

# Scarcity and Wealth Revisited

## Perspectives on Commodity Markets in the 21<sup>st</sup> Century

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*To my parents, Jim and Barbara McGill:*

*To the memory of my father,  
who in every way saw me through to the completion of this thesis  
but did not live to call me 'Doctor'.*

*And to my mother,  
whose dedication to learning, generosity of spirit, humour, and love  
keep his spirit alive, and sustain me.*

## ABSTRACT

This thesis explores a selection of the ways in which an era of high mineral commodity prices – commonly dubbed the ‘super-cycle’ of the 2000s – is reshaping the map of global commodity markets. It pursues this agenda through three research aims: (1) to recast the relationship between geophysical resource supply, prices, and markets; (2) to examine some of the institutions that channel and benefit from resource wealth; and (3) to ‘open the black box’ of the commodity price formation process. The thesis pursues this agenda through four substantive papers, each with its own set of research objectives and findings, and primarily uses the example of phosphate as a vehicle for discussion.

The first half of the thesis focuses on the production side of commodity markets. It begins by exploring the multidimensional nature of the concept of resource scarcity, both in its geophysical and socioeconomic aspects, by interrogating a prominent inherited conception of natural resource scarcity: ‘peak’ natural resources, specifically peak phosphorus discourses (chapter 3). The thesis then carries on the research agenda suggested by this initial study by conducting a field research-based case study of the little-known Moroccan state-owned phosphate mining and fertilizer company, OCP Group (chapter 4). It explores the particular type of principal-agent problem in generating and distributing national resource wealth that national extractive companies (NECs) such as OCP face.

The second substantive half of the thesis is concerned with global commodity trading and price formation. It constructs an ‘anatomy’ of global phosphate markets in order to shed light on the phosphate price formation process (chapter 5). Based on this investigation, the thesis argues that despite the opacity of the processes by which phosphate is priced, an apparent lack of a ‘benchmark’ or reference price is not necessarily as problematic as market theorists might assume. Finally, the thesis takes a macro-level perspective of the relationship between finance and physical commodity trade by examining the role of financial trading in the governance of commodity markets (chapter 6).

Overall the thesis distils the following findings. To begin with, a deeper and more nuanced understanding of the concept of resource scarcity puts short-term price movements as indicators of resource availability into perspective while revealing an unforeseen degree of complexity, as well as certain ‘blind spots’, in the geopolitical and institutional aspects of resource supply and trading. Second, the power of two particular, less-researched types of institutions that channel and benefit from resource wealth – names, national extractive companies and financial investors – is both less great and different in nature than is commonly assumed. Third, for institutional as well as geographic reasons that are specific to different types of commodities, the commodity price formation process is even further from the joint ideals of market transparency and liquidity than is commonly assumed. Finally, insofar as commodity production and trade can be conceived as part of the ‘real economy’, it cannot succumb to what is widely feared as the hegemony of ‘financial logic’.

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Any errors and omissions remain my own.

*Sarah M. McGill*

*Oxford, 3 October 2014*

## CHAPTER 1 | Introduction

### 1.1 Introduction

The first decade of the twenty-first century witnessed spectacular rates of economic growth in developing countries. While the geographic scope of this growth has been historically unprecedented, it has overwhelmingly been led by China, with its share of one-fifth of the world's population. Despite a setback in the form of the ongoing global financial crisis, these forces reshaping the map of global geopolitical power have irrevocably been set in motion, with far-reaching political, socio-economic, and environmental implications. Of course, one of the most fundamental prerequisites for, and consequences of, such growth is the intensive per capita consumption of natural resources. In starker terms, the spectacular economic growth of middle-income countries has not come without environmental costs. The spectre of anthropogenic climate change looms large, but so too does an age-old fear: that of running out of essential resources such as agricultural goods, water, and minerals.

For a great many observers, this apparent 'scramble for resources' can only be a source of profound socio-environmental concern (Nair 2011; Klare 2012). Many conventional accounts of the 'scramble' focus on the potential for interstate or inter-regional conflict, whether diplomatic or armed (Peet and Watts 1994; Homer-Dixon 1999; Le Billon 2001). A complementary take envisages not so much conflict in the more conventional sense but economic warfare in the form of trade barriers and intensified corporate competition for 'what's left' (Klare 2012): 'The multilateral trading system, among others, is set to become the proxy theatre of global resource war' (Lee et al. 2012, 136). It is true that both dynamics are already playing out in a

number of arenas, including the race to claim Arctic minerals, oil and gas reserves, and shipping lanes; tensions in the north-west Pacific between China, Japan, and Korea; and farmland investment in fertile regions by finance-rich, resource-poor nations.

At one level, even modest historical perspective shows that these are simply iterations of a very old story, one defined even in the contemporary era by the thinking of Thomas Malthus. However, without denying the geophysical reality of scarcity or the possibility of (violent or non-violent) conflict over dwindling supplies, this thesis starts from the basic premise that, as a recent *New York Times* opinion piece has put it, ‘There is rarely a simple linear path from abundance to scarcity’ (Sabin 2013). The thesis takes as its focus one point along this path: an era of high prices driven by medium-term scarcity – commonly dubbed the ‘super-cycle’ of the 2000s – that has reshaped the map of global commodity markets such that commodities have proven to be the origin of wealth and sovereign power for a new set of actors, be they nation-states, corporations, or financial institutions.

Put differently, the thesis recognises that the scramble and the super-cycle are two sides of the same coin, and it explores a select few instances that illustrate many of the ways in which commodity production and trade have evolved over the past decade and a half. As the thesis will explain, the rise of China as an economic power has fuelled demand growth for natural resources on such a scale and at such a rate that mineral commodity markets, in particular, are being remade. It is not only the sheer volumes and geographic patterns of production and trade which have been affected; the corporate landscape is also shifting in a number of ways which will be enumerated

in the chapters to follow. All of these factors ultimately find expression through price behaviour: both higher prices and, for many commodities, greater price volatility.

## **1.2 Significance of issues**

In the most general possible sense, this thesis is concerned with the shifting governance of commodity trade in an era of rising demand and uncertain supply. It therefore draws together a number of messily interrelated political-economic issues across four substantive papers, while anchoring itself with reference to the example of phosphate, a resource that has recently taken on the status of a paradigmatic strategic commodity.

### *1.2.1 Mineral sustainability and peak theory*

Any consideration of mineral resource scarcity must take as its point of departure debates about peak minerals, stale as they may be. There is disagreement about exact mechanism by which depletion will occur (Prior et al. 2012); at the same time, it has been argued that ‘the debate about how to frame resource depletion is ongoing’ (Giurco et al. 2009 cited in Prior et al. 2012). Roughly akin to the pessimist-optimist divide is the more formal debate between a neo-Malthusian ‘fixed stock’ paradigm and an ‘opportunity cost’ paradigm (Tilton and Lagos 2007; Prior et al. 2012). The first, rather self-explanatory, worldview not only takes currently estimated quantities of virgin ore and minerals currently in use as given, static amounts; it further assumes that, at some point in the not-too-distant future, metal prices will come to reflect scarcity value as supplies dwindle (Gordon et al. 2006). By contrast, the second

worldview assumes that mineral resource availability is primarily a function of real prices, or the opportunity cost to society of obtaining an additional unit of the resource in question (Tilton and Lagos 2007).

Yet it is easy to overstate the intensity of the debate as it has been rehearsed more recently, and a number of interrelated insights from anti-peak theory are now much more widely taken for granted than in decades past. First, mineral reserves are economically and technologically rather than geophysically defined: they are ‘relational’ or ‘produced’ rather than ‘given’. In more technical terms, it is vital to distinguish between ‘resources’, or the total amount of a given mineral in the earth’s crust, and ‘reserves’, which ‘meets some minimum physical and chemical criteria related to current mining and milling practice, [including] components that are subeconomic’ (USGS cited in Gordon et al. 2006). Resources may come to be defined as reserves as technology improves and extraction costs drop. In Adelman’s (1990, 1) oft-cited words, ‘There is an endless tug-of-war between diminishing returns and increasing knowledge’. Second, for all practical purposes we will never ‘run out’ of any given mineral resource – much less ‘wake up one day to find the cupboard bare or the well dry’ (Tilton 2003b, 101). Rather, production will continue up until the point where ores are of such a low grade that extraction is technically infeasible, overly costly, ecologically unsustainable, or a combination of these. Underpinning both points is the idea that the immediate effect of short-run scarcity is felt in rising prices, which in turn prompt investment in capacity expansion, exploration and development of new reserves, or technological advancements in extraction. When supply eventually rises to meet demand, prices will fall again. To an extent, too, higher prices suppress demand. For all of these reasons, the ‘fixed stock’ paradigm of resource

scarcity (Gordon et al. 2006) has been to an extent eclipsed in favour of an ‘opportunity cost’ paradigm which considers the economic cost to society of additional resource extraction, as represented by real long-run commodity prices (Tilton 2003b, 2006; Tilton and Lagos 2007).

Of course, all of this must be tempered with the caveat that while history has *generally* borne out the anti-peakist perspective, in some cases the very signs of de facto depletion, such as the shrinking energy return on investment of oil extraction, are beginning to appear. In parallel, for human geographers, ‘peaking’ is less a geophysical phenomenon than a crisis of the ‘social relations’ governing resource allocation (Bridge 2010a). It is precisely at this point that the stalemate occurs in the peak/anti-peak debate: when the past is not necessarily a good guide to the future, what more can be said on the subject of scarcity? On the other hand, a less remarked-upon aspect of it is that what is fundamentally at issue is the relationship between geophysical resource scarcity and prices: on the one hand, a normative question of whether prices ought to be a proxy for scarcity, and on the other an empirical question of the ways in which prices mediate scarcity.

### *1.2.2 The global governance of finite resources and the shifting geopolitics of markets*

The spectre of Malthusian shortage has haunted humanity from time immemorial, but in the contemporary era, the tone of debates about resource scarcity was set with the publication of *The Limits to Growth* in 1972. Roughly coinciding as it did with the Arab oil embargo and resultant price spike of 1973, this study also paved the way for the re-emergence and newfound popularity of peak oil theory (Hubbert 1956). Peak

oil, and for that matter peak resource, debates have ebbed and flowed in the years since (see McGill 2011 for a summary). The high point for the cornucopians proved to be the famous Simon-Ehrlich bet of 1980, when economist Julian Simon challenged eco-pessimist Paul Ehrlich to predict the trajectory of the prices of five metals over the following 10 years. Simon, who argued that improved technology would drive prices down, won the wager, and with this triumph of the optimists, the depletion debate lay dormant for several years. At the beginning of the new century, the prospect of global resource shortages seemed, if not less a real possibility, then at worst a very distant one (Tilton 2003b).

