American spot prices had fallen and remained low and disconnected from oil prices. The S-curve that protected sellers during times of very low oil prices by setting a floor and protected buyers during times of extremely high oil prices by setting a ceiling was increasingly questioned and rejected by sellers. Instead full parity oil indexation was favoured, which corresponds to the straight line in Figure 5.28. Gas expert Akira Miyamoto argued: "[… the] S-curve was rejected by sellers during the present period of steeply rising prices on the grounds that it was irrational for LNG to be much cheaper than crude oil."[129] Alternatively, some

[127] Simon Wardell, "GECF wants more international cooperation on gas", *World Markets Analysis*, World Markets Research Centre, 4 February 2002. Accessed via Nexis UK on 26 May 2011.
[128] Simon Wardell, "GECF calls for 'fair' LNG prices, denies it is going the way of OPEC", *World Markets Analysis*, World Markets Research Centre, 28 April 2005. Accessed via Nexis UK on 26 May 2011.
[129] Miyamoto et al., 2010, p. 26.

sellers insisted in contract negotiations on changing the upper-end of the S-curve slope (by lifting the "ceiling"), allowing them capture high LNG prices when oil prices are high.[130]

Examples include the following: "Negotiations were still ongoing earlier last week, as Qatar had been holding out for a more favorable pricing mechanism, including 'absolute oil parity' or a 'weakened or limited' version of the S-curve that is normally incorporated into Japanese LNG contracts, according to industry sources. With oil prices that are substantially higher than when the original Qatargas-1 contracts were signed in the early 1990s, the S-curve provision has blunted effects of rising crude prices on the price Japan pays for Qatari LNG."[131] Moreover, after the period of time under consideration in this thesis, Qatar and other LNG suppliers that sell gas to Japan remained keen "to maintain strong oil-indexation in key Asian markets" as crude oil was expensive and natural gas spot prices remained depressed.[132] Hence, producers have opportunistically changed their preferences with regard to LNG pricing mechanisms (mostly in secret contract negotiations) to maintain or extend their market power. Another common method to preserve market power in the Japanese markets has been the use of destination clauses (or resale restrictions). This simply means that Japanese buyers are not allowed to resell LNG cargoes to third parties—neither in Japan or elsewhere. The use of destination clauses as such neither constitutes nor requires cooperation among the sellers. However, the fact that most of the producers that sell uncommitted LNG cargoes (i.e. not as part of long-term contracts) to European and American buyers at lower prices, but not to Japan requires cooperation. Especially Qatar and Malaysia will not allow an LNG cargo that is sold to the US at Henry Hub prices (of around US$3-5 in 2009

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[130] Expert Interview, Akira Miyamoto, Osaka Gas, Osaka, Japan, October 2010.

[131] Erwin Chan, "Japan's high LNG prices", *International Oil Daily*, 17 April 2007. Accessed via Nexis UK on 17 May 2011.

[132] Unknown Author, "Gas Exporters Urged to Trim Spot Surplus", *Petroleum Intelligence Weekly*, 29 March 2010, accessed via Nexis UK on 28 May 2011.

and 2010) to be bought by Japanese buyers and hence diverted from its original destination (the US) to Japan. Akira Miyamoto from Osaka Gas reported in the expert interview that Japanese buyers cannot get hold of cargoes sold for US$4 to the US despite the fact that Mitsubishi have an LNG import terminal on the US Gulf Coast. Hence, theoretically, Mitsubishi could buy the cargo at Henry Hub prices and then divert the cargo to Japan, which might add US$1-2 in transportation cost, bringing the total to $US6-7, which would be far below Japan's LNG prices of $US11-13 (for contracted gas) and up to $US25 (for occasional spot cargoes bought by Japan). Qatar and other LNG suppliers jointly refuse to let such reselling of cargoes happen.[133] The reason is simple: If the buyer can take advantage of regional price arbitrage, the market power and hence economic rent of the producers will be diminished significantly. Some buyers have consistently complained about destination clauses (or "resale restrictions") that suppliers refuse to give up (except for Nigeria[134]). "Japanese utility Chubu Electric Power is thinking of diversifying into LNG trading as the market develops more liquidity […]. Katsuji Noda, president of Chubu Energy Trading [… argued] that LNG trading will not occur in the near future because of destination clauses in existing term contracts […]."[135]

Figure 5.29 shows that more than a third of all LNG sold in the European and American ("Atlantic") markets is not committed[136] in long-term contracts and hence available for flexible spot trading. In the Middle East about a quarter of all LNG capacity is flexible. And lastly, in the Pacific market, i.e. mostly Japan, South Korea and Tai-

[133] Expert Interview, Akira Miyamoto, Osaka Gas, Osaka, Japan, October 2010.

[134] Sylvie Cornot-Gandolphe, "LNG Cost Reductions and Flexibility in LNG Trade add to Security of Gas Supply", *IEA Energy Prices & Taxes*, 2005. Accessed via Nexis UK on 25 June 2011.

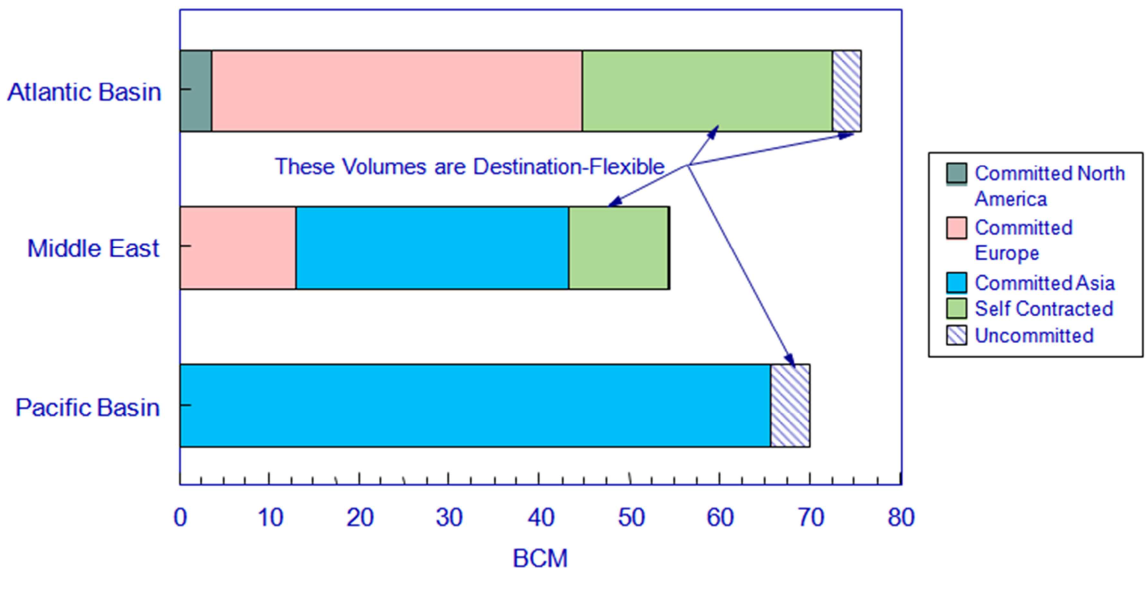
[135] Unknown Author, "Japan Utility Mulls LNG Trade", *International Oil Daily*, 31 March 2010. Accessed via Nexis UK on 17 June 2011.

[136] The term "uncommitted" means that a specific buyer has not been specified yet and "self-contracted" means that the producer "buys" the gas from itself to market it directly via flexible trading to end-consumers such as power plants. Hence both uncommitted and self-contracted gas are volumes available for trading.

wan, almost all of the gas is still “stuck” in rigid, long-term contracts and not available for flexible trading on the spot market, which helps producers maintain their market power. For example, LNG expert James Jensen points that the first two LNG trains of Qatargas 1 have “traditional fixed destination contacts with Asia buyers [while] Qatargas 2, train 4 has contracted with ExxonMobil [one of the joint venture partners in Qatargas], which is now free to take its volumes anywhere it sees fit.”[137] Several other experts, including Takuma Amano, a former Japanese banker and energy and electricity expert and Yasumitsu Himeno of the World Bank’s Japan office, pointed out that Japan “gets a bad deal”[138] because almost all LNG producers refuse to abolish destination clauses that affect Japan in two ways: it cannot resell contracted volumes and it cannot get hold of more competitively priced cargoes from elsewhere.

Figure 5.29: Regional Contract Commitments, 2008[139]

Uncommitted/Self-Contracted Volumes in Regional Markets



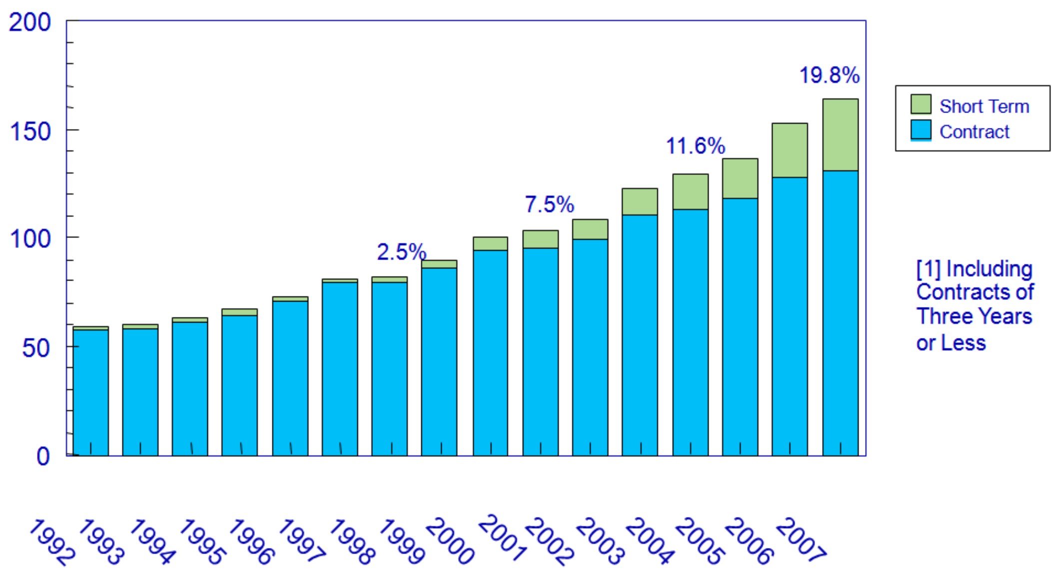
[137] James Jensen, “LNG – Expanding the Horizon of the International Gas Trade”, Presentation to the MIT Gas Study Group, Cambridge, MA, 19 March 2009.

[138] Expert Interview, Takuma Amano, former banker and energy expert, Tokyo, September 2010.

[139] Ibid.

Connected to the issue of destination clauses are long-term contracts, which are a market entry barrier. Most suppliers insist on such contracts to lock in buyers for a long time. Whereas producers are willing to sign shorter-term supply and purchase agreements in the Atlantic market and hence such short-term contracts are becoming more common (Figure 5.30), East Asian buyers find it difficult to reduce the duration of commitment necessary to secure gas volumes.

Figure 5.30: Short-term v Long-term LNG Contracts, in bcm[140]



At the corporate levels, there are some formal cooperative agreements, for example the one between Malaysia's Petronas and Oman and between Petronas and Trinidad and Tobago. "In December 2005, Petronas, through its subsidiary Malaysia LNG Sdn Bhd (MLNG), signed a memorandum of agreement with Oman's Qalhat LNG, marking the start of the partnership between the two major liquefied natural gas (LNG) players. The agreement between Qalhat and MLNG outlines cooperation in areas like exchange of technical information, exchange and training of staff, alternative LNG sup-

140 Ibid.

ply arrangement and cargo swap arrangements to increase value for both companies."[141] Petronas also signed a memorandum of agreement with Trinidad's National Gas Company to "study the joint development of projects in LNG liquefaction, shipping, regasification and marketing, and other related investment opportunities."[142] All three cooperation partners are members of the GECF.

Finally, in 2007 there were some suspicions that Algeria and Qatar jointly attempted to restrict available LNG capacities to drive up prices "[…] Some observers linked the sudden slowdown in Algerian gas output to the country's participation in deliberations of the Gas Exporting Countries Forum (GECF) which could quickly transform itself into cartel of producer countries and influence world supply. Qatar, the prime mover behind GECF, also scrapped projects.[143] Moreover, "after announcing last month it was reconsidering a project for the integrated development of the Tinhert gas fields, Sonatrach has finally decided to cancel the scheme."[144] Given that both Algeria and Qatar are major LNG supplier to the Japanese market, such moves towards managing and restricting short-term supply and long-term capacity expansions, can (and already may) have an effect on the Japanese market.

5.2.3. Integration

Integration is the "deepest" type of cooperation. In Figure 5.26 an example for this form of cooperation spanning the international and national levels would be a global cartel that constrains the sovereignty of participating GECF member states. This does not exist at present.

[141] Kamarul Yunus, "Petronas signs natural gas deal with Oman", *Business Times (Malaysia)*, 20 April 2009. Accessed via Nexis UK on 20 June 2011.
[142] Unknown Author, "Petronas signs deals with Trinidad, Oman firms", *Business Times (Malaysia)*, 5 January 2006. Accessed via Nexis UK on 17 June 2011.
[143] Unknown Author, "Gas Projects Hit by Delay", *Africa Energy Intelligence*, 30 May 2007. Accessed via Nexis UK on 16 May 2011.
[144] Ibid.

There is, however, some integration between GECF member states' gas production projects at the corporate level. For example, Malaysia's Petronas oil and gas company has had a presence in Egypt since 2001. It is involved in the production of natural gas "in the North East Mediterranean Deepwater Block awarded by the Egyptian government."[145]

There is also some minor degree of integration between Petronas and Russia's Gazprom.[146] "Russia and Malaysia are also members of the GECF. While no agreement on the formation of a pricing cartel was reached at the organization's April meeting in Doha, Moscow and Kuala Lumpur are developing close ties in energy. The Malaysian Petronas acquired a 1-percent share in Rosneft for USD 1.1 billion in July of 2006, and Gazprom is now in negotiations with the Malaysian [company] on joint gas production."[147]

Finally, in 2009 Petronas signed another agreement with Oman—an exploration and production sharing agreement (EPSA)—with the intention to explore and sell natural gas in the Gulf state.[148] Given that the Petronas/Oman agreement was concluded in 2009, i.e. after the period studied here in this thesis, it is not particularly influential in terms of the analysis. Given that all producers mentioned here are significant suppliers of LNG to the Japanese market, measures aimed at achieving a higher degree of integration (e.g. joint operation and ownership of production facilities) among those producers are an important development and need to be considered as a factor in explaining cooperative and collusive effectiveness.

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[145] Petronas company website. Accessed on 20 June 2011: http://www.petronas.com.my/community/global_outreach/egypt.aspx.

[146] Gazprom only became a supplier to the Japanese gas market in 2009, i.e. after the period of time under consideration in this thesis. The impact is therefore minor.

[147] Aleksandr Gabuev, "Rosoboronexport Is Participating in Number of Malaysian Tenders", Kommersant, No. 104 (3680), 19 June 2007, p. 10. Accessed via Nexis UK on 26 May 2011.

[148] Yunus, "Petronas signs natural gas deal with Oman", 2009.

This and earlier sections have looked at cooperative policies, efforts and actions including discussions, exchanges of information, informal and formal cooperation as well as integration of activities among Japan's GECF suppliers. This investigation thus far has been based mainly on publicly available data and reports in addition to information collected in expert interviews in Japan. Looking at the process of cooperation was an important first step. The following step, as before in the Turkey case study, will be to determine whether cooperation is a causal explanation for market power in the Japanese gas market by studying the outcome (existence of market power) and then working backwards to possible causes. Studying a range of possible causal variables, one can more confidently establish whether or not producer cooperation does play an important role in explaining market power in the Japanese gas market. The quantitative analysis in section 3 will do that.

Japan's suppliers of natural gas were introduced in section 1 of this chapter and section 2 described and analysed the relations among those suppliers. As before in the Turkey case study, a brief note on the chosen period of time is in order. The major focus of the following economic analysis is on the years from 2006 to 2008, but as the previous sections have shown, it is useful to take into account potentially relevant events before and after this specific time frame for a comprehensive understanding. There are also important practical reasons for the chosen period of time (2006-2008) in the subsequent analysis is this: good data on prices, marginal cost and other necessary inputs into the model is available only during that specific period of time for all three case studies.

5.3. Quantitative Analysis: The Conduct Parameter Model

This section aims to demonstrate whether or not Japan's suppliers of LNG enjoy a significant amount of market power in the Japanese market. Specifically, the conduct parameter model will be used to calculate to what extent producer cooperation explains the producers' market power. It will also be explored whether the most appropriate measure of market power should be the mark-up over marginal costs[149] or the mark-up over the non-cooperative oligopoly outcome. The outcomes will then be examined and an approximate estimate of economic rent extracted by the producers will be produced.

5.3.1. Does Market Power Exist in the Japanese Gas Market?

When market power is prevalent in a certain market, producers manage to charge price above their marginal cost of production. The simple fact that significantly different prices for the same homogenous product exist is a first indication of the existence of market power since firms are "price makers" rather than price takers that accept one single price set by the market. As Table 5.4 shows, every producer charges a different price[150] for natural gas, a homogeneous product. The Lerner Index of market power allows one to estimate more precisely the degree of market power if data on prices, on firm's marginal costs and market shares are available.

Average import prices. Table 5.4 shows the average price of imported LNG Japanese buyers paid to its various suppliers. The calculations of the annual average prices are based on the IEA's official statistics. The prices for LNG are in US$ per mmbtu (whereas pipeline gas is priced in US$ per thousand cubic metres, Mcm. The conversion factor is: 1 mmbtu = 35.3 Mcm.)

[149] That is, assuming a perfectly competitive market where price equals marginal cost.
[150] Prices are not simply different because of transportation cost.

Table 5.4: Average Gas Import Prices and Market Shares in Japan, by country of origin[151]

	Price US$/mmbtu	Mkt. share (by volume)	Mkt. share (by value)	Price US$/mmbtu (continued)	Mkt. share (by volume)	Mkt. share (by value)
	United States			**Indonesia**		
2004	4.98	1.6%	2.0%	5.98	21.1%	30.7%
2005	5.76	1.7%	2.1%	7.10	19.3%	28.0%
2006	6.69	1.8%	1.7%	8.15	22.0%	25.1%
2007	6.08	1.1%	0.9%	8.54	19.9%	21.7%
2008	7.81	1.0%	0.6%	11.70	20.5%	19.0%
	Australia			**Malaysia**		
2004	4.90	11.7%	13.9%	4.94	17.9%	21.5%
2005	5.62	14.6%	16.8%	5.71	18.3%	21.4%
2006	6.50	19.9%	18.1%	6.56	19.3%	17.7%
2007	7.02	17.3%	15.5%	7.85	19.4%	19.5%
2008	11.61	17.9%	16.5%	13.02	19.6%	20.3%
	Algeria			**Nigeria**		
2004	-	-	-	6.22	0.2%	0.2%
2005	-	-	-	-	-	-
2006	10.15	0.3%	0.4%	10.60	0.3%	0.4%
2007	10.49	1.4%	1.9%	10.87	1.5%	2.1%
2008	17.87	0.7%	1.0%	17.08	2.7%	3.6%
	Brunei			**Oman**		
2004	4.75	8.6%	10.0%	5.74	1.5%	2.1%
2005	5.53	8.6%	9.7%	7.17	1.5%	2.3%
2006	5.90	10.1%	8.3%	9.04	4.5%	5.7%
2007	6.38	9.7%	7.9%	8.17	5.4%	5.6%
2008	13.24	9.0%	9.4%	12.44	4.5%	4.4%
	Egypt			**Qatar**		
2004	6.22	-	-	5.06	9.2%	11.3%
2005	8.41	0.2%	0.3%	5.91	8.9%	10.8%
2006	10.37	0.9%	1.3%	7.67	12.2%	13.0%
2007	10.68	2.4%	3.2%	8.20	11.9%	12.5%
2008	17.48	1.9%	2.6%	13.48	11.9%	12.7%
	Equatorial Guinea			**UAE**		
2004	-	-	-	4.86	6.9%	8.2%
2005	-	-	-	5.56	7.5%	8.5%
2006	-	-	-	6.78	8.3%	7.9%
2007	7.78	0.8%	0.8%	7.22	8.2%	7.5%
2008	12.66	1.7%	1.7%	11.58	8.2%	7.5%

Market share. Table 5.4 also shows each individual supplier's market share in the Japanese gas market. There are two ways to calculate a firm's market share in a given market, by sales volume or by value (in US$). For the purposes of this model it is preferable to use sales revenues (value) as the basis for market share since the focus is on prices and value rather than just physically traded quantities. The difference between

[151] Table & calculations: author; data source: IEA, 2010.
(Russia only started exporting to Japan in 2009.)

the two is often marginal, however, as Table 5.4 shows. With that, two of the three essential data inputs for the Lerner Index have been provided.

$$L_t = \sum_i s_{it} \frac{P_t - MC_{it}}{P_t}$$ [152]

Figure 5.31: Range of production costs for selected gas producing regions[153]

(in US$/mmbtu)

Country	Production costs	
	Lowest	Highest
Algeria	0.40	0.80
Australia	0.60	1.00
Canada	0.70	1.20
Indonesia	0.50	1.00
Iran	0.35	0.70
Netherlands	0.20	1.40
Nigeria	0.60	1.20
Norway (North Sea)	0.80	1.40
Norway (Barents Sea)	1.20	1.70
Qatar	0.35	0.60
Russia (Western Siberia)	0.40	1.20
Russia (Barents Sea)	1.00	1.30
Russia (Sakhalin)	0.80	1.30
UK	1.20	1.60
USA (Gulf and onshore)	0.70	1.70
Venezuela	0.60	1.00

Marginal cost. The last input is marginal cost (MC). Since producers' marginal costs are difficult to determine, estimates must be obtained or generated. Such marginal cost estimates do exist for essentially all of Japan's natural gas suppliers. The basic estimates come from two different sources shown in Figure 5.31 and Figure 5.32.

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[152] The Lerner Index was reproduced from chapter 3. *P* stands for price, *MC* for marginal cost and *s* for market share, *t* for unit of time (year) and *i* for firm.

[153] A. Seeliger, *Entwicklung des weltweiten Erdgasangebots bis 2030: Eine modellgestuetzte Prognose*, Oldenburg Verlag, 2006, Munich, pp. 52-56. Cited in: Stefan Lochner and David Bothe, "The development of natural gas supply costs to Europe, the United States and Japan in a globalizing gas market—Model-based analysis until 2030", *Energy Policy* 37 (2009), p. 1521.

Figure 5.32: Upstream, liquefaction and transportation costs gas producing regions[154]

	Gas extraction and liquefaction costs C_i (\$/1000m^3) *	Unit shipping costs T_{ij} for LNG (\$/1000m^3)				
		Asia				
		China	India	Japan	South Korea	Taiwan
Trinidad and Tobago	21.19	82.32	86.29	90.77	95.82	102.59
Oman	14.13	47.24	16.64	63.99	57.05	51.81
Qatar	10.59	53.11	20.61	64.78	62.96	54.63
UAE	12.36	54.21	20.29	65.91	64.08	55.73
Algeria	15.89	83.27	52.44	91.71	93.66	84.9
Egypt	21.19	68.02	39.32	81.2	78.31	71.49
Equatorial Guinea	17.66	95.95	73.84	108.04	104.25	97.42
Libya	17.66	74.89	43.92	88.51	85.22	77.59
Nigeria	17.66	94.35	73.3	106.28	103.95	95.39
Brunei	14.19	23.14	28.46	31	27.68	27.86
Indonesia	8.97	23.18	41.02	29.09	27.61	22.44
Malaysia	35.47	24.41	37.99	30.21	25.96	23.08

*2001 figures

The marginal cost data in these sources were generated at different times (the Seelinger data in Figure 5.31 in 2006 and the Massol/OME data in Figure 5.32 in 2001), hence it is necessary to adjust for changes in cost over time to make the figures comparable and to arrive at estimates for the relevant period of time under consideration. The IHS CERA Upstream Capital Cost Index (UCCI) will be used for the relevant adjustments in the same way the UCCI was used in the Turkey case study.[155] Seelinger uses the standard unit for LNG in Figure 5.31, US\$/mmbtu while Massol et al. use US\$/Mcm. The final estimates for the relevant years studied in this thesis were all converted to US\$/mmbtu[156] and can be found in Table 5.5.

To illustrate how the data in Table 5.5 were generated, one example will be provided. Qatar's average production costs in 2006 according to Figure 5.31 were \$US0.475/mmbtu (using the central estimate). Accounting for cost inflation with the UCCI, the 2007 estimate is \$US0.53 /mmbtu and the 2008 estimate is 0.63\$/mmbtu.

[154] Olivier Massol and Stéphane Tchung-Ming, "Cooperation among liquefied natural gas suppliers: Is rationalization the sole objective?", Energy Economics 32, 2010, p. 944.

[155] I should like to thank Michael Stoppard, Managing Director for Global Gas of CERA for the suggestion to use the UCCI. Please refer to Chapter 3.1 for further details.

[156] 1 mmbtu = 35.3 Mcm

Adding transportation cost of $US1.84/mmbtu from Qatar to Japan (from Figure 5.32: $US64.78/Mcm, which equals $US1.84/mmbtu), the total cost estimate for the years 2006, 2007 and 2008 are $US2.31, $US2.37 and $US2.46/mmbtu – see Table 5.5.

Table 5.5: Marginal Cost of Production and Transportation Cost to the Japanese border[157]

in US$/mmbtu

	Upstream US$/mmbtu	**Transp. cost** US$	**Total cost** US$	(continued)		
	Australia			**Trinidad & Tobago**		
2006	0.80	2.00	2.80	0.99	2.57	3.56
2007	0.90	2.00	2.90	1.11	2.57	3.68
2008	1.05	2.00	3.05	1.30	2.57	3.87
	Nigeria			**Oman**		
2006	0.90	3.00	3.90	0.66	1.82	2.48
2007	1.01	3.00	4.01	0.74	1.82	2.56
2008	1.18	3.00	4.18	0.87	1.82	2.69
	Indonesia			**UAE**		
2006	0.25	0.82	1.07	0.58	1.87	2.45
2007	0.29	0.82	1.11	0.65	1.87	2.52
2008	0.33	0.82	1.15	0.76	1.87	2.63
	Malaysia			**Egypt**		
2006	1.65	0.86	2.51	0.99	2.30	3.29
2007	1.86	0.86	2.72	1.11	2.30	3.41
2008	2.17	0.86	3.03	1.30	2.30	3.60
	Algeria			**Eq. Guinea**		
2006	0.60	2.60	3.20	0.82	3.06	3.88
2007	0.68	2.60	3.28	0.93	3.06	3.99
2008	0.79	2.60	3.39	1.08	3.06	4.14
	Qatar			**Brunei**		
2006	0.48	1.84	2.31	0.66	0.88	1.54
2007	0.53	1.84	2.37	0.74	0.88	1.62
2008	0.63	1.84	2.46	0.87	0.88	1.75
	United States					
2006	1.20	3.00	4.20			
2007	1.35	3.00	4.35			
2008	1.58	3.00	4.58			

One important comment is necessary regarding transportation/shipping costs. While the cost of upstream production has gone up—and is accounted for by adjusting the figure with the UCCI—shipping costs for LNG have steadily declined over the past

[157] Table: author; Sources: Detailed and comprehensives references are to be found in section 3.1, subsection *marginal cost*.

two decades, principally because of larger tankers which generate economies of scale, which bring down the cost per unit.[158] Yet, the 2001 data for shipping costs from Figure 5.32 are used for every year (and not lower costs as time progresses). This is consistent with the chosen conservative approach in this thesis that would rather understate than overstate the degree of collusion.

Table 5.6: Lerner Index for Japanese natural gas market, 2006-2008[159]

	US	Australia	Algeria	Brunei	Egypt	Eq. Guinea	Indonesia
2006	0.01	0.10		0.06	0.01	0.00	0.22
2007	0.00	0.09	0.01	0.06	0.02	0.00	0.19
2008	0.00	0.12	0.01	0.08	0.02	0.01	0.17
	Malaysia	**Nigeria**	**Oman**	**Qatar**	**T&T**	**UAE**	**Total**
2006	0.11	0.00	0.04	0.09	0.00	0.05	**0.69**
2007	0.13	0.01	0.04	0.09	0.00	0.05	**0.70**
2008	0.16	0.03	0.03	0.10	0.00	0.06	**0.80**

Table 5.6 shows the Lerner Index results for the period of time under consideration. The overall Lerner Index is the sum of each individual supplier's Lerner Indices, weighted by each supplier's market share. A Lerner Index of zero would mean a perfectly competitive market in which producers are not able to charge prices above their marginal cost of production. A Lerner Index of 1 would imply a monopoly or a perfectly collusive group of suppliers. The results for the Japanese market point to a very high degree of market power with results ranging between 0.69 and 0.80.

What follows is the conduct parameter model (CPM), which takes into account the elasticity of demand and market concentration to estimate to what extent the residual—product conduct (cooperation or competition)—explains the high degree of market power. The results of the conduct parameter model for the Japanese market for the period of time from 2006 to 2008 will be explained and presented.

158 This is also evidenced by the fact that charter rates for LNG tankers have fallen significantly and steadily since the 1990s.

159 Table: author.

5.3.2. Explaining Producers' Market Power – The Role of Collusion

The Lerner Index results showed that Japan's suppliers of LNG enjoy significant market power in the Japanese gas market. To assess the role of producer conduct, two steps are necessary before the CPM result can be calculated. First, the data on market shares needs to be translated into a suitable measure of market concentration. The Herfindahl Index (H) is used in the conduct parameter model. The Herfindahl Index for each year is simply calculated by adding the squared market shares of each supplier to the Japanese market (see Table 5.7).

Table 5.7: Market Shares and Herfindahl Index (H)

	2006	2007	2008
Unites States	1.7%	0.9%	0.6%
Indonesia	25.1%	21.7%	19.0%
Australia	18.1%	15.5%	16.5%
Malaysia	17.7%	19.5%	20.3%
Nigeria	4.0%	2.1%	3.6%
Brunei	8.3%	7.9%	9.4%
Oman	5.7%	5.6%	4.4%
Egypt	1.3%	3.2%	2.6%
Qatar	13.0%	12.5%	12.7%
Eq. Guinea		80.0%	1.7%
UAE	7.9%	7.5%	7.5%
Algeria	4.0%	1.9%	1.0%
H	**0.161**	**0.142**	**0.140**

The other missing input into the CPM is the price elasticity of demand **ε** and since the conduct parameter result is very sensitive to the level of **ε**, a careful analysis of the available elasticity data is required. A broad range of elasticity estimates—both short-run and long-term ones—for natural gas consumption is available. Since producers' collusive efforts to maximise economic rents have both a short-term and a longer-term dimension,[160] an elasticity estimate that lies between the generally inelastic short-run figure and the less inelastic longer-run one will be used.

A comprehensive review of the literature shows that most estimates are in the range between -0.3 and -0.9 in the Japanese gas market. Koji Miyawaki, Yasuhiro Omori and Akira Hibiki's study show a somewhat inelastic figure of -0.84 for demand from the household sector.[161] Another paper by I. Matsukawa, S. Madono, and T. Nakashima estimates the elasticity of industrial gas demand to be -0.63.[162] The most inelastic figure comes from a study conducted by the Cabinet Office of the Japanese government: -0.373.[163] One explanation for such relatively inelastic demand could be explained by the fact that gas and power companies buy gas almost regardless of price, because they can directly pass on their costs to consumers. Hence even if prices soar, LNG buyers' quantity demanded is not very sensitive to higher prices. Given these three estimates, -0.56 will be used for the purposes of this analysis. The figure lies within the range of the three estimates mentioned above and it was also used in a study by Al-Sahlawi of OECD countries' long-run price elasticity of natural gas demand.[164]

Moreover, a sensitivity analysis will also be conducted to ascertain whether the results change substantially if the elasticity of demand is assumed to be 25 percent below or 25 percent above the figure employed here. This sensitivity analysis, shown in Table 5.8 along with the CPM results, hence uses not only -0.56 to perform the calculations, but also -0.42 (more inelastic) and -0.70 (more elastic).

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[160] Raising prices by too much in the short-run might eventually create a correspondingly significant quantity reaction since demand is more elastic in the long-run.

[161] Koji Miyawaki, Yasuhiro Omori and Akira Hibiki, "Discrete/Continuous Choice Model of the Residential Gas Demand on the Nonconvex Budget Set", *CIRJE Discussion Paper*, October 2010, p. 23.

[162] I. Matsukawa, S. Madono, and T. Nakashima, "An empirical analysis of Ramsey pricing in Japanese electric utilities", *Journal of the Japanese and Industrial Economies*, vol. 7, no.3, 1993, pp. 256-276.

[163] Tadahiro Nakajima, "The residential demand for electricity in Japan: An examination using empirical panel analysis techniques", *Journal of Asian Economics*, vol. 21, 2010, p. 414.

[164] Tarr and Thomson, "The Merits of Dual Pricing of Russian Natural Gas", 2004, pp. 1189-90.

Having presented and discussed all necessary data inputs into the Conduct Parameter Model, Table 5.8 and Figure 5.33 show the results of the model.

