DEPARTMENT OF ECONOMICS
OxCarre (Oxford Centre for the Analysis of Resource Rich Economies)

Manor Road Building, Manor Road, Oxford OX1 3UQ
Tel: +44(0)1865 281281 Fax: +44(0)1865 281163
reception@economics.ox.ac.uk www.economics.ox.ac.uk

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Oil and Growth in Transition Countries

Christa N Brunnschweiler

(CER-ETH Center of Economic Research at ETH Zurich & OxCarre)

Direct tel: +44(0) 1865 281281 E-mail: celia.kingham@economics.ox.ac.uk

Oil and Growth in Transition Countries

Christa N. Brunnschweiler
CER-ETH Center of Economic Research at ETH Zurich
and OxCarre, University of Oxford *

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Abstract

This paper examines the impact of oil on economic growth in transition economies of the former Soviet Union and Central and Eastern Europe. I use oil production and reserves data in a series of panel estimations to show that oil has had positive growth effects between 1990-2006, although they appear to be diminishing for very large producers. These positive effects are confirmed when I consider different oil ownership structures. Oil has however had a negative effect on human capital formation, and corruption and democracy levels. Additionally, I find that privatisation levels have had positive growth effects, while privatisation speed has had negative effects on growth.

Keywords: oil, resource curse, economic growth, transition countries, oil ownership
JEL classification: Q32, O40, O13, P28

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1 Introduction

The apparent paradox that natural resource abundance leads to lower growth performance has sparked much research into the so-called resource curse (see e.g., Sachs and Warner, 1995). The issue is not confined to the realm of economics: in political sciences there have also been numerous studies on the influence of natural resources on institutional quality and political stability (see Rosser, 2006 for an overview). Recent contributions from both fields have pointed to the particularly strong negative economic and political impacts of mineral resource abundance, especially oil. It is therefore not surprising that the interest in oil and development has also extended to the transition economies of Central and Eastern Europe (CEE) and the former Soviet Union (FSU).[1]

Several transition economies, particularly some of the newly independent nations of the FSU, possess sizeable oil and gas reserves. The Russian Federation, Azerbaijan, Kazakhstan, Turkmenistan, and Uzbekistan are part of the Caspian Sea Basin, which is estimated to hold the largest oil and gas deposits outside the Persian Gulf.[2] According to one recent study, these countries together constitute "the most important – and fastest-growing [in terms of oil supply] – oil-producing region outside OPEC" (Ahrend and Tompson, 2006, p. 5).

After a large decline following the initial transition shock and through the mid-1990s, all oil-producing FSU countries saw very high growth rates right up to the current global economic crisis. According to recent information by the European Bank for Reconstruction and Development (EBRD), Russia, the largest oil producer in the region, had a GDP growth rate of 8% during the first half of 2008, and full annual growth is still estimated to have reached 5.6%. The other oil-producing FSU countries have had similar or even higher recent growth rates, with Azerbaijan reaching a record 30.5% growth in real GDP in 2006. The projected average growth rate in real GDP of the oil-producing transition countries for 2009 – when the global crisis hit the region in full – is around

[1] The term "transition" countries or economies commonly refers to countries that are in the process of transforming their economic (and political) systems from a socialist centrally-planned economy to a market-based one. Here, I concentrate on the more recent transition countries of CEE and the FSU, plus Mongolia, without considering China, Vietnam and other transition countries.

[2] The Caspian Sea Basin also includes Iran. There is still some degree of uncertainty over the exact dimension of the reserves in the region, see e.g., von Hirschhausen and Engerer (1999) and Ahrend and Tompson (2006).

0.7%, which, while modest, nevertheless compares favourably with an average decline of -3.7% in the non-oil transition economies.

This raises the question of whether oil can help us explain the growth performance of transition economies, and whether its contribution to growth has been positive or negative. The fact that all countries of the FSU and CEE started on their transition paths at more or less the same time, and with very similar initial socio-economic conditions, makes the study of the influence of oil abundance on growth particularly appealing. The presence of oil deposits can be argued to be randomly assigned to the transition countries, rendering the analysis of their economic effects remarkably similar to a natural experiment. Once we have controlled for other economic and political factors, we should therefore be able to isolate the effect of oil with more precision than is usually possible in cross-country samples.

The present paper focuses on oil and growth by examining the determinants of growth since the start of transition in 27 countries from 1990-2006 in a series of empirical estimations. The results show that on average oil abundance, measured in terms of per-capita production or reserves, has increased economic growth rates, even after considering many other plausible factors. Of course, it is yet too early to draw conclusions for long-term growth: we must wait another decade for that. With a note of caution, I therefore conclude that there has been no oil curse so far. Instead, the exploitation of their mineral resources seems to have helped the resource-rich countries in their recovery from the transition shock, although there is evidence of diminishing returns to oil when I consider the possibility of non-linear effects.

The analysis also offers a first attempt at differentiating the growth effects of oil based on the resource's ownership structure. The findings show somewhat controversially that fully state-owned oil sectors seem to have contributed most positively to growth, followed by domestic private ownership of oil. However, the small number of oil states in the sample, the limited variation in ownership strategies, as well as the relatively short time period advise against generalising the result at this point.

A look at various indicators of economic and social development shows that oil has had negative effects on the amounts of government spending on education, while the effects on inequality have been encouraging but insignificant so far. The findings for institutional quality and the level of democracy appear less promising: both oil production and reserves are clearly linked to more corrup-

tion and less democracy. With other words, there are some signs of a negative impact of oil wealth on key socio-economic and political factors.

A further conclusion regards the debate on privatisation (or liberalisation) speeds: by separating privatisation levels from privatisation speed, I show that the overall level has had positive growth effects, while higher speed (in the style of "shock therapy") has dampened growth. Finally, after well over a decade of transition, only a few measures of initial conditions still have an effect on economic performance.

The paper is organised as follows: Section 2 provides a literature overview; Section 3 presents the data and methodology; Section 4 shows the estimation results; and Section 5 closes with a discussion of the results.

2 Literature overview

This paper draws on two strands of literature: the first regards the resource curse, while the second looks at growth and development in transition economies. Only a handful of studies so far explicitly include the former issue in the analysis of the latter.

The resource curse literature has been greatly influenced by the research of Sachs and Warner (1995, 1999), who popularised primary resource exports over GDP as a measure of resource wealth. The contributions since then have been too numerous to list in detail here; for a critical discussion and more extensive literature overview, see Brunnschweiler and Bulte (2008a,b). Several studies have not only differentiated resources based on their geographical concentration and ease of appropriability – so-called point resources – but have stressed the particularly deleterious effects of petroleum, describing the long-term corruptive influence of plentiful oil rents on institutional quality and growth (e.g., Karl, 1997; Sala-i-Martin and Subramanian, 2003), and on institutional quality, political stability and armed conflict (e.g., Ross, 2001, 2006; Fearon, 2005).[3]

The performance of transition countries has also been a popular research topic. Although the transition of China and Vietnam had already featured in scholarly debates, the fall of the Iron Curtain and the dissolution of the Soviet Union was an unprecedented event not only for political scientists and histo-

[3]There are of course also dissident views: see Brunnschweiler (2008), Brunnschweiler and Bulte (2008a), and Alexeev and Conrad (2009) on oil and growth, and Smith (2004) and Brunnschweiler and Bulte (2009) on oil and civil war.

rians, but also for economists. The sheer size of the task of simultaneously transforming so many formerly centrally-planned economies into market-based systems, and building the supporting institutional (and social) structures – often practically from scratch – has prompted countless contributions on the merits of one transition strategy versus another, and the determinants of successful post-transition growth.

One of the earliest studies to evaluate the determinants of post-transition economic performance was provided by De Melo et al. (1996), who introduced a widely used index of liberalisation to measure reform progress. Subsequent work includes De Melo et al. (1997) and Krueger and Ciolko (1998), who concentrate on the importance of initial conditions such as pre-transition macroeconomic distortions for explaining growth performance; Aslund et al. (1996) and Heybey and Murrell (1999), who distinguish between the effects of liberalisation (or privatisation) *speed* and *level* without however reaching any definite conclusion on the matter; and Havrylyshyn and van Rooden (2003), who concentrate on the importance of institutions and the policies that emerge from them. Most recently, Godoy and Stiglitz (2006) have re-evaluated previous findings to conclude that initial conditions are no longer determining factors in economic performance, and that "shock therapy" (fast-liberalising) countries have grown more slowly in the first ten years of transition. Thorough literature overviews are given by Guriev and Ickes (2000), who focus on the microeconomic factors influencing growth in CEE and FSU countries, and Campos and Coricelli (2002). The latter are also among the few authors to emphasise the importance of financial (credit) markets for a successful transition.