Now, however, because of the scale and intensity of recent resource exploitation rates, the neo-Malthusian narrative has taken on new life. Population growth, expected to peak at 9 billion by 2050, is only part of the story here: with the rise of a number of developing economies, led by China and to a lesser extent India, per capita consumption of resources of all types has been driven up by demands for a higher standard of living by a new 'global middle class' of 3 billion consumers (Nair 2011). The struggle for supply to keep pace with demand is most apparent with respect to crude oil: although exploration spending has quadrupled since 2002, the rate of discovery of new reserves has stagnated (Zhdannikov 2012), while the marginal cost of producing a barrel of oil has risen from \$20 in 2002 to \$85 in 2012 (Blas 2012). Indeed, of the five metals in the original Simon-Ehrlich bet, the prices of four were higher in real terms in 2011 than in 1980 (Grantham 2011).

Much like the public debate, scholarly treatment of resource geopolitics is largely conflict-centric (Peet and Watts 1994; Homer-Dixon 1999; Le Billon 2001; Klare

2012), an approach that has already been criticised as lopsided (McNeish 2010). At the same time, while much attention has been paid to the geopolitical shifts engendered by the policies of large importer states such as China (Lee et al. 2012), less discussed have been geographic shifts in supply (Bradshaw 2009) and increased corporate concentration. In the case of minerals, extraction rates in ‘mature’ producers are approaching or have already passed their peak, while there remains enormous potential in under-prospected or less-developed regions, notably much of sub-Saharan Africa (Collier 2010). Moreover, geopolitical concentration of reserves, or at least current production, in relatively few regions is apparent for many minerals other than phosphate, including potash (Russia, Belarus, and Saskatchewan), lithium (Chile, Australia, and China), rare earths (China), and speciality minerals such as cobalt (DRC) (Bradshaw and Hamacher 2012; Lee et al. 2012). Because of the specific political-economy contexts of many of these countries, the proportion of mineral production and trade that falls under direct state ownership and control has risen to levels approaching those last seen before the end of the Cold War (Ericsson and Löff 2011). Needless to say, when the state is directly responsible for mineral production, trade, or both, politics and economics are at the greatest risk of colliding.

The factors described above are but a handful of reasons why, in the more immediate term, the most visible and controversial sign of scarcity has been the dramatic and sustained rise in mineral commodity prices, otherwise known as a ‘super-cycle’. Beginning around 2003, following the accession of China to the WTO in 2001 and a round of quantitative easing by that country the following year, the prices of mineral commodities began a steep upward trend that was interrupted only briefly with the onset of the global financial crisis in 2008 and has only recently begun to level off.

While it is widely agreed that the super-cycle was primarily caused by a China-led demand shock, it is also true that supply-side factors such as declining reserve grades, higher costs of production inputs such as energy, and stricter regulation have contributed to higher prices (Humphreys 2009). For the peakists, then, high metals prices proved a belated vindication of Ehrlich's fears: of the six metals included in the original Simon-Ehrlich bet of 1980, the prices of all but one have risen markedly. Most recently, this 'finite world' thesis (Krugman 2010) has proven especially contentious, as moderating commodity prices have led many observers to declare an end to the super-cycle (Blas 2012; Denning 2012). As explained in chapter 6 of this thesis, a loosely related view would have it that investor demand for commodities and commodity derivative contracts as an 'asset class' can at least in part be blamed for price spikes as well as volatility. This has not only the result of placing access to certain commodities at certain times out of reach of many consumers; it can also negatively affect the investment decision-making processes of producers. Yet accurately conceptualising the relationship between financial investment and commodity markets has proven elusive, and this is therefore an area of heated controversy.

### *1.2.3 The phosphorus issue*

At the confluence of the twin 21<sup>st</sup>-century concerns about mineral depletion and food security lies a particular class of commodities: fertilizers. Inorganic fertilizers have been essential to sustaining modern agricultural yields and will be of ever-greater importance as demand for all agricultural goods, particularly input-intensive foodstuffs such as meat and dairy products, rises. However, all three of the key raw

ingredients in fertilizers are non-renewable: phosphate rock, potash, and natural gas. Of these three, concerns about the sustainability and security of phosphate reserves are greatest. Accordingly, as will be explained in chapter 3 of the thesis, the issue of phosphate scarcity is an emerging area of research across the natural and social sciences and is of great interest to policymakers in the EU in particular, where phosphate is increasingly regarded as a strategic resource (HCSS 2012). While global phosphate demand growth is projected to be 2-3 per cent per annum to 2050 (Cordell 2010) (against a projected population growth rate of 0.77 per cent (UN 2004)), supply is feared to face constraints in the long term.

Unlike other elements essential to life, such as carbon and nitrogen, the global biogeochemical phosphorus cycle is very slow (Smil 2000). The formation of phosphate-rich deposits takes place over a much longer period than a civilizational timescale; meanwhile, since phosphorus is highly insoluble in rock form and in soils, mobilisation by plants into the organic phosphorus cycle is very difficult.

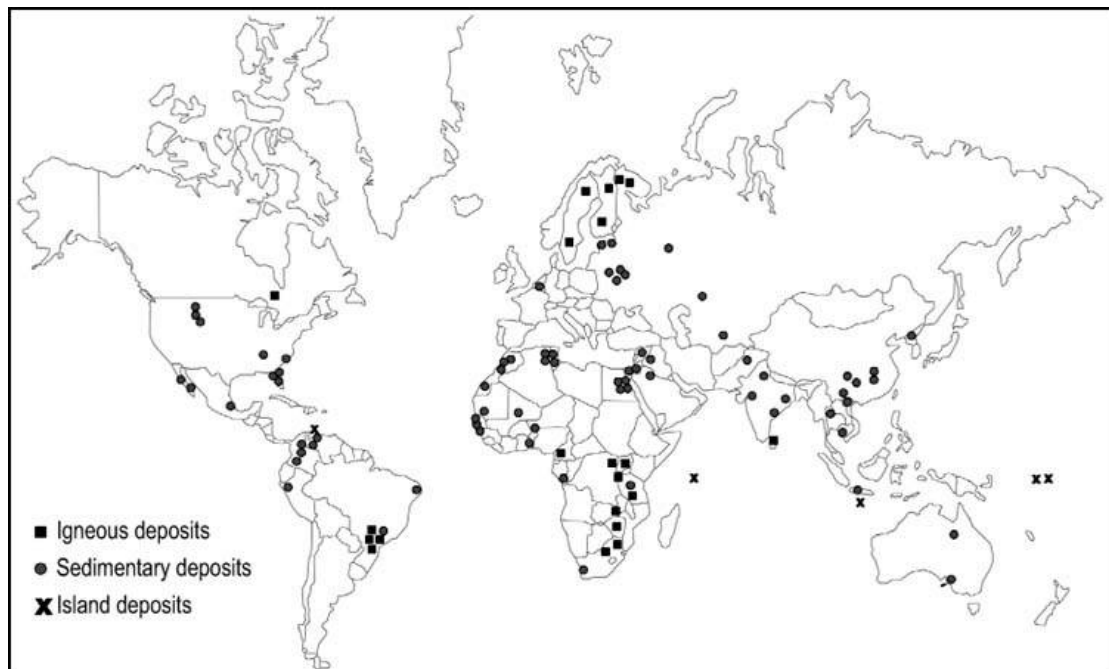
Phosphorites, the main source of phosphate ores, are sedimentary marine and terrestrial deposits formed over millions of years from the natural processes of the inorganic phosphorus cycle: mineralisation, weathering, erosion, and runoff (Smil 2000). Phosphate rock, 95% of which is in the form of apatite, typically has phosphorus (elemental P) concentrations at least 100 times higher than ordinary sedimentary rock, or about 10-20% by weight (Smil 2000; Cooper et al. 2011).<sup>1</sup>

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<sup>1</sup> Phosphorus in rock form is generally found as phosphorus pentoxide ( $P_2O_5$ ). Phosphate rock grades are expressed as a percentage of  $P_2O_5$  within the fertilizer industry; 30% or above is considered high grade (observation from fieldwork, July 2013).

The chemical process by which phosphate deposits are formed, phosphogenesis, is not yet perfectly understood, but it is believed that phosphate rock formation has been episodic through geologic time, with ‘unique intervals of Earth history where the rate of weathering and input of P from the continents to the oceans must have been extremely high’ (Filipelli 2011). While difficult to quantify, the majority of deposits are known to occur in the deep ocean, while the majority of accessible reserves are found either along the western coasts of continents where deposits were formed by upwelling ocean currents (e.g. Morocco, Namibia, Peru), or along eastern coasts, where deposits were formed by the meeting of ocean countercurrents (e.g. Nauru, Florida) (Smil 2000, 66). Much smaller phosphate-rich deposits are found on land in the form of apatite from igneous rock (e.g. Russia, South Africa) (ibid.).

**Figure 1: Economic and potentially economic phosphate deposits of the world**



(Source: FAO 2004)

Until the mid-19<sup>th</sup> century, humanity relied on organic sources of phosphorus, including human and animal excreta and crop biomass, for use in agriculture. First developed by John Bennett Lawes in 1841, inorganic phosphate-based fertilisers allowed for plant uptake of phosphorus that was orders of magnitude more efficient, and effectively helped to reverse the effects of soil degradation and famine in Europe. In the 20<sup>th</sup> century, ‘[p]opulation growth was only possible because we found phosphorus deposits *and* cheap energy to extract, transform and transport it to farms’ (Déry and Anderson 2007; emphasis in original). Mining and processing of phosphate rock began in earnest after the Second World War, when the finiteness of such an abundant and easily accessible resource was not of any concern (Cordell 2010, 116). Inorganic fertilisers have played a particularly important role in realising gains from the Green Revolution of the 1950s and 1960s: abundant supplies of phosphate rock coupled with improvements in fertiliser technologies made during this time have contributed to dramatic improvements in crop yields, thereby fuelling and sustaining the 4.2 billion-person increase in the world’s population since the mid-20<sup>th</sup> century (Déry and Anderson 2007; Cordell et al. 2009, 294; Elser and Stuart 2010).

The phosphate rock price spike of 2007-08 drew attention not only to the importance of phosphate to global food security, but also the finite and geographically concentrated nature of the resource: at the time, projections based on USGS data put the life of total global reserves at roughly 150 years (Cordell et al. 2009), with up to 90 per cent of current and future supply coming from just five countries (Cordell 2010). Revised estimates show that known resources should last for 300-400 years (van Kauwenbergh et al. 2010), so absolute geophysical scarcity no longer seems imminent. Equally, the price spike encouraged investment in mine capacity expansion

and the development of new projects worldwide. Although it is highly unlikely that prices will ever return to their historic norm of \$30/tonne, at the time of writing, they have declined significantly from their historic high of \$400/tonne to approximately \$150/tonne.