Table 5.8: Results from Conduct Parameter Model[165]

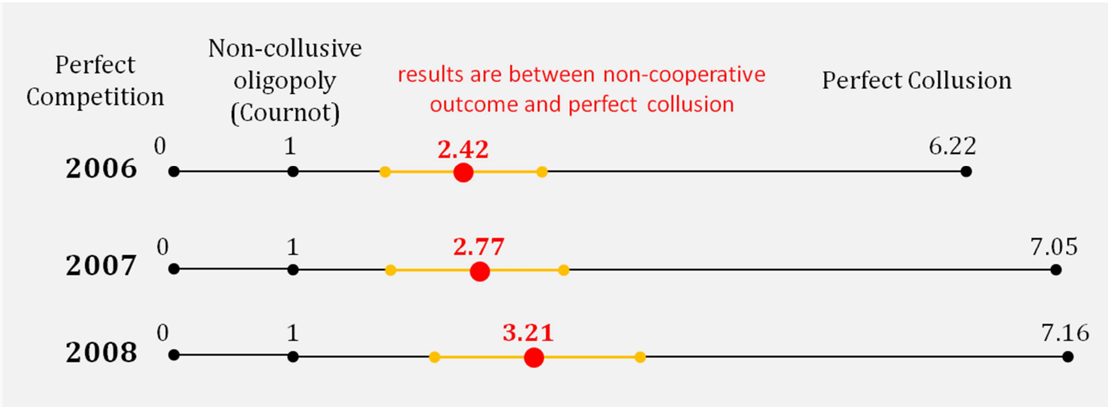
	Results			Spectrum of Possible Outcomes		
	Conduct Parameter θ			**Perfect Comp.**	**Non-coop. oligopoly**	**Perfect collusion**
2006	1.81	**2.42**	3.02	0	1	6.22
2007	2.08	**2.77**	3.46	0	1	7.05
2008	2.41	**3.21**	4.02	0	1	7.16
Elasticity ε	-0.42	**-0.56**	-0.70	θ = 0	θ = 1	θ = 1/H

Sensitivity analysis of ε: -25% and +25% of estimate

Taking into account elasticity of demand and market concentration the CPM results for 2006, 2007 and 2008 show that collusion is a credible explanation for part of the difference between marginal costs and Japan's LNG import prices. The result for every year is between the non-cooperative oligopoly solution (=1) and the respective result for perfect collusion (=1/H), which suggests that cooperation is an important explanation for producers' market power in Japan. The sensitivity analysis shows that even if the elasticity of demand is assumed to be 25 percent below or 25 percent above -0.56, the result is still in the same range (between the non-cooperative and the perfectly cooperative outcomes). It is interesting to note that the results in Figure 5.33 (the red dots) are closer to the non-collusive oligopoly outcome as compared to the Turkey outcome. That suggests that producer cooperation—while still significant—is a less important explanation for market power in Japan than it is in Turkey. This will be discussed in further detail in chapter 7, which will analyse and compare results across all cases.

[165] Table: author.

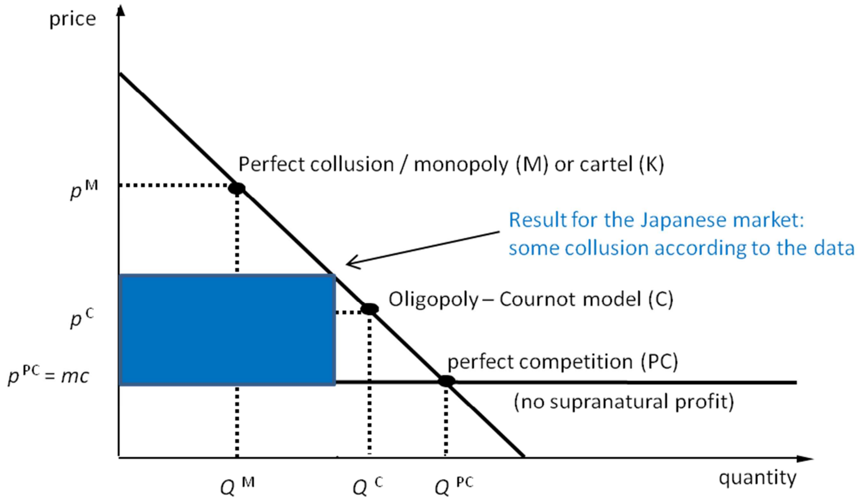
Figure 5.33: Spectrum of Possible and Actual Conduct Parameter Outcomes[166]



What is the significance of these results in the wider context? As has been shown before in this chapter, there have been instances of cooperative efforts, policies and actions among Japan's suppliers of LNG. Furthermore the model confirms that producer conduct (here cooperation instead of competition) is an important explanatory variable. However, the model rests on a variety of assumptions and does not take into account other factors such as market entry barriers (which might overstate the conduct parameter outcomes in terms of ascribing too much significant to cooperative behaviour) and concentration on the buying side (which might understate the conduct parameter outcome). Hence these results need to be put into perspective. Other factors might be important too, such as a range of issues related to the Japanese domestic gas and electricity market. A qualitative assessment of the results—the fourth part of this chapter—will address these questions in greater detail.

[166] Figure: author.

Figure 5.34: Schematic illustration of CPM result[167]



To finalise this section, a brief comment on the welfare implications of producer cooperation in the Japanese gas market will be provided. Figure 5.34 schematically shows the conduct parameter outcome and the blue box illustrates the economic rent earned by producers by charging prices above marginal costs. All statements that can be made will remain schematic because any specific welfare calculations would require much more complex modelling that is beyond the scope of this thesis.[168]

[167] Figure: author.

[168] Calculating economic rents would require one to estimate a change in quantity demanded in response to price changes. Lower prices—at the oligopoly level and at the competitive price level (marginal cost)—generally imply higher quantities consumed. To model those would be extremely complex and using the observed quantities with conjectured price levels to calculate revenues and rents will neither be correct nor marginally useful.

5.4. Qualitative Assessment of the Results

5.4.1. Collusion, Cooperation and the Issue of GECF Membership

According to the preceding analysis, cooperation among those countries that export natural gas to Japan, and which are part of the GECF, does play an important role when one considers the question of market power and pricing of natural gas. Part 2 of this chapter discussed exporters' cooperative policies, efforts and actions at the corporate, bilateral government-to-government and international (multilateral) GECF levels. The data and calculations of the conduct parameter model in section 3 confirm that if one considers other important factors which influence pricing, such as market structure and the price elasticity of demand, cooperation is a valid explanation for the market power producers enjoy in the Japanese market. This conclusion also holds true if one conducts a sensitivity analysis in which some variables were changed substantially in order to determine whether the conclusion remains the same even if one's estimates are somewhat different.

However, market concentration and inelastic demand alone are unsatisfactory explanations for market power and in light of the fact that the conduct parameter model is not perfect, one must ask how important cooperation as an explanation for the enormous price-cost margin is. The CPM does not consider market entry barriers, the impact of buyer concentration, bad policy, political interference and motives, corruption and other possible explanations. The main reason for this is that such factors are extremely hard to quantify and hence cannot be included in the model.

This section will address these limitations. First, the significance of the factors considered in the CPM—with a special focus on cooperation, of course—will be considered, e.g. by looking at suppliers which are not GECF members. Second, other possible causes will be analysed in detail to determine their impact on market power in the Japanese gas market.[169] Such contextual qualitative analysis has proven useful in the last chapter on the Turkish case and is an important complement to the quantitative analysis performed in the preceding section.

Before additional light will be shed on the factor producer conduct, a brief note on the two other variables in the CPM are in order. First, market concentration is less pronounced in Japan than in the Turkey case and indeed in many other highly import-dependent gas markets. The Japanese government emphasised diversification of sources early on and the flexible nature of LNG (as compared to fixed pipelines) led to a fairly favourable situation of having more than a dozen different suppliers, with none of them being dominant.[170] This means that, for the purpose of this analysis, market concentration is not the main cause for producers' market power.

The second variable is the elasticity of demand. As the figure in the previous section shows, demand is fairly inelastic. This means the quantity reaction (i.e. a reduction) is relatively benign when price hikes occur. In fact, as Figure 5.35 shows, Japanese buyers occasionally purchase spot LNG cargoes (in addition to the quantities they receive through long-term contracts) at astronomical prices. This suggests that short-run demand[171] is extremely inelastic, i.e. Japanese buyers will pay almost any price to obtain cargoes. The demand in the long-run (used in the CPM in section 3) tends to be

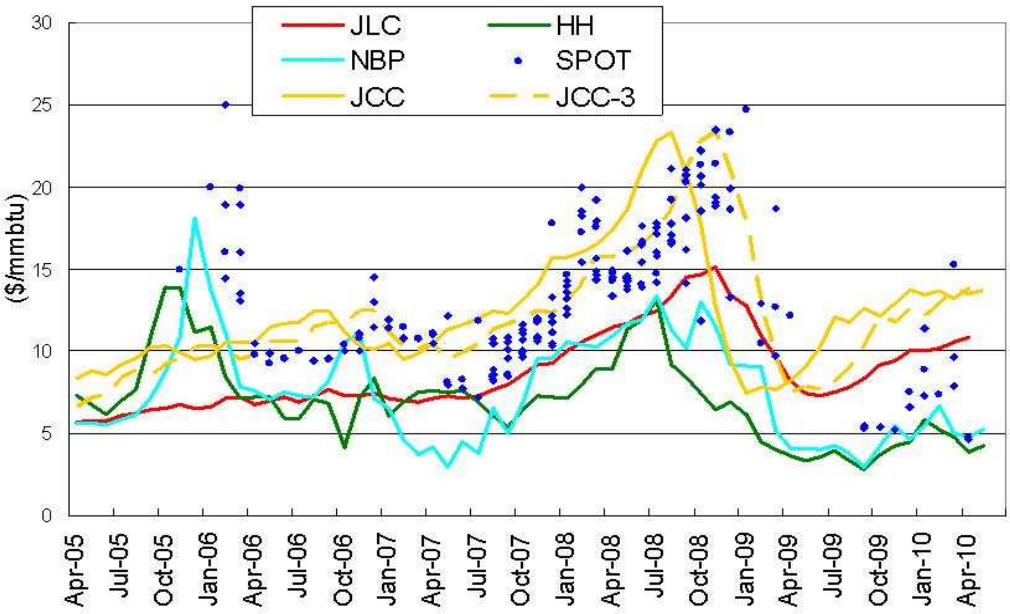
[169] A third test is to look at a case where there is some market power, but where cooperation among GECF members is not possible (i.e. less than two GECF members export significant quantities to that market). Case study 3 in chapter 6 will do exactly that.

[170] A market share of close to 20 percent in the case of Australia, Indonesia and Malaysia is still very considerable, but much smaller in comparison to e.g. Russia's market share of more than 60 percent in Turkey.

[171] Since purchases on the spot market are usually short-term in nature, a more appropriate reference is the short-run elasticity of demand.

somewhat more elastic, but this type of occasional "panic buying"[172] for short term purposes demonstrates that even in the long-run Japanese gas demand is rather inelastic.

Figure 5.35: Natural Gas and Oil Prices[173], 2005-2010[174]



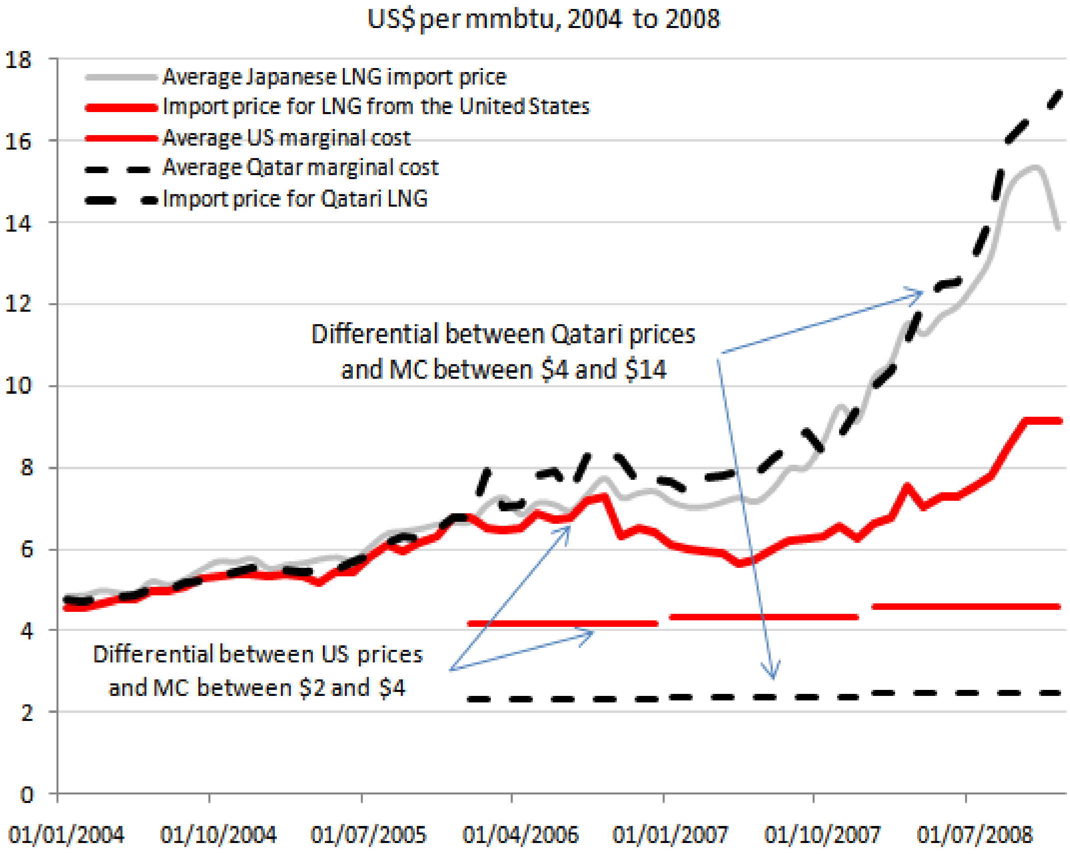
What this means is that inelastic demand—more so than in the case of Turkey—is an important explanation for producers' pricing power in the Japanese market. It seems that Japanese buyers are—for various reasons as the next section will explain—not very sensitive to price hikes, which means that producers can get away with charging higher prices. Hence the mark-up over their marginal cost of production can in part be explained that way.

[172] It seems to be appropriate to call spot purchases for $US20 or $US25 per mmbtu "panic buying" when average import prices are around $US10 or below (while Henry Hub spot prices are around $US5-8).

[173] JLC: Japanese Liquid Cocktail, i.e. the average Japanese LNG import price;
NBP: National Balancing Point, i.e. the UK spot price for gas
JCC: Japanese Crude Cocktail, i.e. the average Japanese crude oil import price
HH: Henry Hub, i.e. the US spot price for gas;
Spot: Japanese LNG purchases on the spot market

[174] This figure was kindly provided by Akira Miyamoto, Osaka Gas Company, Osaka.

Figure 5.36: Qatari and US natural gas prices and marginal costs[175]



The final variable of the CPM to be considered is producer conduct. The analysis in section 3 demonstrated that producer conduct in part explains the market power suppliers enjoy in the Japanese gas market. Another way to corroborate, or to call into question, this finding is to look at the individual prices charged by various producers (if available). Fortunately, the IEA publishes individual prices on a monthly basis. The most striking finding is that LNG supplied by the United States, which is not a member of the GECF, is always cheaper than LNG supplied by all the other suppliers.[176]

At the same time, the LNG sold from Alaska to Japan has a higher marginal cost of production than most of the other suppliers to the Japanese market face. That means

175 Chart: author; Data: IEA energy statistics, 2011 and author's calculations.
176 This is despite higher transportation cost from Alaska across the Pacific as compared to Brunei, Malaysia and Indonesia, from which the distance to Japan is much shorter (and hence the transportation element of the price is lower).

that the mark-up over marginal cost is much smaller for supplies from the US while those from GECF countries can be enormously high. Figure 5.36 illustrates this. (Since transportation cost is part of the marginal cost figure, a supplier with a similar distance, Qatar, was chosen.)

There is a second supplier to the Japanese market, which is not a member of the GECF: Australia. According to Derek Brown and Seiya Ishii, Australian diplomats interviewed at the country's embassy in Tokyo, Australia has no interest in joining the GECF or other groups opposed to competitive markets. In fact, they argued, Australia strongly tries to promote more competition in the LNG market.[177] If one compares Australian prices to those of the three other major suppliers in the Pacific market, Brunei, Indonesia and Malaysia, those prices are on average lower than those of the other three, which are members of the GECF.[178] (And this is despite the fact that transportation costs from Australia to Japan are higher than those from their other three suppliers.) What is more, according to marginal cost estimates employed in the preceding section, Australia faces higher marginal costs of producing and shipping LNG to Japan than do Brunei, Indonesia and Malaysia. For example, Australia's MC are up to three times higher than Indonesia's and about twice those of Malaysia and Brunei.[179] Similar to the United States example provided above, Australia's LNG exports tend to be cheaper than comparable regional alternatives while facing higher costs. Hence, the mark-up over marginal cost (and hence pricing power) for both supplying countries to the Japanese market that are not part of the GECF is much smaller than those of GECF member

[177] Expert Interview, Derek Brown and Seiya Ishii, Research Officer (Resources & Industry), Australian Embassy, Tokyo, October 2010.
[178] IEA Energy Statistics, 2011.
[179] Author's calculations on the basis of these studies:
Seeliger, Entwicklung des weltweiten Erdgasangebots bis 2030: Eine modellgestuetzte Prognose, Oldenburg Verlag, 2006, Munich, pp. 52-56. Cited in: Stefan Lochner and David Bothe, "The development of natural gas supply costs to Europe, the United States and Japan in a globalizing gas market—Model-based analysis until 2030", Energy Policy 37 (2009), p. 1521.
Olivier Massol and Stéphane Tchung-Ming, "Cooperation among liquefied natural gas suppliers: Is rationalization the sole objective?", Energy Economics 32, 2010, p. 944.

countries. This finding is consistent with the results of the CPM results and corroborates the conclusions drawn from the preceding analysis.

Cooperation among producers does matter. This is also the conclusion of a senior energy expert at the Japanese Ministry of the Economy, Trade and Industry (METI). He mentioned reports from Japanese gas-buying companies which argue that there is at least "informal cooperation among suppliers, especially those in the Gas Exporting Countries Forum"[180]

The outcome of the conduct parameter model suggests that cooperation does play a role in explaining elevated prices. Such cooperation, however, could also include non-GECF suppliers. If this were true, it could mean that non-GECF member states also collude and the impact of GECF membership could not be determined with confidence. Yet, the evidence concerning price differentials between members and non-members of GECF confirms the hypothesis: both supplying countries that are not part of the GECF, i.e. Australia and the United States, charge significantly lower prices than those within the GECF. At the same time their marginal cost of production is higher. Hence high prices and GECF membership are connected. That shows that cooperation as evidenced in the CPM results is not a general producer phenomenon, but is specific to the GECF member states.

Having employed a variety of methods and having carefully analysed the data, one can be confident that cooperation is an important explanation for the price-cost margin in the Japanese natural gas market. Two things however are also evident. Collusion here is not limited to narrowly-defined traditional price fixing in the way that other cartels such as OPEC have operated. The broadly conceived analysis of cooperative actions in the section 2 showed this. The other point is another interesting observation.

[180] Expert Interview, Tetsuya Azuma, energy market expert, Ministry of the Economy, Trade and Industry (METI) of Japan, October 2010.

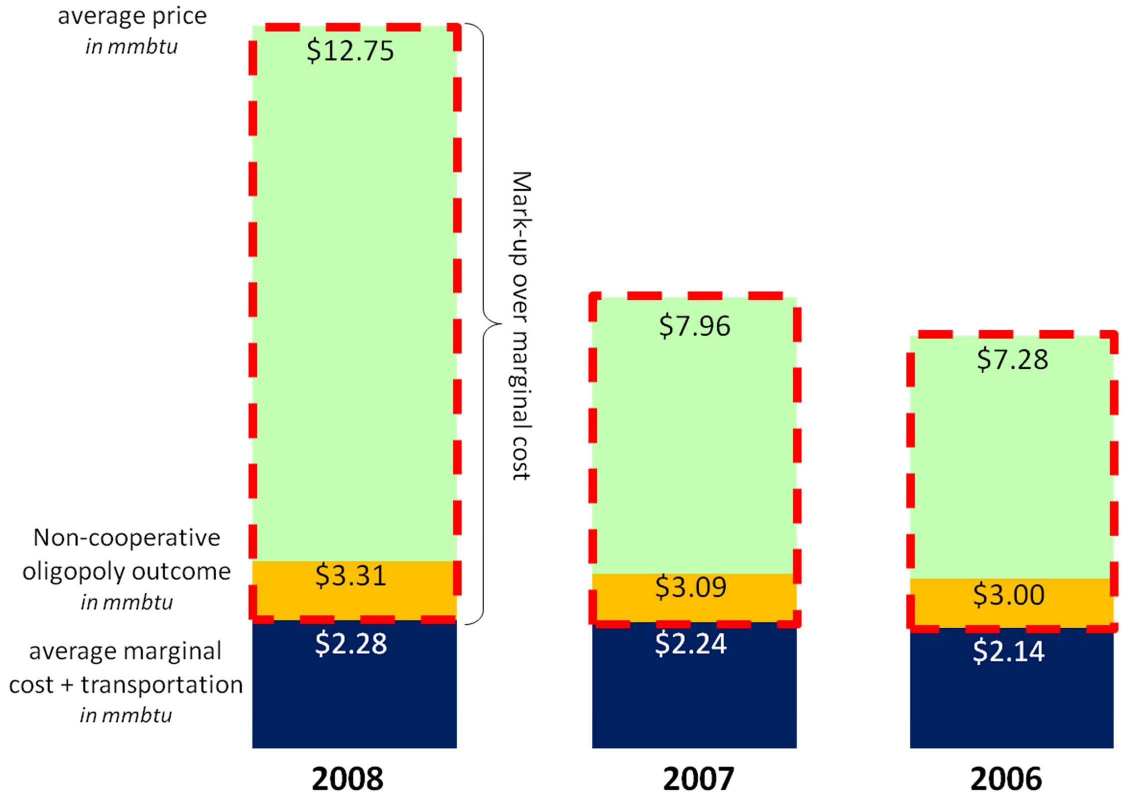
Since the focus of the thesis is not principally on the GECF as an institution, but on the actions of GECF members in certain markets, it can be concluded that the GECF is an important factor which to an extent explains market power. While it is not possible to prove specific collusive actions within the GECF by obtaining hard evidence from those involved[181], the outcome-focused analysis conducted in this chapter nonetheless confirms the hypothesis that market power is in part explained by cooperation among GECF suppliers.

5.4.2. Market Power and Economic Rent: Other Factors

The results of the conduct parameter model calculations in section 3 showed that in each year between 2006 and 2008 price levels were not only far above the marginal cost level, but also above the non-cooperative oligopoly level. An outcome between the non-cooperative level and perfect collusion indicates that there is a small group of firms at least some of which engage in cooperative activities in order to raise prices or maintain prices above the competitive level. On the basis of the simple CPM, it is impossible to ascribe a specific portion of the price-cost margin to cooperation and other formal factors that are part of the model, such as the elasticity of demand, as well as factors that are not part of the model. Such other factors will be discussed qualitatively in this section in order to shed some light on alternative, case-specific explanations of market power.

[181] I.e. the producers that are members of the Forum.

Figure 5.37: Schematic Illustration of Economic Rent earned by Exporters[182]



To illustrate the size of the mark-up over marginal cost and over the non-cooperative outcome, Figure 5.37 schematically shows the actual average annual price charged by suppliers of LNG to Japan and the producers' average marginal cost.[183] The non-cooperative oligopoly outcome is an approximation and shows that the mark-up over this price level is still very considerable. There are additional potential factors of market power that may explain the existence of market power. It is useful to picture the extensive size of the mark-ups before moving on to describe these various other factors.

The conduct parameter model takes into account three important explanations of market power: market concentration, the elasticity of demand and producer conduct. Other factors, however, may also play an equally or even more important role in explaining market power than those mentioned. As pointed out in chapter 3, the role of

[182] Figure: author.
[183] Both prices and marginal costs are weighted by the market share of each supplier.

buyer concentration and market entry barriers are not part of the model and could lead to an understatement or overstatement of the role of cooperation among producers in the model results. These two and other possible factors will be discussed in the following paragraphs.

Buyer concentration. If consumers of a good or service are numerous, but the number of producers is small, producers, because of their small number and the possibility to collude easily, are in a better bargaining position and hence are likely to enjoy market power. If the number of consumers is small too, this may be different. Buyer concentration is not part of the CPM and it has played an increasingly negligible role in the Japanese market. In the past, half a dozen or more utility companies would form a buying consortium in Japan and jointly negotiate projects and prices with LNG suppliers. As the overview of supply contracts in section 1 showed, contracts between individual Japanese utilities and LNG producers have become very common over the past two decades. Hence there is less buyer concentration than in past. Also, while e.g. Tokyo Electric (TEPCO) and Kansai Electric (KEPCO) did not compete in the past—and still do not do so—there have always been city gas companies[184] that competed at least in a limited way with the power companies. Hence buyer concentration does not play an important role and therefore an understatement of the CPM result seems unlikely.

Market entry barriers. Contrary to buyer concentration, market entry barriers could lead to an overstatement of the conduct parameter, i.e. suggesting that producer conduct—cooperation in this case—is more important than it actually is. If there are high barriers to entry for potential market participants, collusive producer conduct may not be as important an explanation as the model suggests. Given the huge upfront costs of developing a gas field and building a liquefaction terminal, the natural gas market

[184] Such as Tokyo Gas in the Tokyo area and Osaka Gas in the Kansai prefecture.

entrants face such high barriers. It is, however, important to distinguish between natural market entry barriers and others which may be established or sustained with an anti-competitive motivation ('artificial barriers'). Natural barriers are high upfront costs for developing natural gas fields and for building pipelines or LNG tankers. These certainly exist for new suppliers though not in all cases.[185] Hence, the natural entry barriers do exist, yet they are not as significant as they could be. Therefore, these barriers are unlikely to fundamentally overstate the CPM.

However, there is a second type of market entry barrier as well: artificial ones put up to keep the market uncompetitive. A competitive market, among other things, needs transparency, flexibility and prices that reflect supply and demand. Yet, in the Japanese natural gas market this is not the case. One entry barrier is the wide-spread use of long-term contracts. Suppliers insist on those contracts in order to commit the consumer for up to 30 years, hence shutting out potential rivals for decades. Although there is a trend towards shorter-term contracts (of ten years or less), many supply agreements that were signed in the past decade are still traditional long-term contracts. As pointed out in section 2, while there is a strongly growing amount of flexible LNG cargoes in the Atlantic market, such flexible volumes are very scarce in the Pacific market. The same producers that sell large quantities of uncontracted LNG to Europe (such as Qatar) refuse to give up long-term contracts in Japan and South Korea, thereby keeping out competition for years and decades. Finally, another artificial barrier to market entry is worth mentioning: the practice of conducting negotiations on LNG supply and purchase agreements in secret and keeping the contract terms secret too. This lack of transparency makes it difficult for competitors to enter the Japanese market.

[185] Many of Japan's existing LNG suppliers source their gas from already developed fields, where high upfront costs have largely been amortised over the years. That is in part why their marginal costs are relatively low. (It is true that for some of the new fields, especially in Australia, the costs for exploration, production and shipping are comparatively high.)

As was described in section 2, GECF suppliers to the Japanese market use a number of cooperative efforts and actions in order to retain and extend their market power such as the pricing mechanism. Moreover, some of the artificial entry barriers mentioned here also contribute and sustain producers' market power. In fact, there is an interdependence between such artificial entry barriers and producer cooperation. Producers jointly insist on secret negotiations, on locking customers into two or three decade-long contracts and on resale restrictions (see section 2). These barriers make it easier to keep out competition and less competition makes it easier to cooperate on matters of price and contract terms.

Hence, some *natural* market entry barriers may to an extent overstate the conduct parameter result. However, *artificial* market entry barriers that are the result of (openly) cooperative action should not be understood as potential overstatement of the CPM, but instead they should be considered part of the CPM result. Given the prevalence of these artificial entry barriers, it could well be that their existence even understates the CPM figure in terms of actual cooperative conduct.[186]

Domestic Factors. While inelastic demand for gas in Japan as well as collusive and cooperative conduct by the suppliers play a significant role in explaining the mark-up over marginal cost for LNG sold to the Japanese market, other important factors must be mentioned as well. First domestic issues and other demand-related factors will be discussed. ***Cultural factors*** were emphasised surprisingly often in the expert interviews conducted for this thesis in Tokyo and in Osaka in 2010. The Japanese obsession with security (or "religion of security"[187]) was cited as one of the reasons why Japanese

[186] Accounting for both secret collusion and overt cooperation.
[187] Expert Interview, Tetsuo Morikawa, Institute for Energy Economics Japan (IEEJ), Tokyo, September 2010.

gas buyers were willing to pay higher prices among various experts.[188] This fixation on security, the "aversion to price volatility"[189] as well as "securing volumes first"[190] thinking, leads to a "security [price] premium"[191] for imported LNG. Other issues related to culture, such as the importance of maintaining good "long-term relationships with their suppliers instead of short-term trading for (perceived) small benefits" was mentioned by various experts.[192] In addition to this, there were more fundamental aspects. Since Japan has a group-focused mentality where *order* and *harmony* are paramount, the disorderly and 'messy' concept of competition is sometimes perceived as a Western approach.[193] To what extent these factors explain LNG suppliers' pricing power is hard to measure, but given the number of times such cultural issues were cited, they seem to be rather significant. Some have called the pricing arrangements that are in part a result of the Japanese "preoccupation with supply security" "irrational."[194] Another important factor that was mentioned is ***government policy***. The influence of powerful bureaucrats and their long-time aversion to competition and liberalisation was described as having an effect on the lack of competition in the Japanese gas market.[195] Liberalisation has been happening at a very slow pace and is now stuck in the political process.[196] In comparison, liberalisation efforts elsewhere were much more vigorous than those in Japan. The United States liberalised their gas market in the 1970s and 1980s. The European Com-

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[188] Expert Interview, Takuma Amano, Japanese energy and electricity market expert, Tokyo, September 2010.
[189] Ibid.
[190] Expert Interview, Tetsuo Morikawa, Institute for Energy Economics Japan (IEEJ), Tokyo, September 2010.
[191] Expert Interview, Tetsuya Azuma, energy market expert, Ministry of the Economy, Trade and Industry (METI) of Japan, October 2010.
[192] Expert Interview, Yasumitsu Himeno, Senior Representative, World Bank, Tokyo, September 2010.
[193] Expert Interview, Tetsuo Morikawa, Institute for Energy Economics Japan (IEEJ), Tokyo, September 2010.
[194] Akira Miyamoto, Chikako Ishiguro and Takashi Yamada, "Irrational LNG Pricing Impedes Development of Asian Natural Gas Markets: A Perspective on Market Value", Unpublished Working Paper obtained at Interview with Mr Miyamoto, Osaka Gas Co, Ltd, pp. 2-3.
[195] Expert Interview, Takuma Amano, Japanese energy and electricity market expert, Tokyo, September 2010.
[196] Ibid.

mission has undertaken significant efforts and has achieved some progress in this direction since the late 1990s. The Turkish government, as shown in the previous case study, passed a very aggressive gas market liberalisation law in 2001. The lack of efforts in this area in Japan allowed LNG suppliers to continue to earn economic rents with less effort than in other markets. Hence the lack of a strong liberalisation drive explains in part gas producers' market power in Japan.

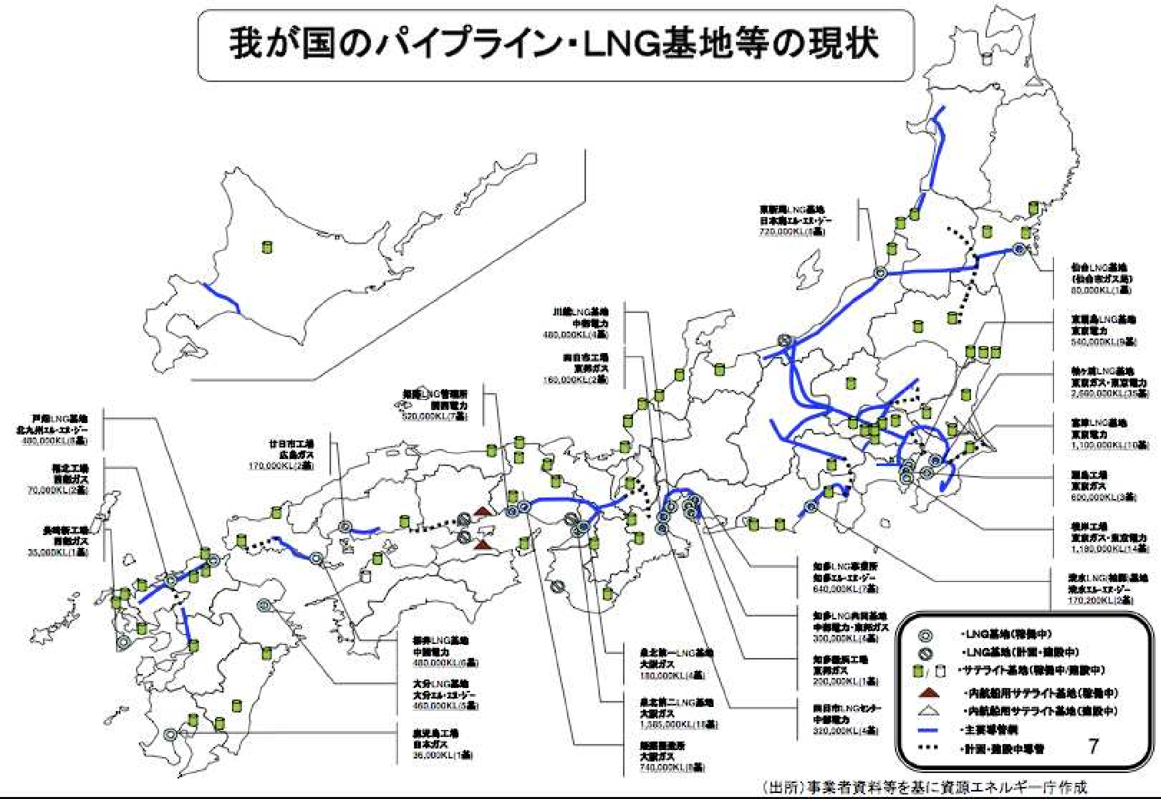
Another reason is the dominant position of the utility companies. Though there are more than 200 of them as was pointed out in section 1 of this chapter, regional markets are still quite disconnected with powerful incumbent firm such as TEPCO, KEPCO, Osaka Gas and Tokyo Gas enjoying quasi-monopolist positions regionally. Moreover, these firms can pass on their high LNG import costs directly to the consumer.[197] That means power companies and city gas firms have no incentive to look for more competitively priced sources of gas or to bargain hard with the producers for better prices. This "cost-of-service based pricing" of Japanese utilities and the pass-through of higher costs on to their customers[198] may also in part explain why LNG suppliers enjoy so much pricing power in the Japanese market. Another domestic factor, which was alluded to earlier is the absence of nation-wide competition due to the lack of physical infrastructure. Figure 5.38 shows how regional markets remain separate as a result of lacking pipeline connections.