The role of resource wealth has been considered in several studies on the economic performance of transition countries. De Melo et al. (1997) were the first to include a simple qualitative measure of natural resource abundance in their estimations of the determinants of growth, inflation and liberalisation in the transition economies of CEE, the FSU and East Asia. They classified the countries in the sample as resource-poor, moderately or highly resource-abundant, and then constructed a dummy variable for resource-rich and resource-poor countries on this basis (it is unfortunately not altogether clear how the classification was drawn up). This dummy variable was subsequently included in one of their principal-components clusters of initial conditions. The results indicate that resource abundance had (weak) positive growth effects, although it is difficult to pinpoint the influence of natural resources in the cluster. Several studies

have since used a similar approach, including Berg et al. (1999) and Fischer and Sahay (2000). Gylfason (2000) uses the share of natural capital in total wealth to measure natural resource abundance in a series of regressions and qualitative comparisons. He finds that resource-abundant transition countries have seen lower income growth and overall development progress than their resource-poor counterparts. Kronenberg (2004) uses the share of primary exports in total exports in his OLS estimations to arrive at a similar conclusion. However, both of these last measures are more properly seen as indicators of resource dependence rather than abundance. Moreover, Kronenberg (2004) uses end-of-period resource dependence measures in his regressions, casting doubt on the validity of the results.

Given the presence of several mineral-fuel abundant countries in the group of recent transition countries from CEE and the FSU, it isn't surprising that some studies have focused on the influence of oil (and gas) on economic performance.[4] Drawing on a series of qualitative comparisons, Esanov et al. (2001) argue that resource rents have allowed the fuel-mineral-rich FSU countries to postpone real reform efforts. Ahrend (2002) examines the case of Russia and finds that resource abundance – proxied by oil, gas and coal production – had a positive impact on the economic performance of Russian regions during the first few years of transition.

Finally, it is worth mentioning the contributions of Jones Luong and Weinthal (2001, 2009), who focus on the oil (and gas) ownership structures in mineral-rich FSU countries in their qualitative studies. They draw some conclusions on the fiscal policy outcomes under the different ownership structures, without however extending their predictions to overall economic performance (see the following section for a more detailed discussion).

In sum, although natural resources and oil have featured in several studies, none offers a systematic empirical analysis of the effects of oil on economic growth in transition countries. The present paper therefore offers a new contribution based on panel data not only on oil (and oil ownership) and growth, but also on the effects of oil on some other indicators of economic and socio-political development.

[4]For an overview of the oil and gas sectors in the FSU, see von Hirschhausen and Engerer (1999) and Ahrend and Tompson (2006).

3 Data description and methodology

The primary interest of this paper lies in determining whether the oil-rich transition countries have fared better or worse in terms of economic growth than their oil-poor counterparts. I concentrate on the countries of Central and Eastern Europe (CEE) – including some former Yugoslav republics technically in Southeastern Europe – and the newly independent states of the former Soviet Union (FSU). I have also collected data on Mongolia, which – though nominally independent – was a socialist country very closely tied to the Soviet Union, and began its transition process during the same time frame. This gives me a sample of 15 FSU and 11 CEE countries plus Mongolia, for a total of 27 transition countries, all of which started their economic and political transitions within a limited period between 1990-1992.[5]

All these countries had a common experience of socialist rule over several decades, and faced similar challenges at the start of their transition, including the huge task of transforming their economies from planned into market-based systems. In addition, many countries also found themselves as newly independent states with no or only limited political experience in independent policy-making in living memory. Because they started their transition within a couple of years of each other, we can also say that the external political and economic environment was much the same for all.[6] These similar initial conditions in a relatively homogeneous sample therefore allow me to effectively control for many factors which may possibly influence economic performance. Moreover, the random "assignment" of oil to some countries makes for an experiment-like setting, offering a unique chance of isolating the effects of oil wealth.

On the downside, it is also clear that the observation period from 1990-2006 is short, ranging from a minimum of 9 to a maximum of 17 yearly observations (depending on the start of transition and data availability), which limits the options for empirical work. In particular, I will follow most of the literature

[5]The countries included and the start of their transition are: FSU (1992): Armenia, Azerbaijan, Belarus, Estonia, Georgia, Kazakhstan, Kyrgyzstan, Latvia, Lithuania, Moldova, Russian Federation, Tajistikan, Turkmenistan, Ukraine, Uzbekistan; CEE: Albania (1991), Bosnia and Herzegovina (1992), Bulgaria (1991), Croatia (1990), Czech Republic (1991), Hungary (1990), Macedonia (1990), Poland (1990), Romania (1991), Slovakia (1991), Slovenia (1990); and Mongolia (1990).

[6]This point is not to be discounted, given the importance of international financial organizations such as the International Monetary Fund and the European Bank for Reconstruction and Development in shaping transition policies.

on transition economies and perform panel estimations with yearly data.[7] The limited time period also means that the results apply to the short to medium term; it is yet too early to draw conclusions on more long-term growth effects.

I present results for both random effects and fixed effects estimations throughout the study. Random effects are theoretically more efficient, but they rely on the strong assumption of the regressors being uncorrelated with the country-specific unobserved error term. I control for several initial conditions, but there are very probably some further country effects included in the error term, which may be correlated with the covariates. For example, I do not include (initial) education levels in the estimations due to missing data before the year 2000. It is true that a particularity of the transition country sample lies in their very similar education levels: we have to look at upper secondary school enrollment ratios to find significant variation between countries, since the primary and lower secondary schooling levels are very high for all countries.[8] Nevertheless, differing education levels may have influenced growth performance since the start of transition. Similarly, although years under central planning and other historical initial-conditions variables proved insignificant (see below), there could be further cultural or institutional factors that we cannot observe, but which nevertheless influence growth outcomes. I therefore also perform fixed-effects estimations, where some of the cross-sectional variation contained in time-invariant covariates is lost in favour of greater estimation consistency.

The dependent variable is (log) yearly per capita GDP growth (G), estimated with income data from the TransMONEE database, collected by UNICEF to evaluate the situation of children and women in transition countries. I regress

[7] Several early studies resorted to cross-country OLS estimations, with mixed success. My own OLS estimations for the period since the start of transition gave only weak results (see Appendix, Table B). It is conventional in growth empirics using panel data to perform estimations with five or ten-year averages, in order to eliminate cyclical fluctuations. However, using five or even three-year averages radically reduced the number of observations in the sample, rendering statistical inference meaningless. Instead, I try to control for major common cyclical shocks during the short time period, see below.

[8] At the end of the period in 2006, when data on nearly all countries is available, the ratios (in percent) of relevant age cohorts enrolled in undergraduate studies at the upper secondary level lie between 23.4 and 82.4 percent, with a standard deviation of 18 percent. See also Section 4.3 below for more on this point.

growth on several independent variables according to the following equation:[9]

$$G_{it} = \alpha_1 + \alpha_2 oil_{it} + \alpha_3 X_{it} + \alpha_4 IC_i + \omega_i + u_{it}. \quad (1)$$

ω_i is the unobserved individual effect in country i, while u_{it} is the error term in country i in period t.

oil denotes the measure of oil wealth. I use both a flow and a stock measure, namely oil production (*oilprodpc*) and oil reserves (*oilrespc*), dividing them by population in order to have relative indicators. Oil reserves are better able to capture the concept of oil abundance, while oil production is also subject to other factors such as market price fluctuations, extraction and delivery disruptions, and seasonal influences in the more inhospitable regions.[10] Both measures may be influenced by technology levels; however, because of these countries' common legacies – including very high education levels – it is reasonable to say that if there is indeed an endogeneity issue, the bias will be equal across the sample and therefore not drive the results.[11] The data are based on the BP oil and gas database and cross-checked with the U.S. Energy Information Agency (EIA) database for consistency.[12]

The sample contains six countries that produce a substantial amount of oil. Five of them are FSU countries, namely Azerbaijan, Kazakhstan, Russia, Turkmenistan, and Uzbekistan. The sixth one, Romania, is part of the CEE group of countries. The largest producer in both relative and absolute terms is Russia, which at the end of the period (in 2006) had nearly 80 billion barrels in proven oil reserves and was producing nearly 9.8 million barrels of oil per day; followed by Kazakhstan with nearly 40 billion barrels in reserves and over 1.4 million barrels in daily production; Azerbaijan (7 billion barrels reserves, over

[9] The main results employ same-year variables to maximize the sample size. In robustness tests, I also used explanatory variables lagged by one to five years. Despite the smaller sample sizes, the principal findings – particularly on the sign and significance of the oil variables – remained unchanged (available upon request).