Yet the fact remains that the top five reserve holders account for an estimated 90 per cent of global reserves, as against the 75 per cent of global oil reserves held by the 12 nations that comprise OPEC (van Vuuren et al. 2011). The experience of 2007-08 demonstrated that some of these countries do not hesitate to use their position to their own advantage: China, for example, imposed a 135 per cent export tariff on phosphate products in 2008-09. Most strikingly, however, Morocco is estimated to hold up to 85 per cent of ultimately recoverable reserves (URR) (van Kauwenbergh et al. 2010)<sup>2</sup> which are of relatively high grade; and moreover, all of the country's phosphate reserves are controlled by a state-owned company, the Office Chérifien des Phosphates (OCP) Group. Currently Morocco is the world's top exporter of phosphate products, with one-third of market share (OCP Group 2011); but not only has it invested in expanding annual capacity from 28 MT to 50 MT by 2017, it also aims to capture a larger proportion of the market for value-added products such as phosphoric acid and finished fertilisers (OCP Group 2013a). A further aspect of Morocco's dominant position as a producer is its pricing power in global markets. For example, while the 2007-08 price spike can largely be accounted for by reference to textbook supply and demand factors, OCP acknowledges that it took advantage of this 'perfect

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<sup>2</sup> OCP disputes this figure, which its internal estimates put at 51 per cent; it argues that the greatest source of uncertainty stems from the unreliability and opacity of Chinese data (observation from fieldwork, July 2013).

storm' by pushing for an additional premium in that year's price negotiations (Croset 2012).

### **1.3 Thesis objectives and goals**

This research was originally motivated by curiosity about peak phosphorus narratives, which circulated relatively widely in the media (e.g. Lewis 2008; Elser and White 2010; Schmundt 2010) and in the investor community (Grantham 2011; Rogers 2011) in 2008-2011. Since then, a more nuanced understanding of the issues has evolved (Cordell and White 2011; Cordell and Neset 2014), and policy-makers have begun to take more concrete steps to ensuring 'phosphate security' (HCSS 2012). However, peak resource debates have raised several broad questions which have not yet been investigated with sufficient analytical rigour. In particular, while scientific and policy measures to mitigate scarcity are being pursued with newfound vigour in 'resource insecure' regions such as the European Union (European Commission 2011), the economic and geopolitical aspects of the scramble for resources are often, it must be said, carelessly assumed to follow a pattern witnessed from the 1970s to the 1990s. This is no less true of academic treatments of the issues, which have been surprisingly few and far between considering the prominence and urgency of public debates (Bridge 2010b).

*The **first** objective is to recast the relationship between geophysical resource supply, prices, and markets (chapter 3).* Particularly in the first substantive chapter, the thesis will demonstrate that the greatest shortcoming of the neo-Malthusian school is its lack of both temporal and spatial perspective: in essence, it is a highly stylised account

dividing the history of all human civilisation between an era of resource abundance and an era of severe scarcity or depletion (if indeed such a day ever arrives) which fails to take account of a long intermediate phase in which commodity prices remain persistently high and often volatile. At the same time, it glosses over the often dramatically uneven geographic, political, and economic ownership and control of them. In the most basic sense, then, this thesis aims to advance the concepts of ‘economic scarcity’ – quite simply that prices mediate physical resource availability<sup>3</sup> – as well as ‘geopolitical scarcity’ (Cordell 2010) – the geographic concentration of resource production and control of trade in relatively few regions – by reference to a handful of illustrative and focused studies.

*The **second** objective is to examine some of the institutions that channel and benefit from resource wealth (chapters 4 and 6).* As outlined briefly above, the assumption that state-owned extractive companies are fundamentally inefficient was established in the 1970s and 1980s (Radetzki 1983; Aharoni and Ascher 1998). However, this proposition has rarely been revisited since, despite a growing interest in the wider phenomenon of ‘state capitalism’ (Megginson and Netter 2001; Bremmer 2010, Musacchio and Lazzarini 2012) and the gradual rollback of a wave of privatisations of mineral assets during the 1990s (Radetzki 2008; Ericsson and Löf 2011). The issue of state ownership and control is particularly salient to this thesis, given that state-owned companies account for roughly half of global phosphate output (Al Rawashdeh 2008). While a certain amount of recent work has explored the workings of national oil companies (NOCs) (Marcel 2006; Jaffe and Soligo 2007; Victor et al. 2012), case

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<sup>3</sup> As opposed to a direct reflection of scarcity; see e.g. Krautkraemer (1998), Tilton (2003), Tilton and Lagos (2007), Prior et al. (2012). To an extent, however, prices do contain valuable information about scarcity, as mentioned in chapters 2 and 6.

studies of national mining companies remain few and far between.<sup>4</sup> Despite OCP's market power, very little is publicly known about the company beyond Morocco and, to a lesser extent, the Francophone world. Yet OCP is an important case study of how state-owned corporations conceive of corporate value creation, and so foster economic development.

At the same time, the growth of the involvement of financial institutions in the resources sector since the beginning of the 2000s has raised alarm on a number of counts. Apart from the variety of ways in which these entities are directly involved in physical commodity production and logistics, more salient to this thesis are developments on the 'sell side' of the securities industry. Here, suspicions that financial investors have manipulated commodity prices through their participation in derivatives trading broadly mirror concerns about state 'interference' in the extractive sector: in both cases pricing power, and by extension profits, are perceived to be channelled through increasingly powerful and opaque institutions.

*The **third** objective is to 'open the black box' of the commodity price formation process (chapters 5 and 6).* The 'mainstream' economics and finance literature on price formation in commodity markets is vast, having been of interest to the profession since its earliest beginnings. Although economic geography has made the form and function of markets for various goods and services an area of central theoretical concern, it has yet to extend consideration to commodity markets. For their part, while other branches of human geography have considered the political economy

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<sup>4</sup> But see Humphreys' (2011) study of Norilsk Nickel's recent corporate turnaround for a notable exception. While Norilsk Nickel was fully privatized by 1997, its transformation process bears many similarities to that of OCP described in chapter 4 of this thesis.

of oil (and to a lesser extent mineral) scarcity (e.g. Bridge and Wood 2010; Bridge 2011; Huber 2013), particularly through the lens of global commodity production networks (Bridge 2008; Glassman 2011), these sub-disciplines are primarily concerned with the ways in which capitalism mediates either nature-society relations or the socioeconomic distribution of resources. By drawing extensively on ‘mainstream’ economics and finance literature, the thesis supplements what have primarily been specialist, technical treatments with one that is descriptive and less formal, and one that interrogates the specific mechanisms by which markets process the information that is reflected in prices (Akerlof and Shiller 2009). It also highlights some striking commonalities between ‘mainstream’ and ‘heterodox’ perspectives. This agenda will thus be pursued primarily in the second substantive half of the thesis.

## **1.4 Methods and research design**

### *1.4.1 Theoretical perspective and structure*

Natural resources have inspired a *mélange* of introspections in the social sciences. The thesis accordingly draws on a *mélange* of theoretical perspectives, including various schools of economic thought, political economy, and critical geography, to conceptualise a select few of the changes apparent in global commodity markets in the 21<sup>st</sup> century.

I have chosen to pursue a four-paper approach for two reasons. First, because the topic at hand is so vast in both a conceptual and a very real spatial sense, no single volume could hope to do full justice to it. Four papers offer the advantage of delving

into four related but targeted empirical cases, each with its own suite of (again interrelated) theoretical frameworks underpinning it. By presenting the papers as a collection framed by introductory and concluding matter, the thesis should take on an emergent property. This approach certainly risks attaining breadth at the expense of exhaustive depth. However, a second reason for employing the four-paper method is more personal and practical: each paper should be viewed less as an end in itself than as the germ of a much larger, longer-term future research programme. It is hoped that these agendas will prove mutually complementary and eventually suggest still further avenues of enquiry.

While the thesis is underpinned by the observations about resource scarcity and peak minerals outlined in section 1.2 above, structurally it is anchored by the insights gained from the first substantive chapter: apart from the basic and by now well-worn truism that these socioeconomic ‘dimensions of scarcity’ are of more immediate practical salience, the under-explored theme of economic scarcity and its obverse, resource wealth, emerges from a discursive analysis of peak oil/peak phosphorus debates. The organisation of what follows can be conceived of in three overlapping ways. First, the thesis can be said to be divided into two parts. While the first focuses on ‘scarcity as wealth’ and ‘mineral resource stewardship’ – considering as it does how perceptions about the nature of scarcity can influence the economic governance of resources (chapter 3) and the role of state-owned mining companies in national socio-economic development (chapter 4) – the second concerns markets and price formation, both in the context of a specific commodity (chapter 5) and of the relationship of commodity prices to financial markets (chapter 6). Second, this split can also be said to reflect an evenly divided consideration of mineral commodity

production (first half) and of trade (second half). Finally, while the thesis begins with a bird's-eye view of an issue, it narrows to a micro-level case study of a specific company and national context, progresses to a 'meso'-level analysis of the global market for a single product, and ends back at the macro level. This structure has more than just aesthetic value: as mentioned above, the overlaps and flow between chapters should add up to a more multifaceted but cohesive whole.

#### *1.4.2 Methods*

The thesis relies on a mixed methods approach which combines a discursive analysis of primary and secondary literature with insights gained from fieldwork. A mixed methods approach combining a literature analysis, interviews, and site visits allows for triangulation between sources of information (Elwood 2010). My specific approach varies between chapters, however, with some relying exclusively on a review of relevant literature and others based more upon primary information gathered on-site.

Analysis of relevant literature served as the theoretical backbone of chapters 4 and 5, while discursive analysis is the main method used in chapters 3 and 6. For both of these papers, comparing and contrasting two or more sides of a debate, tracing its evolution over time, and examining the epistemological assumptions of each side reveals their respective biases and limitations. More specifically, it allows for an interrogation of the foundations of public language about economics (O'Neill 2007). This analysis also has practical consequences insofar as 'the way in which people comprehend and make sense of the social world has consequences for the direction

and character of their action and inaction’ (Purvis and Hunt 1993, 194 cited in O’Neill 2007). In all of these respects, the use of this approach is inspired by the critical spirit most evident in Harvey (1974).

For Chapters 3 and 6, my method of discursive analysis consisted of roughly the following steps. My starting point was generally a small handful of texts which provided the initial inspiration for my research question: in the case of peak phosphorus, the work of Dana Cordell and colleagues (Cordell et al. 2009; Cordell 2010); in the case of financialization, a single paper by Mazen Labban (2010). Having been taken in by the ‘hook’ of an interesting and complex problem of which I had no prior knowledge (despite its apparent theoretical and policy importance), in both cases I expanded my reading list in two ways: first, by ‘snowballing’, or selecting works cited in the ‘seed texts’ to read; second, by conducting a basic literature search via Web of Knowledge and Oxford’s library catalogue.

The impetus for my research came when a closer reading of (what was at that early stage) the handful of texts I had gathered from led me to realise that the key terms in question – peak phosphorus and financialization – were deployed in multiple and at times contradictory ways, both within and across texts. Put more simply, there was no consistent single definition of either term, though there had evidently been varied attempts to arrive at what Berg (2001, 26) has called an operational (i.e. agreed-upon) definition. In the case of peak phosphorus, discursants appeared to have taken for granted that peak oil debates of generations past had satisfactorily set the parameters for discussion of phosphate and other minerals. In the case of financialization, it quickly became apparent to me that, much like its sister concept ‘speculation’, not

only had this had long been a case of a hotly contested term, but recent changes in the structure of financial markets had added new layers of meaning – or perhaps more accurately, confusion – to it. More to the point, in both cases the ambiguity and complexity surrounding the core concepts under discussion was so great as to allow scholars to draw radically different conclusions about the nature and existence of a given problem from observing the same broad phenomenon.