[197] Ibid.

[198] Akira Miyamoto, Chikako Ishiguro and Takashi Yamada, "Irrational LNG Pricing Impedes Development of Asian Natural Gas Markets: A Perspective on Market Value", Unpublished Working Paper obtained at Interview with Mr Miyamoto, Osaka Gas Co, Ltd, pp. 2-3.

Figure 5.38: Map of Japan[199]

Domestic Gas Pipelines (blue), Storage Facilities (green)
and LNG terminals (grey circles)



Status quo-oriented utility incumbents are not interested in enabling other competitors to come to their area by building the necessary pipeline connections.[200] There are other reasons for the absence of interconnections too: Japan is mostly mountainous, making the construction of infrastructure difficult and expensive. Moreover, there are other land-use issues, including its high cost. Another important reason is that Japan never had any significant gas production, which meant that pipelines were not originally necessary to transport gas domestically. Finally, another infrastructure issue is the relatively low storage capacity for gas in comparison to other countries.[201] A lack of storage means that only small amounts of emergency reserves are available if there is a crisis.

[199] Kindly provided by Yasumitso Himeno of the World Bank Japan office.
[200] Expert Interview, Yasumitsu Himeno, Senior Representative, World Bank, Tokyo, September 2010.
[201] Expert Interview, Yasumitsu Himeno, Senior Representative, World Bank, Tokyo, September 2010.

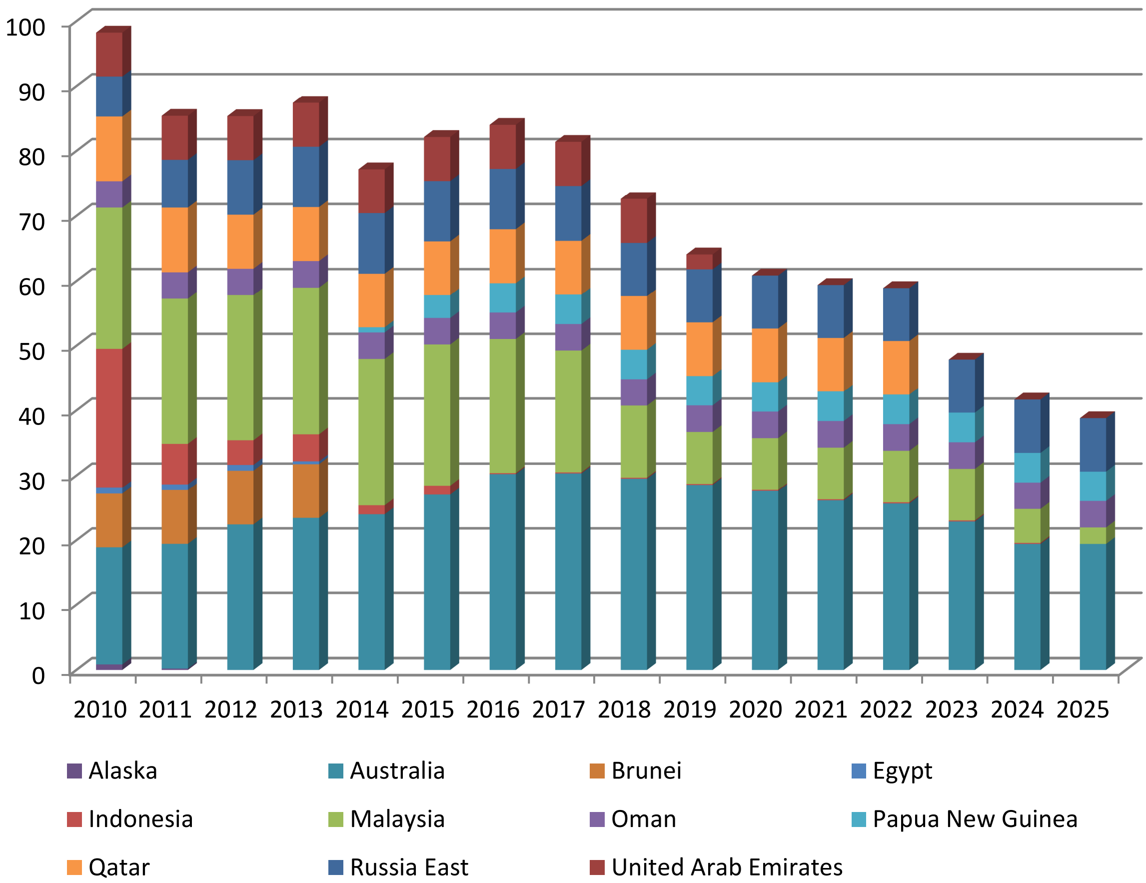
For example, when there are shutdowns of nuclear facilities, Japanese LNG buyers engage in panic buying, leading to spot prices being paid of up to $US25 per mmbtu. Hence, low storage gives sellers additional pricing power, especially in a time of crisis. This is an additional explanation for market power and economic rents enjoyed by suppliers of LNG.

Non-domestic factors. A final explanation for producers' pricing power in the Japanese LNG market is strong demand in the Asia-Pacific region. There are three principal LNG markets in the world, the Atlantic market, the Middle Eastern market and the Pacific market. The Atlantic market is well-supplied because of shale gas discoveries in the United States, which dramatically expanded supply post-2007. Also, demand in the Atlantic market is still quite subdued as a result of the economic crisis of 2008, which affected the United States and Europe more severely and for longer than emerging China and India. The LNG market in the Middle East is also well-supplied since a large proportion of the world's LNG production takes place there. The Pacific region is the only market in which demand outstrips supply, hence putting upward pressure on prices. Especially China's hunger for sources of primary energy is insatiable with demand for clean-burning natural gas continuing to rise dramatically. Given the absence of major production outside Indonesia and Malaysia (which increasingly use more gas domestically), the supply-demand situation is tight in the Pacific market. Hence, if Japanese buyers are not prepared to accept high prices, South Korea might be prepared to accept them.[202] Increasingly China and India will do the same.[203] Of course, pressure to accept higher prices has also intensified after the March 2011 earthquake and tsunami damaged the Fukushima Daiichi nuclear power plant. More sceptical attitudes towards nuclear power in Japan are hence likely to lead to higher LNG demand.

[202] Unknown Author, "Market Insight: Qatari Price Ambitions", *World Gas Intelligence*, 11 April 2007. Accessed via Nexis UK on 17 May 2011.
[203] Expert Interview, Dr Kaoru Kawamoto, technical expert, Osaka Gas Company, Osaka, October 2010.

Figure 5.39: Contracted LNG Demand for Japan[204]

2010-2025, in bcm



Finally, Figure 5.39 shows that a proportion of supply agreements will expire in the coming years, necessitating that additional supply and purchase contracts for LNG will be agreed upon in the near future. This demand may only be satisfied at prices that continue to be far above the competitive level given China and India's strong demand in the region.

This section has considered alternative explanations for the existence of the considerable difference between prices and marginal cost of gas in Japan. The existence of market entry barriers might overstate producers' market power. Equally, a whole range of domestic factors related to cultural issues, the dominance of incumbent utilities, the

[204] Chart: author; data: kindly provided by Osaka Gas, 2011.

lack of an aggressive liberalisation policy as well as the absence of physical infrastructure and national grid may play a significant role in explaining producers' ability to charge far above competitive price levels. Finally, strong demand from other countries in the region may also explain why Japanese buyers had difficulties obtaining more competitively priced LNG cargoes. Nevertheless, after careful consideration of these other possible factors cooperation remains a viable major explanation for the price-cost margin though perhaps not quite to the extent that the conduct parameter model suggests.

5.5. Consequences of Market Power and Conclusion

The preceding study demonstrated that a significant degree of market power in the Japanese LNG market is to a considerable extent not only explained by inelastic demand for gas in Japan, but also by cooperation among Japan's major natural gas exporters, especially those that are members of the GECF. This market power is also perpetuated by producers' insistence on uncompetitive practices and artificial market entry barriers. High prices paid for imported LNG have a range of detrimental implications for Japan in the energy, political and economic spheres though these implications are not as severe as in the prior case study on Turkey.

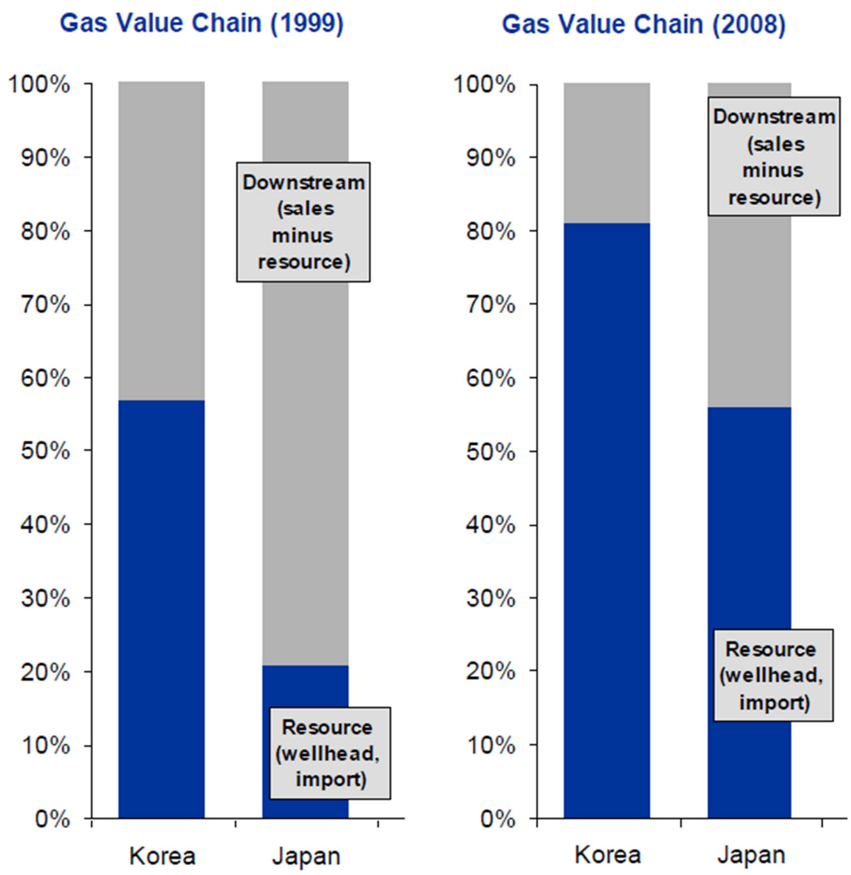
Energy Security. While most often the focus of energy security debates is on physical access to energy, the issue of pricing—especially high and uncompetitive prices—is another important aspect for import-dependent gas importing consuming countries such as Japan. That is why producers' market and pricing power should not only be understood in narrow terms, but also in terms of broader energy security issues. Given that Japan is a very rich country, the lack of access to energy (due to its high price) is perhaps not as critical an issues as it is in poorer countries.

Welfare Implications. Yet, there are significant welfare effects. Reliance on a few colluding suppliers leads to high prices and economic rents earned by those suppliers at the expense of the Japanese economy and consumers. Given that Japan in 2008 spent more than $US40 billion on LNG imports alone, the rents earned by producers range between $US20 and $US30 billion. Figure 5.40 demonstrates how producers of natural gas over the past decade have managed to capture an increasingly large share of the gas value chain, according to the consulting firm PFC Energy Strategic Advisors.[205]

[205] Nikos Tsafos, "Gas in the Crisis Years", Special Presentation to the IEEJ, Tokyo, PFC Energy Strategic Advisors in Global Energy, 10 September 2010.

That imposes a significant burden on the Japanese economy and on Japanese consumers.

Figure 5.40: Upstream Producers capture more Value[206]



High import price for LNG also mean higher end-user prices for electricity, which, according to an expert interviewed for this thesis, stood at around $US28cents per Kwh in Japan,[207] which is approximately three times the average price within the OECD ($9.4cent per Kwh in 2007[208]). Higher prices for electricity also hamper industrial production and competitiveness in Japan.

Political Implications. Since Japan has a well-diversified base of suppliers, the country's relationship with LNG producers is less political than in the case of Turkey.

[206] Ibid.
[207] Expert Interview, Takuma Amano, Japanese energy and electricity market expert, Tokyo, September 2010.
[208] IEA Energy Prices and Taxes, 2010.

To conclude this case study on the role of cooperation and market power in the Japanese LNG market, one can summarise the following findings. Cooperation among natural gas suppliers of LNG is both a clearly stated objective and there is a range of publicly available evidence that cooperative efforts, policies and actions have taken place after the GECF's formation. Section two provided a descriptive account of these efforts at the international, at the bilateral and at the company-to-company levels. The weaker forms of cooperation tend to take place at the international level, e.g. in GECF meetings. The stronger types of cooperation have taken place at the national government and corporate levels.

Hard evidence of collusive price-fixing is of course essentially impossible to obtain, which is why the conduct parameter model and empirical data were very helpful in estimating the conduct of producers, which was cooperative and collusive in the period of time under investigation (2006 to 2008). The subsequent qualitative analysis showed that there might be some other factors that are not part of the model and which might lead to an over- or underestimation of the cooperative nature of the producers' conduct. On balance, these factors do not invalidate the overall result that Japan's producers collude. The model outcome was greater than the non-cooperative oligopoly outcome, but lower than the perfectly collusive outcome, suggesting that cooperation is an important explanation for market power. More evidence for the effect of collusive conduct on gas prices can be found by considering the two suppliers of LNG to Japan that are not part of the GECF, Australia and the US. The import prices for Australian and American were significantly lower than those charged by members of the GECF despite higher costs of production in these countries. Hence high prices and GECF membership are evidently connected. That shows that cooperation as evidenced in the CPM results is not a general producer phenomenon, but is specific to the GECF member states.

5.6. Appendix

Appendix Table 5.1: LNG Import Capacity in Japan[209]

	Capacity		*Storage*	*Start*	*Status*
	bcm per year	*Million tonnes per annum (Mtpa)*	*m^3*		
Negishi	16.5	12.1	1 180 000	1969	Operational
Senboku I	3.4	2.5	180 000	1972	Operational
Sodegaura	39.9	29.3	2 660 000	1973	Operational
Senboku II	17.5	12.9	1 585 000	1977	Operational
Tobata	9.3	6.8	480 000	1977	Operational
Chita Kyodo	10.4	7.6	300 000	1978	Operational
Himeji LNG	11.6	8.5	520 000	1979	Operational
Chita	16.6	11.5	640 000	1983	Operational
Higashi-Ohgishima	21.1	15.5	540 000	1984	Operational
Himeji	6.8	5.0	740 000	1984	Operational
Niigata	12.2	9.0	720 000	1984	Operational
Futtsu	27.4	20.1	1 110 000	1985	Operational
Yokkaichi LNG Centre	9.7	7.1	320 000	1988	Operational
Oita	6.6	4.9	460 000	1990	Operational
Yanai	3.3	2.4	480 000	1990	Operational
Yokkaichi Works	0.9	0.7	160 000	1991	Operational
Fukuoka	1.2	0.9	70 000	1993	Operational
Hatsukaichi	0.8	0.6	170 000	1996	Operational
Kagoshima	0.3	0.2	86 000	1996	Operational
Sodeshi	1.2	0.9	177 200	1996	Operational
Kawagoe	7.5	5.5	480 000	1997	Operational
Shin-Minato	0.4	0.3	80 000	1997	Operational
Ohgishima	8.1	6.0	600 000	1998	Operational
Chita-Midorihama Works	7.3	5.4	200 000	2001	Operational
Nagasaki	0.2	0.1	35 000	2003	Operational
Mizushima	0.8	0.6	160 000	2006	Operational
Sakai	2.8	2.1	140 000	2006	Operational
Subtotal (operational)	*243.8*	*178.5*	*14 273 200*		
Sakaide	0.6	0.4	180 000	2010	Planned
Sodeshi expansion			160 000	2010	Planned
Kawagoe expansion			360 000	2011	Planned
Mizushima expansion	1.4	1.0	160 000	2012	Planned
Subtotal (planned)	*2.0*	*1.4*	*860 000*		

209 Natural Gas Market Review: Japan, 2007, IEA/OECD Paris, p. 113.

Marcel Dietsch
DPhil Candidate
University of Oxford

Issues and Questions for Expert Interview - Japan

Core task of my research: Determining to what extent producer cooperation/collusion explains the enormous gap between producers' marginal cost of production and import prices paid in Japan.

I hope to have a wide-ranging conversation with you about the following issues and questions:

- Relationships between the natural gas suppliers and the importers
  - Especially between foreign companies and Japanese companies
  - And foreign countries' governments and the Japanese government
    - Economic dimension
    - Political dimension
    - Important issues in these economic and political relationships between the exporters and Japan
  - Is there evidence or indications (implicit or explicit) that producers talk to each other when in negotiations with Japanese buyers?

- Competition in Japanese energy /gas markets
  - Level of competition in the domestic natural gas market and other markets (electricity)

- In terms of public policies/energy policy, has there been a strong drive towards liberalisation of gas and electricity markets?

- <u>Issue of producer cooperation</u>
  - Important in Japanese policy debate?
  - **Mitigating factors:**
    - Buyer concentration / monopsony
    - the drive for alternative supplies of gas:
      - pipeline suppliers?
      - more spot LNG?
      - more domestic production or production by domestic firms in other countries?
    - Market entry barriers – remove?
      - Long-term contracts – towards more LNG buy on spot and futures market?
      - Secret negotiations

Related issues:

- Premium to European (Southwest Europe $US6.50 and American spot market $US4) at two to four $US (currently in Japan: $US8.80) – Why?
- Economic efficiency vs (perceived) security of supply – market as source of security
- Concept and meaning of competition – and anti-competitive behaviour
- Business-Government relations / cooperation
- Pricing formula – from “market value” to gas-to-gas competition?
- Current economic and political issues in Japan related to energy market?
  - Economic policy / Other domestic policy / Foreign policy

List of Experts Interviewed in Japan
19 September 2010 and 20 October 2010

Tokyo

Tetsuo Morikawa, natural gas expert, Institute for Energy Economics of Japan.

Takuma Amano, Japanese energy and electricity market expert, former investment banker and advisor to the central bank of Saudi Arabia.

Kensuke Watanabe, Corporate Planning Division, LNG Japan Corporation.

Yasumitsu Himeno, senior representative, World Bank Japan office and former energy trader at Merrill Lynch.

Yoshihiko Sugano, Japanese nuclear power expert and energy industry executive.

Tetsuya Azuma, energy market expert, Ministry of the Economy, Trade and Industry (METI) of Japan.

Professor Masayuki Tadokoro, expert on international relations and law, Keio University

Derek Brown, Economic Division and Seiya Ishii, Research Officer (Resources & Industry), Australian Embassy

Osaka

Dr Kaoru Kawamoto, technical expert, Osaka Gas Company

Akira Miyamoto, expert on gas pricing, Osaka Gas Company

Singapore

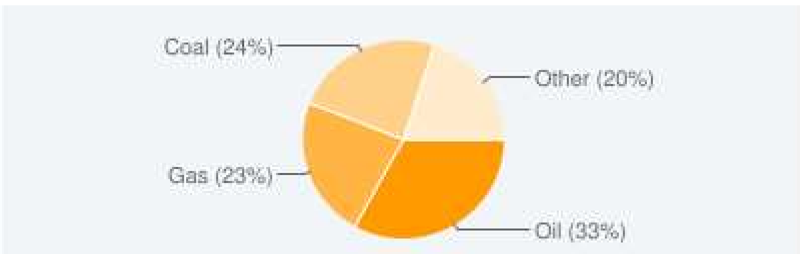
Presentation of preliminary results of case study on Japan at Shell LNG Supply and Marketing.
I should like to thank all participants and in particular Chris Wilshaw, Head of LNG Origination, for their comments and suggestions during the discussion after my presentation.

Chapter 6
Case Study: The German Gas Market and its Suppliers

6.1. Introduction and Background

The final case study is concerned with the German gas market. Following the Japan and Turkey cases in the preceding chapters, Germany is comparable in many ways. The country consumes large quantities of gas, most of which is imported from a few suppliers as Germany's indigenous gas production[1] continues to fall. Figure 6.1 shows Germany's total primary energy supply in 2008. As in Japan, natural gas is the third most important source of energy in the country, just behind coal. Given the plan to completely phase out nuclear power, which accounts for most of the "other" 20 percent of the energy supply in Figure 6.1, by the early 2020s, the demand for clean-burning natural gas is almost certain to continue to grow strongly.

Figure 6.1: Total Primary Energy Supply (2008)[2]



*other: nuclear, hydro, geothermal, solar, combustible and renewable waste

Yet in one important way Germany is different from the two other cases. Only one of its suppliers is a member of the GECF: Russia. The past chapters examined

[1] Indigenous production came to around 19 percent of the country's gas consumption in 2006, but given exports and statistical adjustments, the net contribution of Germany's indigenous production comes to only around 6 percent of total consumption.
[2] IEA Natural Gas Information 2010.

whether the existence of market power and economic rent in Turkey or Japan was at least in part explained by collusion and cooperation among the exporters. However, the GECF cannot achieve their objective of maximising revenues and hence rents in the German market through cooperation since only one member supplies the market and it would take at least two member states to cooperate or to collude. Similarity between Germany and the other two cases except for this important difference enables one to use the country's gas market as a hypothesised 'negative' case. That is, one would expect to find that cooperation and collusion do not play a role in explaining market power, but that there are other factors and explanations instead.

This introductory section aims to provide background information on Germany's market for natural gas and other related domestic issues. It will also present and describe the suppliers of pipeline gas to Germany; there are no existing regasification terminals to receive LNG as of 2011. The following section will briefly consider evidence of cooperation among the suppliers at the corporate, at the bilateral and at the international levels. Section three will use available empirical data on prices, cost, market shares and demand elasticity to run the conduct parameter model that estimates by how much the difference between the cost of production and import prices at the German border are explained by producer conduct, taking into account the price elasticity of demand for gas and market concentration. Finally, a range of factors that could explain the existence of producer market power will be considered and discussed in some detail in section four.

Figure 6.2: Map of Germany – Natural Gas Infrastructure[3]

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[3] IEA Natural Gas Information, 2010, p. IV.25.

6.1.1. Overview of Germany's Sources of Natural Gas Supply

Germany's indigenous gas reserves are very small on a global scale. The BP Statistical Review of World Energy states that there were approximately 100.5 bcm of available reserves left in the country by the end of 2008.[4] That corresponds to around 0.05% of the world's natural gas reserves. The reserve figure is also roughly equal to the annual consumption of gas in Germany, that is, if all of the remaining reserves could be produced immediately, it would merely cover one year's worth of consumption. At the actual rate of production in 2008 (13 bcm),[5] this implies a reserve-to-production ratio of 7.8 years.

The fact that such small reserve figures still make Germany the fifth-largest reserve-holder of gas (and the third-largest producer of gas)[6] in the European Union, does not indicate that Germany is well-positioned within Europe in terms of gas production and reserves, but instead that the European Union as a whole suffers from a severe lack of reserves.

Imports met around 90 percent of Germany's domestic demand in 2007. According to the IEA, "there is a broadly diversified geographical spread of import sources, with Russia accounting for 35%[7] of total supply (42% of imports), Norway for 24% of total supply (29% of imports), the Netherlands for 20% of total supply (24% of imports) and others (mostly Denmark and the United Kingdom) for 4% of total supply and imports."[8] Table 6.1 shows the quantities of gas imported by Germany from various sources.

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[4] BP Statistical Review of World Energy, 2010.
[5] Ibid.
[6] Unknown Author, "Germany", Country Profiles (online), Energy Delta Institute. Accessed on 17 June 2011: http://www.energydelta.org/en/mainmenu/edi-intelligence-2/our-services/Country-gas-profiles/country-profile-germany.
[7] All figures from the cited IEA report are for 2005.
[8] Unknown Author, "Germany: 2007 Review", *IEA Energy Policies of IEA Countries Series*, 2007, p. 96.

Table 6.1: Germany's natural gas imports (all pipeline) by country of origin[9]

	2007	2008	2009e
	Million cubic metres		
Belgium	-	-	-
Canada	-	-	-
Denmark	-	-	-
France	-	-	-
Germany	-	-	-
Italy	-	-	-
Mexico	-	-	-
Netherlands	22 150	19 972	21 796
Norway	25 204	27 531	32 493
United Kingdom	-	-	-
United States	-	-	-
Other	-	-	-
OECD	**47 354**	**47 503**	**54 289**
Algeria	-	-	-
Azerbaijan	-	-	-
Islamic Republic of Iran	-	-	-
Russian Federation	38 295	40 735	35 751
Other Former Soviet Union	-	-	-
Total non-OECD	**38 295**	**40 735**	**35 751**
Non-specified/other	2 706	3 753	4 517
Total imports	**88 355**	**91 991**	**94 557**

It is difficult for observers to compare the actual quantities of delivered gas to the contracted volumes since the specific contract terms with all major suppliers are kept confidential. The IEA states vaguely that "it is known that the Netherlands will phase out their exports between 2015 and 2020. Meanwhile, Gazprom has extended its export contracts with E.ON Ruhrgas and Wingas to last until 2035. Contracts with VNG[10] have also been extended until at least 2030. This underlines the importance of a diversified portfolio of contracts, including diverse contract terms and lengths."[11]

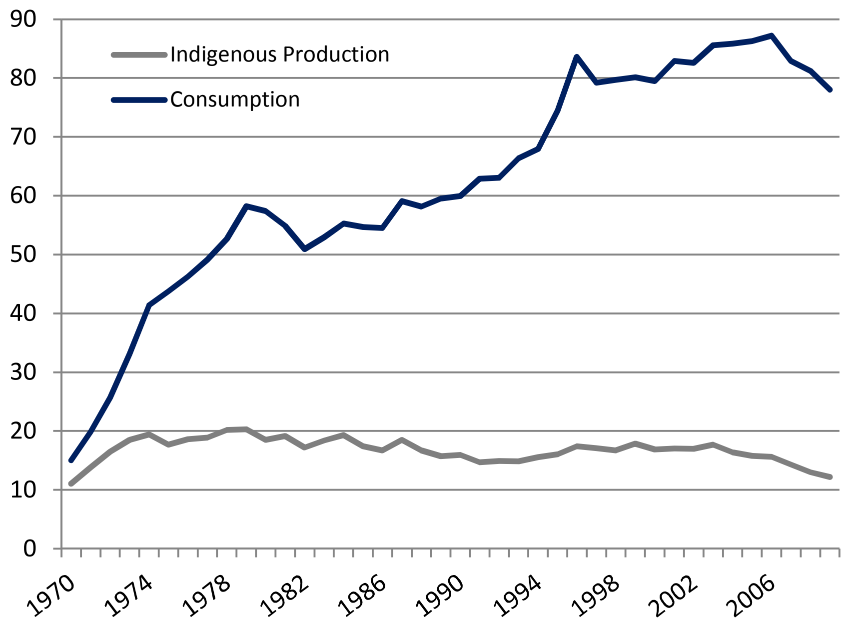
Along with rapidly declining gas reserves in Germany, domestic gas production in the country has fallen steadily over the past decades, meeting an increasingly smaller share of the strongly growing consumption. The peak of Germany's indigenous gas

[9] IEA Natural Gas Information, 2010, p. IV.158.
[10] Verbundnetz Gas
[11] IEA, "Germany: 2007 Review", p. 96.

production was in 1979.[12] Figure 6.3 also shows the strong divergence between production and consumption, hence necessitating strongly growing quantities of imported gas.

Figure 6.3: Germany's Consumption and Indigenous Production of Natural Gas[13]

1970-2009, in bcm



6.1.2. Consumption and the Organisation of the Domestic Sector

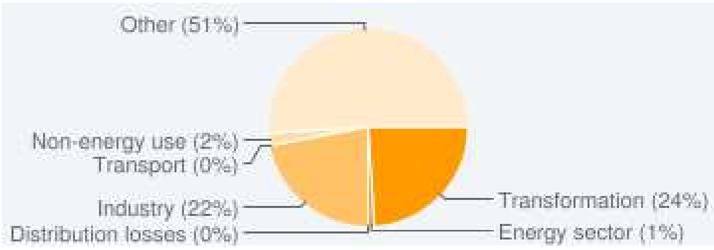
Figure 6.3 shows strong demand growth in past. The economic crisis that started in 2008 temporarily reduced demand. Given the German government's nuclear phase-out and increasing emphasis on climate change mitigation, gas consumption and hence imports are almost inevitably going to soar in the coming decades as gas produces the least amount of carbon emission of all hydrocarbons.

A relatively large proportion of gas is used in the sector labelled as "other" in Figure 6.4. This includes heating of commercial, public and residential buildings.[14] More than one-third of the total amount of gas consumed goes to the residential sector, which

[12] Unknown Author, "Germany", Country Profiles (online), Energy Delta Institute.
[13] Chart: author; data: BP Statistical Review of World Energy, 2010.
[14] Unknown Author, "Germany", Country Profiles (online), Energy Delta Institute.

traditionally features inelastic demand.[15] "Transformation includes the generation of electricity, while the demand from the 'energy sector' refers to gas used for the extraction of coal, oil, and gas and gas used in refineries, coke ovens and gas works."[16]

Figure 6.4: Natural Gas Consumption in various Sectors (2008)[17]



*other: commerce and public, residential, agriculture and non-specified

In terms of the domestic structure of the German gas market, it is often described as having "the most complex structure of all the markets in continental Europe. An important reason for this is that all agents along the value chain, from wellhead producers to local distribution companies, sell to end-users."[18] The German domestic market arrangements are also much less competitive than those of other countries in Western Europe. Despite a decade of European and federal-level liberalisation efforts, the wholesale sector in the German natural gas market "still held a dominant position"[19] in 2007, according to Germany's Federal Cartel Office. This is despite the fact that most transmission system operators (TSOs) as well as the regional distribution system operators (DSOs) are "mostly privatised with the local authorities and the federal states still

15 IEA Natural Gas Information, 2010, p. IV.156.
16 Unknown Author, "Germany", Country Profiles (online), Energy Delta Institute.
17 IEA Natural Gas Information 2010.
18 Frank Asche, Petter Osmundsen and Ragnar Tveteras, "European market integration for gas? Volume flexibility and political risk", *Energy Economics*, vol. 24, 2002 , pp. 251-253.
19 Unknown Author, "Germany", Country Profiles (online), Energy Delta Institute.

holding some shares. [Moreover, …] there are approximately 22 TSOs and some 719 distribution system operators."[20]

Table 6.2: Organisation of Germany's Gas Market[21]

Ownership and operation of gas transmission system Owned and operated by private companies.
Ownership and operation of storage facilities Owned and operated by private companies.
Participation in transmission pipelines abroad Switzerland (Transitgas), Austria (WAG), UK-Belgian (Interconnector), Czech Republic.
Transit of gas Norwegian gas to the Netherlands (and via the Netherlands to Belgium and France and Czech Republic), Russian gas to France and Switzerland, and Dutch gas to Italy and Switzerland.
Transportation tariffs Since 1.1.2009 an incentive regulation encourages system operators to run the system more efficiently. The regulatory authorities grant system operators revenue caps that are based on a benchmark of costs connected to the system operation. Approved revenue caps are then transposed into non discriminatory network access fees charged to a customer.
Distribution Some regional distribution companies and about 700 local distribution companies; some vertical integration with transmission. Network operations need to be unbundled from supply operations. Distribution concessions are no longer exclusive, and demarcation rights have been abolished.

The gas market in Germany benefits from a national grid i.e. a vast network of pipeline and other infrastructure such as some of the world's largest gas storage systems. The entire pipeline network is about 33,509 km long and the country's grid is connected to pipelines in neighbouring countries at 43 cross border points.[22]

6.1.3. Regulation at National and European Levels

It is fair to say that European Commission rather than the German federal government have been the drivers of gas market regulation and liberalisation in Germany. The first

[20] Ibid.
[21] IEA Natural Gas Information, 2010, p. VI.24.
[22] Unknown Author, "Germany", Country Profiles (online), Energy Delta Institute.

EU directive *Concerning common rules for the internal market in natural gas* of 1998 started the process of liberalisation. Yet, as experts describe it, there was a "lack of change in the German gas market and [a] not very satisfying response to the initiative of market liberalisation started in 1998 with the first EU directive, 98/30/EC."[23] The main issues, which were not addressed in the German regulatory debate, were concerned with:

- Network access;
- Long-term contracts;
- Market structure[24]

Especially *network access* was not treated as a priority yet remained the key to substantive change. "The German government did not install a regulatory authority at the beginning of formal market liberalisation but relied on negotiated third party access. But associations were not able to agree on a system that really facilitated access for new market entrants and encouraged competition."[25] The second EU directive of 2003 superseded the first one and focused on these points:

- Third party access to networks, LNG and storage;
- No distinction between transit and transport;
- Capacity allocation and congestion management;
- Transparency and
- Interruptible reserve flows [in pipelines][26]

It was only after this second directive that the German federal government passed a new law concerning natural gas in particular and energy in general. The 2005 energy act "installed a regulatory authority, the *Bundesnetzagentur* (Federal Network Agency) following the prescriptions of the second EU directive 2003/55/EC […]. The *Bundesnetzagentur* fi-

[23] Heiko Lohmann, "The German Gas Market post 2005: Development of Real Competition", *NG Paper No. 33*, Oxford Institute for Energy Studies, September 2009, p. 1.
[24] Ibid.
[25] Ibid.
[26] Mark van Stiphout, "European Policy on Gas Markets", European Commission (DG Energy) Presentation at Florence School of Regulation, 21 March 2011, p. 4.

nally enforced—after lengthy and difficult discussions with the main stakeholder associations—a model of network access."[27] Finally, the third EU internal energy market directive focused on the following issues:

- Unbundling of transmission and supply;
- Framework guidelines and network codes
- Regulatory Authorities and
- Entry-exit systems for gas transmissions.[28]

The European Commission has been the driver of liberalisation in Europe's energy market(s) and faced much opposition not just from incumbent energy companies, especially German ones. Moreover, successive German federal governments also put up resistance against Brussels-led energy market reform efforts. These issues will be discussed in further detail in section four that assesses the extent to which a variety of factors—including domestic regulation and opposition to such regulation—perpetuates market power in the German gas market.