[10] In additional robustness tests (discussed below) I also use net per capita oil exports, as well as the ratio of oil exports over total merchandise exports and over GDP (both measures of oil dependence). I present results for oil reserves and production because they come closer to capturing oil *abundance* or *wealth*.

[11] It is worth noting that civil conflict is also not likely to have influenced oil extraction substantially in any of these oil producing countries: Azerbaijan and Russia both saw conflict during this period, but the conflict areas were not close to the major oil fields.

[12] The EIA database is more detailed than the BP database; however, the EIA data include information on oil refinery and related production, as well as minimal amounts of oil, while the BP data concentrate on major oil producers and are therefore more useful for my purpose.

650 thousand daily production); Turkmenistan (600 million barrels reserves, around 186 thousand barrels daily production); Uzbekistan (nearly 600 million barrels reserves, 125 thousand production); and Romania (over 470 million barrels reserves, 104 thousand production).

X is a vector of time-variant covariates that includes (log) inflation, population growth (*gpop*), the average privatisation level (*avgprivat*) and speed (*privatspeed*), a measure of banking reform (*bankref*), investment (*inv*), and a financial crisis variable. I distinguish between privatisation level and speed (following Heybey and Murrell, 1999; Berg et al., 1999; and Godoy and Stiglitz, 2006) by using the average value of the EBRD Transition Report indicators for combined small- and large-scale privatisation. The transition indicators range between 0 and 5, where 5 denotes full liberalisation (or economic transition). Privatisation speed since transition is calculated as $(L(t) - L(0))/t$, where t denotes the number of years since the start of transition.[13] The banking reform measure is also taken from the EBRD Transition Report indicators and measures overall banking sector reform and interest rate liberalisation; it takes into account the recent conclusion of Campos and Coricelli (2002) that the role of financial sector development in transition countries, though potentially very important, has been neglected in empirical studies. Investment *inv* is expressed in percent of GDP and taken from the TransMONEE database. Including investment in the specification could potentially lead to an underestimation of the effects of oil on growth if we consider that a large part of the investments in oil-rich countries will flow into the oil sector. I therefore do not include investment in the base specification. Finally, X includes an economic shock measure for the major financial crisis that hit East Asia and then Russia and the rest of the FSU and CEE between 1997-1998. The variable *fincrisis* takes on a value of zero until 1997, and then increases with every successive year after the crisis to capture the diminishing dampening economic effects of the shock over time.

IC includes several time-invariant regressors, including most notably some measures of initial conditions that have been mentioned in the literature, namely (log) initial income (*initialinc*), the urbanisation rate in 1990 (*urban1990*), and a measure of trade dependence in 1990 (*tradep1990*).[14] Urbanisation rates

[13] Similar results were found when using only the privatisation speed during the first five or first ten years of transition.

[14] Several other measures of initial conditions have been used in the literature, often "condensed" into principal components. They include average growth before transition; a dummy variable for proximity to a market economy; an indicator for repressed inflation during central

(from De Melo et al., 1997) and the initial income – defined as (log) per capita income during the first year of transition (TransMONEE database) – both proxy for the level of initial economic development, with the latter also controlling for convergence effects. The trade shares in GDP (from De Melo et al., 1997) reflect the degree of dependence on trade with other countries in the Council for Mutual Economic Assistance (CMEA) area; it can be expected that the higher the economic interdependence before transition, the greater the negative shock from the sudden disruption in close economic ties within the CMEA.

Finally, I briefly consider the effects of oil on other indicators of socio-economic and political development and compare them with the growth effects. I discuss results for education expenditure and schooling levels (only available since 2000); income inequality (data are taken from the TransMONEE database); corruption control (since 1996 from Kaufmann et al., 2008); and the political regime (democracy vs. autocracy, from the Polity IV database).

For further details and descriptive statistics on the variables, see the Appendix.

3.1 The issue of oil ownership

The literature has largely ignored the issue of the ownership structure of mineral resources and the possible influence it has on the effects of resource wealth on a country's economic and political development. The most common (implicit) assumption has been that mineral deposits and companies have been mainly state-owned since the 1960s, despite the involvement of many private firms around the world (see for example Karl, 1997). Yet, the mineral ownership structure could have potentially large effects: whether a resource is owned by a private firm or by the government of the resource-rich nation has implications for rent appropriation, exploration and production decisions, and even for the exposure to market price fluctuations.

An exception is given by the studies of Jones Luong and Weinthal (2001, 2009), which have concentrated on the ownership structures of mineral wealth, in particular oil; how they emerged; and what policy effects they have. The

planning; the black market premium before transition; years under central planning; a measure of "over-industrialisation" prior to transition; and a categorical variable for previously independent states, decentralised or newly independent states (see De Melo et al., 1997 for more details). None of these variables – or their combination in principal components – was robustly related to growth over the longer period considered in this paper.

authors developed their theory to analyse the oil and gas-rich former Soviet states, and then extended it to other mineral-rich countries. They propose that it is not resource wealth that "curses" mineral-rich countries, but rather their chosen ownership structure. They distinguish between four different possible ownership structures (see Jones Luong and Weinthal, 2001, 2009 for a more detailed description): the first is state ownership with control (S1), where the state has the rights of developing and exploiting mineral deposits and holds over 50% of mineral sector company shares. Second, state ownership without control (S2), where the state still owns the rights to the mineral deposits as well as the majority ($> 50\%$) of shares, but allows greater scope for foreign investment with foreign managerial and operational control, for example in production sharing agreements (PSAs). The third possibility is private domestic ownership (P1), where private domestic firms hold the rights to the development of mineral deposits and the majority of shares ($> 50\%$) in the sector. The fourth and final ownership structure is private foreign ownership (P2), where private foreign companies own both the rights to develop the mineral deposits and the majority of shares ($> 50\%$) in the mineral sector.

Jones Luong and Weinthal mainly concentrate on how the different ownership structures affect the institutional outcomes in mineral-rich states, in particular the fiscal regimes. S1 can be expected to foster weak fiscal regimes, in the sense of unstable and inefficient tax systems, and low incentives for budgetary discipline and transparency. At the other end of the spectrum, P1 would tend to foster strong fiscal regimes, because this structure gives both domestic private owners and the governing élites incentives for demanding and supplying strong domestic institutions, which limit the government's ability for rent extraction while setting clear rules for mineral exploitation. Fiscal regimes under S2 and P2 are classified as "hybrid", because foreign investors are able to stabilise their fiscal burden and also – to the extent that the governing élites have an incentive for transparency and foreign investors are in favour of corporate social responsibility – direct the use of the proceeds from mineral rents towards socio-economic development.

As a consequence, we would expect countries that choose an ownership structure of type P1 to reap the greatest positive long-term economic benefits from mineral wealth, with those choosing S1 most likely to suffer from a "curse" of mineral wealth on their economic performance. S2 and P2-type ownership structures would lead to economic outcomes somewhere in between these two

extremes.

In order to examine whether the mineral ownership structure changes the growth impact of oil, I interact the oil variables with a dummy for ownership type according to the following equation:

$$G_{it} = \beta_1 + \beta_2 oil_{it} + \beta_3 ownership_{it} * oil_{it} + \beta_4 X_{it} + \beta_5 IC_i + \epsilon_i + v_{it}. \quad (2)$$

I set S1 as the base ownership strategy, whose growth effect is given by β_2.[15] β_3 indicates whether a different strategy has led to higher (i.e. positive coefficient) or lower (i.e. negative coefficient) growth effects of oil; the total effect of alternative ownership strategies is given by the sum $\beta_2 + \beta_3$. The remaining covariates are defined as above in equation (1).