After gathering further relevant texts, I therefore proceeded to collate the multiple ways in which the terms were deployed, lay them out side by side, draw out commonalities and differences among sources, and provide an additional layer of analysis and interpretation. My aim here was to draw out the assumptions, both technical and conceptual, underpinning the rhetoric employed in the literature. From this it was also possible to delineate different ‘epistemic communities’ (Haas 1992), the members of which often but by no means always shared a common disciplinary perspective. The ultimate purpose of the entire process was not exactly to arrive at a consensus definition of either of the terms ‘peak phosphorus’ or ‘financialization’, or to determine conclusively whether either is a real phenomenon. Instead, I have adopted a post-structuralist position whereby identifying underlying assumptions further allowed me to identify ‘the kinds of ‘sense-making’ about the world they reveal’ (McKee 2003, 17) for different epistemic communities or ‘cultures’.

Rather than exhaustively data-driven, my approach here was qualitative and discursive. I did not aim to gather every conceivably relevant source and analyse every instance of the terms in question, but instead selected exemplars from the most widely cited texts I had read. My style has established parallels in two papers by the

economic geographer Meric Gertler, which critically interrogated the much-used but expansive concepts of ‘best practice’ and ‘tacit knowledge’ (Gertler 2001, 2003 respectively). Both papers, which are to date two of the three most highly cited in the *Journal of Economic Geography* (indeed, two of the most widely cited in the field of geography), share a recognition that language is indeterminate, and that a given term may be heterogeneous in meaning.

Fieldwork is essential for gathering primary information about OCP, and on phosphate markets more generally, for chapters 4 and 5. An ‘on-the-ground’ perspective is also vital for truly understanding through direct experience the context and culture of the research subject. As such, this component of the research is conducted in accordance with the fundamental economic-geographic method of building theories based upon empirical observation, rather than the reverse (Clark 1998). Fieldwork includes two components. First, site visits to OCP’s various mines, ports, and processing facilities give the researcher a ‘grounded’ view of the materiality of the economic production process (Kearns 2010; Kama 2013). Second, semi-structured interviews and close dialogue allow stakeholders including OCP staff and market observers outside the company to offer their own account of the subject matter at hand (Clark 1998; Valentine 2005). Particularly in the context of a company based in the ‘global South’ (Croset 2012), these interviews serve a further important purpose of giving participants a hand in ‘constructing’ knowledge, rather than simply allowing the researcher to ‘discover’ it (Whatmore 2003). Multiple visits, first in July 2013 and then in December 2013, allowed for an iterative learning process (Crang 2005).

My fieldwork experiences are detailed in Appendix A. It should also be noted that prior to travelling to Morocco in December 2013, I signed a non-disclosure agreement (NDA) with OCP (reproduced in Appendix C). Among other provisions, this agreement stipulated as a condition of access that any academic papers resulting from my fieldwork would be subject to review by OCP prior to publication. As such, chapters 4 and 5 of this thesis will be submitted to journals for peer review following consultation with OCP.

A brief mention of two other methodological issues is in order. First, the thesis is focused on two specific mineral commodities: phosphate rock and, to a much lesser extent, crude oil. Because it sits at the intersection of a number of sustainability concerns – mineral finiteness, food security, and to a lesser extent freshwater scarcity – phosphate is an exceptionally complex and conceptually challenging, yet in equal measure fascinating and intellectually rewarding, commodity to analyse. Naturally, because of its implications for global food security, ‘the phosphorus problem’ has primarily been conceptualised as having salience for the global food security agenda. However, this thesis will argue that phosphate is also of interest for what it illustrates more widely about the nature of economic scarcity in mineral commodity markets. The thesis therefore conceives of phosphate primarily as an extractive commodity. It is also important to stress here that while phosphate is of intrinsic and practical interest in and of itself, it should be thought of primarily as a vehicle for investigating the changing nature of the global mining industry, markets for ‘hard’ (as opposed to ‘soft’ or agricultural) commodities, and the power of mineral-rich producer states. This is especially important to bear in mind in light of the inclusion of chapter 6, as explained below.

Second, an important note must be made on the use of the terms ‘mainstream’ or ‘orthodox’ economics and finance. While the use of these terms here is inevitable as a mere matter of convenience, I readily acknowledge that it also has the unfortunate side-effect of setting up an artificial dichotomy between orthodoxy and heterodoxy – if not, indeed, giving the appearance of a certain tribalism. While this divide might have held more firmly in decades past, there has been considerable mixing of bloodlines between the two broad ‘tribes’ such that a distinction is now less meaningful – as I hope chapters 5 and 6 in a modest way demonstrate.

## **1.5 Overview of chapters**

*Chapter 1* is the introduction. It introduces the overarching issues and provides a broad overview of the remainder of the thesis.

*Chapter 2* reviews a selection of literature that serves as relevant background to the substantive chapters.

*The first substantive half of the thesis focuses on the production side of commodity markets:*

*Chapter 3* is the first substantive chapter of the thesis. It sets the stage by exploring the multidimensional nature of the concept of resource scarcity, both in its geophysical and socioeconomic aspects. In particular, it interrogates a prominent inherited conception of natural resource scarcity: ‘peak’ natural resources. The

particular case of debates about ‘peak phosphorus’ – the claim that gained widespread attention beginning in 2008 that phosphorus is being mined at unsustainable rates and will be exhausted within 150 years – is outlined, and then critiqued on two grounds. First, the use of Hubbert’s peak to estimate long-term global availability of a resource has not often proven accurate in the past, for reasons detailed in the chapter. Second, even if the concept of peak resource availability is intended as a galvanising message to adopt conservation measures and develop alternative sources, it has largely failed to do so in the past, as the polarisation evident in peak oil debates demonstrates.

Instead I show that narratives about ‘peak’ natural resources in fact reflect two related but distinct threads: more narrowly, fears about long-term, absolute resource depletion; and more broadly, concerns about the manifold socio-economic and environmental problems which reliance on finite resources entails. I argue that the latter is of much greater urgency and must be clearly disaggregated from the former.

Peak phosphorus narratives suggest a great number of directions for research, particularly with respect to the nature of scientific controversy (see e.g. Barry 2008; Kama 2013), socioeconomic inequalities associated with demand (Morris et al. 2007), and the potential for more efficient resource use (Runge-Metzger 1995). However, the remainder of the thesis will focus on a selection of issues related to the geopolitics and political economy of mineral supply and trade. In the case of phosphorus as well as many other minerals, both physical production and marketing of the resource are increasingly controlled by a handful of states and corporations which do not always operate in a transparent manner. In particular, the importance of Morocco as the world’s largest phosphate reserve holder, as well as its current status as its third-largest producer and top exporter, has frequently been raised as a matter of concern,

as has the fact that all of the country's phosphate industry is controlled by a single state-owned company, the OCP Group. Yet little research has been conducted either on OCP or on the wider market in which it operates. Accordingly, each issue will be taken up in turn in the following two chapters of the thesis.

Although the case of recent debates about peak phosphorus is used as a vehicle for discussion, the paper is intended as a template broadly applicable to similar controversies surrounding other types of non-renewable resources. As such, two overarching, and overlapping, themes – the nature and implications of state ownership and control of mineral resources and the changing character of markets – will be explored in the remainder of the thesis.

An earlier version of this chapter formed part of my MPhil thesis, completed in June 2011, and a revised version was published in the September 2012 issue of the *Journal of Sustainable Finance and Investment*.

*Chapter 4* is the first of three papers exploring in greater depth the issues raised in chapter 3. It begins at the micro level with a case study of the world's largest exporter of phosphates, the Moroccan state-owned Office Chérifien des Phosphates (OCP) Group. As noted in chapter 3, concerns have been raised that a 'state capitalist' institution owns and controls such a large proportion of the world's phosphate reserves, arguably for two reasons. First, and most apparent in peak phosphorus discourses, is the fear that Morocco may take advantage of its position to restrict phosphate supplies, raise prices, or both. Second, as a general matter, performance in state-owned enterprises, particularly extractive companies, is assumed to be poor (Al

Rawashdeh 2008; Revenue Watch 2013). In reality, however, very little research has been conducted on OCP and how its relationship with the Moroccan state affects its governance, strategy, or performance.

State ownership and control in the mining sector constituted an area of scholarly interest in the 1970s and 1980s (Radetzki 1983; Aharoni and Ascher 1998), but since the end of the Cold War (and the fall in state interest in extractive companies it entailed) has been little explored. At the same time, while there already exists much past as well as recent literature about national oil companies (NOCs), much less scholarship specifically examines state-owned mining companies. Drawing on information gathered from field visits and on-site interviews with OCP executives and managers, the chapter examines OCP's role in national development. Particular attention is paid to the watershed period of 2006-08, the beginning of an ongoing company-wide 'transformation' (Croset 2012) in which OCP was legally privatised and, alongside an aggressive capacity expansion programme, adopted several new social and environmental investment initiatives. The chapter explores the continuing evolution of the company's attempts to balance its commercial and non-commercial objectives. From a theoretical standpoint, it places OCP's conception of its societal role in both the context of other national extractive companies (NECs) and of private-sector corporations.

This chapter finds that NECs, much like other state-owned corporations (SOCs), face a particular type of principal-agent problem: 'the state' can be conceived either narrowly as the apparatus of government, or broadly as the wider populace it represents. Given this ambiguous nature of the principal, NECs at once have greater

scope to pursue non-commercial objectives while facing greater challenges in balancing them against the imperatives of economic efficiency and financial profitability. The case study of OCP detailed here corroborates these theoretical findings. Ultimately the chapter should contribute to wider scholarship on state involvement in the resource sector – an issue of increasing relevance, given the large proportion of natural resources under state ownership control.

Following consultation with OCP per the terms of the aforementioned non-disclosure agreement, it is anticipated that this chapter will be submitted to *The Extractive Industries and Society*.

*The second substantive half of the thesis is concerned with global commodity trading:*

*Chapter 5* progresses to the level of the phosphate market as a whole. As argued in chapter 3, the 2008 phosphate price spike underscores two blind spots in our knowledge of global commodity trade. Not only is the nature and scope of Morocco's pricing power in international phosphate markets poorly understood; more broadly, the academic literature has devoted little attention to the basic structure of these markets and how they have been reshaped by the super-cycle of the 2000s. This chapter will therefore construct an 'anatomy' of global phosphate markets – including an extensive description of the structure of the industry, the mechanisms of price determination, and how these have changed in recent years – in order to shed light on the phosphate price formation process.