6.1.4. A Short History of Gas Pricing in Germany

Gas was first imported from the Netherlands in the 1970s. The way in which sale and purchase agreements were negotiated has remained essentially the same since then. A consortium of gas buyers including Thyssen Gas, BEB and the largest firm, Ruhrgas (now part of E.ON) negotiated on a bilateral basis with the three main supplying countries, Holland, Norway and Russia. Given differences in terms of the quality of the gas from different sources (Russian and Norwegian gas possessing a higher calorific value than Dutch gas), there are several contractual specifications relating to this issue. "[…] For comparability, contract prices are often listed in terms of payment per calorific unit.

[27] Lohmann, "The German Gas Market post 2005: Development of Real Competition",, p. 1.
[28] van Stiphout, "European Policy on Gas Markets", p. 3.

[Prices] […] listed in USD per million Btu[29] [mean] that the difference in calorific value is accounted for."[30] In terms of German import quantities, oil-indexed agreements still "comprise around 90 percent of German gas supplies (2008)" while the remainder are supplies from the spot market "that are increasingly available at the Dutch-German border and Norwegian pipeline terminals."[31] Hence, oil-indexation remains the dominant form of pricing in Germany to date. The specific pricing mechanism was described by Asche et al.:

> In these contracts, the buyer agrees to receive a certain volume of gas per year or, alternatively, to pay for the part of this gas volume that it does not like to receive. At the same time, the buyer has an option to take out more gas than these minimum annual amounts, thus conveying flexibility. […] The current price on gas delivered according to the long term take-or-pay contracts is determined by a price formula. The formula links the current gas price to the price of relevant energy substitutes, thus continuously securing the buyer competitive terms. The price formula consists of two parts, a constant basis price (fixed term) and an escalation supplement linking the gas price to alternative forms of energy (variable term). Examples of alternative energy commodities used in pricing formulas for natural gas are light fuel oil, coal, and electricity.[32]

The liberalisation efforts described in subsection 1.3 have started to put pressure on this traditional pricing mechanism. More sales on the spot market, where prices in part due to the economic crisis after 2008 are low, take away market shares from the incumbent suppliers of oil-indexed gas. Increasing competition from the spot market also puts pressure on German utility companies that have supply agreements with those suppliers such as Russia, Norway and Holland. More gas-to-gas competition is slowly but steadily eroding the market power of the incumbent suppliers and utility companies.

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[29] The prices used for the subsequent analysis come from the International Energy Agency (IAE) and the International Monetary Fund (IMF). The IEA and IMF recorded the data in US$ per mmbtu, which accounts for the difference in calorific value. The price data was then converted into the unit usually used for pipeline gas in Europe: thousand cubic metres (Mcm) per US$.

[30] Asche et al., "European market integration for gas? Volume flexibility and political risk", pp. 253-255.

[31] Anthony Melling, "Natural Gas Pricing and its future: Europe as the battleground", Carnegie Endowment for International Peace, 2010, p. 31.

[32] Asche et al., "European market integration for gas? Volume flexibility and political risk", pp. 253-255.

Pricing gas not in relation to its production cost and other sources of gas, but by linking it to the price of oil and oil products is becoming increasingly difficult. This pricing mechanism seemed to be justifiable decades ago when a market for gas needed to be established and enormous upfront costs for developing gas fields and transportation infrastructure needed to be amortised. Today, oil-indexation is increasingly recognised as a way for producers to capture the maximum amount of revenue and rent from consumers by pricing gas minimally below the level of substitutes at which they would switch to other sources of energy such as fuel oil.

6.1.5. Germany's Suppliers of Natural Gas - Russia

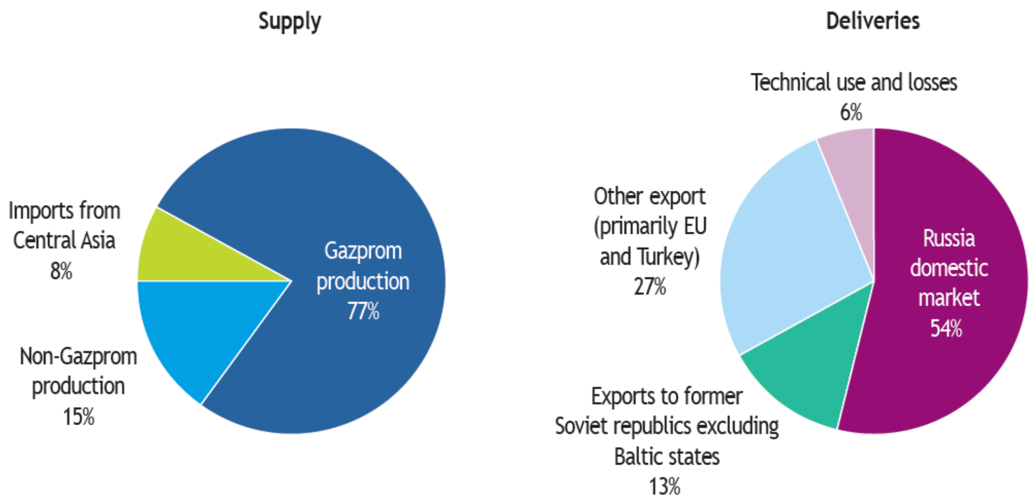
Russia is the largest holder of natural gas reserves in the world. Until 2009, Russia was also the largest producer of gas in the world, but still remains the largest exporter of gas globally.[33] According to the BP Review of Energy, Russia held 44.38 trillion cubic metres (tcm) of gas reserves, which corresponds to 23.7 percent of all gas reserves worldwide. Russia produced 527 bcm of gas in 2009 or 17.6 percent of the overall global production.[34]

"Of Russian gas production, about 70 percent is consumed domestically and 30 percent exported. In 2008, of the total export amounts, together with gas from Central Asia, 34 percent was exported to the CIS [Commonwealth of Independent] states and 64 percent to the Far Abroad, i.e. European countries excluding the Baltic States and including Turkey. Even though the European countries represent only about 30 percent of Gazprom's total sales volume, in 2008 they accounted for 60 percent of its revenues."[35] Figure 6.5 shows Russia's gas balance for 2008, accounting for both the supply side and

[33] Unknown Author, "Russia Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 19 June 2011:, http://www.eia.doe.gov/countries/cab.cfm?fips=RS.
[34] BP Statistical Review of World Energy, 2010.
[35] Bengt Soderbergh, Kristofer Jakobsson and Kjell Aleklett, " European energy security: An analysis of future Russian natural gas production and exports", *Energy Policy*, no. 38, 2010, p. 7829.

the demand side. The numbers in Figure 6.5 do not fully correspond to the data cited here. This is due to measurement differences and inclusion or exclusion of various elements such as gas flaring and gas injection into gas fields and oil fields to support the reservoir pressure.

Figure 6.5: Russia's Natural Gas Balance in 2008[36]



Note: Figures are net of withdrawals and injections into gas storage, and do not include flared gas.

In terms of the structure of Russia' natural gas sector, "state-run Gazprom dominates Russia's upstream, with 90 percent of the total natural gas output produced by Gazprom. Gazprom also controls most of the Russian gas reserves, with more than 65 percent of proven reserves being directly controlled by the company, with additional reserves being controlled by Gazprom in joint ventures with other companies."[37] Since the mid-2000s independent producers have grown their production aggressively, increasing their share in the Russian market to around 16 percent (see Figure 6.5). Yet, the Russian government granted Gazprom a legal monopoly on gas exports, hence eliminat-

[36] IEA World Energy Outlook, 2009, p. 465.
[37] EIA, "Russia Country Analysis Brief", 2011.

ing the possibility for independent producers to participate in export markets that are much more lucrative than domestic sales.[38]

Exports of gas are very significant in terms of volumes and even more important in terms of revenues. Russia exports both to former Soviet republics at comparatively lower prices in relation to other exports and also uses some of these states as transit countries to deliver gas to Western Europe. "Russia's natural gas exports to Eastern and Western Europe shipped on pipelines traversing Ukraine and Belarus have in the past been affected by political and economic disputes between Russia and these natural gas hubs. The disputes with Ukraine and Belarus were centred around natural gas prices in 2006 and 2007, respectively."[39] Figure 6.6 shows some of the pipelines that have caused disputes in the past with transit countries. In addition, Nord Stream, a new pipeline currently under construction as of 2011, is supposed to circumvent transit countries[40] and the potential political conflicts with that might arise with those transit countries.

"In addition to dominating the upstream, Gazprom dominates Russia's natural gas pipeline system as well. There are currently nine major pipelines in Russia, seven of which are export pipelines. The Yamal-Europe I, Northern Lights, Soyuz, and Bratrstvo pipelines all carry Russian gas to Eastern and Western European markets via Ukraine and/or Belarus. These four pipelines have a combined capacity of 4 Tcf [= 113.3 bcm]. Three other pipelines, Blue Stream, North Caucasus, and Mozdok-Gazi-Magomed connect Russia's production areas to consumers in Turkey and FSU republics in the east."[41]

[38] Ibid.
[39] EIA, "Russia Country Analysis Brief", 2011.
[40] Which also happen to be consumers of Russian gas.
[41] EIA, "Russia Country Analysis Brief", 2011.

Figure 6.6: Gazprom's Pipelines to Western Europe[42]

Existing (Solid Lines) and Under Construction (Dashed)

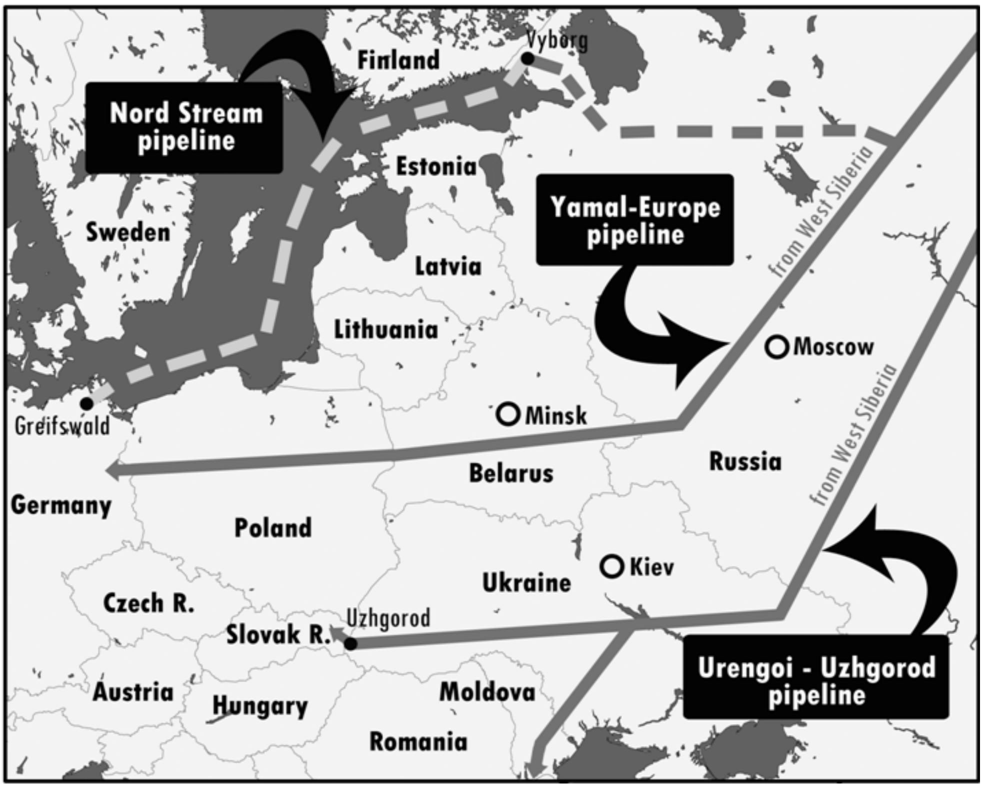


Figure 6.7 shows the outcome of Russia's gas pricing policy. This approach is called a two-tier system of gas pricing[43] since Gazprom has to sell at low regulated prices in the domestic market while selling them at much higher prices in the export markets.[44] This policy subsidises the use of gas in Russia and helps boost demand since prices are low. In effect, however, the two-tier system is actually more a three-tier system if one considers actual prices in Figure 6.7. The domestic market is charged prices that used to be below Gazprom's marginal cost of production, but as a result of repeated increases with the objective of eventual deregulation, prices have now risen close to the

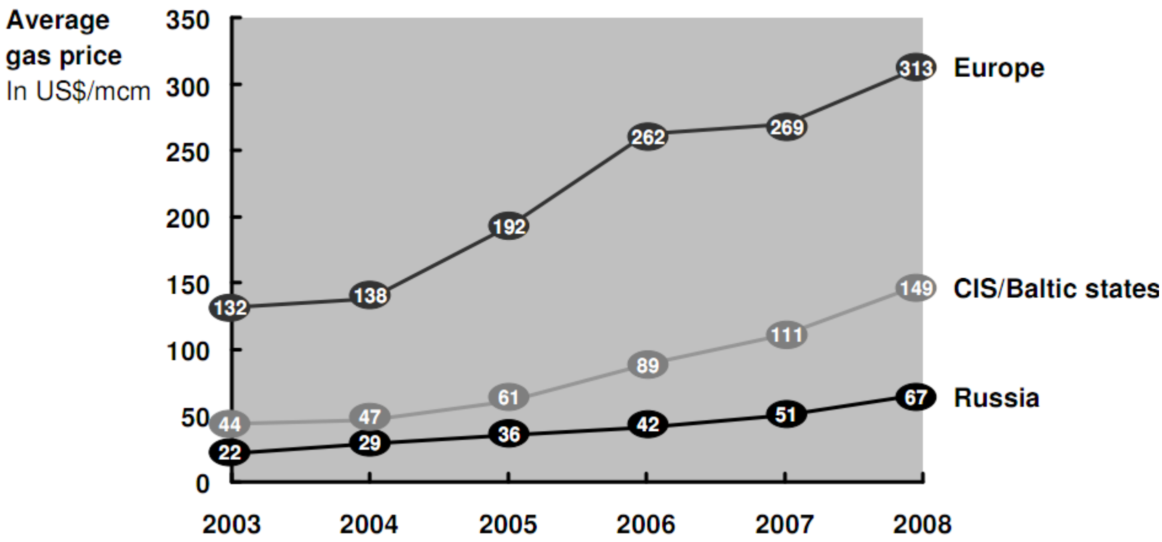
[42] Source: Rawi Abdelal, "Gazprom and Europe: Business and Politics", Presentation at U.S.-Russia Working Group, American Enterprise Institute, 3 June 2009. [Presentation kindly provided by Dr Abdelal in a meeting at Harvard University in February 2010.]

[43] Tarr and Thomson, "The Merits of Dual Pricing of Russian Natural Gas", 2004.

[44] Russia's independent gas companies such as Novatek can sell at "market prices", i.e. above the regulated price at which Gazprom has to sell.

long-run marginal cost level.[45] Subsidised and regulated domestic prices are supposed to be phased out until 2011.[46]

Figure 6.7: Gazprom's price of natural gas in different markets[47]



Germany is an important export market for Gazprom. Gazprom is not merely an exporter of gas to the country; it is also a player in Germany's domestic market. The Russian monopoly's vertical integration efforts—in comparison to other markets—have been quite successful in Germany. Table 6.3 shows the range of Gazprom's subsidiaries in Germany. As of July 2011, there are other developments regarding Gazprom's downstream integration efforts as well. According to press reports, Gazprom is likely to acquire substantial parts of Germany's RWE. This could fundamentally change the German energy market in general and gas market in particular.

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[45] See analysis in the conduct parameter model calculations. The marginal cost data used for the CPM is at the upper end of the spectrum of estimates with around $60 in 2006, $70 in 2007 and $80 in 2008 (hence still above the prices shown in Figure 7). Other studies put the Gazprom's marginal cost of production in the $40 to $60 range in line with the domestic prices charged in the years 2006-2008.

[46] Source: Abdelal, "Gazprom and Europe: Business and Politics", 2009.

[47] Timothy von Ochssée, "The Dynamics of Gas Supply Coordination in a New World: Cooperation or competition between gas-exporting countries from a Russian perspective", PhD Thesis, University of Groningen, 8 July 2010, p. 125. Accessed 2 July 2011: http://dissertations.ub.rug.nl/FILES/faculties/feb/2010/t.a.boon.van.ochssee/14_thesis.pdf.

Finally, Russia is a founding member of the Gas Exporting Countries Forum and has been one of the driving forces of the organisation.

Table 6.3: Gazprom's Holdings in Germany[48]

Agrogaz GmbH (100%)
Centrex Beteiligungs GmbH (38%) gas trading and investment company
Ditgaz (49%)
VNG - Verbundnetz Gas AG (5.3%) gas transportation and marketing
Gazprom Germania GmbH (100%)
Wingas GmbH (50%) Joint Venture with Wintershall, a subsidiary of BASF, for gas transportation and storage
Winterhall Erdgas Handelshaus GmbH&Co KG (50%) Joint Venture with Wintershall for gas trading
HTB Europe GmbH

6.1.6. Germany's Suppliers of Natural Gas – Norway

With 2.22 tcm of natural gas reserves as of 2008 Norway is by far the largest reserve-holder in Europe according to BP energy statistics.[49] The same source of data indicates that Norway holds 1.2 percent of all gas reserves globally, which makes the country a significant player both in the pipeline gas and LNG sectors.

In 2008, Norway produced 99.2 bcm of natural gas, making it the world's fifth-largest producer of gas after Russia, the US, Canada and Iran.[50] At this rate of production, the reserve-to-production ratio is around 22 years, assuming no further discoveries of gas. "Norway's single largest natural gas field is Troll, which is projected to produce

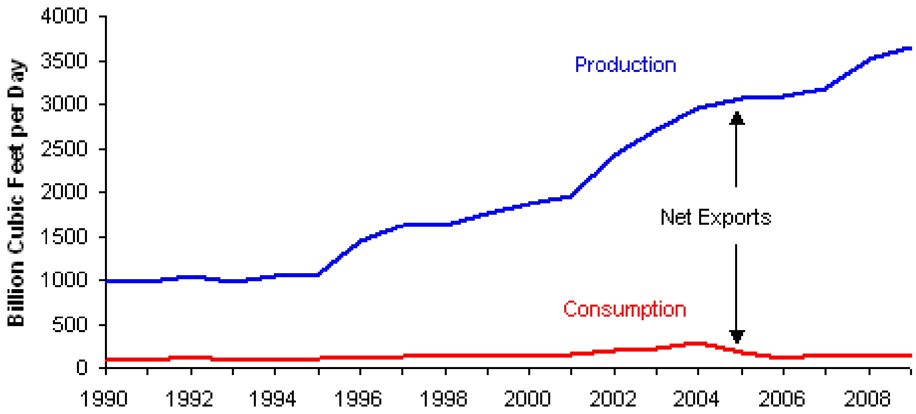
[48] Unknown Author, "List of Gazprom subsidiaries", Wikipedia. Accessed 28 June 2011 and corroborated through other sources, principally Gazprom Export's website: http://www.gazpromexport.ru/en/partners/germany/.
[49] BP Statistical Review of World Energy, 2010.
[50] Ibid.

1.09 Tcf [= 31 bcm] in 2010, according to the Norway Petroleum Directorate, representing about one-third of Norway's total natural gas production. Other important fields include Ormen Lange and Asgard. These 3 fields account for over 60 percent of Norway's total natural gas production. Despite the maturation of its major natural gas fields in the North Sea, Norway has been able to sustain annual increases in total natural gas production by incorporating new fields."[51] Figure 6.8 shows the significant difference between production and consumption, the latter of which is modest due to the small population. The quantities available for export are therefore considerable.

The structure of Norway's gas sector is dominated by Statoil, which partners with "a number of international oil and gas companies, including ExxonMobil, ConocoPhillips, Total, Shell and Eni [all of which] have a sizable presence in the natural gas and oil sectors. State-owned Gassco is responsible for administering the natural gas pipeline network. The company also manages Gassled, the network of international pipelines and receiving terminals that exports Norway's natural gas production to the United Kingdom and continental Europe."[52]

[51] Unknown Author, "Norway Country Analysis Brief", United States Energy Information Administration (EIA). Accessed on 19 June 2011: http://www.eia.doe.gov/countries/cab.cfm?fips=NO.
[52] Ibid.

Figure 6.8: Norway's Natural Gas Production and Consumption, 1990-2009[53]



Norway exported 96.5 percent of its total production in 2009.[54] Germany is the most important destination for Norwegian gas suppliers and took 30 bcm (or 31.3 per-cent) of the 95.72 bcm of total exports in 2009, according to BP statistics.[55] Most of the exports are transported via an extensive pipeline network and a fraction (around 3 bcm[56]) is also exported in liquefied form as LNG.[57] Figure 6.9 shows the complete breakdown of all pipeline exports, indicating that EU countries are the recipients of Norwegian gas. Figure 6.10 shows Norway's pipeline network. Finally, Norway is not a member of the GECF, but attended a number of the Forum's meetings as an observer.

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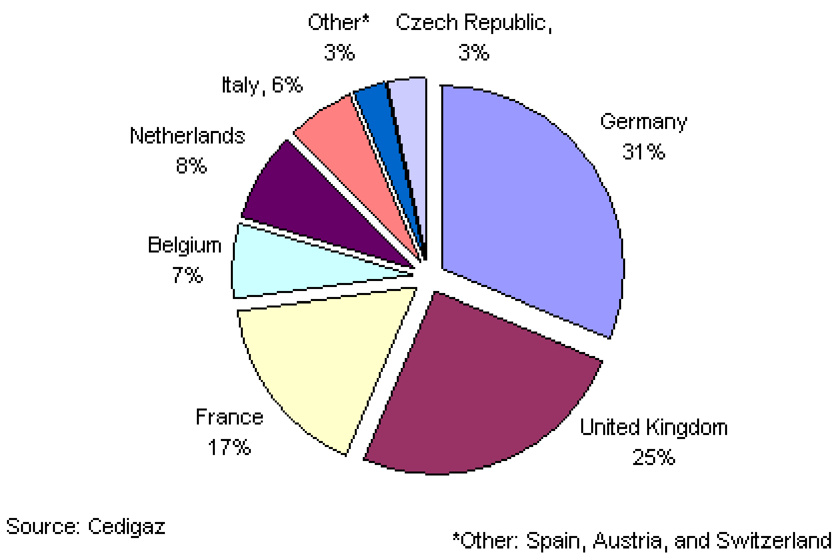
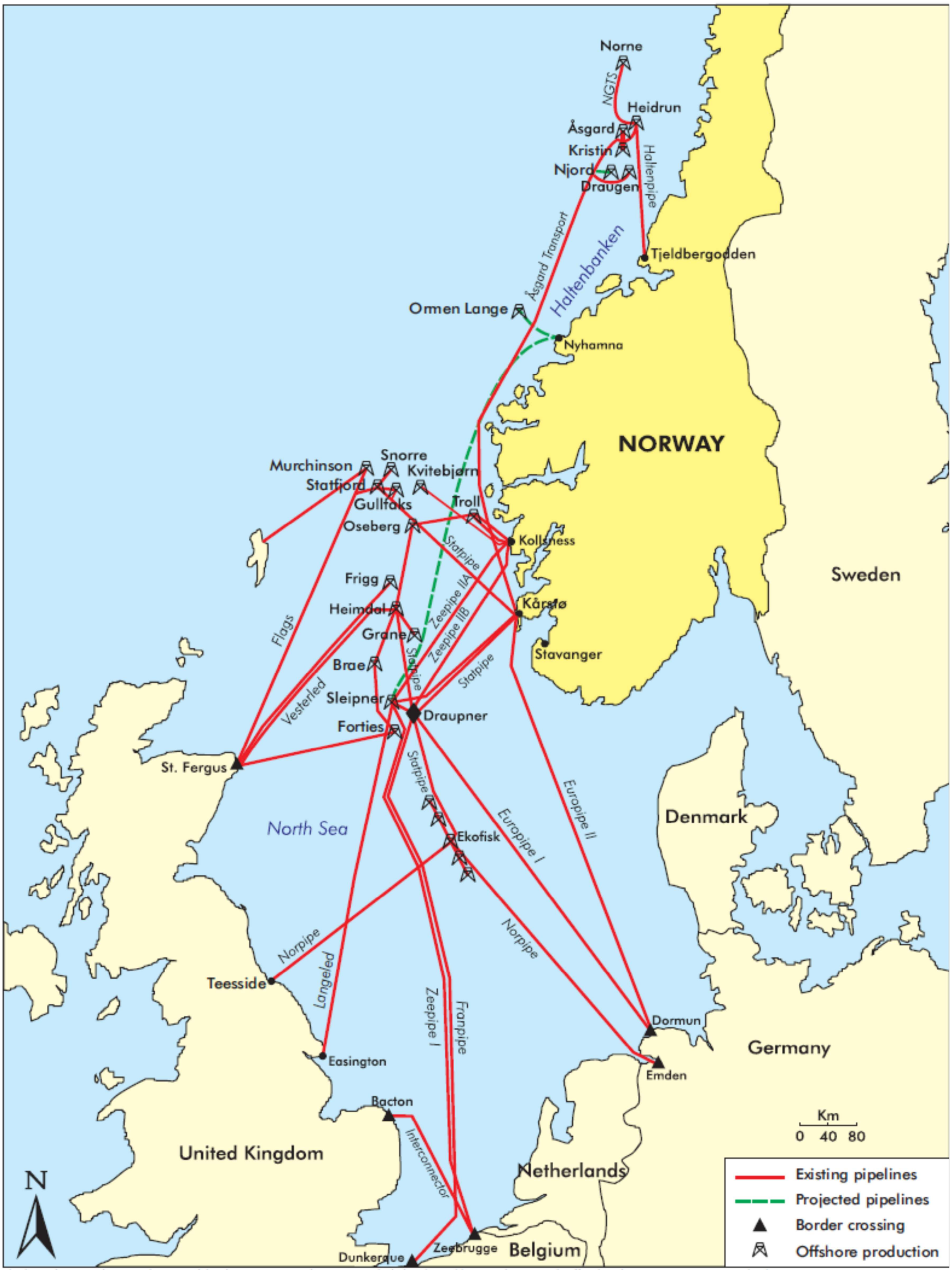
53 Ibid..
54 BP Statistical Review of World Energy, 2010.
55 Ibid.
56 Ibid.
57 EIA, "Norway Country Analysis Brief", 2011.

Figure 6.9: Norway's Natural Gas Pipeline Exports, 2009[58]



[58] Ibid.

Figure 6.10: Map of Norway – Natural Gas Infrastructure[59]



[59] IEA Natural Gas Information 2010, p. IV.47.

6.1.7. Germany's Suppliers of Natural Gas - Netherlands

The Netherlands in 2008 held about 1.14 tcm of natural gas reserves. That amounts to around 0.6 percent of the world's gas reserves and makes the country the second-largest reserve-holder in Europe after Norway and ahead of the UK.[60] "Gas was discovered in the province of Groningen in 1959 by NAM, a joint-venture between a subsidiary of Shell called BPM and the Standard Oil Company of New Jersey (later to become Exxon). Created in 1947, NAM had already discovered a number of moderately sized oil and gas fields in the Netherlands. NAM and the Dutch government started negotiations in 1960, with the size of the Groningen field estimated at 60 [bcm]. In the following years, this number was re-estimated several times, before the final size was confirmed at 2,600 bcm [= 2.6 tcm], 30 years later.[61]

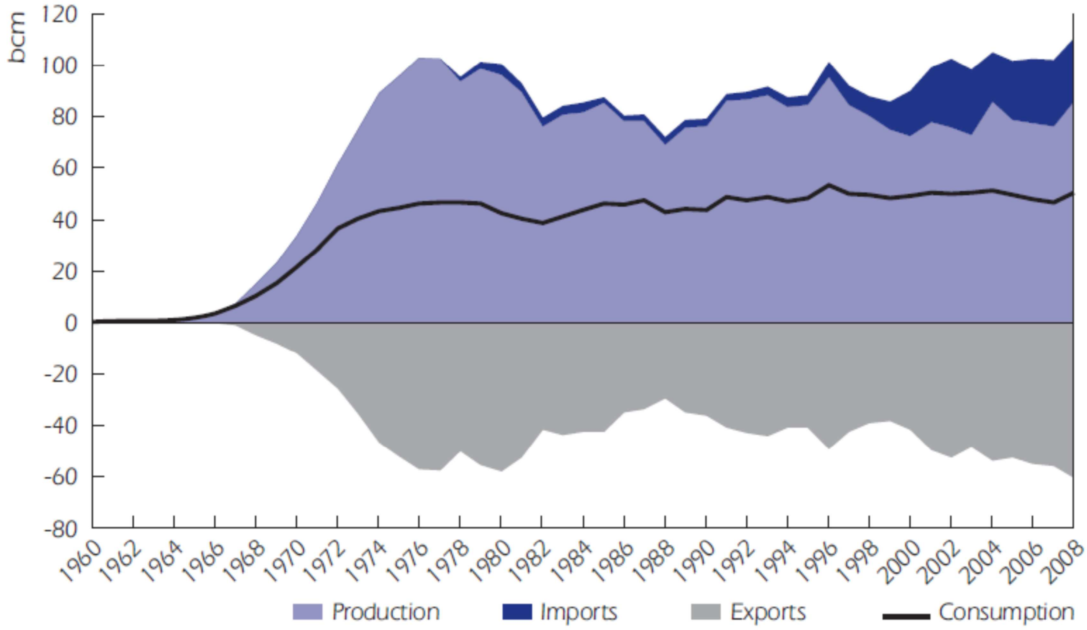
The Netherlands produced 66.6 bcm of gas in 2008, making it the third-largest producer in Europe after Norway and just behind the UK. Figure 6.11 shows the Dutch gas balance for almost five decades, including production, consumption, exports and imports. It is obvious that production is in decline and the increase in exports since 2000 has mainly been due to a rise in imports as consumption remained flat.

Hence Holland remains a major exporter in part as a result of becoming a trading hub, which channels gas from Norway to Germany and other markets in Western Europe, but also Russian gas, e.g. to the UK. "At present, the Netherlands imports gas from Norway, the United Kingdom, Russia and Denmark; H-gas[62] exports from the Netherlands are contracted for European consumers, including Italian, German, British and Swiss; L-gas exports flow to France, Belgium and Germany. In 2006, the transmis-

[60] BP Statistical Review of World Energy, 2010.
[61] Unknown Author, "The Netherlands: 2008 Review", *Energy Policies of IEA Countries Series*, IEA, 2008, p. 62.
[62] Gas with a high calorific value (as opposed to L-gas with a lower value).

sion system operator recorded 982 TWh (100 bcm) of gas entering the system, of which 23 percent [were] imports and 77 percent domestic production, and 972 TWh (99 bcm) exiting, of which 55 percent [were] for export and 45 percent for domestic consumption. The exact origin of imports is difficult to determine for gas entering the Dutch network from Belgium and Germany, the probable origin being Russia and Norway. British gas from the North Sea is imported through Zelzate."[63]

Figure 6.11: Dutch Gas Balance 1960-2008[64]



Gasterra, which is the largest gas marketing company in the Netherlands, handles almost all Dutch gas exports. "Some volumes are exported by independent producers from the Dutch off shore sector directly to Germany via the NGT pipeline but such deals are the exception to the rule."[65]

[63] IEA, "The Netherlands: 2008 Review", 2008, p. 68.
[64] Unknown Author, "Natural Gas Market Review", International Energy Agency, 2009, p. 161.
[65] Melling, "Natural Gas Pricing and its future: Europe as the battleground", p. 94.