The ownership structures of the five oil-rich countries of the FSU and Romania are shown in Table 1 (based on Jones Luong and Weinthal, 2001, 2009). Most of the countries chose S1 at some point. The only country to implement a P1-type strategy was Russia, which switched to S1 in 2005 after a series of takeovers of private domestic oil companies by state-controlled firms. Azerbaijan, and more recently Uzbekistan and Kazakhstan, have an S2-type ownership structure, while Kazakhstan (until 2004) and Romania (since 2004) chose majority foreign private ownership under P2. The fact that I have only one example of P1 in the sample limits the latitude for statistical inference; nevertheless, this exploratory analysis should deliver some interesting insights on the role of mineral ownership in the "oil curse" debate, at least in the short- to mid-term.

4 Estimation results

I present the main estimation results in the following subsections, concentrating first on the growth impacts of oil in FSU and other transition countries, and then on the role of oil ownership. Finally, some findings for other indicators of economic and socio-political development give a more complete view of the effects of oil.

4.1 Oil and growth in transition economies

Table 2 presents estimation results for equation (1) on the sample of 15 FSU countries. Columns (1)-(2) and (5)-(6) show specifications using oil production

[15] Similar results are achieved by using the other ownership types as the base outcome.

per capita (*oilprodpc*) applying random-effects and fixed-effects panel estimations, respectively. Columns (3)-(4) and (7)-(8) show the counterpart estimations using oil reserves per capita (*oilrespc*).

I start out with a parsimonious specification, adding only the oil measure, inflation, privatisation level and speed, and the initial conditions variables (columns (1), (3), (5) and (7)). I then control for population growth (*lnpop*), investment rates, banking sector development, and the shock produced by the financial crisis of 1997-98.[16]

The results remain consistent regardless of the specification: first, oil – both in terms of per capita production and reserves – has evident positive growth effects, most notably when using random-effects GLS estimations. Taking the results from column (1) to calculate the beta coefficients, I find that one standard-deviation increase in oil production (equal to an additional 0.0226 barrels per capita per day) would lead to an increase in growth of $(0.0226 * 1.866/0.1225)$ 0.344 standard deviations, or just over one third (all other things equal). Similarly, column (3) shows that a standard-deviation increase in oil reserves per capita (0.5 thousand barrels per capita) would have a positive growth effect of 0.14 standard deviations. The respective beta coefficients for the fixed-effects specifications in columns (5) and (7) are 0.24 and 0.13. The magnitude of the effects does not vary substantially across specifications and estimation methodologies, although the effects are clearly less significant when using fixed effects. The results suggest that the coefficients are relatively precisely estimated, and moreover, the effect has been economically important, especially regarding oil production.

The other coefficients mostly have the expected signs, with the basic covariates entering with high significance, particularly in the specifications with oil production. Inflation has a negative impact on growth; privatisation levels affect economic performance positively, while privatisation speed on the other hand has a negative effect (however, it is insignificant in the fixed-effects estimations). This is in line with Godoy and Stiglitz (2006), who also found that transition countries that implemented a "shock therapy" approach to privatisation saw slower growth than those that chose a more gradualist approach, and contradicts the earlier findings of Berg et al. (1999) who had arrived at

[16]For space reasons, I do not show the results with piecewise addition of the regressors. However, the results are the same whether adding the covariates one-by-one or all together (available upon request).

the opposite conclusion. However, it is yet too early to tell how long-lasting these growth-dampening effects of fast privatisation were, since we can only judge performance over the first 15 years since the start of transition. Evidence from Poland seems to suggest that a radical shock-therapy approach may bring long-term benefits.

Population growth has the expected negative effect in all but one case, though it is significant only in the fixed-effects estimations. Investment has generally had a positive impact on growth, but not a significant one. Interestingly, banking reforms have not had any strong positive growth effects: on the contrary, the coefficient on *bankref* is consistently negative and in two cases even significant. It may be that the overall economic effects of financial intermediation development have not yet had time to take hold. The financial crisis does not seem to have had any lasting impact on the economies of the FSU.

Finally, (some aspects of) initial conditions continue to have an influence on growth performance, though not always in the expected direction: highly urbanised countries have seen higher growth rates, while initially relatively poor economies show signs of convergence with the higher-income countries. Trade dependence has also had a strong influence on growth outcomes, albeit not in the expected direction: it appears that countries that were more outward-oriented (towards other CMEA-member countries) at the start of transition did not suffer long from the collapse of the CMEA trading region, but were able to take advantage of at least some of their previously established export industries to fuel growth during the transition period.

The findings described above carry over to the results for the larger sample including all 27 transition countries, shown in Table 3. Most importantly, both oil production and oil reserves have strong positive growth effects, with beta coefficients of 0.177 and 0.105 for random effects, and 0.3 and 0.25 for the fixed effects, respectively (using the results from columns (1), (3), (5) and (7)). The effects of oil are smaller – albeit still highly significant – in the larger sample when performing random-effects estimations, but they increase quite substantially in both significance and magnitude when using fixed effects. Note also that the dummy variable for the FSU (in the random-effects estimations) shows that the former Soviet countries have had lower growth rates overall, *ceteris paribus*.

Non-linear growth effects and further robustness tests

The estimation fits in terms of their R-squareds are good, both for the smaller FSU sample and the larger sample with all transition countries, and regardless of estimation method. This indicates that the chosen specifications capture many factors that have been relevant for growth since the start of transition.

However, one interesting question that has not yet been considered is whether oil wealth has non-linear effects on growth. The positive growth impact could potentially diminish with increasing production, with very oil-rich countries reaping fewer benefits, for example due to growing sectoral imbalances along the lines of the "Dutch disease" case. The results in Table 4 indicate that this may indeed be the case, especially in the FSU sample. When adding a square term of the oil variable, the positive growth effect of oil production per capita persists and the coefficient magnitude more than doubles; but the negative squared term suggests that very large oil producers may experience diminishing positive effects of oil. The turning point is around $3.978/(2 \cdot 28.37) = 0.07$ barrels per day and per capita in both the random and fixed-effects specifications. This production level was reached by three countries during the sample period: Kazakhstan from 2003 onwards; Russia from 2005; and Azerbaijan in 2006. The turning point for per-capita oil reserves, on the other hand, is well above the sample mean at around 0.002, a level reached only in Kazakhstan.

The non-linear effects are weaker for the larger sample of all transition countries in the random-effects estimations (columns (3)-(4)), though still strong for the fixed-effects estimations. The respective turning points remain constant at 0.07 for oil production and 0.002 for oil reserves, even with the addition of the oil-producer Romania (the exception is the random-effects estimation in column (3), which is too imprecise to deliver any meaningful information).

Note that these diminishing positive returns to oil do not denote the presence of an oil curse, since the overall effect of oil on growth remains strongly positive. Instead of a straightforward "oil curse", we are seeing evidence of an "oil curse of decreasing benefits". This may be an indication that the oil-rich countries are not re-investing oil proceeds in areas conducive to long-term (and post-oil) development. I investigate whether this is the case in section 4.3 below.

In further robustness tests, I also added lagged income per capita to control for convergence effects, as well as measures for income inequality, education levels, years under central planning, domestic credit to the private sector, a

regime failure dummy, the overall average EBRD transition indicator value, a dummy for post-2000 to capture the possible bias due to soaring oil prices in the second half of the sample period,[17] and variations on the privatisation speed measure to cover only the first five or ten years of transition. Most additional regressors were insignificant, with the exception of lagged income (confirming a convergence effect), the variations on the privatisation speed variable, and the central planning years measure (the latter was significant only in the FSU sample). In all cases, the growth effects of oil remain robust. An interesting, though puzzling result was found when adding a simple dummy variable taking value one from the year many CEE countries started their EU accession negotiations (actual accession took place at the very end of the period – too late for statistical inference). The impact of oil does not change, but one would expect the prospect of EU accession to have positive growth effects: instead, the results show a clearly negative and significant impact on growth (see Table C in the Appendix). This could possibly be explained by the temporary growth-depressing effects of some of the necessary reforms required for accession. Exploring this issue further goes beyond the scope of this paper.