Bilateral contracts were historically the norm in international commodity markets and are still widely used (Radetzki 2013b). While there exists an extensive literature on mineral commodity price formation and market structure, relatively little focuses on commodities that are not traded on formal exchanges. Of this work, the market for iron ore is by far the most commonly researched case (e.g. Sukagawa 2010; Wilson 2012), and much is by now quite dated (e.g. Radetzki 1978; Rogers and Robertson 1987). With respect to phosphate markets, beyond the basic information sketched out briefly above, little is known outside the industry about the contractual arrangements governing international trade in phosphate rock, either prior to or since the 2007-08 watershed. Insofar as previous work on commodity markets governed by bilateral contractual relationships has developed a systematic descriptive framework (e.g. Radetzki 1978; Fattouh 2011), the paper will borrow from these approaches. Ultimately, however, it relies on insights from industrial organisation theory, market microstructure theory, and the literature on long-term contracting to build this framework. In order to describe the structure of the global industry and the mechanisms by which phosphate is priced, on an empirical level the chapter is informed by interviews with OCP employees as well as consultation of written sources. This investigation reveals a high degree of geographic and corporate concentration of phosphate production, and of fragmentation in global trade. It also finds that the processes by which phosphate is priced are relatively opaque, and that recent market changes have presented difficulties in setting reference prices. However, the chapter argues that this apparent lack of a ‘benchmark’ price is not necessarily as problematic as market theorists might assume: in this and other cases, prices should be conceived of as ‘anchoring’ devices by which buyers and sellers make pricing decisions, not as expressions of the absolute value of a commodity.

Following consultation with OCP per the terms of the aforementioned non-disclosure agreement, it is anticipated that this chapter will be submitted to the *Journal of Economic Geography*.

*Chapter 6* takes a macro-level perspective of the relationship between finance and physical commodity trade by examining the role of financial trading in the governance of commodity markets. As already mentioned, much has been written about the super-cycle and the ways in which it is an expression of short-term, cyclical, and structural dimensions of commodity prices. While there is little dispute that the super-cycle represents an unusually strong and long-lasting upswing, for a great many observers, the price dynamics of the past decade cannot entirely be accounted for by reference to ordinary cyclical supply and demand factors. Against the backdrop, financial trading has – rightly or wrongly – taken on the status of a scapegoat for many commodity price spikes, such as that of crude oil in 2006-2008.

The chapter takes the form of a ‘critique of the critique’ evident across a number of social science treatments on financialization and ‘speculation’ in commodity markets. Drawing on the financial economics literature which seeks to establish (or disprove, as the case might be) a causal link between financial investment in commodity futures and price distortions, it argues that the relationship between resources and the global financial system has been insufficiently explored in the literature. After reviewing this literature, it offers a response in two parts. First, the involvement and impact of financial investors in commodity markets will be explained and distinguished from ‘speculation’, a much broader and more nebulous concept. Fundamental as it seems,

this distinction is rarely made explicit, perhaps because a rigorous definition of the term ‘speculation’ is so evasive. Second, the chapter disputes the view prominent in much critical social science literature that derivatives contracts represent no more than ‘fictitious capital’. By extension, it also questions assumptions about the hegemony of finance prevalent in the heterodox political economy literature. The paper supports a growing consensus among researchers that, while financialization can account for a certain amount of short-term price movements, it remains to be seen whether it will have more lasting, structural effects on markets. In other words, it is questionable whether this segment of the so-called ‘real economy’ can succumb to ‘financial logic’. The arguments made in the chapter will be illustrated primarily by reference to the case of crude oil markets.

While the chapter appears to have little to do with phosphate, which is not traded on organised exchanges, it is important to the wider theme of resource scarcity as an origin of wealth in the 21<sup>st</sup> century. In addition, it should be noted that while phosphate, and indeed many other systemically important commodities such as iron ore, are not *yet* traded on organised exchanges, the history of trade in other commodities suggests that markets generally evolve in this direction eventually. Indeed, in the case of iron ore, a nascent spot market began to develop during the course of this research (Sukagawa 2010; Wilson 2012; Hume 2014a).

As of the time of submission of this thesis, chapter 6 has been submitted to *Economy and Society*.

*Chapter 7* is the conclusion of the thesis. It summarises the main findings of the research project, draws out wider implications from it, and suggests directions for future research.

## **CHAPTER 2 | Literature review**

### **2.1 Introduction**

This chapter gives an overview of some of the key themes that underpin the substantive chapters of the thesis (chapters 3-6). More specific and in-depth literature reviews can be found in each of the substantive chapters of the thesis, but for each of these chapters I have selected one or two strands of theoretical literature that further inform the findings and discussion therein. The four sections are presented in the same order as the respective chapters to which they serve as further background.

While not all themes are apparent across all four papers, together these four strands reveal commodity markets to be a meeting point for a plethora of interrelated issues. The present chapter is in large part a selective rehearsal of established thought on the drivers of commodity prices and the institutions which have the potential both to channel and to benefit most from high prices.

The chapter proceeds as follows. Section 2.2 presents important insights from established scholarship on medium- and long-term commodity price dynamics. It begins by explaining the concept of a commodity super-cycle and briefly reviews recent debates surrounding the end-date of the most recent (in some observers' eyes, ongoing) cycle. The following sub-section moves on to discuss long-run commodity price behaviour, to clarify its relevance to society, and to explain what is and is not known about its relationship to geophysical scarcity. Section 2.3 provides some historical context on trends in state ownership and control in the extractive sector over the past half-century – trends which are in many ways linked to the fortunes of

international commodity price dynamics. It also reviews the literature assessing the commercial performance of NECs vis-à-vis their private-sector counterparts. Section 2.4 discusses some basic principles of commodity price formation, with a focus on some of the philosophical and methodological differences between how different branches of economics approach the subject. Particular attention is given to the role information plays in shaping market participants' expectations, and how institutions such as organised exchanges mediate the production and dissemination of market data. Section 2.5 offers two contrasting perspectives on the societal role of the financial sector. The first, drawn from economic geography and cognate branches of the social sciences, takes a more critical stance, while the second, drawn primarily from mainstream finance and economics literature, is concerned more narrowly with the theory of the value of derivatives contracts and their exchange. Finally, section 2.6 briefly summarises the key insights from the review of the literature and maps out their relevance to each of the chapters to follow.

## **2.2 Commodity price behaviour beyond the short term**

### *2.2.1 Commodity super-cycles*

The concept of long macroeconomic cycles has its origins with the work of the Soviet economist Nikolai Kondratiev, who posited that capitalist economic growth is characterised by alternating and sustained periods of relatively high and low growth rates. These 'long waves' typically last about 40-60 years in total (Kondratiev 1984 [1925]). While many economists are now sceptical of the existence of such 'Kondratiev waves' as a general matter, several empirical analyses have identified

three distinct commodity market long waves in the past 150 years (Heap 2005; Radetzki 2006; Cuddington and Jerrett 2008; Jerrett and Cuddington 2008; Erten and Ocampo 2012), with the present boom considered to be the beginning of a fourth. Each of these booms may more formally be considered a *super-cycle*: a broad-based cyclical rise at least 20 per cent above trend in industrial commodity prices lasting between 10-35 years (20-70 years for the full cycle) (Heap 2005; Cuddington and Jerrett 2008; Jerrett and Cuddington 2008; Erten and Ocampo 2012; Jacks 2013).<sup>5</sup> While they are primarily demand-driven, supply-side factors also play a role (Tilton 2006 cited in Cuddington and Jerrett 2008, 557; Humphreys 2009).

As explained in more detail in chapter 6, the current super-cycle began around 2002 with a demand shock driven largely by Chinese macroeconomic growth. In the view of super-cycles as periods of high demand (relative to short- to medium-term supply) for industrial commodities, the current super-cycle is part of an infrastructure investment cycle. In particular, the mean price of metals was higher in the current super-cycle than during the previous one (Erten and Ocampo 2012). The resilience of the cycle even in the aftermath of the global financial crisis of 2008, as evidenced by a rebound in commodity prices in 2011, is also one of its distinguishing features. These traits notwithstanding, from a historical perspective the current boom largely fits a pattern, is not unprecedented in real terms, and thus appears relatively unremarkable. As such, the two to three years preceding the time of writing have witnessed a great deal of controversy about whether the current cycle has already ended.

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<sup>5</sup> Note that while the empirical evidence for commodity super-cycles is strong and widely accepted, it does not follow that the periodicity, strength, and duration of a given cycle follows a clear pattern – a core criticism of Kondratiev and his intellectual brethren (Maddison 1991).

On one hand, many market participants began calling the end of the cycle for several reasons. On the demand side, it is argued, many of the structural changes in the global economy that gave rise to the super-cycle represent long-term geographic shifts in growth from mature to emerging markets rather than an absolute, dramatic, and permanent increase in consumption. China has been the primary driver of the boom from the beginning, given its size and rate of growth as it undertakes an aggressive programme of industrialisation and urbanisation; and it has also sustained the boom in the post-crisis period (Radetzki 2013a). However, the long-term viability of its state-directed, investment-intensive economic model has been called into question. Should its economy falter, even an acceleration in demand from other emerging markets may do no more than supplant a decline in consumption by mature economies characterised by dematerialisation (Radetzki 2006, 63; Humphreys 2009). China's significance as a consumer of commodities is also diminished somewhat in light of the fact that its demand for minerals and energy comes to an extent from an export-driven industrial sector (Humphreys 2009). On the supply side, the super-cycle thesis also rests on the assumption that the extractives sector will continue to have difficulty attracting the necessary investment in capacity expansion to bring prices back down, despite high profits, over the course of one, two, or even three decades. Yet history has consistently shown the extractives sector to be highly cyclical: high prices attract profits necessary to invest in new capacity, raising output and lowering prices over the course of as little as three years but generally no more than a decade.

On the other hand, for every indicator of a lasting slowdown in Chinese growth one can find counter-evidence of its durability. Moreover, many other emerging

economies are still experiencing periods of resource-intensive growth (Blas 2012). At the same time, evidence of the unsustainability of high-grade reserves as mediated by technological change – and, by extension, the long-run downward trend in prices – is mounting. In effect, predictions about the durability of the super-cycle are not only about the sustainability of Chinese economic growth; for those taking the long view, they are more broadly about the robustness of the Prebisch-Singer hypothesis, as explained in the following subsection.

### *2.2.2 Long-term price dynamics and the Prebisch-Singer hypothesis*

Cashin et al. (2002, 277-8) have summarised four ‘stylised facts’ about long-run commodity prices: ‘they are often dominated by long periods of doldrums punctuated by sharp upward spikes (Deaton and Laroque 1992); they have a tendency to trend down in the long run (Grilli and Yang 1988); shocks to commodity prices tend to persist for several years at a time (Cashin et al. 2000); and unrelated commodity prices move together (Pindyck and Rotemberg 1990)’. To these four can be added Deaton’s (1999) frequently cited observation that ‘what commodity prices lack in trend, they make up for in variance’. These stylised facts dominate market sentiment and economic thought alike, and so too does their influence extend to policy formulation.