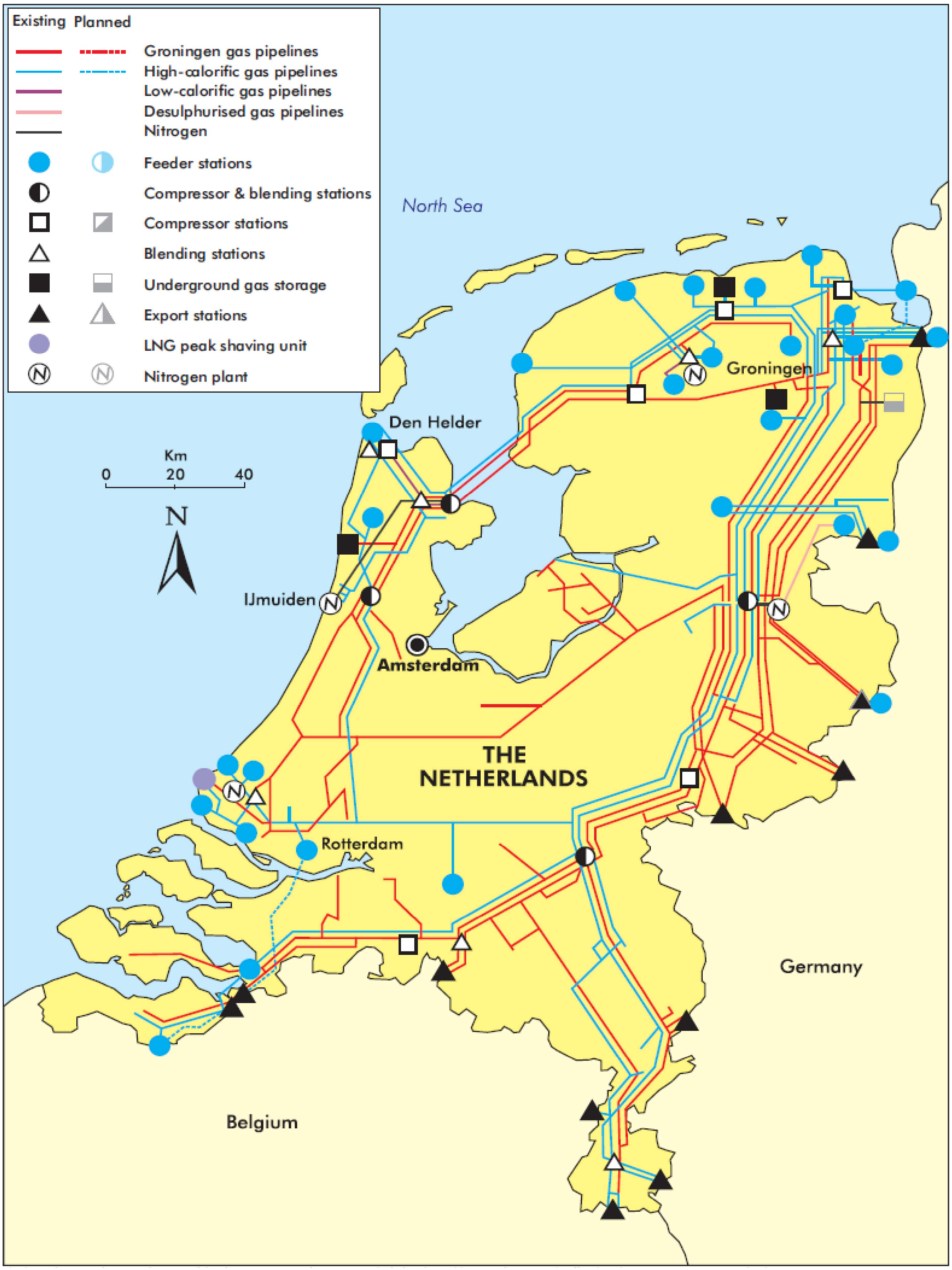
Table 6.4: Organisation of the Dutch Gas Market[66]

Production Liberalised upstream regime. NAM is both the holder and operator of the Groningen concession. The former 80 Bcm national production ceiling is to be replaced by a cap on Groningen production only.
Ownership and operation of gas transmission system Gas Transport Services B.V. has been the operator of the national gas transmission system since July 2005. This independent operator is a 100% subsidiary of N.V. Nederlandse Gasunie, with its own management. N.V. Nederlandse Gasunie retains legal and economic ownership of the transmission grid.
Transit of gas Norwegian gas to Belgium and France. Russian gas to the UK. There is possibly other transit, but this cannot be clearly identified as Gas Transport Services (GTS) has a decoupled entry exit system. For example: planned LNG capacity in The Netherlands can flow to various countries in NW Europe.
Transportation tariffs Since 1.1.2009 an incentive regulation encourages system operators to run the system more efficiently. The regulatory authorities grant system operators revenue caps that are based on a benchmark of costs connected to the system operation. Approved revenue caps are then transposed into non discriminatory network access fees charged to a customer.
Regulatory features The Gas Act was approved in August 2000 and amended in July 2004 to implement the Second European Gas Directive. At the moment there is fully regulated access.

Table 6.4 shows basic features of the Dutch gas market's structure in relation to production and transit of gas. Figure 6.12 shows a map of the Netherlands and the country's onshore natural gas infrastructure. The Netherlands are not a member of the Gas Exporting Countries Forum. Moreover, the country has never sent representatives as observers to GECF meetings either.

[66] IEA Natural Gas Information, 2010, p. VI.42.

Figure 6.12: Map of the Netherlands – Natural Gas Infrastructure[67]



[67] IEA Natural Gas Information 2010, p. IV.43.

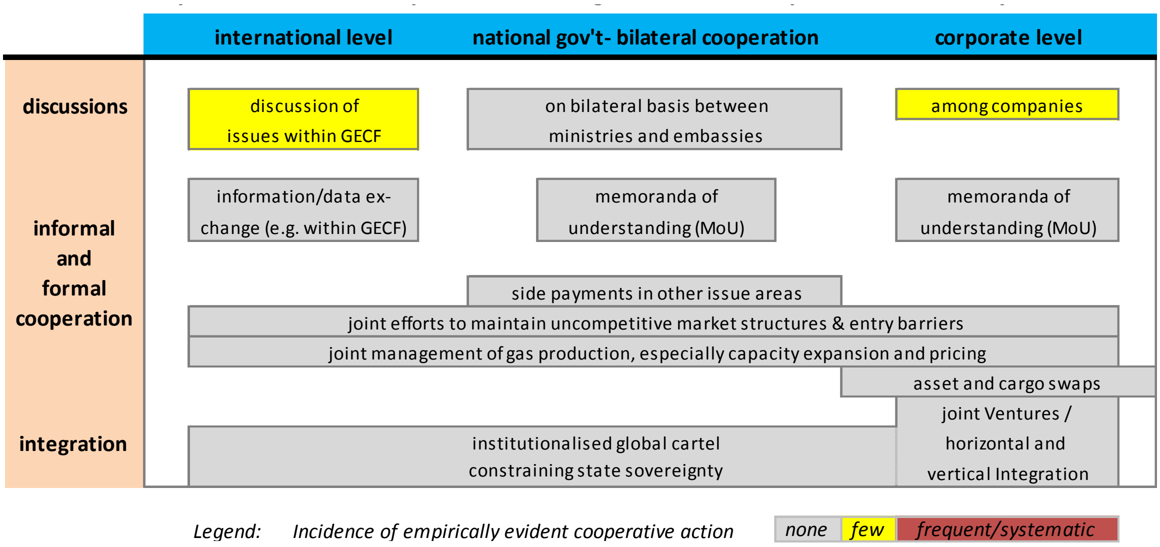
6.2. Cooperative Efforts and Actions

In the previous two case study chapters, this section summarised and discussed instances of cooperation among GECF member states that supplied gas to Turkey and Japan during the period from the GECF's creation in 2001 up until 2008. This case study on the German market and its suppliers was selected because open cooperation among GECF member in this particular market is technically not possible as there is only one member state (Russia) and it would take at least two to cooperate.

The distinction between collusion and cooperation is especially important here. Of course, Germany's suppliers could collude with or without GECF membership and the conduct parameter model in section 3 will determine that. If collusion does occur, the significance of GECF membership in terms of explaining collusion elsewhere would be somewhat diminished. If it does not occur, then GECF membership would seem to be conducive to collusion and on top of that would also enhance GECF producers' pricing power by additional overt cooperation that cements market structures and hence power.

As in the previous chapters, the same analysis of, and research on, a broad range of mutual policy coordination to realise joint gains on an international level, the bilateral government-to-government level and at the corporate level of the countries' individual oil and gas companies was performed for the German case study as well. A taxonomy of cooperation was introduced in chapter 1 and is specified here to reflect the results for the German case study. Figure 6.13 shows these results. As the ensuing brief discussion shows, overt cooperation among Russia, Norway and the Netherlands seems negligible.

Figure 6.13: Cooperation among Natural Gas Exportes - Germany[68]



6.2.1. Discussions

As Figure 6.13 shows, discussions between producing countries, in particular among Norway and Russia may have taken place at GECF meetings. While Russia is a member of the GECF, Norway and the Netherlands are not. Yet, Norway attended some of the ministerial level meetings as an observer as Table 6.5 shows. While there is no publicly available evidence of any specific discussions between Russia and Norway, there is a possibility that such discussions may have taken place. After the period of time being studied in this thesis, the Netherlands also started attending GECF meetings as an observer. "The Netherlands was present in the public part of the last forum [December 2008], which was held in Moscow. This year [in 2009], attendance at the GECF forum has so far been confirmed by Algeria, Bolivia, Iran, Libya, Nigeria, Norway (as an observer), Russia, Trinidad & Tobago, Venezuela, Equatorial Guin-

[68] Source: author.

ea, and the UAE (as a guest). These will accompany Qatar, the host country."[69] As of 2010, both the Netherlands and Norway were listed as observer countries on the website of the Gas Exporting Countries Forum.[70]

Table 6.5: GECF Ministerial Meetings, 2001-2008, Germany's suppliers in bold

Tehran 2001	**Algiers** 2002	**Doha** 2003	**Cairo** 2004	**Port of Spain** 2005	**Doha** 2007	**Moscow** 2008
Algeria Brunei Indonesia Iran Malaysia Nigeria Oman Qatar **Russia** Turkmenistan **Norway***	Algeria Bolivia Brunei Egypt Indonesia Iran Libya Malaysia Nigeria Oman Qatar **Russia** Venezuela	Algeria Brunei Egypt Indonesia Iran Libya Malaysia Nigeria Oman Qatar **Russia** T&T UAE Venezuela **Norway***	Algeria Brunei Egypt Indonesia Iran Libya Malaysia Nigeria Oman Qatar **Russia** T&T UAE Venezuela **Norway***	Algeria Brunei Egypt Eq. Guinea Iran Malaysia Nigeria Qatar **Russia** T&T UAE Venezuela **Norway***	Algeria Bolivia Egypt Indonesia Iran Libya Malaysia Nigeria Qatar **Russia** T&T UAE Venezuela **Norway***	Algeria Bolivia Brunei Egypt Indonesia Iran Libya Malaysia Nigeria Qatar **Russia** T&T UAE Venezuela **Norway*** Eq. Guinea*
Source: Hadi Hallouche (2001-2005 meetings)[71]; IHS Global Insight (2007)[72]; Reuters (2008)[73] * means states are not members, but attend as observers						

After the period of time under consideration in this thesis, Norway and Russia undertook steps towards closer cooperation. A long-standing dispute had made such co-operation difficult if not impossible in the past: "Since the 1970s, Norway has been engaged in a dispute--first with the former Soviet Union, and later with Russia--over a 176,000-square-kilometre maritime area situated in the Barents Sea and the Arctic Ocean. The disputed areas are believed to contain vast oil and gas reserves."[74] That dis-

[69] Unknown Author, "Dutch minister meets Qatari counterpart to discuss LNG deliveries", *European Spot Gas Markets*, 16 June 2009. Accessed via Nexis UK on 16 July 2011.
[70] GECF website, http://www.gecforum.org/gecf/web.nsf/web/members. Accessed on 25 August 2010.
[71] Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making?", p. 17.
[72] Unknown Author, "Gas Exporters Stop Short of Declaring a Cartel", IHS Global Insight, 10 April 2007.
[73] Katya Golubkova and Dmitry Zhdannikov, "Russia says gas OPEC will not set up output quotas", *Reuters*, 26 November 2008.
[74] Blanka Kolenikova, "Norway, Russia Reach Preliminary Agreement to End Decades-Old Border Conflict", *IHS Global Insight*, 28 April 2010. Accessed via Nexis UK on 16 July 2011.

pute was resolved in April of 2010 as Dmitry Medvedev, the Russian president and Norway's prime minister agreed to divide Arctic territorial waters.[75]

Later in 2010, Russia's Gazprom and Norway's Statoil intensified their discussions regarding closer cooperation "in the exploration of oil and gas in northern areas of Russia and Norway, Gazprom said Thursday following a meeting between Gazprom CEO Alexei Miller and Statoil CEO Helge Lund."[76] In particular both companies are keen to work together on the Shtokman gas field in the Barents Sea.[77]

No additional publicly available evidence of other forms of cooperation either during the period of time being studied here or afterwards was available.

[75] Ibid.
[76] Unknown Author, "Gazprom, Statoil mull cooperation in oil, gas exploration", *Prime-Tass English-language Business Newswire*, 14 October 2010. Accessed via Nexis UK on 16 July 2011.
[77] Andrew Neff, "Gazprom, Novatek Sign Deal to Permit Exports From Yamal LNG Project", *IHS Global Insight*, 21 June 2010. Accessed via Nexis UK on 16 July 2011.

6.3. Quantitative Analysis: The Conduct Parameter Model

This section aims to demonstrate whether or not Germany's suppliers of gas enjoy a significant amount of market power in the German market. Specifically, the conduct parameter model will then be used to calculate whether and, if so, to what extent producer collusion explains the producers' market power.

6.3.1. Does Market Power Exist in the German Gas Market?

Market and pricing power is exercised by producers if they are able to charge prices above their cost of production in a sustained way. The Lerner Index of market power allows one to estimate precisely the degree of market power and requires data on prices, on firm's marginal costs and market shares. These relevant data inputs will be presented first. Then the Lerner Index will be calculated with the given inputs to determine whether market power exists.

Average import prices. Table 6.6 shows the annual average price of gas imported by German buyers. Since the German Federal Ministry of the Economy whose data the IEA uses in their reports does not publish the import prices for each individual supplier, the average price is used for each exporter. There are other sources of more detailed data, gathered by the trade publication World Gas Intelligence (WGI), but the Ministry's data is more reliable[78] and will hence be used. The WGI will be introduced later for a different purpose as well. The prices for gas are given in US$ per thousand cubic metres (Mcm), which is the standard unit for pipeline gas. Although domestic production in Germany is declining rapidly, it still is of a significant quantity as Table 6.6 and the discussion of market shares show.

[78] Expert Interview, Anthony Melling, European gas market expert and former senior executive at British Gas, London, July 2011.

Table 6.6: Average Gas (Import) Prices and Market Shares in Germany[79]

by country of origin

	Average Price US$/Mcm	**Market share** (by volume)	**Market share** (by value)
		Russia	
2006	278.11	34.8%	37.4%
2007	282.28	35.8%	38.5%
2008	409.27	37.7%	40.1%
		Norway	
2006	278.11	22.8%	24.5%
2007	282.28	23.6%	25.3%
2008	409.27	25.5%	27.1%
		Netherlands	
2006	278.11	21.8%	23.5%
2007	282.28	20.7%	22.3%
2008	409.27	18.5%	19.7%
		Others	
2006	278.11	3.3%	3.5%
2007	282.28	2.5%	2.7%
2008	409.27	3.5%	3.7%
		Domestic[80]	
2006	167.00	17.3%	11.2%
2007	169.00	17.4%	11.2%
2008	246.00	14.9%	9.5%

Hence a price estimate for domestic production is needed too. Given that the gas is domestically available and does neither need to be transported thousands of miles nor is produced from expensive offshore fields (as is the case in Norway and in the Netherlands), prices can be assumed to be below those of imported gas. Given the absence of available data, a 40 percent discount was applied to the average import price to arrive at

[79] Table & calculations: author; data source: IEA, 2010 / German Federal Ministry of the Economy.
[80] All prices except for those shown under “domestic” are import prices from government statistics. The domestic production prices were calcuated in consulting with gas market experts from Germany and the UK.

prices for domestically produced gas. This assumption was corroborated as being reasonable in discussions with experts.[81]

Market share. Table 6.6 also shows each individual supplier's market share in the German gas market. There are two ways to calculate a firm's market share in a given market, by sales volume or by value (in US$). For the purposes of this model it is preferable to use sales revenues (value) as the basis for market share since the focus is on prices and value rather than just physically traded quantities. The treatment of Germany's domestic production and exports needs careful attention as well. Unlike Turkey or Japan, Germany has both non-negligible indigenous gas production as well as exports (of both domestically produced gas and imported gas or gas for transit). The practice in the past two case studies was to use the imported amounts of gas to generate market share figure as the imported amount more or less matched the total domestic consumption figure.

Figure 6.14: German Natural Gas Supply and Consumption[82]

Million cubic metres

	1973	1978	1980	1990	2006	2007	2008	2009e
Indigenous production	**23 124**	**25 636**	**22 881**	**18 919**	**19 609**	**18 612**	**16 093**	**14 497**
+ From other sources	-	-	-	-	-	-	-	-
+ Imports	17 220	37 982	48 082	54 288	93 730	88 355	91 991	94 557
- Exports	135	286	2 632	1 218	11 642	12 222	12 685	11 305
+ Stock changes	- 129	- 174	- 508	- 395	- 1 252	2 547	698	- 2 281
- Statistical difference	- 1 221	- 1 239	- 727	1 871	670	622	- 1 895	2 822
Total consumption	**41 301**	**64 397**	**68 550**	**69 723**	**99 775**	**96 670**	**97 992**	**92 646**

Yet, Germany's gas production of e.g. 19.6 bcm in 2006 and 11.6 bcm of exports require a more delicate treatment. In the absence of detailed data, the most appropriate way of dealing with this is to assume that Germany's exports are sourced from

[81] Expert Interview, Jonas Graetz, Project Associate, German Institute for International and Security Affairs (SWP), Berlin, July 2011.
[82] IEA Natural Gas Information, 2010, p. IV.156.

both indigenous production and imports and in proportion to the relative size (market share) of the source. That is, exports are apportioned to, and deducted from, the volume figure of each source (imports and domestic) proportionally. With that, two of the three essential data inputs for the Lerner Index have been provided.

Marginal cost. The last input is marginal cost (MC). Since producers' marginal costs are difficult to determine, estimates must be obtained or generated. Such marginal cost estimates do exit for essentially all of Germany's natural gas suppliers. The basic estimates come from one of the two sources used before in the previous case studies and are shown in Figure 6.15.

Figure 6.15: Range of production costs for selected gas producing regions[83]

(in US$/mmbtu)

Country	Production costs	
	Lowest	Highest
Algeria	0.40	0.80
Australia	0.60	1.00
Canada	0.70	1.20
Indonesia	0.50	1.00
Iran	0.35	0.70
Netherlands	0.20	1.40
Nigeria	0.60	1.20
Norway (North Sea)	0.80	1.40
Norway (Barents Sea)	1.20	1.70
Qatar	0.35	0.60
Russia (Western Siberia)	0.40	1.20
Russia (Barents Sea)	1.00	1.30
Russia (Sakhalin)	0.80	1.30
UK	1.20	1.60
USA (Gulf and onshore)	0.70	1.70
Venezuela	0.60	1.00

The marginal cost data was generated in 2006, hence it is necessary to adjust for changes in cost over time to make the figures comparable and to arrive at estimates for

[83] A. Seeliger, *Entwicklung des weltweiten Erdgasangebots bis 2030: Eine modellgestuetzte Prognose*, Oldenburg Verlag, 2006, Munich, pp. 52-56. Cited in: Stefan Lochner and David Bothe, "The development of natural gas supply costs to Europe, the United States and Japan in a globalizing gas market—Model-based analysis until 2030", *Energy Policy* 37 (2009), p. 1521.

all years of the relevant period of time under consideration. The IHS CERA Upstream Capital Cost Index (UCCI) is used for these adjustments as before in chapters four and five. Seelinger uses the standard unit for LNG in Figure 6.15, US$/mmbtu. The final estimates are converted into Mcm[84] as is common for pipeline gas and can be found in Table 6.7. Given that gas production within Europe has been declining rapidly and has hence become more expensive, marginal cost estimates towards the upper end of the spectrum given in Figure 6.15 are used.

Table 6.7: Marginal Cost of Production and Transportation Cost to the German border[85]

In US$ /Mcm

	Upstream US$/Mcm	**Transp. cost** US$	**Total cost** US$
		Norway	
2006	45.00	30.00	75.00
2007	50.69	30.00	80.69
2008	59.30	30.00	89.30
		Russia	
2006	59.61	40.00	99.61
2007	71.27	40.00	111.27
2008	83.30	40.00	123.30
		Netherlands	
2006	42.36	20.00	62.36
2007	47.71	20.00	67.71
2008	55.80	20.00	75.80
		Others	
2006	-	-	79.00
2007	-	-	86.60
2008	-	-	96.10
		Indigenous	
2006	-	-	62.36
2007	-	-	67.71
2008	-	-	75.80

[84] 1 mmbtu = 35.3 Mcm

[85] Table: author; Sources: Detailed and comprehensives references are to be found in section 3.1, subsection *marginal cost*.

The marginal cost estimates were created in exactly the same way as in the previous case study chapters. Two issues need clarification. First, suppliers listed in the German import statistics under “other” need a marginal cost estimate as well. Since these “other” suppliers often include Denmark and the UK, the average of the other three figures for Russia, Norway and Holland will be used. Finally, a cost estimate for Germany’s indigenous production is required. Since Germany’s fields are located in the north-western part of country, they are geologically similar to the nearby Dutch fields. Hence the production cost profile is comparable, though German fields due to their smaller size have fewer economies of scale than the Dutch fields (implying higher costs), but at the same time they are located closer to centre of German gas consumption (lowering transportation costs).[86] Hence Dutch marginal cost estimates will be used for Germany’s indigenous production as shown in Table 6.7.

Table 6.8 shows the Lerner Index results for the period of time under consideration. The overall Lerner Index is the sum of each individual supplier’s Lerner indices, weighted by each supplier’s market share. A Lerner Index of zero implies a perfectly competitive market in which producers are not able to charge prices above their marginal cost of production. A Lerner Index of 1 would imply a monopoly or a perfectly collusive group of suppliers. The results for the German market point to a high degree of market power with results ranging between 0.67 and 0.74. These results are somewhat lower than those for the Turkish and Japanese markets studied before, but not significantly smaller.

[86] Expert Interview, Anthony Melling, European gas market expert and former senior executive at British Gas, London, July 2011.

Table 6.8: Lerner Index for Japanese natural gas market, 2006-2008[87]

	Netherlands	Norway	Russia	Other	Indigenous	Total
2006	0.18	0.18	0.24	0.02	0.07	**0.70**
2007	0.17	0.18	0.23	0.02	0.07	**0.67**
2008	0.16	0.21	0.28	0.03	0.07	**0.74**

What follows is the conduct parameter model (CPM), which takes into account the elasticity of demand and market concentration to estimate to what extent the residual—product conduct (collusion or competition)—explains the high degree of market power in the German market. The results of the conduct parameter model for Germany for the period of time from 2006 to 2008 will be explained and presented.

6.3.2. Explaining Producers' Market Power – The Role of Collusion

The results of the Lerner Index analysis shown in Table 6.8 demonstrate that Germany's suppliers of natural gas exercise significant market power in the German gas market. In order to assess the role of producer conduct, two steps are necessary before the conduct parameter can be calculated. First, the data on market shares needs to be converted into the appropriate measure of market concentration. The Herfindahl Index (H) is the measure used in the conduct parameter model. The Herfindahl Index for each year is simply calculated by adding the squared market shares of each supplier to the German market as presented in Table 6.9.

Table 6.9: Market Shares and Herfindahl Index (H)

	2006	2007	2008
Netherlands	23.5%	22.3%	19.6%

[87] Table: author.

Norway	24.5%	25.3%	27.1%
Russia	37.4%	38.5%	40.1%
Other	3.5%	2.7%	3.7%
Indigenous	11.2%	11.2%	9.5%
H	**0.268**	**0.275**	**0.283**

The second necessary data input required for the CPM is the price elasticity of demand **ε** and since the conduct parameter result is very sensitive to the level of **ε**, a broad look at the available elasticity data is required. A broad range of elasticity estimates—both short-run and long-term ones—for natural gas consumption is available. Since producers' collusive efforts to maximise economic rents have both a short-term and a longer-term dimension,[88] an elasticity estimate that lies between the generally inelastic short-run figure and the less inelastic longer-run one will be used.

A review of the literature with a focus on German and Western European data shows that short-run estimates can be as low as -0.1 (or even closer to 0) implying extremely inelastic demand.[89] There is a wide range of long-run estimates ranging from -0.20 or -0.30 to into the elastic range (1 and higher).[90] Others use -0.7 as a long-run elasticity figure for gas demand in Western Europe, "which reflects a certain inelasticity of the natural gas demand. Shifting from natural gas to another fuel would require changes in the technical installations, which are costly and time-demanding."[91] Using the two different long-run estimates shown in Figure 6.16: -0.364 and -0.243 as well as

[88] Raising prices (by?) too much in the short-run might eventually create a correspondingly significant quantity reaction since demand is more elastic in the long-run.
[89] G. Liu, "Estimating Energy Demand Elasticities for OECD Countries. A Dynamic Panel Approach." *Discussion Papers*, Statistics Norway, 2004.
[90] See:
J. Estrada and O. Fugleberg, "Price elasticities of natural gas demand in France and West Germany", *Energy Journal*, vol. 10, no. 3, 1989, pp. 77-90.
Liu, 2004.
[91] Franziska Holz, Christian von Hirschhausen and Claudia Kemfert, "A strategic model of European gas supply", *Energy Economics*, 2007, p. 11.

-0.7 in Holz, von Hirschhausen and Kemfert,[92] one arrives at an average of approximately -0.45. That will be used as the basic elasticity estimate for this thesis.

Figure 6.16: Elasticity Estimates for Energy Goods in OECD[93]

Residential Sector and Industrial Sector

Products	SR price ela.	LR price ela.
Electricity	-0.030 (0.018)	-0.157 (0.095)
Natural Gas	-0.102 (0.161)	-0.364 (0.493)
Hard Coal	0.000 (0.227)	0.001 (0.443)
Gas Oil	-0.143 (0.056)	-0.318 (0.110)
Motor Gas.[b]	-0.191 (0.017)	-0.600 (0.082)

Products	SR price ela.	LR price ela.
Electricity	-0.013 (0.022)	-0.044 (0.073)
Natural Gas	-0.067 (0.023)	-0.243 (0.086)
Hard Coal	0.162 (0.111)	0.589 (0.447)
Gas Oil	0.043 (0.070)	0.127 (0.205)
Auto. diesel [b]	-0.094 (0.018)	-0.268 (0.068)

The figure lies between the extremely inelastic short-run estimates and the more elastic long-run estimates. It also takes into account the fact Germany uses less gas in the elastic power generation sector and more in the inelastic residential sector (for heating) than other Western European countries such as the UK and the Netherlands. Hence German elasticity estimates for gas demand are on average at the lower end of the spectrum in comparison to those in the OECD and in particular Western Europe. The chosen estimate of -0.45 is also within the range of the long-run own-price elasticity figures of -0.317 and -0.743 used in Odd Bjarte Nilsen, Frank Asche and Ragnar Tveteras' study.[94]

Table 6.10: Results from Conduct Parameter Model[95]

Results					**Spectrum of Possible Outcomes**		
Conduct Parameter θ					**Perfect Comp.**	**Non-coop. oligopoly**	**Perfect collusion**
2006	0.88	**1.17**	1.46		0	1	3.72

[92] Ibid.
[93] Liu, 2004.
[94] Odd Bjarte Nilsen, Frank Asche and Ragnar Tveteras, "Natural gas demand in the European household sector", *Working Paper No. 44/05*, SNF Project No 7220, Institute for Research in Economics and Business Administration, August 2005, p. 10.
[95] Table: author.

2007	0.82	**1.09**	1.37		0	1	3.64
2008	0.89	**1.19**	1.48		0	1	3.53
Elasticity ε	-0.34	**-0.45**	-0.56		θ = 0	θ = 1	θ = 1/H

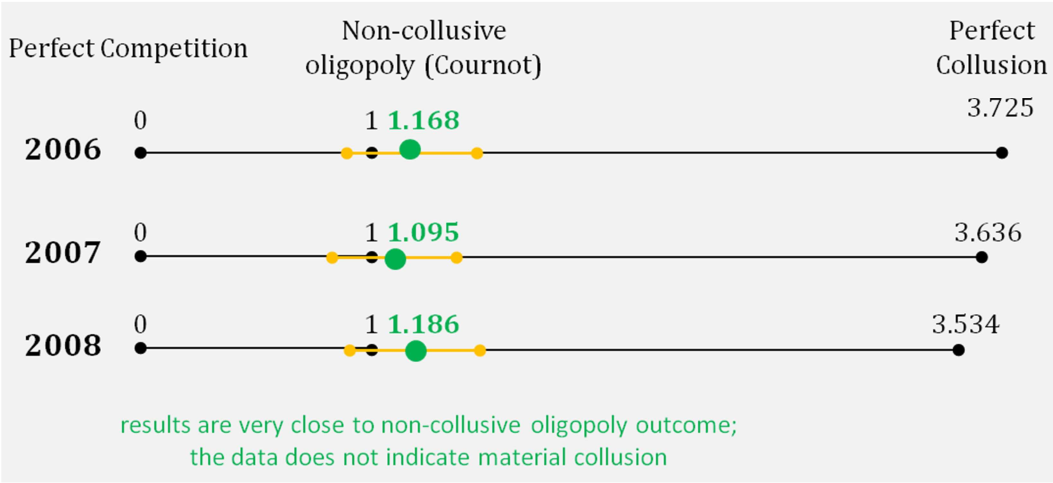
Sensitivity analysis of ε: -25% and +25% of estimate

Moreover, a sensitivity analysis will also be conducted to ascertain whether the results change substantially if the elasticity of demand is assumed to be 25 percent below or 25 percent above the figure employed here. This sensitivity analysis, shown in Table 6.10 along with the results of the conduct parameter model, therefore employs not only -0.45 to perform the calculations, but also -0.34 (more inelastic) and -0.56 (more elastic). Having presented and discussed all necessary data inputs into the Conduct Parameter Model, Table 6.10 and Figure 6.17 show the results of the model.

Taking into account elasticity of demand and market concentration, the CPM results for 2006, 2007 and 2008 show that producer collusion is not a cause of market power in a material way since the result is very close to the non-collusive oligopoly outcome. According to the model results, the price-marginal cost margin is therefore mainly explained by a high degree market concentration and inelastic demand as well as other possible factors which will be discussed in section 4.

Figure 6.17: Spectrum of Possible and Actual Conduct Parameter Outcomes[96]

[96] Figure: author.



The sensitivity analysis shows that if the elasticity of demand is assumed to be 25 percent below the estimate employed here, the result falls in the range between perfect competition and non-collusive oligopoly, i.e. between 0 and 1. If the price elasticity is assumed to be 25 percent above the estimate, it falls into the range between non-collusive oligopoly and perfect collusion, i.e. between 1 and 1/H. This indicates that collusion might explain a small fraction of the difference between prices and MC. In both prior cases, collusion was an important explanation for producers' pricing power and all results (including those of the sensitivity analysis) were clearly above the non-collusive oligopoly outcome. This is not the case in Germany. These results will be discussed in further detail in chapter 7, which will analyse and compare results across all cases.

Another study corroborates this finding from a different perspective. Kong Chyong and Benjamin Hobbs at Cambridge's Electricity Policy Research Group modelled Russian gas exports to Europe.[97] Their focus is on quantities and market structure rather than on prices and market structure. Different market structures not only lead to different prices, but also to different quantities demanded. It shows that perfect competi-

[97] Kong Chyong and Benjamin F. Hobbs, "Economics of Nord Stream: Effect of Competitive Assumptions", Presentation, April 2010, p. 6. Accessed on 17 June 2011: http://www.eprg.group.cam.ac.uk/wp-content/uploads/OH_EDF_Gas_Hobbs_April2010_f.pdf.

tion would lead to the highest quantities consumed (69.8 bcm) because of more competitive prices. An oligopoly situation would imply 34.1 bcm, which is reasonably close to the 38 bcm of actual quantity consumed in 2008.

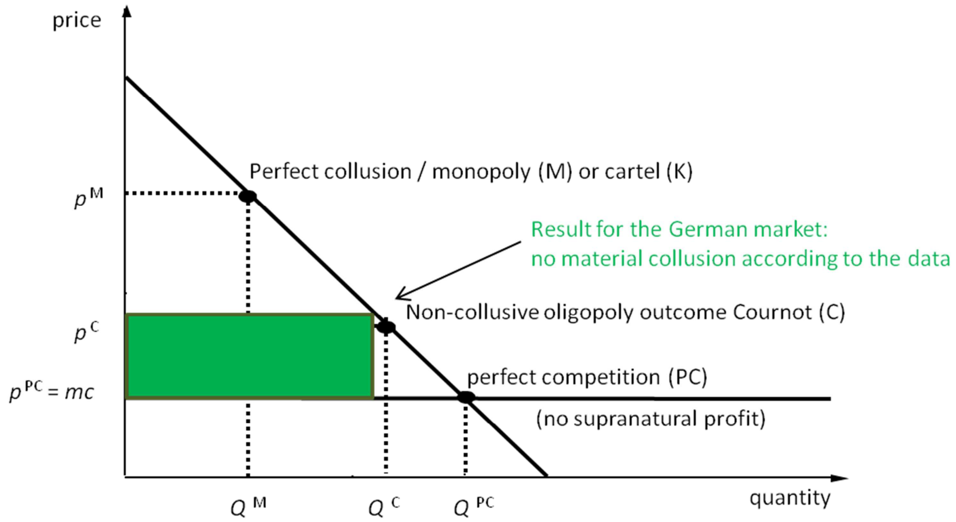
Figure 6.18: Russian Gas Exports: Selected Markets[98]

	Model Results			Real Data***		
	Germany	France	Italy	Germany	France	Italy
Double Marginalisation	19.5	0.5	3.4	38	10.9	22.4
Upstream oligopoly	34.1	11.4	20.5			
Perfect Competition	69.8	0	34.7			

What is the significance of these results in the wider context? It was shown earlier in this chapter that there were hardly any cooperative efforts among Germany's gas suppliers. Furthermore the model confirms that collusive producer conduct is not an important explanatory variable. As before, a discussion of factors that are not part of the model is necessary, both to put the results into perspective and to look for additional explanations for market power. Such explanations might include market entry barriers (which might overstate the conduct parameter outcomes in terms of ascribing too much significance to cooperative behaviour) and buyer concentration (which might understate the conduct parameter outcome). Other factors might be important too, such as political and strategic considerations as well as a range of issues related to Germany's gas market. A qualitative assessment of the results—the fourth part of this chapter—will address these questions in greater detail.

[98] Ibid.

Figure 6.19: Schematic Illustration of CPM result[99]



To finalise this section, a brief comment on the welfare implications of producer cooperation in the German gas market is in order. Figure 6.19 schematically shows the conduct parameter outcome and the green box illustrates the economic rent earned by producers by charging prices above marginal costs. All statements that can be made will remain schematic because any specific welfare calculations would require much more complex modelling that is beyond the scope of this thesis.

[99] Figure: author.