Finally, I also used three alternative oil measures, namely per capita oil exports, and the ratio of oil exports to total merchandise exports and to GDP (the latter two more aptly capturing oil dependence). The results remained robust to these changes (available upon request). Most importantly, per capita oil exports and oil exports over total merchandise exports were positive and highly significant, while oil exports over GDP – albeit positive – were not significant.

4.2 Does oil ownership matter?

As mentioned above, an interesting but often neglected issue concerns the effect of resource ownership on the ultimate impact of mineral wealth on the economy. In order to examine whether the ownership structure changes the results seen above, in Table 5 I add an interaction term between the oil measure and the ownership type dummy (according to equation (2)), with full state ownership (S1) being the base outcome.[18] This means that the coefficient for the

[17] See van der Ploeg and Poelhekke (2009) for more on the strong impact of commodity price volatility on the growth performance of resource-rich countries.

[18] I show results only for the basic specifications for both samples and estimation methods; adding additional variables did not affect the findings. Moreover, for space reasons I don't show the results for the other covariates. Full results are available upon request.

oil measure (*oilprodpc* or *oilrespc*) shows the effect for S1-type ownership of oil resources, while the interaction terms give the variation for the respective ownership strategy.

I first test whether the four oil variables – the oil measures with and without interaction – are jointly significant. Joint significance is confirmed in six out of eight cases, namely in columns (1), (3) and (7) (at the 1%-level), and columns (2), (5) and (8) (5%-level), while joint insignificance cannot be rejected for specifications (4) and (6).

Second, it is interesting to see that the net growth effect of oil, measured either in terms of production or of reserves, remains positive and significant for all ownership structures. Recall that the net growth effect of oil in countries with S2-type ownership, for example, is given by summing up the coefficients of the respective interaction term (S2=1) and the oil measure without interaction.

However, although the interaction terms are only sometimes significant, they are mostly negative, especially in the random-effects estimations. This suggests that S2 and P2-type ownership structures in particular have brought lower positive growth effects than majority state ownership without important foreign investment (S1), the base group. A P1-type structure achieves only the second-largest positive impact in the random-effects specifications, though it does appear to trump state ownership with control (S1) in the fixed-effects estimations, albeit not significantly. Note that P2-type ownership structures give the most precisely estimated effects of all interaction terms, strengthening the impression that majority foreign ownership has not really benefitted these countries in terms of their growth performance since the start of transition.

Comparing the magnitudes of the effects with those found in the previous specifications without differentiating by ownership structure, countries with S1-type oil ownership have had larger positive growth benefits, with beta coefficients for oil production of 0.48 in the FSU and 0.25 in the full sample, and of 1.03 and 0.56, respectively, for oil reserves (looking at the random-effects specifications). The fixed-effects specifications give greater effects to both S1 and P1 in all but column (6). The size of the positive growth effects for countries choosing other ownership structures is more in line with the magnitudes found in Tables 2-3.

These findings apparently contradict the expectations based on the hypotheses of Jones Luong and Weinthal (2001, 2009), according to which S1-type (P1) mineral resource ownership leads to the worst (best) fiscal regime outcomes,

and therefore supposedly also to the worst (best) overall economic performance. The explanation may however lie less in a mistake in the theoretical prediction than in the size of the sample at our disposal for the empirical estimations. The findings are likely due to the small number of petroleum-rich states among transition countries on the one hand, and on the other to the fact that most of these oil states have chosen S1-type ownership strategies for at least part of the (short) time period under examination. Only one country (Russia) chose P1. This introduces a statistical bias in favor of S1-type ownership strategy. Moreover, the relatively short time period of the analysis does not allow to draw conclusions for the long term. Therefore, these results are an interesting first attempt at differentiating oil-rich countries according to the ownership structure of their mineral sectors and evaluating the economic effects of the chosen strategies, and further research into this issue is encouraged.

4.3 Oil and development

So far, all results have pointed to a strong positive effect of oil on GDP growth, at least in the short to mid-term. This runs counter to the idea of a general curse of oil on growth. However, income growth is only one possible indicator of overall economic and social development. Table 6 presents results for several important development indicators, many of which have also been indicated as possible "transmission channels" of the resource curse in previous literature (fixed-effect results are relegated to the Appendix for space reasons).

First, I examine the impact of oil on human capital formation. Gylfason (2001) and Papyrakis and Gerlagh (2004), for example, argue that resource abundance has a negative effect on schooling rates, since a boom in the primary sector leads to lower returns to education via a decline in the manufacturing sector. Bravo-Ortega and de Gregorio (2005) however show that high-enough human capital levels, proxied by the number of years of schooling, always offset the negative growth effects of natural resources and can even turn them into positive effects. It is difficult to ascertain the impact of oil on education levels in transition economies at this point. Schooling levels change only slowly, and in addition, a particularity of transition economies is their generally very high level of schooling, which can be attributed to strong socialist policies to boost the education level of its population. Consequently, there is (still) very little variation in primary and lower secondary schooling levels, which are very high

in all countries in the sample.[19] I therefore use two different proxies for human capital formation: first, the GDP share of public expenditure on education, which changes more rapidly than education levels, while at the same time being a good indicator of (future) developments in schooling levels. And second, upper secondary schooling (i.e. undergraduate level), where the variation is much larger than for lower-level schooling. The results for education expenditures are shown in columns (1)-(2). Both oil production and reserves have a negative and significant impact on education expenditures. Oil production has a negative, albeit insignificant effect on upper secondary schooling ratios, while oil reserves have a positive and significant impact (not shown for space reasons – available upon request). These findings point towards a worrying tendency in oil-rich countries to neglect human capital formation.

A second indicator of overall economic and social development is the level of income inequality. Similar to schooling levels, inequality changes only slowly over time, and it may therefore be too early to see whether oil wealth has affected income distribution, either by closing or widening the gap between rich and poor. In fact, the results – shown in columns (3)-(4) – prove encouraging but inconclusive: oil production and reserves both seem to have resulted in pro-poor growth and therefore reduced inequality, but their impact is significant only for oil reserves in the random-effects estimation.

Finally, I use two institutional variables: the first measures the level of corruption control (columns (5)-(6)), while the second classifies a country's government system or polity on a scale from highly autocratic (-10) to highly democratic (10) (columns (7)-(8)). Again, the literature on the resource curse suggests that resource-abundant countries tend to be more corrupt and to have less democratic political regimes. The results unfortunately do not prove these theories wrong: both oil production and reserves clearly lead to higher corruption and less democratic regimes with both estimation methods.

The results for the development indicators prove altogether less favorable for oil-rich countries, suggesting that the experience to date has not been as rosy as the growth results imply. However, these findings should be interpreted with caution: although the negative impacts seem quite strong for the human capital and institutional measures, it is unclear whether they indicate a causal

[19] The lowest enrolment ratios for basic (primary and lower secondary) school were in Bosnia & Herzegovina and Turkmenistan, which nevertheless were close to 90 percent according to the TransMONEE database.

relationship. Institutions in particular change only slowly – much more slowly than growth rates, for example: although I include the number of years under central planning in the random-effects specifications and the sample is relatively homogeneous, institutions may nevertheless be influenced by other historical and cultural factors. In sensitivity tests using dynamic Arellano-Bond GMM estimations, the negative signs are in fact reversed, and oil turns out to have strong positive effects on both polity and corruption control (results available upon request). It is difficult to reach a definite conclusion on oil and development with the data currently available (most data start only in the mid-1990s or later); this point is left to further research.

5 Discussion and conclusions

The so-called resource curse has been a popular research topic among economists and political scientists during the last decade. Many studies concur that negative economic and political outcomes are most likely with certain types of natural resources – often termed point-source resources – one of which is oil. Some of the reasons for oil's negative effects supposedly lie in the high rents that can be extracted from oil production, and oil's relatively easy appropriability, which both make it an attractive target for corruptive and potentially economically and politically disruptive rent-seeking.