The second of these stylised facts is formally known as the Prebisch-Singer hypothesis, jointly named for the two economists who independently found that commodity prices exhibit a secular decline (Prebisch 1950; Singer 1950). Some subsequent research appeared to confirm these findings (Grilli and Yang 1988; Erten

and Ocampo 2012; Harvey et al. 2012). Further discussion of Prebisch-Singer can be found in chapter 6; however, three points can be made about more recent developments in this literature.

First, although some updated assessments broadly support Prebisch-Singer, a number of studies have drawn different conclusions about the long-run trend of mineral commodity prices. Most notably, Slade (1982) found that the long-term trajectory for metal prices would follow a U-shaped curve rather than a deterioration. Other analyses find only weak support at best for Prebisch-Singer (e.g. Arezki et al. 2013; Jacks 2013; Yamada and Yoon 2013). In this vein, it might be said that less considered in all of this was just how long the ‘long run’ might be – and so, perhaps with an implicit nod to Keynes’s famous quip that ‘in the long run, we are all dead’, the downward trend in real prices has effectively been assumed to last in perpetuity.

Economic theory has struggled to accommodate the complexities of geologic depletion (Krautkraemer 1998; 2005). While proponents of Prebisch-Singer tend to focus on demand-side factors and the role of investment and technology in expanding supply and depressing long-term prices, others point to evidence that geologic and other supply-side constraints may not simply be secondary drivers of this super-cycle but rather key determinants of a more durable trend to higher prices (Humphreys 2009). While not going so far as to say that extractive commodities are in danger of imminent depletion, the loose interpretation of peak theory suggests that it is the depletion of high-grade reserves that poses a more significant threat to supply, as proportionally greater investment is required to extract the same amount of a given resource. This appears to be precisely the ongoing trend in the extractive industry:

few opportunities to exploit high-grade ores remain, and so most projects undertaken in the past decade have been more capital- and technology-intensive, resulting in higher net costs and longer production lags (ibid.).<sup>6</sup>

Second, less deeply explored have been the varying implications of Prebisch-Singer for different types of commodities. Oil, for example, is the well-known exception to the hypothesis, having trended upwards for much of the twentieth century (Erten and Ocampo 2012). Copper, for its part, is one type of metal that does not conform nearly to the hypothesis: long-term prices trended downwards for the 30 years preceding the current boom, but had been stable or positive at various stages during the 19<sup>th</sup> and 20<sup>th</sup> centuries (Svedberg and Tilton 2006). Indeed, much comparative analysis finds mixed results for the Prebisch-Singer hypothesis for different commodity groups. For example, Issler et al. (2014) find that the real prices of copper, nickel and zinc more than doubled from 1900-2010 even as those of aluminium, lead, and tin declined by 70-90 per cent. In a parallel breakthrough, Svedberg and Tilton (2006) argue that the slope of the downward trend might be exaggerated, as the use of alternative deflators shows a significantly less steep trend line for copper prices.

Finally, what is often overlooked is that Prebisch and Singer's original intent was not to make a point about resource availability as represented by prices, but rather to draw implications for policy: given the apparent long-run decline in commodity prices *relative* to manufactures, it seemed advisable for resource-rich nations to diversify their economies away from primary production and towards industrialisation. Yet

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<sup>6</sup> Other factors unrelated to geology, including a shortage of skills and equipment, have also fuelled cost inflation. Additionally, resource nationalism in its various manifestations, delays in approval for projects, and other political factors – many of them stemming from local concerns about greater environmental damage from more complex projects – have constrained production over the past decade (Humphreys 2009).

apart from inconclusive evidence of a decline, the realities of heterogeneous historical and institutional conditions in different resource-rich economies may not imply that economic diversification will improve their terms of trade (see Tilton 2013). The broad policy question of national resource wealth management is taken up in the following section.

## **2.3 State ownership and control in mining**

### *2.3.1 State control of national mineral wealth*

Like the relationship between commodity price dynamics and economic growth, the closely related subject of the relationship between national resource endowment and socio-economic development is one of the oldest areas of economic inquiry.

Commodity price levels and fluctuations have important implications for economic growth in developing countries, both major commodity producers and nations that rely on imports. Sinnott et al. (2010, 3-5) offer the following stylised facts about the implications of primary commodity production for economic development:

- The extractive industries in particular generate high rents.
- International market prices are highly volatile, again particularly for minerals.
- Upfront capital investments in commodity production are high, with long-term and risky payback, ‘creating disincentives for private investment’.
- The non-renewability of mineral commodities means that extraction rates as well as rents must be managed over time.
- Extraction generates negative externalities.

- Extraction occurs through ‘enclave production’, with both positive and negative spillover effects concentrated in specific regions.

For all of these reasons, resource-rich states’ prudent management of their natural wealth at the national as well as sub-national levels has long proven a challenge to say the least. While there exists a vast and still-expanding literature on the ‘resource curse’ (attributed to Sachs and Warner 1995; see Frankel 2010 for a summary), the focus of inquiry has begun to shift towards the nature of the institutions that are conducive to the preservation and distribution of resource wealth (Humphreys et al. 2007). It is well beyond the scope of this thesis to treat each of these in any detail. For our purposes, we need only focus on one of the most favoured – if not necessarily successful – policy measures of the past half-century: the partial or complete nationalisation of the industry (Auty 2000).

Historically control of mineral supply and trade has been regarded as politically and strategically important (Ericsson and Löf 2011, 2). After dropping significantly with the fall of the Soviet Union, the share of global mineral deposits under state control has increased in recent years as the governments of resource-rich nations seek to capitalise on the commodity boom of the 2000s and early 2010s. State control ranges from approximately 20 per cent for some base metals to as much as 90 per cent for others (ibid., 9). While state control over total world phosphate reserves and production has not attained the high proportion found in oil (73 per cent and 61 per cent, respectively) and gas (61 per cent and 52 per cent) (Victor et al. 2012, 3), the figure stood at nearly one-third in 2011 (Ericsson and Löf 2011, 11-12) and is projected to grow.

One crucial point often overlooked in the literature is that considerations of state involvement in extractive companies must distinguish ownership from control (Radetzki 2008; Ericsson and Löf 2011). Whereas ownership simply denotes possession of shares in a company and thus is easily defined and measured, control is a more nebulous concept. However, Raw Materials Group, the well-regarded mineral economics consultancy, usefully defines state control as either majority shareholding or minority shareholding with ‘no other dominant owners’ (cited in Radetzki 2008, 169). For Radetzki (2008), it is control rather than equity ownership that determines NEC behaviour and so distinguishes these entities from private companies. For Ericsson and Löf (2011, 43), ‘to be in control is to have [the] possibility to act decisively on strategic issues’, such as ‘the broad policies of a company, decisions on large investments, buying or selling of subsidiaries and power to appoint or dismiss management’ – though not necessarily ‘having day-to-day influence over all its decisions’. Control may be direct or indirect, although evidence suggests ‘that it may not be enough to have even a majority of the equity in a company to be in full control’ (ibid., 44). Moreover, as important as control over extraction is control over processing (ibid.).

The most direct form of control over national mineral resources is direct ownership via a state-owned corporation. National oil, gas, and mining companies – or, to adapt a definition posited by Victor et al. (2012, 3-4), a ‘national extractive company’ (NEC) – is best thought of as an umbrella term for a mining or oil company in which states have varying degrees of involvement and which may carry out a wide range of commercial and non-commercial functions. In recent years, NECs have not only been

examined for their hybrid public-private functions and performance (Victor et al. 2012); they have also come under greater scrutiny as entities of geopolitical concern – particularly trepidations about the supply behaviour of these companies (Bremmer 2010). More generally, NECs appear in scholarship on ‘state capitalism’ as vehicles through which (non-democratic) governments practice neo-Mercantilism (ibid; Musacchio and Lazzarini 2012).

At the same time, evident in much public, policy, and scholarly discourse is the presumption that state ownership must entail a particular suite of poor governance practices – particularly inefficiency and political rent-seeking (Radetzki 2008). However, as recent scholarship on national oil companies (NOCs) has demonstrated, case studies of SOEs that cut across geographic regions and different types of political systems offer instead a much richer picture of the variety of governance forms and practices of NOCs (Marcel 2006; Jaffe and Soligo 2007; Victor et al. 2012). By contrast, that which considers mining was largely carried out before the fall of Communism and so – apart from being dated – frequently comes laden with a certain ideological bias. Nonetheless, while most work on state-owned extractive companies is focused on the oil and gas sector, the lessons from it are still broadly applicable to mining. The reasons for this skewed focus are practical and political: while NOCs are the norm in the oil industry, private ownership has been typical in mining (Ericsson and Löf 2011, 33). In world-historical terms, most mineral commodities do not have the same strategic importance and direct overall economic impact as energy commodities, and so political interest in the mining sector has been lower (ibid., 22).

### *2.3.2 History and theory of NEC commercial performance*

The latter half of the twentieth century witnessed the ascendancy and rapid decline of the multinational mining company as an institution. Up to that point, state ownership in the mineral sector was not common (Radetzki 2008, 167). The 1960s and 1970s witnessed a wave of post-colonial independence movements in Africa and Asia, along with nationalisations of resource companies. From the 1960s through the early 1980s, the growth of (mainly developing-country) state involvement in mining remained strong (Al Rawashdeh 2008). Until that time, multinational corporations (MNCs) accounted for most of the developing world's mining production. However, following, or at times accompanying, the wave of decolonisation that swept across Africa, Southeast Asia, and Latin America was a trend towards nationalisation in the mining sector. Newly independent mineral-rich countries felt it was only fair that decisions regarding their own economies should be made on their own soil rather than at a foreign-owned company's headquarters (Auty 2000), particularly given the great potential for mining to contribute to national development (Ericsson 2006 cited in Al Rawashdeh 2008). A number of milestones, such as Nasser's nationalisation of the Suez Canal in 1956 and the success of OPEC in driving up oil prices in 1973, further encouraged these ideas (Al Rawashdeh 2008). Coupled with the spread of these political ideals was the unprecedented performance of mineral commodity prices in the post-war period.

Unfortunately, the experience of the period from the mid-1970s to the late 1980s did not match aspirations for the newly nationalised industries. Due to both exogenous and endogenous factors – most notably, a dramatic slowdown in mineral demand growth and resulting lower prices coupled with state mismanagement and a lack of

investment in exploration and development (Al Rawashdeh 2008; Ericsson and Löf 2011) – the state-owned mineral sector tended to underperform relative to its private-sector counterparts. Put another way, developing-country government interest in the mining sector followed commodity price levels (Ericsson and Löf 2011, 37). The combination of low revenues and the worldwide decline of socialism as an ideology and a viable political system encouraged a wave of privatisations through the late 1980s and 1990s (Radetzki 1992; Auty 2000; Ericsson and Löf 2011).