6.4. Qualitative Assessment of the Results

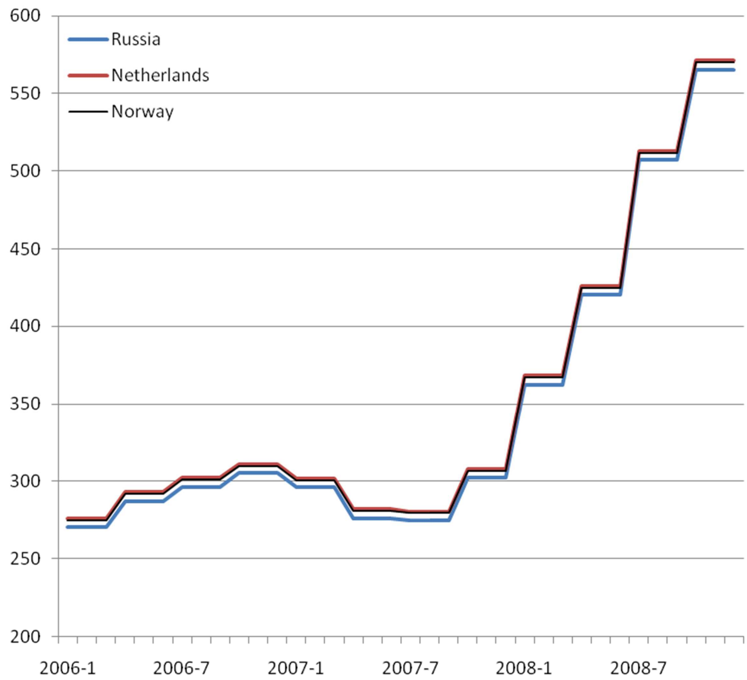
6.4.1. Collusion, Cooperation and the Issue of GECF Membership

According to the CPM results in the preceding section, a high degree of market concentration and inelastic demand for gas principally explain producers' pricing power and economic rent in the German market. Collusion, the residual, is hence not borne out by the data. Instead the result is the non-collusive oligopoly outcome and lies between the perfectly competition and perfect collusion levels. Moreover, the absence of substantive (overt) cooperation described in section 2 indicates that not only secretive collusion, but also public cooperative efforts are unlikely to be prevalent in the German market.

The CPM considered three very important drivers of producer market power, but it is only a model that does not fully reflect reality and hence it is important to consider other possible explanatory factors as well. This should be especially useful given that some degree of market concentration and inelastic demand also prevailed in the other two case studies. Having established in which cases collusion and cooperation occur (Turkey and Japan) and one—the hypothesised 'negative' case—in which they do not occur (Germany), one must ask why cooperative efforts have succeeded in some cases and why they do not matter (or fail) in others. A comprehensive discussion of this issue will be conducted in chapter 7. At this stage, alternative explanations for market power in the German market will be considered in order to set the stage for the next chapter's discussion of why cooperation does not matter or fails in certain cases.

One way of determining the significance of collusive and cooperative conduct with a particular focus on GECF member states in the prior case studies was to look at the different price levels charged by GECF members and by non-members. Despite the absence of evidence for cooperation and the non-collusive CPM outcome, a look at the price levels charged by different suppliers to the German market seems useful as well. This, however, is a challenging enterprise since Germany's federal ministry of the economy only publishes average monthly import prices. The respected trade publication World Gas Intelligence publishes monthly estimates of the border prices for gas from the Netherlands, Norway and Russia. These are most often within a reasonable range compared to the official government statistics and they show that the prices charged by the three main suppliers are very close to each other, varying by only US$5-15 as Figure 6.20 shows.

Figure 6.20: German Border Price Estimates for Different Origins[100]



[100] Chart: author; data: the price data was collected from the monthly issues of World Gas Intelligence between 2006 and 2008. Accessed via Nexis UK between 25-27 June 2011.

Such pricing outcomes often occur in oligopolistic market structures and are not necessarily an indication of collusion or cooperation. Incidentally, Gazprom's price tends to be lowest of the three import prices and the Dutch price the highest one (within the very narrow range pointed out before). Gas pricing expert Anthony Melling explained that the Netherland essentially charge a slight premium for providing significant volume flexibility to match seasonal variations in demand, i.e. to deliver more gas during winter time when demand soars and less during the summer months.[101] "The much longer transport distances make it much more expensive for the Russians to offer volume flexibility (*swing*), since this requires excess capacity in the pipelines. Swing services can be provided at lower costs by suppliers that are situated close to the market, i.e. Norway and—in particular—the Netherlands. Volume flexibility is an important product attribute for the buyers that are facing fluctuating demand, implying differences in the willingness to pay."[102] Hence slightly higher prices for Dutch gas can be explained as being a premium for volume flexibility that the other two major suppliers are not willing or able to provide. Studying the (estimated) individual prices charged by the Netherlands, Norway and Russia is hence less crucial to the analysis than in the other two cases.

6.4.2. Market Power and Economic Rent: Other Factors

Buyer concentration. The first issue discussed in this sub-section is buyer concentration, a factor that is not included in the conduct parameter model. If there were strong concentration among gas buyers in Germany (as is the case with Turkey's BOTAS for example), then the conduct parameter result could be understated, i.e. collusion among

[101] Expert Interview, Anthony Melling, European gas market expert and former senior executive at British Gas, London, July 2011.
[102] Asche et al. "European market integration for gas? Volume flexibility and political risk", 2002, pp. 262-264.

producers could be an important explanation whereas the results suggest it is not. There are half a dozen wholesale buyers, more than 20 transmission companies and over 700 local and regional distribution companies[103] all of which can in theory buy gas directly from the suppliers (and many do in practice). While connections between some of those companies exist, Germany's domestic market structure does not constitute buyer concentration.

Market entry barriers. Contrary to buyer concentration, market entry barriers may lead to an overstatement of the CPM result that is to say that the outcome may not be near the non-collusive oligopoly outcome, but closer towards zero, indicating a more competitive market. Given the huge upfront costs of developing a gas field and building long-distance pipelines, the natural gas market entrants face such high barriers. It is, however, important to distinguish between natural market entry barriers and others which may be established or sustained with an anti-competitive motivation ('artificial barriers'). Natural barriers, as mentioned above, are high upfront costs for developing natural gas fields and for building pipelines. However, many of Russia's gas fields are mature and almost all of Norway's and the Netherland's field were developed decades ago. Hence, the natural entry barriers do exist, yet they are not as significant as they could be. Therefore, these barriers are unlikely to fundamentally overstate the CPM.

There is a second set of market entry barriers as well: artificial ones put up to keep the market uncompetitive. A competitive market, among other things, needs transparency, flexibility and prices that reflect supply and demand. It was shown that as an active member of the GECF, Russia actively opposes such efforts towards liberalisation. Yet, the two other major suppliers have a more competitive orientation – not necessarily out of choice. European Union directives apply both in the Netherlands and in Norway

[103] IEA Natural Gas Information, 2010, p. VI.24.

as well despite the fact that the country is not a member state.[104] That means Norway and the Netherlands are bound by pro-market and pro-liberalisation policies of the European Union. Hence, rather than supporting artificial market barriers (such as resale restrictions/destination clauses) these two non-GECF suppliers are in favour of more and not less market-based gas trading in Europe. The Netherlands is particularly engaged in acting as a hub through which gas supplies flow into all directions.[105] Hence, both natural and artificial barriers are unlikely to overstate the CPM in the case of Germany.

Policy Issues and Germany's Domestic Market Structure. The regulatory environment of the domestic gas market in Germany is partly to blame for the lack of competition and hence contributes to the producers' ability to charge prices above marginal cost. Studies (cited below) and experts interviewed for this thesis describe the German market as the epitome of complexity and lack of competitiveness. German gas expert Heiko Lohmann described the market in a comprehensive paper in the following way. "Gas companies at all levels of the industry perceived themselves as part of a single 'gas family'. In addition to long-term contracts, these family relationships were underpinned by the following arrangements:"[106]

- Mutual shareholdings between interregional gas companies.
- Shareholdings of interregional gas companies in regional gas companies and local distribution companies.
- The principle of sales partnership, where the supplier supported the local distribution companies with advice, know-how and finance on

[104] Norway, like other non-members in Europe including Switzerland, has agreed to implement almost all directives of the European Commission in order to benefit from free trade agreements with the entire EU.
[105] Unknown Author, "The Netherlands: 2008 Review", IEA Energy Policies of IEA Countries Series, 2008, p. 50.
[106] Lohmann, "The German Gas Market post 2005: Development of Real Competition", 2009, p. 5.

all aspects of the business, including market penetration, and customer service. [107]

- Sales contracts with distribution companies that were not only long-term but also included "No-Worry Packages" where the customer paid for the annual gas off-take and flexibility he used. Local distribution companies therefore had only very limited incentives and competence to manage their gas procurement.[108]

- Very strong informal relationships.

- No gas-to-gas competition between the incumbents

Anthony Melling also focused on the complexity and status quo-orientation of the domestic market players. "All firms had an interest in preserving the status quo by not competing with each other. Everybody in the whole chain—from transmission to regional and local distribution companies—had a pre-determined, stable profit margin. Changing the system and the structure would have reduced the 'reasonable' profit margin. That way, the system could exist for decades." Jonas Graetz, another expert interviewed for this thesis, added that the "natural gas elite" in Germany is very small and has no interest in change and in allowing outsiders to enter "their" system. This is particularly obvious when one considers the opposition to third party access to networks (discussed two paragraphs below). Graetz also pointed out the tightly-knit relationships between gas companies and all levels of government,[109] ranging from local companies and their cosy relationship with local political elites up to the federal level, where politicians are known to lobby against European Commission liberalisation efforts on behalf of German gas companies.

The lack of regulation encouraging local monopolies to compete is part of the reason for the existence of market power in the German market. It was the European

[107] Ibid.
[108] Lohmann, "The German Gas Market post 2005: Development of Real Competition", 2009, pp. 5-6.
[109] Expert Interview, Jonas Graetz, Project Associate, German Institute for International and Security Affairs (SWP), Berlin, July 2011.

Commission that had to force the German federal government to start regulating the gas market in such a way that would incentivise local and regional players to change and to compete. The issue of network access (for third parties) has been particularly important.

"During the first phase of liberalisation[110] Germany relied on a regime of negotiated Third Party Access. Negotiations among the four major associations of network operators and network users were a nightmare and did not result in a truly transparent, non-discriminatory and workable system that allowed third parties reliable and efficient access to the German networks to supply all customers groups in Germany. In 2003 discussions about regulated Third Party Access started after the 2nd EU directive on the opening of the gas market made regulated Third Party Access compulsory and forced Germany to establish a new system. But two years of legal process amending the German energy law[111] did not produce a comprehensive and clearly worded framework that could be implemented directly by network operators and easily monitored by the newly created regulator *Bundesnetzagentur*. The months that followed [the enactment of the energy law in 2005] demonstrated very clearly how the German network operators fought fiercely and skilfully against a model of network access, which would really endanger the established market structure."[112]

There is a set of policy issues that also helps explain producers' pricing power in the German market. Given Germany's emphasis on 'green' policies, reducing carbon emission has for at least two decades been an increasingly important priority. Since gas burns more cleanly than coal or oil, it has become a premium fuel, which, due to its desirable environmental qualities, can attract higher prices. Climate change legislation has also made other forms of hydrocarbon fuels (mainly coal) more expensive and hence less attractive. Power plant operators often do not have a real choice: either the coal-fired power plant must be phased out anyway or its operation becomes so expensive that

[110] From 1998 to 2003.
[111] Which came into force in 2005.
[112] Lohmann, "The German Gas Market post 2005: Development of Real Competition", 2009, p. 4.

at least in the medium-term it makes sense switch to gas-fired power generation. This also pushes up the willingness to pay for more expensive gas and hence gives both sellers in the domestic market as well as their suppliers abroad additional pricing power.

Politics and Corruption. Domestic politics plays a distinct role in Germany's gas sector. The lobbying influence of German gas companies on the federal government as well as the European Commission is strong.[113] Moreover, security of gas supply is an important issue in German politics. That induces buyers to be prepared to pay higher prices, a security premium.[114]

In terms of foreign policy, the relationship with the Netherlands and with Norway—at least in terms of gas supplies—is fairly depoliticised as companies with commercial objectives negotiate without significant government influence. The relationship with Russia is different. The extent to which Gazprom is commercial in its objectives and to what extent the company is used for political ends is difficult to determine. Yet, political relationships matter. While Gazprom and the Russian government have had an adversarial relationship with many Eastern European gas customers and those in CIS countries—especially with those whose governments are not pro-Moscow (any more)—the relationship with Germany has been rather cordial since 1992. Germany is seen as an important customer of oil and gas, but also as a moderator between Russia on the one side and Western Europe and the US on the other.

Good relations, one could argue, are evidenced by E.ON Ruhrgas' shareholdings in Gazprom as well as the close relationship that former chancellor Gerhard Schroeder has with former president and now prime minister Putin. Indeed, the relationship was so close that it was publicly called corrupt in 2005 and afterwards.

[113] Expert Interview, Jonas Graetz, Project Associate, German Institute for International and Security Affairs (SWP), Berlin, July 2011.
[114] Ibid.

Both politicians finalised negotiations on the Nord Stream pipeline in early 2005[115]. Then Gerhard Schroeder, a few weeks before being voted out as chancellor in September 2005, obtained German government guarantees for the pipeline's financing and construction only to become chairman of the Gazprom subsidiary that owns and operates the pipeline in November 2005. The merits of the Nord Stream pipeline in terms of enhancing energy security in Europe are debatable. Whether the pipeline is commercially sensible and advantageous to German gas consumers is also debatable given the comparatively high cost of subsea pipelines.

However, joining Gazprom's payroll in November 2005 shortly after using one's power as chancellor to secure German government funds for Nord Stream reeks of corruption. Nord Stream seems a bad economic and political decision for almost everyone except for Gazprom. It commits German gas companies to this large and expensive project, creating an interest in fully utilising its capacity while reducing the incentive to look for other (more competitive) sources of gas. It also increases the market share of Germany's largest supplier instead of diversifying the country's supplier base. Moreover, it increases the political and economic dependence on Russia. Finally, it is more expensive than onshore pipelines, increasing the cost to consumers even further. Political influence, a cosy relationship with Russia and corruption hence may also explain suppliers' market power.

Other Domestic Factors. Other issues include the lack of transparency and infrastructure. Most highly developed national gas and energy markets benefit from a high degree of transparency and availability of data. That is the case in the US, in the UK and e.g. Japan at least publishes monthly data on gas import prices and quantities broken down by country of origin. The German federal ministry of the economy publishes

[115] Running from Russia via the Baltic Sea's seabed directly to Germany, circumventing traditional transit (and consuming) countries in Eastern Europe. Under construction as of 2011.

monthly averages, which are not broken down by country of origin. While this may seem a small matter, it is indicative of the general lack of transparency in the German gas market, which also explains in part its dysfunctional nature.

Finally, as was noted in an expert interview, there are no LNG terminals in Germany (also see Figure 6.2 in this chapter). Given that LNG is an increasingly important means of transportation for gas and offers the benefits of flexibility and diversification of supply sources, LNG import facilities could add tremendously to competition in Germany, especially if LNG is imported not via oil-indexed long-term contracts.[116]

Vertical Integration. Another factor explaining the existence of market power in the German gas market is vertical integration of companies from upstream production (abroad) to downstream distribution (in Germany).[117] This practice started decades ago when Shell and Exxon produced gas in the Netherlands and then sold it to BEB in Germany. BEB was a joint venture, owned by Shell and Exxon. Hence, sales from the upstream producer to the wholesale importer (which also distributed gas to retail customers) were essentially intra-company sales rather than supply and purchase agreements of separate companies.[118] Price-setting was therefore an internal affair of a vertically integrated company.[119] Unbundling of such vertically integrated companies began in the late 1990s and early 2000s, hence market structures that dominated the German gas sector for decades are slowly changing.[120]

Yet, as unbundling of German utilities and companies that used to dominate both upstream and downstream production is underway, one firm is going into the op-

[116] Expert Interview, Jonas Graetz, Project Associate, German Institute for International and Security Affairs (SWP), Berlin, July 2011.
[117] Asche et al. “European market integration for gas? Volume flexibility and political risk”, 2002, pp. 251-253.
[118] Expert Interview, Anthony Melling, European gas market expert and former senior executive at British Gas, London, July 2011.
[119] Expert Interview, Jonas Graetz, Project Associate, German Institute for International and Security Affairs (SWP), Berlin, July 2011.
[120] Expert Interview, Anthony Melling, European gas market expert and former senior executive at British Gas, London, July 2011.

posite direction: Gazprom. The Russian monopolist is actively engaged in expanding its reach across the value chain from upstream production in Russia to ownership of transmission (midstream) infrastructure to downstream distribution systems. For example, Gazprom has a subsidiary in Germany jointly owned together with Wintershall (a BASF company). The subsidiary, Wingas, has a 20 percent market share in Germany, which gives Gazprom access to the retail consumers.[121] Table 6.11 illustrates Gazprom's vertical integration strategy and efforts in various European countries.[122] Hence, in addition to all the other factors presented in this sub-section, vertical integration is another explanation for market power in the German gas sector.

Table 6.11: Gazprom's Expansion Abroad[123]

	Share of Domestic Pipeline	Share of Transit Pipeline	Direct Sales to Customers	Campaign to Gain Pipeline Contract
Austria			x	
Buglaria	x		x	
Estonia			x	
France			x	
Germany	**x**	**x**	**x**	**x**
Greece				x
Hungary		x	x	
Italy			x	
Poland		x		
Serbia	x	x		

[121] Jonas Graetz, "Nationale Ressourcen im globalen Kontext: Zur Internationalisierung russischer Öl- und Gaskonzerne", Russland-Analysen Nr. 217, Freie Universität Berlin, Osteuropa-Institut, 25 March 2011, p. 12.
[122] The list of these ventures is actually much more comprehensive, but only a select few countries are presented here.
[123] Table: author; Data (selection): Marshall Goldman, *Petrostate: Putin, Power, and the New Russia*, New York: Oxford University Press, 2008.

6.5. Consequences of Market Power and Conclusion

Section 3 of this chapter demonstrated that suppliers of natural gas enjoy a high degree of market power in the German market as evidenced by the Lerner Index result. The CPM indicates that this market power is mainly caused by a highly concentrated market structure and by relatively inelastic demand, both of which give producers pricing power and allow them to earn considerable economic rents.

Germany, unlike Turkey, is a rich country in which expensive gas is not an issue of basic welfare. However, there are welfare considerable implications worth noting. In a World Bank study, Gazprom's gas pricing strategy was discussed and the welfare effects of current pricing practices in comparison to competitive (LRMC) pricing were calculated. These are the results for the whole of Western Europe: "If Gazprom were to sell its natural gas to Europe at its full long-run marginal cost plus transportation costs, Gazprom would lose between $5 billion and $7.5 billion per year. However, in the first instance consumers in Europe would gain between $7.5 billion and $10 billion per year because they could consume more gas at cheaper prices, partly from switching from other energy sources and partly from using more gas with existing technology."[124] Given that Germany is by far Gazprom's largest export destination, a considerable share of the amounts of lost economic rent (for Gazprom) and increased welfare (for consumers) would accrue in Germany. Aside from economic welfare arguments, more competitively priced gas—not just from Gazprom, but also from the other suppliers—would lead to a higher degree of consumption of gas, displacing high-carbon alternatives such as coal in power generation and heating oil in the residential heating sector. Therefore market power creates not only economic rents that are earned by exporters at the expense of the consumer, but it also incentivises the use of fuels cheaper (and dirtier) than natural gas.

[124] Tarr and Thomson, "The Merits of Dual Pricing of Russian Natural Gas", 2004, p. 1174.

Arguments for reducing market power and rents can hence also be made on environmental grounds.

Finally, artificially high gas prices also impact competitiveness negatively. "Industrial consumers have been among the main driving forces for a liberalization of the German market. German industry has paid some of the highest gas prices in Europe, and increased competition among energy suppliers would make German manufacturing industries more competitive abroad."[125]

In the German case, the conduct parameter model and empirical data were very helpful in estimating the conduct of producers, which was non-collusive in the period of time under investigation, i.e. from 2006 to 2008. The subsequent qualitative discussion showed a whole range of other factors that are not part of the model and which are significant explanations for market power in the German gas market.

[125] Asche et al., "European market integration for gas? Volume flexibility and political risk", 2002, pp. 251-253.

6.6. Appendix

Marcel Dietsch
DPhil Candidate
University of Oxford

Issues and Questions for Expert Interview - Germany

Core task of my research: Determining whether open cooperation or collusion among Germany's gas suppliers—Russia, Norway and the Netherlands—explains the large difference between the producers' marginal cost of production and import prices paid at the German border.

I hope to have a wide-ranging conversation with you about the following issues and questions:

- Relationships between the natural gas suppliers and the importers
  - Especially between foreign suppliers and German utilities/buyers
  - And foreign countries' governments and the German government
    - Economic dimension
    - Political dimension
    - Important issues in these economic and political relationships between the exporters and Germany
  - Are you aware of any evidence or indications (implicit or explicit) that producers talk to each other when in negotiations with German buyers?

- Competition in German energy /gas markets
  - Level of competition in the domestic natural gas market and other markets (electricity)

- In terms of public policies/energy policy, what is the state of gas and electricity market liberalisation? Are German and European Union policies being fully implemented?

- <u>Issue of market power</u>

  - There is a considerable difference between the border prices of gas imports into Germany and the exporters' marginal cost of production. Such uncompetitive pricing still exists despite the European Commission and the German federal government's efforts to introduce more gas-to-gas competition after 1998. (This difference also exists when oil prices are either high or low, so oil indexation itself is not a satisfactory explanation.)

    - In your view, why are prices still two to six times higher than the marginal cost of production?
      - Market structure/oligopoly? Influence of German utilities trying to cement their market power? Other reasons?

Questions regarding pricing data:

- Is there much of a difference between import prices for Dutch, Norwegian and Russian gas?
- Data on prices for indigenous German gas production? And MC estimates?

List of Experts Interviewed for Germany Case Study

28 July 2011

Anthony Melling, gas market consultant and former senior executive, British Gas, London.

Jonas Graetz, Project Associate, Research Division Russian Federation/CIS, German Institute for International and Security Affairs (SWP), Berlin.

Chapter 7
Cross-case Comparisons and General Lessons for Gas Markets, Cooperation and Cartelisation

7.1. Overview

Every case study chapter described in great detail the respective importing country, its suppliers, the suppliers' cooperative efforts and policies. It also measured the extent to which collusive conduct among the producers explains market power in the importing market. Finally, the outcome of the conduct parameter model was put into perspective by qualitatively discussing the result and other possible factors that affect market power. The task in this chapter is compare the three case studies in order to determine what one can learn from the cases about gas markets and about international cooperation and commodity cartels more generally. Given that the focus so far was mainly on political economy issues concerning how cooperation among states can support cartelisation efforts as well as market power, the connection to the politics and power will be emphasised.

7.2. Cross-case Comparisons

7.2.1. Structural Conditions

The conduct parameter method in each chapter analysed three factors that explain producer market power. The CPM is an improvement from earlier attempts to link market concentration to market outcomes. This was attempted to both explain market power and the likelihood of success of cartelisation. The empirical link turned out to be weak regarding market power and insufficient regarding cartelisation as the literature review showed. Moreover, the empirical evidence in the chapters shows that market concentration is not correlated with the degree of market power, with the lowest concentration observed in Japan, where the degree of market power is highest. Also, collusive effectiveness—to be found in Turkey and Japan—is not directly correlated with market concentration either: Germany, where the outcome of the CPM analysis was non-collusive has a higher degree of concentration than Japan (both in terms of the number of suppliers and as demonstrated by the Herfindahl Index) as Table 7.1 shows.

Table 7.1: Market Concentration[1]

Number of Suppliers (#) and Herfindahl Index (H)

	Germany		Japan		Turkey	
	#	H	#	H	#	H
2006	4	0.268	11	0.161	4	0.466
2007	4	0.275	12	0.142	5	0.465
2008	4	0.283	12	0.14	5	0.542

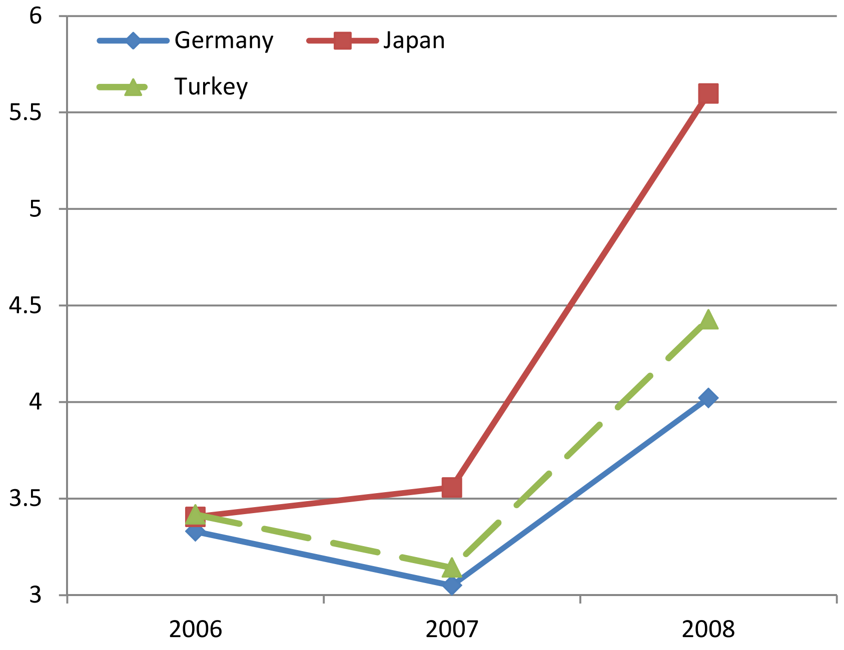
Another component of the conduct parameter model is the elasticity of demand. In all three cases, the elasticity is between 0 and -1, that is, in the inelastic range. Inelastic demand is conducive—and indeed necessary—for a price-raising cartel to work.[2] Hence, the structural conditions for cartelisation and collusive price action exist in all three cases. Yet, I find evidence of such collusion in only two of the three cases, Japan and Turkey, where GECF members dominate the countries' supply. (A discussion of the broader significance of the GECF is to follow in this chapter.)

[1] Table: author; Data: from case studies.

[2] As a reminder, an elasticity of 0 would imply no quantity reaction to prices changes. An elasticity of -1 would imply that as prices go up by 1 percent, the quantity demanded will go down by the same amount of 1 percent. Elastic demand would be a figure smaller than -1, which means that as prices e.g. rise by 1 percent, the quantity demanded will go down by more than 1 percent. Inelastic demand is between 0 and -1 and implies the opposite: As price goes up, the quantity demand falls less (proportionally) than the price rises. Inelastic demand is crucial for cartels since it is the only way that revenue will increase as cartel members increase prices (because of the proportionally smaller quantity reaction).

Figure 7.1: Mark-up over Marginal Cost

(Price as Multiple of MC)[3]



The main structural conditions—market concentration enjoyed by a small number of producers and inelastic demand—are hence favourable for collusion and cartelisation in each of the cases. What about other structural factors? The regional and fixed nature of pipeline infrastructure may be another reason favouring collusive conduct and hence the exercise of market power. The comparison between Turkey and Germany where there are fixed pipelines with Japan, where there is (at least theoretically) the possibility of flexibility and speedy diversification of resources due to the use of LNG, could be instructive. Yet, I find that in the case in which flexible LNG suppliers are possible, the degree of market power as evidenced by the mark-up over marginal cost is highest (see Figure 7.1[4]).

On the face of it, it may seem puzzling that Turkey and Germany, which have to make do with fixed pipelines (and hence fixed suppliers, which are at the other end of

[3] Chart: author; Data: based on data and results from case study chapters 4, 5 and 6.
[4] Reproduced from chapter 1.

those pipes), face less producer market power than Japan. There is an explanation for this.[5] Japan uses long-term contracts that are very similar to the ones used for supplies to Germany, Turkey and indeed in most other markets outside the US and the UK. Such long-term contracts created fixed consumer-supplier relationships and limit flexibility in the same way that fixed infrastructure does. One reason is that most suppliers oppose shorter-term contracts, especially Japan's GECF suppliers. Hence, while fixed network-based infrastructure such as pipelines are a natural barrier to market entry, Japan theoretically could enjoy more flexibility were it not for artificial market entry barriers such as the long-term contracts defended in particular by GECF members. (Turkey and Germany also face similar artificial market entry barriers as well, which present an additional element that stifles the entry of competitors aside from infrastructure limitations.)

7.2.2. Procedural Conditions

Given that producer conduct[6] is a procedural rather a structural factor in the analysis of cartelisation, the conduct parameter outcomes are presented here. Each individual chapter showed the outcome for each year including 2006, 2007 and 2008. Here, the average of these three years was produced for each case to make the cross-case comparison more straightforward.

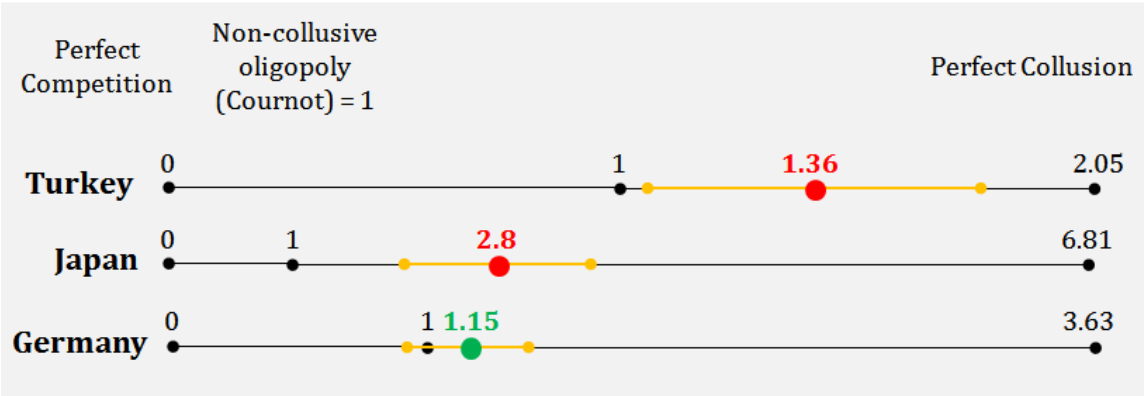
As Figure 7.2 shows, the producer conduct is, according to the CPM outcomes, most collusive in Turkey (at 1.36 out of 2.05 rather far above the non-cooperative oligopoly outcome at 1). In Japan collusion also plays a fairly important role with an average result of 2.8 out of 6.81, producer conduct is significantly above the non-cooperative outcome. Only in Germany is the CPM result around 1, the non-cooperative outcome. The average result is slightly above one, indicating a very small (and essen-

[5] Also see hypothesis 5, chapter 8 (8.2.5).
[6] As measured in the conduct parameter model.

tially negligible) degree of collusion. If one compares the numbers in Figure 7.1 and Figure 7.2, i.e. the connection between market power (measured as mark-up over marginal cost) and the CPM, a correlation can be observed.

Figure 7.2: Spectrum of Possible and Actual Conduct Parameter Outcomes[7]

(Averages for 2006, 2007 and 2008)



Given similar circumstances in terms of structural conditions—in all markets there is concentrated supply and demand tends to be inelastic—the producer conduct is the only factor correlated with the degree of market power being exercised in a market.[8] That is, there is both a higher degree of market power and collusion in the Japan and Turkey cases, but in Germany—where collusion is not a significant factor—the degree of market power is lowest. The question of causation and the direction of causality regarding producer conduct and the GECF's role in this will be discussed later in this chapter. Moreover, the other two major procedural issues faced by a group of producers aiming to cooperate—the internal procedural challenge of detecting and punishing defection from joint agreements and the external challenge of keeping non-member pro-

[7] Chart: author; data: from case study chapters.
[8] There was no clear and consistent relationship between market power on the one side and inelastic demand and market concentration on the other side as pointed out in the paragraphs before.

ducer out of the cartel's market—will be discussed both from a comparative perspective and in general terms in the section on the significance of the GECF.

Before examining the robustness of the overall analysis in this thesis, a few words concerning other similarities across cases are in order. As the literature review showed, part of the scholarship on cartelisation focuses on game-theoretic models that model internal procedural challenges such as cheating and defection as prisoners' dilemma-type collective action problems. One of the lessons from this thesis is that a detailed study of the empirical reality unveils factors that may either be overlooked in abstract analyses or are too specific or complex to be modelled. For example, cheating and defection problems might be less severe in some cases. Moreover, domestic factors, in particular the influence of politicians as well as corruption were discussed in each case study. Political influence and corruption played a role in every case. Moreover, in Japan cultural factors[9] were also considered to be important in terms of understanding why market power exists.

7.2.3. Robustness of the Analysis

In the case studies, it was explained that the period of time under consideration—from 2006 to 2008—was chosen for a variety of reasons that will be mentioned only very briefly here. For one, the data requirements for the conduct parameter model are considerable. Obtaining all the necessary data for three years was challenging enough. For the time after 2008, data was often not yet available. For the time before 2006, some data was (still) available, but not all necessary inputs. Also, the time frame seem expedient since the main objective is to determine to what extent producer cooperation led by the GECF explains market power in various import-dependent countries.

[9] See chapter 5.

The GECF was only founded in 2001, hence trying to estimate the impact of the organisation right after its creation—and before any decisions were taken—was likely to be fruitless.

Yet, the data constraints and other justifications for the chosen time frame are no excuse for not conducting a test of the results' robustness. While market concentration and elasticity of demand tend to change very slowly, their variation is likely to be minimal in the years before and after the chosen period of time. Marginal costs have risen along with the prices of gas (and also declined slightly in the wake of the financial and economic crisis.)[10] The variable with the highest volatility is actually the price of gas. Given relatively stable elasticity and market concentration figures, the price of gas tends to have the biggest impact on the CPM outcome over time. Yet, calculations of the CPM result with randomly selected partially available price data show that the result post-2008 and pre-2006 are generally consistent with the results generated in the case study chapters. While pre-2006 prices were lower than during the period of time between 2006 and 2008, marginal costs were also lower.[11] That means the price-cost differential was similar because prices and marginal costs often change together. The same is true of the post-2008 phase, where due to the economic prices both prices and cost estimates fell together.