This paper examines the oil curse hypothesis for a narrow set of transition countries of the former Soviet Union (FSU) and Central and Eastern Europe (CEE). These countries present the interesting characteristic of having started out on a major economic and political reform path at virtually the same time and with very similar initial socio-economic conditions, thereby eliminating some of the inference problems of larger and more heterogeneous samples. Some 15 years later, this huge "experiment" allows us to draw some conclusions on whether the presence of oil in a handful of these countries has contributed to economic performance, and if so, in what direction.

The findings show clearly that oil – measured both in terms of per capita production and reserves – has so far on average had decidedly positive growth effects, although there appear to be diminishing positive benefits for the largest oil producers. The positive growth effects of oil are confirmed for different mineral ownership strategies, whether mostly state- or private-owned, which is – to my knowledge – the first time that this issue has been addressed explicitly

in the context of resources and growth. State-controlled oil assets in fact seem to have given the greatest positive effects, reminiscent of the positive experience in Norway.

However, it is also important to note that the positive growth effects found so far in the transition economies of the FSU and CEE need not automatically hold in the future, as well. A necessary provision for continued strong growth performance is the wise investment of oil revenues not only into the oil sector itself (in order to maintain and possibly increase production and distribution), but also into other sectors of the economy (in the spirit of long-term economic diversification) and into education. This provision may not be met in all countries under analysis, a point which is suggested by the negative results on education expenditures. Anecdotal evidence from Russia, for example, shows that there are signs that the economy is worryingly biased towards the oil and gas sector, while at the same time not enough new investment is being undertaken to secure future production. This combination bodes ill for long-term development in the region's largest economy, and the current large economic contraction following the global economic crisis does nothing to dispel these worries.[20] Further evidence that oil may have had negative effects on overall development is given by the (preliminary) results for institutional quality and political system: oil-rich countries seem to be both more corrupt and less democratic.

It also remains to be seen whether integration into the European Union may not prove to be a much more important driver of economic growth in the future than mineral wealth, setting the CEE countries even farther apart from their fellow former Council for Mutual Economic Assistance members of the FSU. Already, it is apparent from the empirical results that FSU countries – including the oil-rich ones – are generally lagging behind the CEE countries in terms of economic performance. It will therefore be interesting to re-examine the results of the present paper further down the line to see whether there is still no oil curse in sight.

[20] Note that the Russian President Dmitri Medvedev, in his address to the nation in November 2009, warned that the Russian economy was too reliant on the oil and gas sector and overall not competitive. He also called for a fundamental modernisation of the country on the basis of democratic values.

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Table 1. Oil ownership strategies in transition countries

	Oil ownership strategy
FSU	
Azerbaijan	S2
Kazakhstan	P2 (until 2004), S2 (since 2005)
Russian Federation	P1 (until 2004), S1 (since 2005)
Turkmenistan	S1
Uzbekistan	S1 (until 2000), S2 (since 2001)
Other transition countries	
Romania	S1 (until 2003), P2 (since 2004)

Notes: Oil ownership strategies taken from Jones Luong and Weinthal (2001, 2009).

Table 2. Oil and growth in FSU countries

	re	re	re	re	fe	fe	fe	fe
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
oilprodpc	1.866***	1.894***			1.282*	1.735**		
	(3.62)	(3.83)			(1.77)	(2.31)		
oilrespc			34.226***	34.20***			31.66	42.66
			(3.49)	(3.47)			(1.08)	(1.24)
inflation	-0.016***	-0.017***	-0.020***	-0.020***	-0.014**	-0.012**	-0.014**	-0.013**
	(2.73)	(2.79)	(3.22)	(3.27)	(2.12)	(1.97)	(2.11)	(2.02)
avgprivat	0.074***	0.099***	0.059***	0.091***	0.104***	0.110***	0.105***	0.107***
	(4.52)	(4.24)	(3.79)	(3.99)	(4.71)	(4.25)	(4.71)	(4.18)
privatspeed	-0.124***	-0.126**	-0.137***	-0.121**	-0.060	-0.084	-0.064	-0.077
	(2.97)	(2.38)	(3.27)	(2.25)	(1.4)	(1.51)	(1.48)	(1.37)
gpop		-1.026		0.026		-3.073**		-2.753*
		(1.02)		(0.03)		(2.04)		(1.83)
inv		0.001		0.001		0.001		0.001
		(1.07)		(1.48)		(0.52)		(0.6)
bankref		-0.039**		-0.048**		-0.011		-0.01
		(2.11)		(2.46)		(0.5)		(0.42)
fincrisis		0.001		0.003		0.001		0.002
		(0.67)		(1.42)		(0.40)		(0.86)
initialinc	-0.072***	-0.060*	-0.041*	-0.033				
	(2.61)	(1.85)	(1.70)	(1.11)				
tradedep1990	0.006***	0.006***	0.003***	0.004***				
	(3.53)	(3.53)	(2.80)	(2.88)				
urban1990	0.003***	0.003*	0.002*	0.003				
	(2.62)	(1.81)	(1.87)	(1.6)				
Observations	214	214	214	214	214	214	214	214
Countries	15	15	15	15	15	15	15	15
R^2 within	0.64	0.65	0.62	0.63	0.66	0.67	0.65	0.67
R^2 between	0.48	0.41	0.46	0.45	0.19	0.27	0.21	0.29
R^2 overall	0.61	0.62	0.58	0.61	0.47	0.45	0.47	0.45

Notes: Dependent variable is annual real per capita growth. Constant term included in all estimations (not shown). Robust z-statistics in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Table 3. Oil and growth in transition countries

	re	re	re	re	fe	fe	fe	fe
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
oilprodpc	1.153***	1.163***			1.947***	2.384***		
	(3.25)	(4.05)			(2.78)	(3.76)		
oilrespc			27.61***	24.87***			66.60**	79.14***
			(3.66)	(4.01)			(2.4)	(2.93)
inflation	-0.018***	-0.019***	-0.019***	-0.019***	-0.017***	-0.018***	-0.017***	-0.018***
	(4.96)	(4.98)	(4.99)	(4.95)	(4.78)	(4.95)	(4.80)	(4.94)
avgprivat	0.051***	0.056***	0.047***	0.055***	0.064***	0.082***	0.064***	0.081***
	(5.45)	(5.06)	(5.13)	(4.92)	(5.89)	(5.7)	(5.85)	(5.62)
privatspeed	-0.091***	-0.110***	-0.098***	-0.109***	-0.045	-0.076**	-0.047	-0.075**
	(3.39)	(3.78)	(3.71)	(3.78)	(1.33)	(2.01)	(1.40)	(1.97)
gpop		-1.020*		-0.637		-1.195		-1.107
		(1.73)		(1.09)		(1.53)		(1.42)
inv		0.001		0.001		0.001		0.001
		(1.38)		(1.62)		(0.75)		(0.77)
bankref		-0.009		-0.014		-0.022		-0.022
		(0.98)		(1.45)		(1.53)		(1.55)
fincrisis		-0.001		-0.0005		-0.003*		-0.002
		(0.75)		(0.31)		(1.7)		(1.3)
fsu	-0.043**	-0.047***	-0.021	-0.023				
	(2.18)	(2.73)	(1.35)	(1.64)				
initialinc	-0.03***	-0.028***	-0.026***	-0.024**				
	(3.01)	(2.99)	(2.72)	(2.55)				
tradedep1990	0.002***	0.002***	0.001**	0.001**				
	(2.60)	(3.05)	(2.12)	(2.16)				
urban1990	0.001*	0.001	0.001**	0.001*				
	(1.90)	(1.34)	(1.99)	(1.77)				
Observations	396	396	396	396	397	397	397	397
Countries	27	27	27	27	27	27	27	27
R^2 within	0.54	0.55	0.53	0.54	0.546	0.57	0.54	0.56
R^2 between	0.33	0.32	0.37	0.34	0.12	0.09	0.17	0.14
R^2 overall	0.50	0.51	0.49	0.5	0.413	0.41	0.41	0.41