Based in no small part on this experience, state involvement in the extractive industries is typically viewed with suspicion on three grounds. First, as domains of government control, NECs are loci for struggles between managers and government officials for control of resource wealth (Aharoni and Ascher 1998). In a twist on the principal-agent problem, NECs with an important role in the domestic economy may take on the character of a ‘state within a state’ if they also take responsibility for a broad set of policy goals such as maintaining employment levels, collecting resource rents, environmental regulation, or infrastructure development, to name a few (Aharoni and Ascher 1998, 204; Boscheck 2007, 374; Radetzki 2008).

Second, and as a result, as corporations NECs are presumed to perform poorly, for a variety of potential reasons. These include failure to control costs; irresponsible mineral reserve exploitation; multiple and potentially conflicting corporate objectives; diversification into areas in which managers lack expertise; executive leadership by civil servants rather than experienced industry professionals; political interference; corruption; lax regulation; over-staffing; and moral hazard due to access to cheap financing and guarantees against bankruptcy (Aharoni and Ascher 1998; Auty 2000,

34-5; Radetzki 2008). Ultimately, because NECs operate in what is commonly considered a 'strategic' sector, they face little prospect of privatisation and so are insulated from competitive pressures (Aharoni and Ascher 1998, 203). One result is that NECs tend to be unresponsive to market signals (Auty 2000, 40), further exacerbating their lack of competitiveness. Third, again as a result of this prevailing inefficiency as well as corruption, NECs are often a drain on the state's fiscal resources. One further contributing factor to this strain on national budgets may be currency appreciation or 'Dutch disease' (Radetzki 2008).

Framed differently, in view of the history of MNC involvement in developing countries' extractive sectors, state ownership was widely viewed at the outset as, at one level, a solution to the principal-agent problem of foreign ownership and/or management of national wealth. In practice, however, the specific institutional arrangements which state ownership entails creates a different, no less problematic suite of principal-agent problems. This is in no small part due to the nature of the shareholder: 'Any government is far from a monolithic entity' (Stevens 2008). While the specifics vary according to country or political system, at the most basic level one can point to the differing – and often competing functions and incentives of – politicians and bureaucrats (*ibid.*; Aharoni and Ascher 1998). Given that states often exercise their rights as shareholders through a number of channels – including individuals – the result is frequently 'too much and poorly coordinated owner intervention' (Radetzki 2008, 181, 182). At the same time, in many cases the power asymmetries evident between the government and the NEC may parallel those typically found in the private sector: most notably, while the government may set the institutional context, the NEC retains technical and commercial expertise, creating

information asymmetries in the company's favour (Marcel 2006, 4; Stevens 2008). In a word, 'the blurred nature of the principal-agent relationship' often means that NECs become 'powerful political and economic empires' (Radetzki 2008, 182).

Despite these historic difficulties, as a rule of thumb, developing-country government interest in the extractive sector is correlated with prevailing international commodity price levels. In other words, state interest, like the sector itself, is cyclical (Ericsson and Löf 2011). Thus during the super-cycle of the past decade, the tendency towards privatisation began to reverse itself once again, albeit only to a small extent and as part of a much wider trend of 'resource nationalism' which has entailed various policy changes to capture a higher proportion of the economic benefits of mining in-country (ibid. 38). With respect to the specific form of the MNC as an expression of state control, however, the global privatisation process has produced both a handful of high performers including Codelco, LKAB, Polish Copper, and NMDC of India, and suboptimal performers such as Gecamines, some formerly state-owned Indian companies, and various players in the Venezuelan iron ore and aluminium industries (Ericsson and Löf 2011, 31).

As this bifurcated list suggests, the empirical evidence has more recently generated a certain amount of debate regarding the extent to which inefficiency is preordained by the simple fact of state ownership. As the high performance of companies such as those cited above suggests, state ownership need not entail inefficiency. Aharoni and Ascher (1998, 202) have argued that competitive efficiency is a result of country-specific political economy variables: here the form of corporate ownership is of only secondary importance to a market environment that supports entrepreneurialism while

relying on effective government oversight. Similarly, Radetzki (2008, 172-3) has expressed scepticism that private-sector and NEC behaviour can be so easily distinguished either in theory or in practice. In principle, the composition of firm ownership should not influence corporate behaviour, since the same laws apply equally to all companies. In reality, too, the distinction is blurred not only because of the heterogeneity in NEC form and function already mentioned but also due to an increased emphasis on CSR in the private mineral sector from the 1990s on.

## **2.4 Commodity price formation**

### *2.4.1 Models vs. institutions*

Along with the more easily observable *behaviour* of commodity prices, the *determinants* of these prices is one of the most researched topics in economics. An enormous body of literature is devoted to the formal modelling commodity price formation, in part reflecting a high degree of heterogeneity across different types of commodities. This literature has been condensed elsewhere (see Radetzki 2008; Valiante 2013); suffice to note here that most of these models are based on a supply-demand framework (Fattouh 2007). More recently, there have been attempts to incorporate macroeconomic variables such as GDP growth and inflation into these models (Frankel and Rose 2010). In a similar vein, the literature on market microstructure directly addresses the question of how particular trading mechanisms and processes work to produce prices (O'Hara 1995). Market microstructure models take account of details such as types of traders, specific trading rules, and the availability of information.

While formal models of price formation have a number of virtues, they do have two particular deficiencies. First, while the influence of market microstructure theory has encouraged the mainstream to provide a partial account of what actually occurs within the ‘black box’ of price formation, on the whole this literature does not directly address the question of what constitutes a market, much less describe it in any detail. Here an alternative approach is employed by Çalışkan (2010), who draws on the anthropological methods of science and technology studies (STS) to examine the micro-level institutions, agents, and decision-making involved in price formation in global cotton markets. In this view, price formation is fundamentally a *process* which, rather than being linear or resulting a singular output called ‘the market price’, is continuous and iterative – and one of which prices are themselves an integral, constituent part. At the same time, as a process ultimately driven by human agents, pricing developments owe much to individual trader psychology.<sup>7</sup> While Çalışkan’s work owes much to that of Callon (1998) and, perhaps more directly, MacKenzie (2006), his is perhaps unique to date for its focus on a primary commodity.

Çalışkan’s (2010) view of markets as ‘sociotechnical universes’ also draws on the concept of market ‘embeddedness’. First advanced by Polanyi (2001 [1944]), this refers to the insight that economic processes are inextricably bound up with wider social processes – in other words, that markets are inseparable from the historical, geographic, and institutional conditions in which they exist. Economic sociologists further distinguish between social, institutional, and cognitive embeddedness (Beckert

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<sup>7</sup> This point is, of course, made by Shiller (2000) and Akerlof and Shiller (2009), albeit in a slightly different context.

2010).<sup>8</sup> In recent years embeddedness has itself become a contested notion: its ‘central paradox’ as imagined by Polanyi (2001 [1944]) and as reconceived by Granovetter (1985) is that the very embeddedness of the market in wider social relations calls into question the essence of ‘the market’ itself (Krippner et al. 2004). However, it seems reasonable to accept that Polanyi’s point here was not to identify boundaries between ‘the market’ and the rest of society but rather to explore the nature of the economic realm and its relationship to other human endeavours (Çalışkan 2010; Muellerleile 2013; see also Callon 1998).

While the work undertaken in this thesis occurs a step above the level of fine-grained analysis of individual agents and the power relations between them that characterises much work in economic sociology (see chapter 5, note 33), many of the perspectives on markets evident in this thesis give an implicit nod to the concept of embeddedness. As we shall see in chapter 6, for example, of particular interest is Polanyi’s (2001 [1944]) question of what happens in market economies when the relationship between the economic and the wider social spheres is turned on its head: in other words, what happens when ‘market logics’ begin to govern other realms of activity. This logic, it should be noted, is largely exercised through cognitive processes, and so relates to the (as yet little-researched) notion of cognitive embeddedness, or ‘the ways in which the structured regularities of mental processes limit the exercise of economic reasoning’ (Zukin and DiMaggio 1990, 15, cited Dequech 2003, 462).<sup>9</sup>

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<sup>8</sup> Or alternatively, between structural, cultural, political, and cognitive embeddedness (Granovetter 1985; Zukin and DiMaggio 1990, both cited Beckert 2007).

<sup>9</sup> But see Dequech (2003); Beckert (2010).

Somewhere between the somewhat abstracted ‘stylised facts’ of formal models and the micro-level, qualitative descriptions of sociologists of economics lies a third possibility. Perhaps best dubbed the ‘informal approach’ (Fattouh 2007), this relies on qualitative description of a given market. Its most notable shortcoming is its lack of predictive power and, likely for this reason, it is used relatively infrequently. On the other hand, the informal approach has the advantage of accounting for specific features of a given market – a crucial point given the heterogeneity of commodity market structures – and suggesting how they might influence the price formation process. As such it can be useful for identifying reasons why, for instance, observed price changes might be due to cyclical as opposed to structural factors (Fattouh 2007, 36-7); or, at a more granular level, how market structure influences the bargaining power and hence the division of benefits between buyers and sellers of a given commodity (Radetzki 1978).

#### *2.4.2 The role of information*

A second limitation of formal modelling is that commodity price formation is still subject to considerable uncertainty. This is not merely an observation about the fundamental difficulty of predicting the future. Another recurring theme that runs through much of this thesis is the problematic nature of the paucity of reliable data that characterises most commodity markets. Information has long been recognised as the cornerstone of proper market function, be it for pure goods (Akerlof 1970; Stigler 1961), services (Coase 1937), labour (Spence 1973), or financial products (Fama 1970). The field of information economics is broadly concerned with the implications of asymmetric information for buyers and sellers in a given market, and thus for

market performance as a whole. An important assumption here is that markets are *not* perfectly efficient (cf. Grossman and Stiglitz 1980). As such, information is economically valuable in and of itself.

One inspiration for the development of this field came from Hayek's (1945) contention that prices themselves contain valuable information. However, for Hayek (1937, 1945), the 'central problem of economics' is that knowledge is not simply 'out there' at the disposal of all market participants, as neoclassical theory assumes. Rather, information is subjective, dispersed, dynamic, and frequently tacit (Bronk 2013, 85). To an extent, prices themselves perform a coordinating role by summarising relevant information in 'symbolic' form – even if this serves only to supplement individual agents' own local and tacit knowledge (Bronk 2013, 92). A primary function of markets, then, is price discovery: in other words, they serve as aggregators of information as well as venues for exchange. Yet there is a significant gap between Hayek's fundamental optimism about the 'wisdom of prices' and the specific processes by which information is generated, disseminated, and translated into prices. As such, it has been left to subsequent generations to examine the different types of formal institutions of price discovery as well as the power relations among them.

Transparency of information about prices and supply and demand dynamics is widely regarded as crucial for the efficient functioning of these markets (Fajarnes 2011).

More specifically, 'The availability of up-to-date and reliable information on commodity supply, demand and stocks is essential for the formation of accurate price expectations and an efficient functioning of commodity markets' (UNCTAD 2011, 4).

In commodity markets, however, accurate, complete, and timely information is lacking for a number of reasons. Data is available from a variety of sources, but collection, processing, and presentation methods may be opaque or subject to time lags and are not harmonised across sources. Further exacerbating the problem of opacity is that much information on production, inventories, and transactions is generated and held by the private sector. For all of these reasons, uncertainty surrounds much of the volume of trade in commodities (ibid.).