[10] The IHS CERA Upstream Cost Indicators were used in the CPM analysis and show the subsequent development of upstream cost indicators. http://www.ihsindexes.com.

[11] See case study chapters for details regarding this, especially the part on the Upstream Cost Index that was used to account for inflation in marginal costs.

7.3. Political Dimension and Power

While the case studies explored various specific political dynamics that affect gas producer cooperation, this section will bring together the various political factors. The connection of this study of gas market cartelisation driven by GECF members to politics and power are manifold. First, GECF members' practice to regularly convene political actors (nation states and their affiliated state-owned gas companies) at the international and national government levels with the objective to cooperate and coordinate their affairs in order to influence markets and economic outcomes is in itself inherently political.[12] While the collusive practice of (narrowly defined) price fixing can be inferred from the CPM, the GECF's cooperative actions go beyond this traditional form of cartelisation. The overt, cooperative policies endorsed by GECF members include broader forms of cooperation, especially with regard to shaping market conditions[13] such as the maintenance of artificial market entry barriers (long-term contracts, destination clauses and so on). That is, GECF members (also) use political means to achieve the aim of rent-maximisation. The creation of the GECF itself is also a political reaction by states aiming to protect their market power and economic rent to the policy decision by the European Commission in 2001 to press ahead with liberalising the European gas market.

Second, the (procedural) determinants of cooperation are also mainly political in nature. For the GECF's challenge of keeping non-GECF gas production out of 'their' market is often met through political means. In the case of Turkey, Turkmenistan and Azerbaijan did have the potential to diminish GECF's market power and economic rent in the Turkish market, but Russia and Iran both managed to keep those two countries

[12] Meaning the involvement of governments in market decisions and outcomes.

[13] For a conceptual political economy treatment of "politics shaping market conditions", see Robert Gilpin, *The Political Economy of International Relations*, 1987, p. 9.

out of the GECF. At the same time, they also limited the volumes Azerbaijan could sell to Turkey and undertook efforts to stop Turkmenistan from fulfilling its delivery obligations to Turkey altogether.[14]

Some have argued that the gas prices charged by Gazprom in the CIS are 'political prices.' "The absence of competitive pressures in pricing has led to "political" prices, reflecting more interstate relations than costs and benefits (e.g. between Russia and its newly independent neighbours), and the balance of market power when stronger states interact. The latter has led to a negotiated pricing formula for delivery of natural gas to Europe based on the market price of a primary potential fuel substitute, oil [which is a] highly advantageous price to the seller."[15] Prices reflecting the political relations between sellers and buyers may be a particular phenomenon in the CIS states. In Western Europe and Turkey, sellers tend to prefer profit-maximising prices, i.e. the highest possible prices they can get. Hence there are not just political elements in terms of the determinants of cooperation, but also in terms of exporters' objectives.

A related argument was advanced by Timothy von Ochssee. "For Russia, cooperation with important gas-exporting countries in and outside the gas ellipse translates into political power because of Russia's ability to gain influence vis-à-vis the US in the rimland. Such cooperation also enhances Russia's bargaining position vis-à-vis the EU. The possibility of organising political cooperation and cohesion through common interest in a comparatively new dossier, i.e., in the sphere of an expanding but uncertain, interregional gas market, offers Russia additional international political clout. Internation-

[14] See chapter 4 for a detailed discussion of this issue.
[15] Richard Ericson, "Eurasian Natural Gas Pipelines: The Political Economy of Network Interdependence", *Eurasian Geography and Economics*, vol. 50, no. 1, 2009, p. 37.

al, horizontal energy diplomacy may therefore prove to be expedient, as long as it does not affect Russia's sovereignty."[16]

However, not only cooperation and joint "energy diplomacy" e.g. with other GECF members contribute to a state's political power. Producers aim to achieve high gas prices, because of the political imperative to secure their power (of both the state and the politicians who run it). For example, as a Brookings Institution report argues: "In the end, Russia's strength is garnered not from energy production, but rather from the wealth generated by windfall profits from high energy prices."[17] This wealth and power argument was already briefly introduced in chapter 1. A considerable amount of economic rent earned from (oil and) gas exports can bolster a state's power by expanding its political capabilities. Declining rents threaten the power position of both the leadership and the state itself. The Soviet Union did not collapse due to a drastic fall in oil and gas prices in the mid-1980s alone, but it surely had an important impact as Soviet oil and gas rents collapsed from US$350 billion in 1980 to around US$100 billion just five years later.[18]

[16] von Ochssée, "The Dynamics of Gas Supply Coordination in a New World: Cooperation or competition between gas-exporting countries from a Russian perspective", 2010, p. 373.
[17] Unknown Author, "The Russian Federation", *The Brookings Foreign Policy Studies Energy Security Series*, The Brookings Institution, October 2006, p. 4.
[18] Unknown Author, "The Russian Federation", *The Brookings Foreign Policy Studies Energy Security Series*, The Brookings Institution, October 2006, p. 8.

Figure 7.3: Nominal and Real Prices of

Brent crude oil in US$/barrel[19]

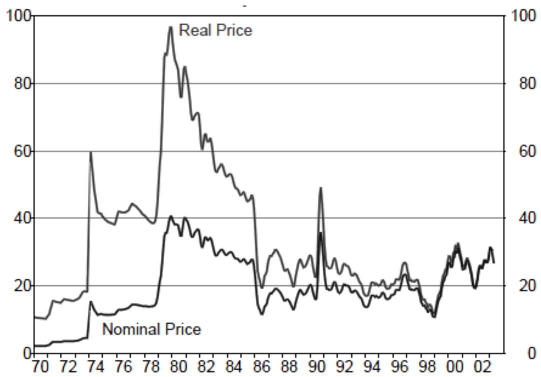
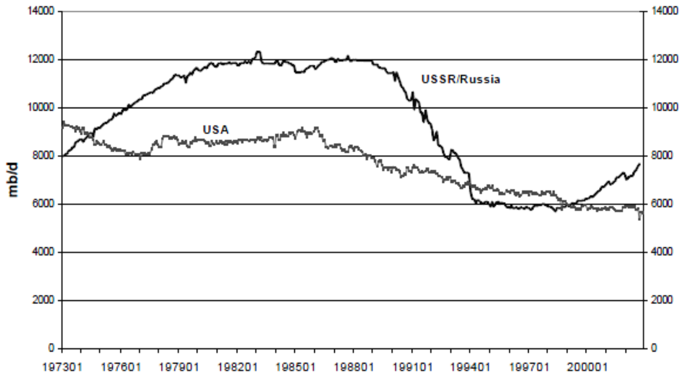


Figure 7.3 shows the collapse of the oil price in the 1980s, which in real terms declined by around 80 percent between 1980 and 1986. The quantity produced (Figure 7.4) remained flat throughout the 1980s for the Soviet Union. The implications for the Soviet's state budget could hardly have been more serious.

The post-2000 recovery and surge in commodity prices had exactly the opposite effect on Russia. That was in part also due to the fact that the Russian state managed to capture a larger part of this rent after Vladimir Putin took over the presidency in 2000 (see Figure 7.5 for the rent distribution in Russia). Marshall Goldman, in his book on petro politics, was one of the first analysts to point out that the rise in oil and gas prices would profoundly changing Russia's foreign policy.

[19] International Monetary Fund.

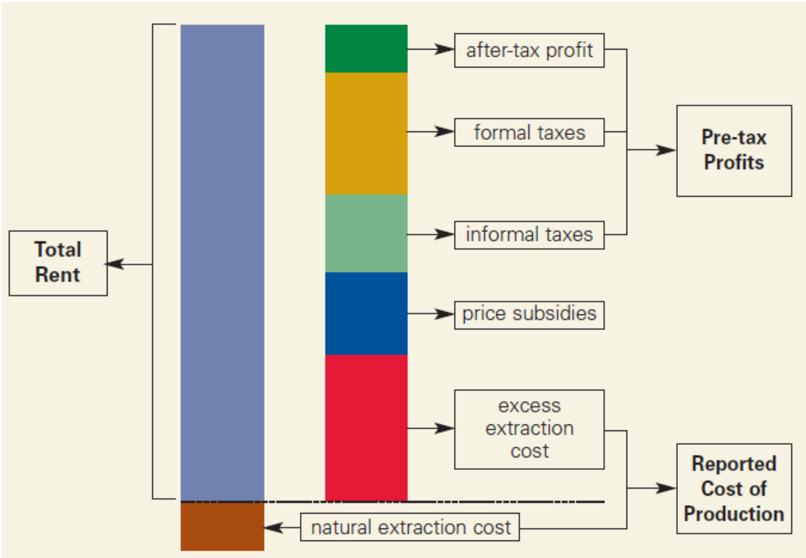
Figure 7.4: Oil production, USSR/Russia and US[20]



Goldman argues that high oil prices bring mostly economic benefits (which of course could also translate into political strength) while higher gas prices bring geopolitical benefits: "petroleum exports have generated the cash blizzard that has made Russia rich… but [Moscow's] monopoly control of gas pipelines… transformed Russia from an anaemic and essentially bankrupt charity case into a robust energy superpower with restored political muscle."[21] This has also changed the way in which resurgent Russia deals with its neighbours. The aggressive stance and invasion in Georgia in 2008 is an example of that.[22] Similar thematic arguments about the change between paradigms of "markets and institutions" on the one hand and "regions and empires" on the other have been made as well.[23]

[20] Ibid.
[21] Goldman, *Petrostate*, 2008.
[22] I thank my DPhil supervisor Neil MacFarlane for this suggestion.
[23] Dominique Finon and Catherine Locatelli, "Russian and European gas interdependence: Could contractual trade channel geopolitics", *Energy Policy*, No. 36, 2008, p. 425.

Figure 7.5: Natural Gas Production in Russia: Rent-sharing[24]



The main focus of this thesis was of course not just on Russia, but other GECF members as well. (Because of its size and its large resource endowment and gas production, Russia is the most salient example and hence discussed more often.) Other examples include Malaysia and Indonesia: Depressed resources rents also contributed to other political and economic crises in 1997 and 1998 when the oil price (and hence oil-index gas prices) reached a low of US$12, almost eliminating the economic rent usually earned by producers. In 1998, Russia defaulted on its debt and plunged into a crisis. Malaysia and Indonesia, two other important long-term exporters of oil and gas, almost collapsed. Indonesia's ruler Suharto was removed amid wide-spread protests and discontent in 1998. Securing economic rents in heavily export-dependent countries through high prices is therefore a political imperative. Hence, both the cooperative process within the GECF is partly political and the motivations for the GECF's creation and objective are political in the sense that cooperation to achieve higher prices and rents is crucial in terms of securing the survival of those states and their rulers.

[24] Brookings Institution, "The Russian Federation", 2006, p. 8.

7.4. Significance of the GECF and why does Cooperation work?

Another overarching issue in this thesis is the significance of the GECF as an international organisation. The GECF and GECF membership of a natural gas exporting state are important factors in terms of explaining producer cooperation in the gas market. The GECF is sometimes dismissed as unimportant[25] in part because of its low degree of institutionalisation.[26] A comprehensive empirical account of the GECF's and their members' cooperative objectives and policies was documented in the case study chapters of this thesis (which should constitute the most detailed description and analysis of this issue anywhere in the literature so far). This account is the starting point for considering the significance of the GECF in terms of successfully achieving their stated goal of closer cooperation to avoid competition, to raise and to maintain economic rents derived from gas exports.

The GECF is a venue for both secret collusion and open cooperation. One of the institutional properties of the GECF is to facilitate the exchange of information and data regarding gas markets in order to help producers to coordinate their actions, which contributes to avoiding unnecessary competition in their respective markets. Information exchange may include information on prices, contract terms and quantities concerning producers' secret contracts (traditional collusion). It also, among others, includes exchange of information regarding current and investments and plans for capacity expansions. This is a broader type of cooperation, but has the same objective: managing future capacity expansions to avoid creating too much capacity at the same time is, in effect, the same as artificially restricting output to drive up prices. Other issues concerning more open and broader forms of cooperation include pricing mechanisms (e.g. oil-

[25] See the literature review concerning the GECF in chapter 1.
[26] See the section on the significance of the "level of institutionalisation" in chapter 7.

indexation), retaining artificial market entry barriers such as long-term contracts and so forth.

Stated objectives and cooperative efforts do not necessarily translate into cooperative success measured in terms of outcomes. However, it turns out that in the cases considered for this thesis, the producer collusion and cooperation is an important explanatory factor contributing to producers' market power as evidenced by the quantitative model (CPM) results and by the qualitative, contextual discussion of political and economic factors. But it is due to the GECF? After all, every producer that supplies a certain market, including the non-GECF states, could secretly collude in other venues or even via telephone.[27] The CPM result shows collusive conduct for all market participants, not just for GECF members. How can one determine the specific significance of the GECF in terms of measured cooperative success (as opposed to the cooperative process)?

Both the case study design—and indeed the outcomes of the case studies—and the empirical data on prices help one to address this question. First, three similar country cases were selected from the case universe: Germany, Japan and Turkey. All three countries—as the preceding summary in this chapter shows—were highly dependent on gas imports, had a relatively small number of foreign gas suppliers[28] and had inelastic demand for natural gas. Moreover the domestic market in each of these countries suffers from structural rigidities, a lack of competition and is dominated by a few incumbent wholesale importers. In other words, the structural conditions are similar and they are conducive to giving (foreign) gas suppliers market power and hence the ability to extract economic rents.

[27] Collusion at the international level and especially among sovereign states and their state-owned companies is not illegal and no national anti-trust/competition authority can realistically intervene.
[28] Although (with very few exceptions) not the same suppliers, so that phenomena related to a certain set of suppliers could be excluded.

One of the three cases in this thesis was the hypothesised 'negative' case study (Germany) in which many if not most characteristics were very similar to the two other cases except for one: of Germany's foreign gas suppliers only one, Russia, is a member of the GECF. Where there is only one member state, cooperation among GECF members cannot take place since that would require two or more members.[29] The CPM results confirm this. The outcome for the German case does not indicate collusive producer conduct, but instead the result is the *non-cooperative oligopoly* outcome.[30] In contrast, the outcomes for the Turkish and Japanese markets (in which mostly GECF member states dominate gas supply to these countries), are in both cases clear: a significant degree of producer collusion exists. Suppliers in Turkey and Japan surpass the German outcome—the "equilibrium of failed cooperation"[31]—and achieve a degree of collusion.[32] Given similar circumstances in all cases, but different outcomes, one can infer that the GECF seems to successfully facilitate cooperation and collusion in those markets in which GECF members dominate supply.

To corroborate the finding that collusion explains in part producers' market power and that collusion is specific to the GECF members (and does not include non-GECF suppliers), one must consider another element of empirical evidence. The evidence presented in case study chapters 4 and 5 on Turkey and Japan show exactly that. The significant price differential between members and non-members of GECF confirms the hypothesis: supplying countries that are not part of the GECF, e.g. Australia and the United States in the case of Japan and Azerbaijan in the case of Turkey, charge

[29] Yet, theoretically, other producers could still collude among each other or with the sole GECF supplier.
[30] That also means that neither of Germany's suppliers collude. (It could have been that, e.g. Norway and the Netherlands collude, which would have shown a collusive outcome in the CPM result.)
[31] I thank Professor Duncan Snidal at Nuffield College, Oxford for this suggestion. He pointed out that the non-cooperative oligopoly result is often also called an outcome of failed cooperation.
[32] Selecting cases on the independent variable, cooperation, helps determine the significance of the GECF in another way too. Had producers that supply the German market colluded anyway (despite the absence of GECF-led cooperation), it would show quite clearly that the GECF may be rather unimportant in the other cases.

significantly lower prices than those within the GECF. At the same time their marginal cost of production is higher (that is true in the case of the US and Australia). Non-GECF members charge lower prices while incurring a higher marginal cost of production. That means that GECF membership and high economic rents[33] are evidently connected. It also shows that cooperation as evidenced in the CPM results is not a general producer phenomenon, but is specific to the GECF member states, at least in the cases considered here.

Another issue is the direction of causality. Does the GECF enable its members to earn higher rents? Or are the countries that are members of the GECF simply more prone to collude than others anyway? If that were true, the GECF's existence would be epiphenomenal. I conclude that GECF members must believe that they get a return on the time and money they invested in creating and maintaining the GECF. If the GECF had no (perceived) value for the producers, they would be unlikely to pay membership fees, to maintain a bureaucratic structure and to use ministers' time for regular meetings. Indeed, in 2008 the GECF formalised and strengthened the organisation, which suggests that producers derive some value in terms of generating better cooperative outcomes.[34]

According to the empirical analysis in the case study chapters, the main value of the GECF can not only be observed in terms of achieving higher economic rents. Procedurally, in addition to information and data exchange, the GECF helps manage an important *external* challenge any cartel or cartel-like organisation faces: keeping non-member producers out of 'their' market, in terms of preventing current and future sales. The capacity for non-GECF members to expand sales in Turkey and Japan is extremely

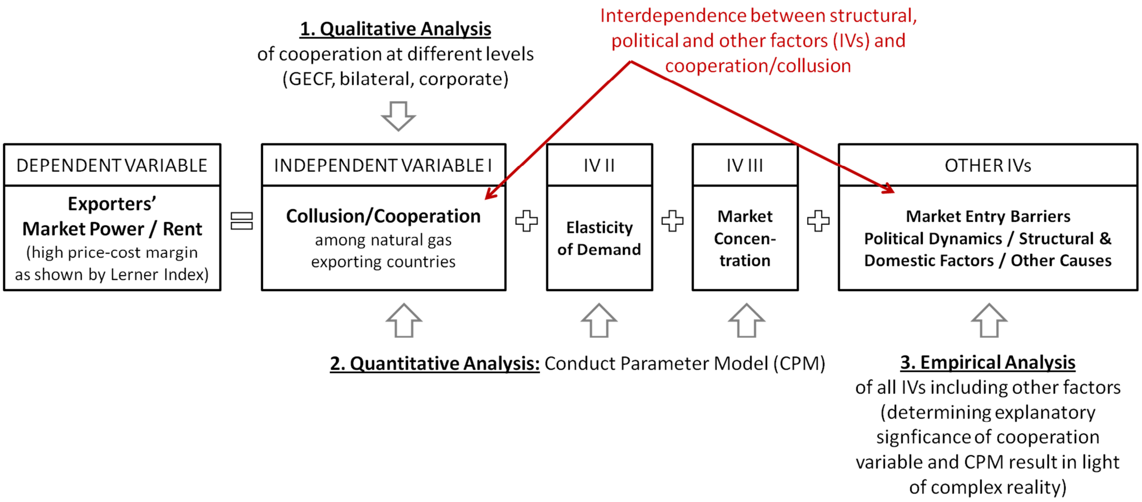
[33] Economic rent is basically the difference between prices and the marginal cost of production. The GECF member countries' prices are higher than those of the non-GECF member while their production cost is lower.
[34] I would like to thank Neil MacFarlane for this suggestion.

limited since there are fixed, long-term contracts which commit buyers to taking deliveries from their long-term suppliers. Moreover, the practice of defending secretly negotiated long-term contracts often with destination clauses means that artificial market entry barriers will keep out large volumes of potential non-GECF supply in the future as well.

These artificial market entry barriers, which GECF members jointly defend,[35] are part of a broader phenomenon: the preservation of the uncompetitive structure that exists in so many (especially import-dependent) gas markets. There is an interdependence between the ability to collude and the maintenance of artificial market barriers mentioned here. The producers cooperate in terms of keeping the market structure uncompetitive (and keep out producers that are non-members). These market structures make collusion among GECF easier. Hence GECF members kill two birds with one stone: defending artificial market entry barriers not only helps manage the 'external challenge' of keeping out non-member producers, it also facilitates the collusive process itself.

[35] See case study chapters for details, especially chapter 5 on Japan.

Figure 7.6: Cooperation and Collusion are Interdependent[36]



A final issue is the pricing mechanism for gas. The GECF uses this as a means of deriving the maximum economic rent as well, by favouring oil-linked gas prices most of the time (when oil prices are relatively high) and by preferring more gas-to-gas competition on the spot market (with gas prices decoupled from oil) when spot prices are higher than oil-indexed prices. This practice was described in detail in the Turkey and Japan case studies.

Owing to the complex and rigid structure of the gas market, these are methods of cartelisation that are not often discussed in the literature on cartels and producer cooperation. The use of artificial market entry barriers such as the ones mentioned above may merit closer inspection in other markets to get a better understanding of cartelisation efforts and market power, especially when traditional concepts of cartelisation are unsatisfactory.

Having discussed the significance of the GECF in explaining market power in gas markets, one must ask what (apart from favourable structural conditions) makes cooperation feasible within the GECF and what we might learn from this about cartelisa-

[36] Chart: author.

tion and cooperation more generally. Various reasons are conceivable. There might be certain similarities among GECF members and among non-members. The issue of specific objectives and motivations for these objectives among exports could be important. Perhaps there are procedural advantages that are conducive to cooperation in gas markets? Finally, the question of why a weak organisation such as the GECF with low levels of institutionalisation can be effective (according the results in this thesis) must be addressed.

First, it is sometimes suggested that prior cooperative and institutional experience contributes to better cooperative outcomes. As Krasner argued regarding OPEC: "The greater the level of shared experience among producers, the more aware they will be of their mutual interdependence. Shared experience also makes it more likely that producers will agree on principles that enable them to allocate the burden of market control."[37] Karen Mingst pointed to the same political factor in her study on cartelisation in the copper market that a "[…] background of shared successful experiences in producer regulatory activity is apt to expedite cooperation."[38] Indeed, it may be prior experiences within OPEC that made cooperation among GECF more feasible.

Table 7.2: GECF Members and OPEC Membership, 2001-2008

Tehran 2001	**Algiers** 2002	**Doha** 2003	**Cairo** 2004	**Port of Spain** 2005	**Doha** 2007	**Moscow** 2008

[37] Stephen Krasner, "Oil is the Exception", *Foreign Policy*, no. 14, Spring 1974, p. 75.
[38] Karen Mingst, "Cooperation or Illusion: An Examination of the Intergovernmental Council of Copper Exporting Countries", *International Organization*, vol. 30, no. 2, Spring 1976, p. 265.

Algeria Brunei **Indonesia** **Iran** Malaysia **Nigeria** Oman **Qatar** Russia Turkmenistan Norway*	**Algeria** Bolivia Brunei Egypt **Indonesia** **Iran** **Libya** Malaysia **Nigeria** Oman **Qatar** Russia **Venezuela**	**Algeria** Brunei Egypt **Indonesia** **Iran** **Libya** Malaysia **Nigeria** Oman **Qatar** Russia T&T **UAE** **Venezuela** Norway*	**Algeria** Brunei Egypt **Indonesia** **Iran** **Libya** Malaysia **Nigeria** Oman **Qatar** Russia T&T **UAE** **Venezuela** Norway*	**Algeria** Brunei Egypt **Eq. Guinea** **Iran** Malaysia **Nigeria** **Qatar** Russia T&T **UAE** **Venezuela** Norway*	**Algeria** Bolivia Egypt **Indonesia** **Iran** **Libya** Malaysia **Nigeria** **Qatar** Russia T&T **UAE** **Venezuela** Norway*	**Algeria** Bolivia Brunei Egypt **Indonesia** **Iran** **Libya** Malaysia **Nigeria** **Qatar** Russia T&T **UAE** **Venezuela** Norway* Eq. Guinea*
Source: Hadi Hallouche (2001-2005 meetings)[39]; IHS Global Insight (2007)[40]; Reuters (2008)[41] * means observer status / in bold: OPEC members[42]						

According to the OPEC website, the following countries are members: Iraq, Iran, Kuwait, Saudi Arabia, Venezuela (since 1960), Qatar, Indonesia (1961), Libya (1962), UAE (1967), Algeria (1969), Nigeria (1971), Ecuador (1973), Gabon (1975) and Angola (2007).[43] Ecuador suspended its membership from 1992 to 2007 while Gabon left in 1995.[44] Table 7.2 shows which of the GECF member countries belong to OPEC as well. What is interesting is that almost all non-GECF members analysed in the case studies—Australia, the Netherlands, Norway and the US—are all members of what may be called OPEC's rival organisation, the International Energy Agency.[45] The IEA was founded in 1974 by OECD members in part to counteract OPEC's cartelisation efforts.[46] Conversely, none of the GECF members are members of the IEA. Table 7.2 shows that more than half of all GECF members have been are members of OPEC as

[39] Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making?", 2006 , p. 17.
[40] Unknown Author, "Gas Exporters Stop Short of Declaring a Cartel", IHS Global Insight, 10 April 2007.
[41] Katya Golubkova and Dmitry Zhdannikov, "Russia says gas OPEC will not set up output quotas", *Reuters*, 26 November 2008.
[42] OPEC website. Accessed on 05.08.2011: http://www.opec.org/opec_web/en/about_us/25.htm.
[43] Ibid.
[44] Ibid.
[45] Except for Azerbaijan.
[46] IEA website. Accessed on 25.07.2011: http://www.iea.org/about/membercountries.asp.

well. This previous institutional experience may facilitate cooperation within the GECF and explain its effectiveness.

Another reason explaining the cooperative success among GECF members might be the well-aligned incentives members face with regarding to extracting the maximum value from their gas exports. Generally, every resource-holder wishes to extract the highest possible value from selling their product. Yet, there are differences as to the time horizon and the national context in which this takes place. If one considers the non-GECF producers[47] that supply Germany, Japan and Turkey, one finds that those countries tend to be long-run maximisers of value. Democratic states tend to try to optimise revenues from energy and other natural resources for the citizens not just at the present time, but also well into the future. For example, the "[...] Netherlands' strategy for many decades has been focused on preserving the long-term potential of its gas industry. The government introduced targeted policies to reduce the depletion rate of its major gas field in Groningen. It limited national gas sales through a gas pricing policy and by imposing a reduction of gas use in the power sector."[48] Such long-term strategies also include linking the gas price to the price of its closest substitute, mostly oil. By always pricing gas just below the price of its closest substitute, producers manage to extract some economic rent (as is obvious in the case of Germany), but non-GECF producers such as the Netherlands and Norway are consistent with regard to this pricing mechanism. In contrast, GECF members went back and forth between pricing mechanisms – advocating spot pricing when this promised higher profits (at least in short-term) and few years later they switched their preference back to oil-indexation (see discussion in both Turkey and Japan chapters). Such opportunistic behaviour is more consistent with short-term maximisation of value rather than a sustainable long-run ap-

[47] Not including Azerbaijan.
[48] IEA, "The Netherlands: 2008 Review", 2008, p. 50.

proach. For example, as Jonas Graetz argued in a recent paper, Russia's strategy with regard to gas has in the past often given preference to short-term profits.[49]

This short-term focus might have numerous causes. Many resource-rich countries are in constant need for revenues and hence place great emphasis on securing short-run gain over long-term benefit. Another reason could be the fact that governments of many resource-rich countries are authoritarian. While leaders in democracies tend to be relatively safe, i.e. the danger of being overthrown is small, leaders in dictatorships often need cash in the short-run to placate their subjects and hence secure their power. Short-run maximisation of gas revenues in this particular case therefore seems to be an imperative for most GECF member countries, which mostly feature authoritarian regimes.

While short-run vs. long-run maximisation of revenues was discussed with regard to GECF members and Germany's non-GECF suppliers (Netherlands and Norway), some light must be shed on Japan's two non-GECF suppliers: Australia and the US. Given that their resource endowments are much smaller in relative terms than Norway's or Holland's, the economic importance of gas sales and revenue-maximisation from those sales is less pronounced. As the first-mover concerning the subject of gas market liberalisation, the US chose competitive markets over the alternative of limiting competition to maximise rents from production. Similarly, Australia supports competitive energy markets as well both nationally and internationally.[50] Hence, GECF members collude effectively in Japan and Turkey according to the CPM results and they achieve higher prices than non-GECF suppliers.

[49] Jonas Graetz, "Nationale Ressourcen im globalen Kontext: Zur Internationalisierung russischer Öl- und Gaskonzerne", *Russland-Analysen Nr. 217*, Freie Universität Berlin, Osteuropa-Institut, 25 March 2011, p. 12.
[50] See expert interviews, chapter 5.

Another reason why cooperative conduct among GECF members is effective is the structure of rigid, complex and secretive trade relationships in gas markets that alleviate procedural internal problems usually faced by cartels. One of the biggest internal challenges of a cartel is to detect and punish cheating, i.e. non-compliance with joint agreements. The reason is that it is in almost all cases individually rational for members to defect from the group's agreements (to increase one's own revenues), but collectively it is irrational (as it reduces the total revenues of the cartel). I argue that the rigid structure of regional gas markets[51] alleviates this cheating and defection problem enormously. This hence makes the exercise of pricing power and correspondingly the extraction of economic rents much easier and more sustainable since strict procedures for the detection and punishment of cheaters that have preoccupied and plagued past cartels, especially OPEC after 1982,[52] are not (or at least less) important.

The cheating and defection problem is less pronounced both in the short-run and in the long-run. Two examples will be used to explain the short-run dimension. Russia's sale and purchase agreement for 6 bcm (annually) of gas to be delivered via the Westward pipeline runs from 1986 until 2011. At the time of the expert interviews conducted for the Turkey case study, i.e. in September of 2010, there was some speculation as to whether the 6 bcm contract was to be renewed with Gazprom or whether supplies should come from another producer. A senior official at the Turkish Foreign Ministry said that a renewal of the Russia contract was virtually certain.[53] Would it then be individually rational for Algeria to come forward and compete for the 6 bcm by offering prices and contract terms that undercut not just the Russian offer but also Algeria's own

[51] Caused in part by 'natural' market entry barriers as well as 'artificial' market entry barriers supported and maintained by GECF members.

[52] The cheating and defection problem became salient after OPEC abandoned target prices and instead focused on quantities by introducing a production quota-based system in 1982.

[53] Interview with Dr. Tuncay Babali, Energy Expert, Turkish Ministry of Foreign Affairs, Ankara, September 2010.

existing contract with Turkey (running since 1988)? That seems unlikely. The difference to the oil market is twofold: The oil market is liquid and flexible, hence undercutting fellow OPEC members by selling additional volumes for extra gain is individually rational in the short-run. The second reason is that in the global oil market one can sell a hundred thousand barrels a day fairly anonymously. In contrast, undercutting another supplier, when competing for a 20 year supply contract, will be (at least eventually) a public matter, despite the fact that specific contract terms usually remain secret. Hence cheating in the gas market in the short-run often is not individually rational. It is common practice for Gazprom executives to talk to leaders at Algeria's Sonatrach about prices and contracts terms in order to *avoid* undercutting each other.[54]

A second structural reason that alleviates the cheating problem in the short-run can be observed in Japan. LNG exporters in some cases own part of the import terminals in Japan so that their LNG cargos will be only be regasified for consumption in Japan at their own terminals. Conversely, Japanese utilities also own, in some but not all cases, tiny fractions of the upstream project in producing countries. Both factors reduce the incentive to change suppliers when contracts expire and producers take advantage of this situation by not undercutting each other.

The long-run dimension of the cheating and defection (non-)issue among GECF members is actually closely connected to the GECF's main objective of preserving an uncompetitive market structure. It is collectively irrational for GECF members that seek to maintain their market power and economic rent to abolish long-term contracts, destination clauses, secret contract negotiations and so on as it reduces every members' market power. Individually the same is true. A single supplier has nothing to gain by offering more competitive terms in the long-run since it will erode his own market power.

[54] Expert Interview, Dr Cenk Pala, Chief Executive, E.ON Ruhrgas Turkey, Ankara, September 2010.

The more competitive the market, the more likely it will approach marginal cost levels as it has in the United States. As of August 2011, US natural gas sells for about US$4 per mmbtu at Louisiana's Henry Hub whereas the marginal cost estimates for US gas production range between US$3.00 and 5.00, i.e. price and marginal cost are very close to each other. In Japan, natural gas sells for US$12.00 and 14.00 per mmbtu while marginal costs including transportation costs range between $US1.50 and 4.00. It is neither individually nor collectively rational for (GECF) producers to offer changes to long-term contract terms[55] that would lead to a more competitive gas market.

7.5. Levels of Institutionalisation and Cooperative Effectiveness

The level of (or degree of) institutionalisation of an international organisation is often considered to be an important determinant of the cooperative effectiveness of the organisation. For example, neoliberal institutional theory developed by Keohane and others see international institutions as having a positive effect on promoting cooperation by "managing both communication inefficiencies and risks that are inherent in international relationships."[56] Empirical tests of this theory—both in the economic and security realms—seek to connect "a measure of institutionalisation and a measure of cooperation [and] a correlation is sought between higher and deeper levels of institutionalisation and higher levels of cooperation."[57] Moreover, Peter Gourevitch argued in an article on governance problems in IR that higher, i.e. more formal levels of institutionalisation tend to lead to better cooperative outcomes.[58]

[55] Which, of course, would be better for consumers and might entice them to change suppliers.
[56] Richard Herrmann, "Linking Theory to Evidence in International Relations", in Walter Carlsnaes and Beth Simmons, eds., *Handbook of international relations*, Sage Publications, 2005, p. 128
[57] Ibid.
[58] Peter Gourevitch, "The Governance Problem in International Relations", in David Lake and Robert Powell, eds., *Strategic choice and international relations*, Princeton University Press, 1999, p. 140.

Furthermore, Snidal sees a similar connection between less challenging issues among states on the international stage (mere coordination problems) requiring lower levels of institutionalisation on the one hand and more challenging issues involving e.g. prisoners' dilemmas requiring higher levels of institutionalisation on the other hand.[59]

In relation to other forms of cooperation—alliances—Stephen Walt argues that in the security realm, a higher level of institutionalisation also contributes to stronger, longer lasting and hence more effective alliances. "The greater the level of institutionalisation within an alliance, the more likely it is to endure despite an extensive change in the array of external threats." Citing NATO as one example, he continues: "if the alliance generates a large formal bureaucracy, this will create a cadre of individuals whose professional perspectives and career prospects are closely tied to maintaining the relationship. Such individuals are likely to view the alliance as intrinsically desirable and will be reluctant to abandon it even when circumstances change. The longer the alliance lasts, the more numerous and influential its advocates will be."[60] Others such as Hurrell are more cautious, stating that cooperative arrangements such as "inter-state or inter-governmental agreements or regimes […] can be formal or informal, and high levels of institutionalization are no guarantee of either effectiveness or political importance."[61]

In the literature on the GECF, the same argument about weak degrees of institutionalisation and resultant weak cooperative outcomes is, at least implicitly, made by some observers as well.[62] Such analyses usually stop at the claim that a weak organisation cannot (or at least is unlikely to) be effective.