Notes: Dependent variable is annual real per capita growth. Constant term included in all estimations (not shown). Robust z-statistics in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Table 4. Non-linear effects of oil on growth

	re	re	re	re	fe	fe	fe	fe
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
oilprodpc	3.978***		1.462		7.499**		11.18***	
	(2.9)		(1.59)		(2.12)		(3.52)	
oilprodpc square	-28.37**		-4.419		-55.77*		-83.03***	
	(2.01)		(0.39)		(1.92)		(3.21)	
oilrespc		147.5***		87.07**		160.0*		225.1**
		(3.05)		(2.24)		(1.82)		(2.53)
oilrespc square		-46778***		-26076*		-38607*		-47989**
		(2.75)		(1.81)		(1.80)		(2.23)
inflation	-0.013**	-0.018***	-0.018***	-0.018***	-0.013*	-0.014**	-0.016***	-0.017***
	(2.16)	(2.86)	(4.95)	(4.96)	(1.97)	(2.17)	(4.52)	(4.82)
avgprivat	0.088***	0.070***	0.052***	0.049***	0.103***	0.102***	0.063***	0.063***
	(4.48)	(4.15)	(5.28)	(5.2)	(4.65)	(4.52)	(5.85)	(5.72)
privatspeed	-0.124***	-0.137***	-0.09***	-0.099***	-0.07	-0.067	-0.054	-0.051
	(2.99)	(3.29)	(3.33)	(3.76)	(1.56)	(1.55)	(1.56)	(1.51)
lninitialinc	-0.092***	-0.06**	-0.031***	-0.027***				
	(2.88)	(-2.23)	(3.03)	(2.86)				
tradedep1990	0.007***	0.004***	0.002**	0.002**				
	(3.50)	(3.28)	(2.49)	(2.35)				
urban1990	0.004***	0.003**	0.001*	0.001*				
	(2.89)	(2.2)	(1.90)	(1.93)				
fsu			-0.046**	-0.031*				
			(2.08)	(1.76)				
Sample	FSU	FSU	all	all	FSU	FSU	all	all
Observations	214	214	396	396	214	214	397	397
Countries	15	15	27	27	15	15	27	27
R^2 within	0.65	0.63	0.54	0.53	0.66	0.66	0.55	0.55
R^2 between	0.46	0.48	0.32	0.36	0	0.22	0	0.12
R^2 overall	0.62	0.6	0.5	0.5	0.35	0.45	0.2	0.36

Notes: Dependent variable is annual real per capita growth. Constant term included in all estimations (not shown). Robust z-statistics in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Table 5. Oil ownership and growth in transition countries

	re	re	re	re	fe	fe	fe	fe
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
oilprodpc	2.587***		1.608**		3.667***		3.955***	
	(2.84)		(2.2)		(3.02)		(3.49)	
s2*oilprodpc	-0.794		-0.266		-2.662*		-2.264*	
	(0.93)		(0.31)		(1.91)		(1.73)	
p1*oilprodpc	-0.266		-0.948		0.638		0.592	
	(0.40)		(1.41)		(1.26)		(1.40)	
p2*oilprodpc	-0.783		-0.634		-2.876**		-2.377*	
	(1.04)		(0.92)		(2.04)		(1.79)	
oilrespc		252.3**		145.7*		188.3		271.6**
		(2.35)		(1.88)		(1.2)		(2.20)
s2*oilrespc		-197.9*		-101.4		-157.9		-207.1*
		(1.96)		(1.31)		(1.00)		(1.66)
p1*oilrespc		-19.64		-83.24		-11.87		7.315
		(0.33)		(1.28)		(0.67)		(0.46)
p2*oilrespc		-209.1**		-123.2*		-161.3		-211.8*
		(2.12)		(1.65)		(1.01)		(1.69)
Sample	FSU	FSU	all	all	FSU	FSU	all	all
Observations	214	214	396	396	214	214	396	397
Countries	15	15	27	27	15	15	27	27
R^2 within	0.64	0.63	0.54	0.53	0.66	0.65	0.55	0.54
R^2 between	0.41	0.38	0.35	0.35	0.07	0.17	0.04	0.12
R^2 overall	0.61	0.59	0.5	0.5	0.39	0.45	0.34	0.39

Notes: Dependent variable is annual real per capita growth. Inflation, privatization level and speed, and constant term included in all estimations (not shown). Random-effects estimations also include initial conditions (initial income, trade dependence in 1990, and urbanization in 1990), and FSU dummy in large sample. Robust z-statistics in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Table 6. Oil and development in transition countries

	(1) eduexpend	(2) eduexpend	(3) inequality	(4) inequality	(5) corruption	(6) corruption	(7) polity	(8) polity
oilprodpc	-24.42***		-0.275		-5.771***		-60.96***	
	(3.92)		(1.46)		(4.43)		(2.77)	
oilrespc		-755.2***		-18.80***		-243.0***		-2362***
		(2.83)		(3.16)		(5.39)		(3.77)
lngdppc	0.378	0.0789	-0.0497***	-0.0498***	0.446***	0.428***	0.358	0.37
	(0.89)	(0.18)	(4.66)	(4.83)	(5.97)	(5.94)	(0.47)	(0.47)
inflation	-0.017	-0.032	0.001	0.001	-0.007	-0.007	0.363***	0.374***
	(0.31)	(0.61)	(0.36)	(0.35)	(0.50)	(0.51)	(2.82)	(2.93)
avgprivat	-0.2	0.113	0.0281***	0.0283***	0.0363	0.0533	1.244***	1.271***
	(0.48)	(0.29)	(5.61)	(5.67)	(0.59)	(0.88)	(4.29)	(4.42)
privatspeed	-3.162*	-3.146*	-0.030**	-0.030**	0.252	0.273	-1.379*	-1.459*
	(1.87)	(1.81)	(1.97)	(2.00)	(1.01)	(1.08)	(1.74)	(1.91)
fsu	1.295	0.44	0.129**	0.132**	-0.138	-0.179	-2.427	-2.594
	(0.73)	(0.26)	(2.05)	(2.18)	(0.62)	(0.78)	(0.84)	(0.88)
tradedep1990	0.019	0.044	-0.003**	-0.004***	0.011*	0.013**	0.031	0.042
	(0.38)	(0.96)	(2.44)	(2.63)	(1.87)	(2.11)	(0.28)	(0.37)
urban1990	0.001	0.011	0.002	0.002	-0.002	-0.002	0.223***	0.219***
	(0.04)	(0.34)	(1.52)	(1.57)	(0.37)	(0.31)	(2.85)	(2.76)
centralplan	-0.034	-0.033	-0.002	-0.002	-0.010	-0.011	-0.147*	-0.158**
	(0.72)	(0.71)	(1.07)	(1.13)	(1.39)	(1.52)	(1.84)	(1.97)
Observations	150	150	370	370	279	279	312	312
Countries	25	25	25	25	27	27	26	26
R^2 within	0.12	0.11	0.19	0.18	0.14	0.14	0.07	0.08
R^2 between	0.38	0.31	0.6	0.62	0.9	0.89	0.66	0.65
R^2 overall	0.41	0.33	0.51	0.53	0.84	0.83	0.58	0.57

Notes: All estimations are random effects GLS panel estimations. Constant term included in all estimations (not shown). Robust z-statistics in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Appendix

Data description

post-transition growth: Year-on-year growth rate of real GDP per capita (constant prices) after start of transition. Source: TransMONEE database, May 2008, UNICEF Innocenti Research Centre.

oil production per capita (***oilprodpc***): Oil production in barrels per day. Source: British Petroleum 2008 Statistical Review of World Energy, cross-checked with Energy Information Agency database.

oil reserves per capita (***oilrespc***): Oil reserves in million barrels. Source: British Petroleum 2008 Statistical Review of World Energy, cross-checked with Energy Information Agency database.

oil ownership dummy variables (***S1***, ***S2***, ***P1***, ***P2***): Oil ownership structure classified as majority state-owned with no or little foreign investment (S1), majority state-owned with substantial foreign investment (S2), majority private domestic ownership (P1), and majority foreign private ownership (P2). Source: Jones Luong and Weinthal (2001, 2009).

inflation (***inflation***): natural logarithm of inflation (GDP deflator), annual %. Source: World Development Indicators.

privatization level (***avgprivat***) and **speed** (***privatspeed***): privatization is given by the yearly average of small- and large-scale privatization indicators. privatization speed since start of transition is calculated as (L(t)-L(0))/t where t denotes the number of years since the start of transition. Source: EBRD Transition Report.

population growth (***gpop***): (log) yearly growth of population. Source: TransMONEE database, May 2008, UNICEF Innocenti Research Centre, and Penn World Tables 6.2.

investment in percent of GDP (***inv***): Investment as percent of GDP. Source: TransMONEE database, May 2008, UNICEF Innocenti Research Centre.

banking reform (***bankref***): Banking reform and interest rate liberalisation indicator. Source: EBRD Transition Report.

financial crisis (***fincrisis***): Financial crisis measure with value zero until 1997 and increasing value with every year after the crisis.

initial income (***initialinc***): Natural logarithm of GDP per capita (constant prices) in year of start of transition. Source: TransMONEE database, May 2008, UNICEF Innocenti Research Centre.

trade dependence in 1990 (***tradep1990***): Trade dependence in 1990 in percent of GDP. From de Melo et al. (1997).

urbanization rates in 1990 (***urban1990***): Urbanization rate in 1990 in percent of total population. From de Melo et al. (1997).

years of central planning (***centralplan***): Years under central planning prior to start of transition. From De Melo et al. (1997).

FSU country dummy (***fsu***): Country dummy with value one for 15 countries of former Soviet Union.
education expenditure (***eduexpend***): Public expenditure on education as percent of GDP. Source: TransMONEE database, May 2008, UNICEF Innocenti Research Centre.
inequality: Distribution of income according to Gini coefficient (income-based). Source: TransMONEE database, May 2008, UNICEF Innocenti Research Centre.
corruption control (***corruption***): Corruption control measure on scale from -2.5 (worst) to 2.5 (best). From Kaufmann et al. (2008).
polity: Polity 2 indicator on a scale of -10 (strong autocracy) to 10 (strong democracy). From Polity IV database.

Table A. Descriptive statistics

FSU countries					
Variable	Obs	Mean	Std. Dev.	Min	Max
post-trans growth	219	0.0061	0.1225	-0.581	0.2854
oil production pc	262	0.015	0.0226	0	0.0931
oil reserves pc	228	0.0002	0.0005	0	0.0027
ln inflation	270	3.3399	2.0825	-2.9986	9.6449
privatization level	270	2.5424	1.0949	1	4.165
privatization speed	225	0.2844	0.2137	0	1.335
population growth	390	0.0047	0.0122	-0.0258	0.0322
investment (percent GDP)	232	24.3668	8.0799	-0.7	59
banking reform	270	1.8827	0.8393	1	4
ln initial income	260	7.0828	0.764	5.7287	8.315
urbanisation 1990	237	56.9958	13.317	32	74
trade dependence 1990	237	28.6768	7.4265	11	41
All transition countries					
Variable	Obs	Mean	Std. Dev.	Min	Max
post-trans growth	406	0.0143	0.1048	-0.581	0.6268
oil production pc	421	0.0065	0.0161	0	0.0931
oil reserves pc	421	0.0001	0.0004	0	0.0027
ln inflation	410	3.0814	1.9302	-3.0945	9.6449
privatization level	422	2.997	0.9089	1	4.1650
privatization speed	422	0.2621	0.2096	-0.5	1.335
population growth	432	-0.0002	0.0118	-0.0581	0.0373
investment (percent GDP)	421	23.9798	7.0864	-0.7	59
banking reform	422	2.3090	0.8846	1	4
ln initial income	414	7.4429	0.8519	5.7287	8.9951
urbanisation 1990	420	58.0119	11.0182	32	74
trade dependence 1990	420	19.8129	12.1474	3.7	41

Table B. OLS estimations

	(1)	(2)	(3)	(4)
	FSU	FSU	All transition countries	All transition countries
avg oil production pc	0.708		-0.041	
	(1.17)		(0.11)	
avg oil reserves pc		16.377***		8.426
		(2.78)		(1.42)
avg privatization	0.037**	0.024**	0.006	0.006
	(2.09)	(2.39)	(0.62)	(0.60)
inflation	0.009	0.005	-0.011**	-0.012**
	(1.38)	(0.88)	(2.17)	(2.37)
initial income	-0.039*	-0.026	-0.027***	-0.027***
	(1.81)	(1.62)	(3.13)	(3.08)
trade dependence 1990	0.003*	0.002***	-0.0001	-0.0001
	(1.70)	(2.91)	(0.28)	(0.16)
urbanisation 1990	0.003***	0.002***	0.002***	0.002***
	(3.00)	(2.72)	(3.34)	(3.29)
Constant	-0.122	-0.090	0.138**	0.141***
	(1.43)	(1.18)	(2.50)	(2.59)
Observations	15	15	27	27
R^2	0.62	0.62	0.48	0.48
F-stat p-value	0.2	0.09	0.042	0.041

Notes: All estimations are OLS with average per capita growth in GDP since transition as the dependent variable. Robust t-statistics in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Table C. The effect of EU accession negotiations on growth in transition economies

	(1)	(2)	(3)	(4)
	re	re	fe	fe
oilprodpc	0.637**		1.594**	
	(2.43)		(2.16)	
oilrespc		17.80***		49.34*
		(3.03)		(1.70)
inflation	-0.019***	-0.019***	-0.016***	-0.016***
	(5.16)	(5.11)	(4.71)	(4.73)
avgprivat	0.052***	0.051***	0.074***	0.075***
	(5.66)	(5.51)	(6.52)	(6.51)
privatspeed	-0.121***	-0.123***	-0.096***	-0.099***
	(4.51)	(4.65)	(2.64)	(2.74)
EU access neg	-0.038***	-0.038***	-0.061***	-0.062***
	(4.31)	(4.19)	(5.15)	(5.28)
initialinc	-0.014	-0.014		
	(1.49)	(1.62)		
tradedep1990	0.001*	0.001*		
	(1.8)	(1.82)		
urban1990	0.001	0.001*		
	(1.58)	(1.85)		
Observations	396	396	397	397
Countries	27	27	27	27
R^2 within	0.56	0.55	0.57	0.57
R^2 between	0.25	0.28	0.09	0.14
R^2 overall	0.5	0.5	0.44	0.44

Notes: Dependent variable is yearly post-transition GDP growth rate. Robust z-statistics in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.

Table D. Oil and development in transition countries - fixed effects

	(1) eduexpend	(2) eduexpend	(3) inequality	(4) inequality	(5) corruption	(6) corruption	(7) polity	(8) polity
oilprodpc	-14.58*		-0.23		-4.914***		-46.69**	
	(1.74)		(1.11)		(3.15)		(2.37)	
oilrespc		-624.2***		-11.93		-260.5***		-2284***
		(2.94)		(1.36)		(4.87)		(3.48)
lngdppc	-0.9	-1.181***	-0.039***	-0.039***	0.425***	0.409***	0.933	0.971
	(1.46)	(2.74)	(2.66)	(2.75)	(3.53)	(3.64)	(1.10)	(1.17)
lninflation	-0.032	-0.041	0.001	0.001	-0.010	-0.009	0.359***	0.365***
	(0.57)	(0.79)	(0.39)	(0.39)	(0.73)	(0.68)	(2.67)	(2.75)
avgprivat	0.945	1.237**	0.027***	0.027***	-0.016	-0.002	1.127***	1.148***
	(1.59)	(2.47)	(5.22)	(5.24)	(0.17)	(0.02)	(3.60)	(3.69)
privatspeed	-5.729***	-6.058***	-0.022	-0.022	0.15	0.142	-1.335	-1.405*
	(2.76)	(3.35)	(1.34)	(1.34)	(0.50)	(0.47)	(1.63)	(1.75)
Observations	150	150	371	371	279	279	313	313
Countries	25	25	25	25	27	27	26	26
R^2 within	0.17	0.18	0.19	0.19	0.14	0.15	0.07	0.08
R^2 between	0.11	0.12	0.37	0.39	0.85	0.84	0.51	0.46
R^2 overall	0.1	0.12	0.34	0.36	0.79	0.78	0.41	0.39

Notes: All estimations are fixed effects (within) panel estimations. Constant term included in all estimations (not shown). Robust z-statistics in parentheses. *, **, *** statistically significant at 10, 5, and 1 percent levels, respectively.