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[59] Duncan Snidal, "Coordination vs. Prisoners' Dilemma: Implications for International Cooperation and Regimes", *The American Political Science Review*, vol. 79, no. 4, December 1985, p. 938.
[60] Stephen Walt, "Why alliances endure or collapse", *Survival*, vol 39, no. 1, Spring 1997, p. 166.
[61] Andrew Hurrell, "Explaining the resurgence of regionalism in world politics", *Review of International Studies*, no. 21, 1995, p. 336.
[62] Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making?", June 2006.

What is evidence of a high degree of institutionalisation? For example, members of OPEC meet twice a year or more and discuss specific oil market related issues, especially with regard oil prices and production levels. They also make specific proposals at those meetings and individual members choose to join or decline certain agreements. Each decision is recorded. Yet, despite these formal procedures and the existence of a bureaucratic structure, OPEC is described as an organisation with a degree of institutionalisation:

> OPEC is an instrument of member governments, and its low degree of institutionalization results from the reluctance of these countries to endow it with initiative and a measure of autonomy. […] That OPEC has not developed as an autonomous institution should not, however, detract from the fact that the tasks performed by OPEC, or with its assistance, are (and are likely to remain) significant in scope or importance. […] Low institutionalization does not therefore mean that the productivity of co-operative effort is commensurately low.[63]
>
> The process of cooperation among OPEC countries does not necessarily rest on building a strong central institution, on creating an awareness of common identity and mutual obligation, or on political security. It is closest to what Joseph Nye calls "policy integration." He says that "the concern here is not with the institutions or methods used in reaching decisions, but with the extent to which a group of countries acts as a group (by whatever means) in making domestic or foreign policy decisions." [64]

The author argues that despite a low level of institutionalisation, OPEC is (was) still effective in terms of producing positive cooperative results. The same, I argue, is true of the GECF. The GECF in comparison to OPEC is a much weaker institution. The meetings, especially during the first few years after its creation in 2001, did not always take place on a regular basis. Moreover, the membership fluctuated somewhat over time. These are not signs of a strong institution. Yet, as the evidence from the case studies shows, collusion is a credible explanation for market power in the markets whose

[63] Zuhayr Mikdashi, "Cooperation among Oil Exporting Countries with Special Reference to Arab Countries: A Political Economy Analysis", *International Organization*, vol. 28, no. 1, Winter 1974, pp. 25-26.
[64] Ibid., pp. 27-28.

supply is dominated by GECF members. Moreover, the price differential between gas supplied by GECF members v non-members points to a GECF-specific phenomenon rather than to collusion among all producers. Hence, the GECF's demonstrated effectiveness seems to be at odds with the theoretical claim that higher levels of institutionalisation lead to more effective cooperative outcomes.[65]

What may explain this apparent contradiction? First, it may be that the GECF achieves cooperative effectiveness through 'policy integration' mentioned in the above citation and in particular by focusing on 'low-cost' measures such as exchange of information and data. Indeed, this argument was made by Mikdashi regarding OPEC too: "Moreover, policy coordination is more often forthcoming in areas not involving sacrifices or risks (for example, exchange of information) than in areas such as restricting or allocating exports where some governments have to bear costs, with the ensuing problem of allocating fairly both costs and benefits."[66] Moreover, Milner argues that positive cooperative outcomes could also be the result of successful *policy integration* rather than higher levels of institutionalisation. And successful policy integration is driven by "greater levels of political commitment"[67] to joint policies rather than commitment to greater levels of institutionalisation.

Furthermore, the lack of traditional collective action problems facing cartels such as cheating and defection that are not pronounced in most gas markets due to structural rigidities might also be an explanation. If fewer difficult and costly internal cartel problems have to be addressed, a weaker organisation with lower degrees of institutionalisation may be quite effective too.

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[65] The same argument was made about OPEC, but given OPEC's comparatively stronger institutional structure, the contradiction between empirical result and IR theory is less stark and less contradictory.
[66] Mikdashi, "Cooperation among Oil Exporting Countries with Special Reference to Arab Countries: A Political Economy Analysis", p. 28.
[67] Helen Milner, *Interests, Instiutions and Information: Domestic Politics and International Relations*, Princeton University Press, 1997, p. 9.

In conclusion, this chapter compared both the quantitative and the qualitative results from the case studies. A striking finding is that while market concentration and elasticity of demand are not correlated with market power, collusion is. That means while all three factors (accounted for in the CPM) partly explain the existence of market power, only a higher degree of collusion is directly linked to a higher degree of market power, whereas the two other contributing factors show an indeterminate relationship in the cross-case comparison. The subsequent parts of the chapter emphasised the connection between economic wealth and political power and discussed in depth the significance of the GECF as an international organisation and with regard to its role in terms of achieving positive cooperative outcomes for its members. Finally, the puzzling finding that the GECF as an organisation with a weak degree of institutionalisation is still able to achieve effective cooperative outcomes was addressed.

Chapter 8 Conclusion & Outlook

This final chapter will briefly summarise the content of each thesis chapter. Moreover, the hypotheses put forward in the first chapter will be discussed in light of the results of the analyses conducted both in the case studies and in chapter 7. Furthermore, the thesis' substantive and theoretical contributions to the literature on the GECF, natural gas markets, natural resource cartels more generally, international cooperation and collective action issues will be presented. In addition, issues for further research will be suggested and a brief outlook concerning possible future developments in gas markets will be provided.

8.1. Brief Summary of Thesis Chapters

The introductory chapter gave a general overview of the research project by describing the thesis topic, motivations for the research and background information. Furthermore, the core research questions, the main analytical frameworks and methodological issues were introduced.

The second chapter illustrated and analysed in detail the structure of natural gas markets. It set the stage for the examination of cooperation among natural gas producers and exporters by discussing the fundamental structures of the natural gas trade, including the supply and demand sides as well as modes of transport. Moreover, major regional markets—North America, Europe and Asia Pacific—and their specific characteristics such as differences in price elasticity of demand for gas were introduced. Finally, basic information on natural gas producer cooperation in general and an overview of net exporters and the Gas Exporting Countries Forum in particular were presented.

Chapter 3 provided detailed theoretical and methodological background information on international cooperation, on cartelisation in commodity markets and an introduction to the relevant economics literature. Moreover, a thorough discussion of the case selection set the stage for the in-depth case studies in the subsequent chapters. The challenges of studying cooperative outcomes were discussed, i.e. the question of whether the outcome was actually caused by cooperation or by other factors. The conduct parameter model provides the possibility of modelling counterfactual outcomes by using available empirical data. This *outcome*- rather than *process-based* approach contributes to a better understanding of the effect of cooperation.

The fourth chapter contains the country case study on Turkey. The first section of that chapter examined the (foreign) supply side of gas producers, from the upstream and midstream parts of the gas value chain up to the Turkish border, and the demand side, that is, the domestic part of the midstream component, as well as the different purposes for which gas is used at the downstream end of the chain. Gas in Turkey is very important both in the power generation and heating sectors. The major players on the exporting side were introduced and include: Algeria, Azerbaijan (the only non-GECF member), Iran, Nigeria and Russia. The case study uncovered that a considerable proportion of the price-cost margin is explained by producer collusion and anti-competitive practices. The second section of the chapter analysed existing evidence and patterns of cooperation among Turkey’s suppliers demonstrating that cooperative activity occurs across almost all levels both in terms of depth of cooperation and venue (international, national government and corporate levels). The final part of the chapter pointed out the considerable welfare implications of market power in Turkey, including the impact on poor households and inflation.

Chapter 5 conducted the same type of case study of the Japanese market. The first section of that chapter examined the (foreign) supply side of gas producers, from the upstream and midstream parts of the gas value chain up to the Japanese LNG receiving terminals. Gas is very important especially in power generation in Japan. The major players on the exporting side were introduced. Important GECF suppliers include Brunei, Indonesia, Malaysia and Qatar. Important non-members are Australia and the United States. The case study showed that a considerable proportion of the price-cost margin is explained by producer collusion and anti-competitive practices. Subsequently, existing evidence and patterns of cooperation among Japan's suppliers were analysed. This demonstrated that cooperative activity occurs across almost all levels both in terms of depth of cooperation and venue but is somewhat less pronounced than in the Turkish case. The final part of the chapter discussed the economic inefficiencies and welfare losses that are the result of market power and high natural gas prices in Japan.

Chapter 6 contained the hypothesised 'negative' case study of the German market. The first section of that chapter examined the supply side of Germany's foreign gas suppliers. As the 'negative' case, Germany has only one GECF supplier, Russia. The other suppliers include Denmark, the Netherlands and Norway. The case study showed that producers achieve only the equilibrium of failed cooperation, i.e. the non-cooperative oligopoly outcome, but not a conduct parameter outcome that indicates collusion. Market power among Germany's suppliers is still considerable. This is mainly due to Russia's dominant position and due to the complex and anti-competitive structure of the domestic market.

Chapter 7 compared the quantitative and the qualitative results of the three preceding case studies and discussed how this research can contribute to our understanding of gas markets, international cooperation and commodity cartels more generally. It pointed out that neither market concentration nor elasticity of demand is correlated with market power across the three cases. I find that the CPM outcome is the only indicator that is actually positively correlated with market power; hence it is a better explanation of market power than the two traditional measures. The chapter also emphasised the connection between economic wealth and political power giving examples of Russia and Indonesia. The Russian case showed how energy rents can weaken and strengthen regimes. Hence rent-seeking, e.g. through GECF cooperation in gas markets, and political power are closely connected. Another important insight is the finding that the GECF as an organisation with a weak degree of institutionalisation is still able to achieve positive cooperative outcomes due to a conducive market structure and the absence of collective action problems typically faced by cartels.

8.2. Comparing the Hypotheses to the Results

8.2.1. First Hypothesis

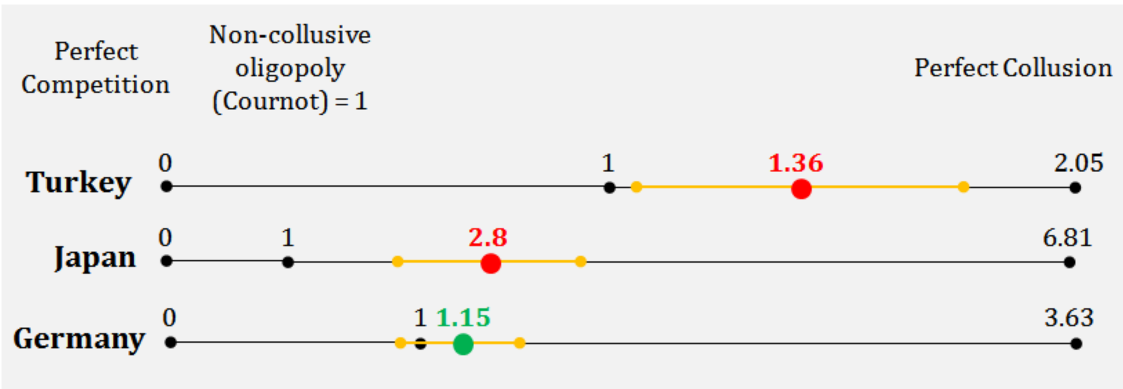
Given structural and procedural conditions favouring cartelisation and the GECF members' determination to protect and increase economic rents earned from gas exports, collusive and openly cooperative producer conduct is expected to be an important explanatory factor for the producers' market power in consuming markets dominated by GECF suppliers.

The results from the conduct parameter model in each of the case study chapters confirm the hypothesis. Figure 8.1 is reproduced from Chapter 7 and shows the producer conduct is most collusive in Turkey (at 1.36 out of 2.05 far above the non-cooperative oligopoly outcome at 1). Moreover, collusion also plays a fairly important role with an average result of 2.8 out of 6.81 in Japan with producer conduct significantly above the non-cooperative outcome. The only CPM result showing an outcome of approximately 1, i.e. the non-collusive level is to be found in the German case.

Given similar circumstances in terms of structural conditions—in all markets supply is concentrated among only a few players and demand tends to be inelastic—the producer conduct is the only factor correlated with the degree of market power being exercised in a market.[1] That is, there is both a higher degree of market power and collusion in the Japan and Turkey cases, but in Germany—where collusion is not a significant factor—the degree of market power is lowest.

Figure 8.1: Spectrum of Possible and Actual Conduct Parameter Outcomes[2]

(Averages for 2006, 2007 and 2008)



8.2.2. Second Hypothesis

Cooperation and its influence in terms of achieving high economic rents are expected to be specific to the GECF member states and not a general phenomenon among all producers.

The discussion of the first hypothesis above shows that suppliers in Turkey and Japan surpass the German outcome—the "equilibrium of failed cooperation"[3]—and achieve a

[1] There was no clear and consistent relationship between market power on the one side and inelastic demand and market concentration on the other side. Figure 1 in chapter 7 shows the degree of market power for each case.
[2] Chart: author; data: from case study chapters.
[3] I thank Professor Duncan Snidal at Nuffield College, Oxford for this suggestion. He pointed out that the non-cooperative oligopoly result is often also called an outcome of failed cooperation.

degree of collusion.[4] Given similar circumstances in all cases, but different outcomes, one may infer that the GECF successfully facilitates cooperation and collusion in those markets in which GECF members dominate supply. However, collusion in the Japanese and Turkish cases could take place among not just GECF members, but among all producers. To confirm the second hypothesis, one must corroborate that collusion is specific to the GECF members (and does not include non-GECF suppliers). The evidence presented in case study chapters 4 and 5 on Turkey and Japan show exactly that.

There is a significant price differential between members and non-members of GECF, which points to the ability of GECF suppliers to achieve higher prices and confirms the second hypothesis. In contrast, supplying countries that are not part of the GECF, e.g. Australia and the United States in the case of Japan and Azerbaijan in the case of Turkey, charge significantly lower prices than those within the GECF. At the same time their marginal cost of production is higher (that is true in the case of the US and Australia). Non-GECF members charge lower prices while incurring a higher marginal cost of production. That shows that collusive conduct as evidenced in the CPM results is not a general producer phenomenon, but is specific to the GECF member states.

8.2.3. Third Hypothesis

The GECF has influence on cooperative outcomes despite a low level of institutionalisation. This is hypothesised to be the case for two reasons. First, it is due to the member countries' political commitment to the cooperative policies (instead of a higher degree of institutionalisation) as it secures economic rents and political power. Second, the GECF, unlike other cartels, faces less severe internal procedural challenges such as cheating.

[4] Selecting cases on the independent variable, cooperation, helps determine the significance of the GECF in another way too. Had producers that supply the German market colluded anyway (despite the absence of GECF-led cooperation), it would shown quite clearly that GECF may be rather unimportant in the other cases.

As the literature review pointed out, the degree of institutionalisation of an international organisation is often considered to be an important determinant of the cooperative effectiveness of the organisation. Therefore, the GECF's influence on cooperative outcomes seems to be at odds with the conventional view that higher degrees of institutionalisation lead to more effective cooperative outcomes. There are two possible explanations for this. The first one is that the GECF achieves cooperative effectiveness by focusing on a joint commitment to *policy integration* rather than on institutionalisation especially by concentrating on low-cost measures such as the exchange of information and data.

Another reason was also discussed in greater detail in chapter 7: the absence of collective action problems usually faced by cartels such as cheating and defection. Normally, it is in almost all cases individually rational for members to defect from the cartel's agreements[5], but collectively it is irrational.[6] I find that structural reasons, e.g. the rigid structure of regional gas markets, help reduce these collective action issues. If fewer difficult and costly internal cartel problems have to be addressed, a weaker organisation with lower degrees of institutionalisation can be effective too. Section 5 in Chapter 7 provides specific examples from the case studies showing how issues of cheating and detection are less severe both in the short- and long-run.

8.2.4. Fourth Hypothesis

Cooperative effectiveness of the GECF is expected to be facilitated by a joint background of cooperative and institutional experience in other associations such as OPEC.

[5] In order to increase one's own revenues.
[6] Because it reduces the total revenues of the cartel.

As Krasner,[7] Mingst[8] and others suggest, prior cooperative and institutional experience among cartel members may contribute to better cooperative outcomes. An analysis performed in chapter 7 shows that more than half of all GECF members have been members of OPEC as well. This previous institutional experience facilitates cooperation within the GECF and is another credible explanation for its effectiveness. Moreover, further examinations reveal that almost all non-GECF members (which were studied in the three case studies of this thesis)—Australia, the Netherlands, Norway and the US—are all members of the International Energy Agency,[9] an organisation founded in response to OPEC's cartelisation efforts in the 1970s.[10] At the same time, none of the GECF members are members of the IEA.

8.2.5. Fifth Hypothesis

Cooperation is also hypothesised to be facilitated because GECF members share the objective of short-term revenue maximisation from gas exports, whereas non-GECF suppliers focus on other aims, e.g. long-term revenue maximisation or competitive markets with marginal cost pricing.

Generally resource holders aim to extract the highest possible value from selling their product. However, there are various approaches to this depending on a supplier's time horizon. The approach of leading GECF members such as Algeria and Russia[11] has been described as being focused on the maximisation of revenues in the short run. Other members such as Egypt have been vocal in this debate as well. As described in the case studies GECF members went back and forth between pricing mechanisms – advocating

[7] Krasner, "Oil is the Exception", p. 75.
[8] Mingst, "Cooperation or Illusion: An Examination of the Intergovernmental Council of Copper Exporting Countries", p. 265.
[9] Except for Azerbaijan, which has only started exporting gas since 2007.
[10] IEA website, http://www.iea.org/about/membercountries.asp. Accessed on 25.07.2011.
[11] Jonas Graetz, "Nationale Ressourcen im globalen Kontext: Zur Internationalisierung russischer Öl- und Gaskonzerne", *Russland-Analysen Nr. 217*, Freie Universität Berlin, Osteuropa-Institut, 25 March 2011, p. 12.

spot pricing when this promised higher profits (at least in short-term) and few years later they switched their preference back to oil-indexation (see discussion in both Turkey and Japan chapters). Evidence of such opportunistic behaviour is more consistent with short-term maximisation of value rather than a sustainable long-run approach and confirms the hypothesis that similar objectives among GECF members foster cooperation success. A focus on the short run could have numerous causes, which were described in chapter 7. The same chapter also discusses the strategies of non-GECF, which are markedly different from those in GECF.

8.2.6. Sixth Hypothesis

The regional nature of the relationship between exporting and importing countries and the limitations of fixed infrastructure are expected to produce more effective cooperative outcomes.

Pipeline infrastructure is fixed and tends to limit markets to their respective regions. Such a limitation could be another reason favouring collusive conduct and hence the exercise of market power. However, this hypothesis is the first and only one so far that is not supported by the evidence. Chapter 7 compared the Turkish and German case studies, where there are fixed pipelines, with the Japanese case, where it is at least in principle possible to diversify the supplier base by obtaining geographically flexible LNG cargos. The result was that in Japan (where flexible LNG suppliers are possible), the degree of market power as evidenced by the mark-up over marginal cost is highest. This finding, although contradicting the hypothesis, is not very surprising. Japan also uses long-term contracts that are similar to the ones used for pipeline deliveries to Germany and Turkey. It is not the fixed infrastructure, but the nature of the contracts that limits flexibility and creates fixed consumer-supplier relationships. Despite attempts to introduce shorter-term contracts by Japanese (and a whole range of other) buyers, the suppliers oppose such shorter-term contracts. Long-term contracts, as the discussion in the case study chapters showed, are an artificial market entry barrier that is vigorously defended in particular by GECF members.

8.2.7. Seventh Hypothesis

Cooperation within the GECF works despite the absence of a preponderant player (or hegemon) often needed in cartels to bear a disproportionate share of the various economic and political costs of cooperation. This is hypothesised to be the case due to structural conditions in the gas market that are both conducive to cartelisation and alleviate (procedural) collective action problems at the same time.

Moran explains the important "role of the preponderant player(s), who take a long-term view, cushion shocks, accommodate free riders, and generally bear a disproportionate share of the costs of maintaining the stability of the [cartel] system. They provide a public good (that is, a public good from the point of view of the oligopoly) which otherwise would be undersupplied and without which the short-term self-interest of the individual members would be likely to prevail."[12] In the cases no evidence of such hegemonic leadership can be found in the sense that there is no single supplier bearing a disproportionate amount of the costs of cooperation and operating the GECF. The largest member, Russia, is supported by Iran and Qatar, which also contribute to funding initiatives and activities. "Specifically, Iran was commissioned to create a database of gas projects and contracts terms and conditions of all GECF members. […] [Moreover], "there was a study on new gas utilisations and associated costs, especially those related to LNG, to be undertaken by Qatar."[13] Finally, since cheating and defection are less crucial prob-

[12] Theodore Moran, "Managing an Oligopoly of Would-Be Sovereigns: The Dynamics of Joint Control and Self-Control in the International Oil Industry Past, Present, and Future", *International Organization*, vol. 41, no. 4, Autumn, 1987, p. 576.
[13] Hallouche, "The Gas Exporting Countries Forum: Is it really a Gas OPEC in the making", p. 13.

lems among GECF members than in other cartels, hegemonic leadership may also not be required to facilitate cooperative outcomes.

8.3. Substantive and Theoretical Contributions to the Literature

This research has sought to make both substantive and theoretical contributions to the issues of gas market cartelisation, the study of the GECF and cooperation within natural resource cartels more generally. Substantively, the first contribution was to offer a better understanding of the GECF as an organisation and of the actions of its members, in particular with regard to the exercise of market power. Different forms of cooperation among GECF members were examined in order to determine whether secret collusion and open cooperation play an important role in explaining producers' market power in highly import-dependent gas markets. The case studies and chapter 7 then provided a detailed examination of how and why such cooperative behaviour may or may not work. Given that natural gas is one of the most important sources of energy, a better understanding of cartelisation efforts and market power in gas markets can be considered a valuable substantive contribution.

8.3.1. Important Substantive Issues

The preceding section tested whether the hypotheses about gas producer cooperation within the GECF were supported by empirical evidence and by the analysis performed in this chapter. The GECF is not a traditional cartel with global reach, but it still manages to exercise market power in a number of gas markets which rely heavily on imports from GECF suppliers. This is the case despite the GECF's weak degree of institutionalisation. The GECF's cooperative effectiveness in terms of securing and expanding its member countries' market power has a variety of reasons. First, there are conducive structural conditions in gas importing markets favouring cartelisation. Second, the GECF uses somewhat unusual methods such as artificial market entry barriers (e.g. long-term term contracts negotiated in a non-transparent way) to secure their market power. Third, the GECF faces fewer and less severe internal procedural challenges that plague other cartels such as collective action problems, especially cheating and defection. These insights have so far not been part of the literature on political economy issues in gas markets and hence it is hoped that they represent a substantive contribution to this specific literature.

Further substantive issues are economic welfare and inefficiencies that are created by market power. Since the GECF's cooperative actions are in part responsible for retaining producers' market power (or even for increasing it), the GECF does achieve its objective of continuing to extract economic rents at the expense of consumers. Moreover, this is not only a distributive issue as between consumers and producers, but also about the overall reduction of social welfare both in the short-run and in the long-run.[14] The GECF has hence a role in perpetuating a transfer of wealth from importers to exporters as well as creating economic inefficiencies.

There is also a climate change dimension to this. The GECF's cooperative actions contribute to (already) high natural gas prices in Europe and Asia as the analysis demonstrated. The more expensive gas becomes, the less likely it is that power companies will switch from 'dirty' coal-fired power plants to cleaner gas-fired power genera-

[14] Machiel Mulder and Gijsbert Zwart, "Market failures and government policies in gas markets", Paper no. 143, *CPB Netherlands Bureau for Economic Policy Analysis*, 23 February 2006, p. 13.:

"Exercise of market power reduces total social welfare compared to perfect competition. [In] the short term, prices that are too high lead to static allocative inefficiency as, from a welfare point of view, too little gas is consumed (*dead-weight loss*). Productive efficiency may be compromised if, as a consequence of distorted price levels, companies invest in techniques and gas production, use of storage and imports that would not be viable under full competition. If, due to reduced competitive pressures, there is too little incentive on parties to innovate, dynamic inefficiency may results. As a result, total welfare is below its optimum.

tion. Given that coal, gas and oil are among the most important sources of power generation, more expensive gas drives consumers away from gas, the cleanest hydrocarbon source, and hence contributes to increasing carbon emissions. This is particularly relevant in Japan where carbon-free nuclear power is being scaled down and this nuclear capacity is likely to be replaced by coal and gas, with coal being the cheaper alternative. The more expensive gas remains, the longer it takes for switching from coal to gas to occur.[15] There is at least an indirect link between gas pricing and climate change mitigation in the sense that cartelisation efforts among GECF members hinder efforts to reduce carbon emissions.

Finally, the case studies showed that the in-depth examinations of the German, Japanese and Turkish gas markets have been fruitful not just in terms of shedding light on the GECF and gas producer cooperation. The case analysis also produced some interesting case-related insights, especially in the Turkey case. A small contribution was hence made to the regional studies literature on the political dynamics between GECF members, non-members and importing countries.

8.3.2. Important Theoretical and Methodological Issues

The first insight that is relevant to the broader literature on cooperation and cartelisation in commodity markets, is that a detailed, empirical approach such as the one used in thesis is sometimes more useful than the conventional and more abstract game-theoretic analysis of cartels that are prevalent both in the IR as well as the economics literature. Not all international organisations comprising producers of natural resources

[15] Many developed countries have started putting a price on carbon, making the dirtiest fossil fuel source—coal—driving up its price (which still remains below other sources though).

that wish to cooperate more closely are affected by traditional prisoners' dilemma-type of collective action problems.

One of the interesting insights from this research is that a detailed study of the empirical reality unveils factors that may either be overlooked in abstract analyses or are too specific or complex to be modelled. Domestic factors, in particular the influence of politicians as well as corruption were discussed in each case study. Political influence and corruption played a role in every case. Moreover, in Japan cultural factors were also considered to be important in terms of understanding why market power exists.[16]

Moreover, the assumption that a strong degree of institutionalisation within the (cartel) organisation is necessary for positive cooperative outcomes can in some cases be wrong due to the nature of the specific market. Also, Milner's insight that when it comes cooperation (or *policy integration*, which she uses interchangeably), the members' political commitment to joint policies can be a more important factor than the degree of institutionalisation.

Another insight regarding the study of market power and cartelisation is that the issue of 'artificial' market entry barriers[17] and related tools such as pricing mechanisms remain understudied. These instruments are explicit cooperative policies of the GECF as the case studies showed. They were found to be an important explanation for the GECF's ability to jointly secure and expand their market power. The use of these artificial market entry barriers may merit closer inspection in other markets to get a better understanding of cartelisation efforts and market power, especially when traditional concepts of cartelisation are less appropriate. Further and future study of these issues may yield some interesting and perhaps surprising results.

[16] See chapter 5.
[17] Especially those barriers that are created and maintained by the producers.

8.4. Areas for Future Research and Outlook

As the last section pointed out, the study of (artificial) market entry barriers should be a focus in the literature on producer cooperation and cartelisation. This factor, for example, is not part of the conduct parameter method that was used in this thesis to measure producer conduct on the basis of two other important structural factors: market concentration and elasticity of demand. The inclusion and formalisation of market entry barriers in empirical measurement models such as the CPM remains a difficult challenge, but, if successful, could help economists and political scientists alike in their effort to better understand cartelisation and cooperation.

The GECF itself and gas producer cooperation more broadly remain topical and indeed are likely to become more important in the future as natural gas becomes an ever more important source of fuel. As energy market expert Daniel Yergin argued: "[an] association of some kind among LNG exporters is likely."[18] That of course points towards cartelisation efforts on a global scale, i.e. in the way that OPEC has been operating since the 1970s. So perhaps the collective action problems facing OPEC and other cartels may come to haunt the GECF in the coming years and decades too, as LNG helps globalise gas markets. Concerning the near future, others have speculated as well about the role of the GECF.

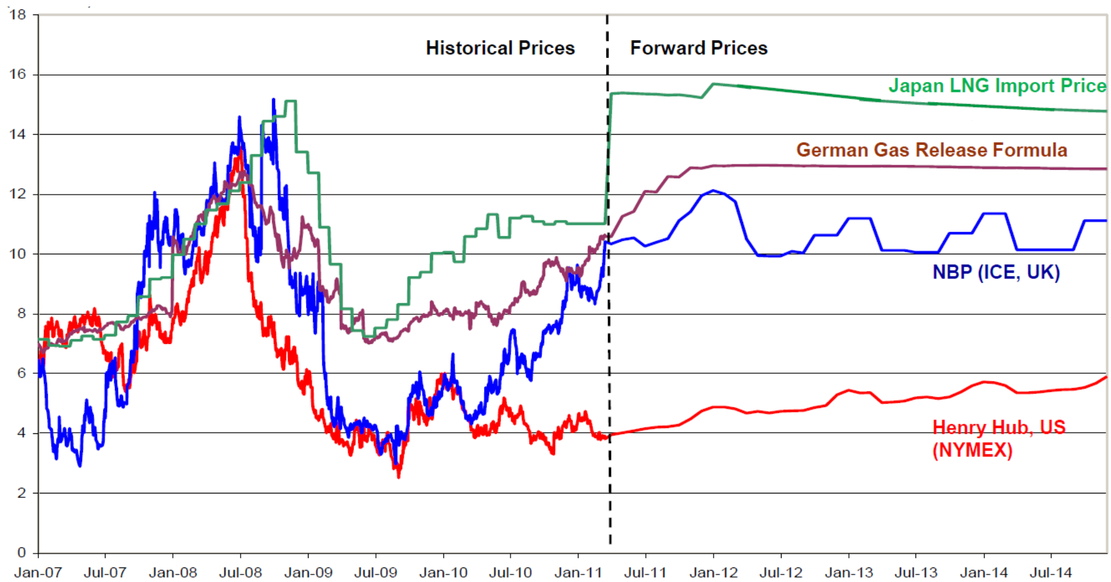
> The GECF [appears] to be geared towards the regulation and coordination of long-run investments, which may—with the emphasis on 'long-run'—determine a certain level of gas supply, traded either in long- or short-term contracts. Besides sharing information, the mechanisms for further cooperation in the GECF […] can consist of the following: (1) limiting flexible supplies (on a short-term basis); (2) coordinating capacity expansions; (3) coordinating pricing regimes in contracts; (4) sharing the economies of scale by developing their resources together. In this respect, national gas firms can reduce long-run competition in pricing through overcapacity as they jointly sell out-

[18] Daniel Yergin and Michael Stoppard, "The Next Prize", *Foreign Affairs* 82, no. 6, 2003, p. 121.

put in multiple markets; (5) market division of regional and sub-regional markets is a possibility for long-run pipeline and LNG flows.[19]

Moreover, the issue of institutional strength remains in question. “Whether these developments will progress further into institutionalisation depends on a number of factors, including the financial and organisational capabilities of firms involved, the level of cheat behaviour and overall gas market conditions.” Or, given changing market structures, will the GECF be able to achieve favourable cooperative outcomes in the future despite a low degree of institutionalisation?

Figure 8.2: Historical and Forward Prices of Natural Gas in different regional Markets[20]



Source: - Bloomberg, NYMEX, ICE, FX converted on a daily basis. Historical prices show evolution of Month-ahead contract.

*Assumptions: - Japan LNG is historically based on JKM price; forward prices at 14% * Brent correlation.*

Current forwards as per 15th March 2011

[19] Tom Smeenk, “Russian Gas for Europe: Creating Access and Choice Underpinning Russia’s gas export strategy with Gazprom’s infrastructure investments”, PhD Thesis, University of Groningen, 8 July 2010, p. 359. Accessed 2 July 2011: http://dissertations.ub.rug.nl/.

[20] Andy Williamson, “The Outlook for Traded Gas Markets in Europe”, Presentation by Gazprom Marketing & Trading Limited at Gas Trading & Contracting Day (EFET), Gastech 2011 Conference, 22 March 2011.

In the near future, gas markets expect that in highly import-dependent markets in continental Europe and in East Asia producers will be able to hold on to their market power as Figure 8.2 shows. The prices in Germany (representative for continental Europe) and in Japan (representative for East Asia) are three to four times high than those in the United States at the Henry Hub. This is despite the fact that US producers' marginal production costs are higher than those of the suppliers delivering to the German and Japanese markets.

The uncertainties regarding future developments are numerous. On the supply side, the production of gas from unconventional sources[21] was dramatically expanded in especially in the United States after 2008 as a result of improved production technologies. That (and slower demand) lead to a dramatic fall in the US gas price. Comparable developments (regarding the expansion of the unconventional reserve base) may happen in China, where shale gas is expected to plentiful, and elsewhere. Hence while the supply side is uncertain, there are promising prospects for increased gas production outside the GECF. Unconventional gas production in until recently unexpected places could have dramatic (negative) effects on the GECF and the prospects for further cartelisation.

On the demand side, one can observe that demand has recovered as of 2011 from the recent slump after the 2008 economic and financial crisis. In fact, strongly growing demand in China and the political decisions to phase out coal and nuclear power in parts of the world will likely lead to drastically higher demand for the main alternative fuel: natural gas. To what extent this prediction of rising demand may impact the ability of GECF member countries to collude and cooperate remains an open question and many scenarios are possible.

[21] Such as shale formations (often just called "shale gas") or from coal-bed seams.

The future of natural gas, the GECF and the prospects for international cooperation will remain exciting areas of research individually, but also—and especially—when considered in connection to each other. This thesis sought to bring together theories from political science and economics with the empirical reality of natural gas markets to achieve a better understanding of both. It is hoped that this first effort will be followed by further studies in these important areas of research.

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