On the other hand, frequently overlooked in discussions of data scarcity is that *complete* information is not tantamount to *perfect* information. Given the central role of expectations in commodity price formation (see chapter 6), Fattouh and Allsopp (2009, 2) note that if traders respond to all available information in a highly transparent and data-abundant market environment, this may have the unintended consequence of greater volatility levels (see also Kay 2012, 35). Indeed, in this sense ‘perfect’ information is neither desirable in and of itself nor, in any case, possible.

These points are particularly salient with respect to futures trading. Futures exchanges provide a facility for continuous trade, for financing inventory holdings, and for hedging (Radetzki 2013b). Their main virtue, however, lies in their important role in price discovery in liquid markets for commodities for which an easily defined standard exists (UNCTAD 2011, 7). Such markets are characterised by the ‘double auction’ principle, with both parties to a transaction are equally active in making bids and offers throughout the process of trading – a condition regarded as essential to competitive pricing (Radetzki 2013b). As such, significant price differentials are arbitrated away relatively quickly (UNCTAD 2011, 7). It is for these reasons that the

prices set on futures exchanges, in comparison to those determined by other means, are widely regarded as both efficient and transparent.

In practice, however, a financial component in the price formation process introduces considerable uncertainty as to the reliability of signals. That physical market data is incomplete and not entirely reliable leads market participants to look to futures markets to convey accurate information, which ‘increases the risk of herd behaviour and a perpetuation of the misleading price signals’ and may ultimately lead to a speculative bubble. The presence of financial actors which trade on the basis of considerations related to their own portfolio management rather than market fundamentals also complicates the process of forming pricing expectations (UNCTAD 2011, 6). In sum, the ideal of ‘perfect’ information is both problematic conceptually and evasive in reality.

## **2.5 Financialization**

### *2.5.1 Background to the financialization thesis: heterodox views*

Lee et al. (2009) have identified seventeen overlapping (and at times conflicting) conceptualisations of ‘financialization’ in the literature. All conceive of financialization as a hegemonic process, logic, or system, whether overtly or implicitly. At its heart, financialization is believed to be no less than the totalising realisation of neoclassical finance and economics theory, as (arguably) epitomised in Merton and Bodie (2005). In the broadest sense, financialization is alleged to have created a governing logic that has infused firms and industries (not to mention

individuals, households, and entire economies). The growth of sovereign debt coupled with the rise of institutional investors in the 1970s, in parallel to the decline of corporate profits in the 1970s (Crotty 2005 cited in Muellerleile 2009), meant that corporations came to rely on capital raised via financial markets for growth. This reliance, however, entailed ceding some control of corporate governance to financial investors, the interests of which were not necessarily aligned with those of the firm.

From at least the 1990s (if not as early as the 1970s) until the onset of the global financial crisis in 2007-08, finance-led growth was widely regarded as a viable successor to the Fordist regime that had prevailed for much of the 20<sup>th</sup> century (Boyer 2000).<sup>10</sup> As French et al. (2011, 803-4) point out, more recent work in critical social accounting (CSA) attributes the ultimate driver of financialization not to an ‘elite financial-rentier class’, but rather to ‘attempts by middle-class savers to minimise risk and seek long-term financial security through investments and pensions’. This in turn places sufficient pressure on firms to privilege the short-term maximisation of shareholder value over longer-term ‘productive’ investment that corporate behaviour and priorities have indeed been so transformed. Apart from a new corporate governance regime, these forces have encouraged the growth of the financial sector and the spread of so-called financial innovation.<sup>11</sup>

Financialization has therefore created both a new governing logic and an economic space more or less independent of something called ‘the real economy’. However, there has been a certain amount of debate as to whether this parallel universe is

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<sup>10</sup> Others trace these developments back much further, to the turn of the 20<sup>th</sup> century; see Mitchell (2007).

<sup>11</sup> A further effect has been that the primary aim of monetary policy is now the prevention of asset bubbles (Boyer 2000).

entirely divorced from the productive economy, or if not, what the relationship between the two might be. Echoing debates in the mainstream literature on the relationship between physical and financial commodity prices, Labban (2010), for example, argues that ‘the perpetually shifting value of ‘real’ capital is a reflection of the shifting value of fictitious titles’ (545) – in other words, that the financial price of a commodity (in this case oil) drives the physical price. However, Pike and Pollard (2010) reject the dichotomy between finance and the ‘real economy’. As Leyshon and Thrift (2007) point out, ‘even in the context of financialization, the material basis of the “real economy” is inescapable in its framing and calculation of investment opportunities (cited in Pike and Pollard 2010, 34-5).

In an entirely different vein, the term ‘financialization’ could conceivably denote any number of ways in which ‘financial logic’ could be said to influence commodity markets. At the level of individual companies, for example, derivatives ‘are now central elements of corporate accounting’ (Lee et al. 2009; see also Pindyck 2001; Bryan and Rafferty 2006); and producers have come under pressure from investors to cut back on greenfield projects for the sake of enhancing short-term shareholder value (Blas 2012b). Banks have exerted parallel pressures through cutbacks in lending to producers for longer-term, higher-risk exploration and development projects (Fraser Institute 2011); while also reducing commodity trade finance to trading houses (Blas 2011). Investment banks also stepped up their involvement in physical production, storage, and logistics, for example by investing in the LME warehousing system, during the past decade, although most of the large investment banks have begun divesting from these assets in the year or so preceding the time of writing. In parallel, there has been a modest trend towards vertical integration between producers and

traders. While difficult to articulate, this tendency to a ‘trading’ or finance-driven mentality is feared to engender a short-termist approach to commodity production: one that, like all the aforementioned forms of financial logic, encourages a disproportionate focus on short-term profits at the expense of long-term physical supply and, arguably, better-distributed wealth.

Of primary interest here, however, is that strand of the literature which concerns itself with the trade of futures contracts and other financial instruments, otherwise referred to as a type of ‘speculation’. The proliferation of financial derivatives trading in commodity markets is part of a wider trend, again dating to the 1970s and facilitated by advances in information technology. This literature is surveyed in more detail in chapter 6. To provide some context (and perhaps a countervailing view) to it, however, the next sub-section outlines some mainstream views on the theory of financial derivatives.

### *2.5.2 The nature and purpose of derivatives trading: mainstream views*

A brief survey of perspectives within the mainstream economics literature on derivatives trading reveals considerable nuance and debate as to what precisely the nature, purpose, and value of these contracts – and by extension the exchanges on which they are traded – may be. The most established view of derivatives regards them as instruments for insurance or risk management (Miller 1997; Pindyck 2001). Others argue that insurance is only of secondary importance and that arguments presenting hedging as the main purpose of futures markets are ‘over-simplified’ (Working, 1963). Rather, derivatives trading transmits information to stabilize prices

via inventory adjustments (Working 1953, 342; Pindyck 2001). The 1970s and 1980s saw the emergence of further alternative views, including portfolio theory, liquidity theory, and loan markets theory (see Pennings and Leuthold 2000 for an overview). What all of them share is an assumption that hedging is motivated by exchange participants' need to balance risk and return. Still others focus on the impact of hedging on final consumers' welfare (Newbery and Stiglitz 1981 cited in Fattouh and Mahadeva 2012a). Here, some empirical work finds price increases in markets for commodities without a financial component (Headey and Fan 2008; Irwin, et al. 2009 cited in Irwin and Sanders 2010).

However, Pennings and Leuthold (2000) offer a complementary explanation: that futures contracts are a form of inter-firm relationship management. This view is subtly different from the conventional explanation that futures contracts facilitate trade among strangers. This sort of management, in the form of trading on organised exchanges, is necessary because of differences in power – here considered 'the ability of firms to influence the price discovery process' (873). By extension, futures exchanges are necessary to provide a forum for conflict resolution – in the authors' terms, to dispel dissatisfaction on the part of the less-powerful party to given transaction (ibid.). In this sense, organised exchanges allow for certain contractual relationships that would not ordinarily exist not only because they lower transaction costs but because they go some way to even out power asymmetries. By facilitating these relationships, organised exchanges also affect the optimal organisation of industries (881).

Esoteric though they may seem, scholarly debates about the precise nature of the functions of futures exchanges have two particularly important implications. First, there is a subtle difference between a focus on the function and purpose of derivatives *contracts* as opposed to derivatives *exchanges* as a whole. In other words, derivatives can be analysed from the perspective of a single transacting party; from a given bilateral transaction; or from the infrastructure that enables a given universe of transactions. For instance, a focus on the entire exchange reveals three additional, decisive benefits of organised trading: price discovery, price transparency, and reduced transaction costs (UNCTAD 2006).

Second, while much of the literature from the past 30 years or so is positivist, more recent work attempts normative assessments of the ‘proper’ functions of contracts and exchanges. For Sandor (2012), the distinction between ‘good derivatives’ and bad is clear-cut. In the first instance, designing a futures contract ‘is just as much a fastidious science as it is a versatile art’ (548) which ‘requires market, regulatory, and sociological insights’ (549). Second, the institutional infrastructure supporting futures trading must be governed by a clear and unambiguous legal and regulatory framework. Finally, the creation and management of the exchange must include proper accounting standards, legal rules, and the ongoing education of potential and existing participants. Falling short of meeting these conditions results in potential market participants moving their trading activities to another jurisdiction or availing of more opaque hedging methods (547).

As Pennings and Leuthold (2000) suggest, there is a difference between the *efficient* spread of risk among all market participants and the trust shared *equitably* between

two transacting entities. Of course, Sandor (2012) assumes that transparency is universally desirable among all market participants. In reality, however, Working (1963, 22) has argued that ‘Defects in the operation of futures markets tend to arise and be perpetuated primarily by the fact that exchange practices that restrict the usefulness of the market for hedging can be a source of profit to certain members of the exchange’. These powerful members can exploit popular suspicion of futures trading to ensure political and regulatory protection of such defects.<sup>12</sup>

In other words, at the same time as the diversity of players in financial markets has increased, the degree of market concentration in the commodities industry has increased. This is true not only of producers but also of the exchanges themselves. The expansion of exchanges has caused them to drift from their ostensibly not-for-profit function: financial growth has come less and less from product innovation for risk transfer and increasingly from demutualisation and mergers and acquisitions (UNCTAD 2006; Sandor 2012). Power asymmetries are therefore a key, if largely missing, component of theories of contractual nature and function.

## **2.6 Conclusion**

In one important respect, this thesis can be divided in two parts which have been mirrored here. The first two substantive chapters (chapters 3 and 4) deal with some aspect of the subject of commodity price *behaviour*: not only how observable price dynamics can be related to long-term mineral availability and economic growth, but

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<sup>12</sup> Ironically, as Working (1963, 18) relates, one reason the abolition of US onion and potato futures markets gained political support was because large and relatively powerful dealers stood most to gain from the loss of transparency that is a key benefit of futures exchanges.

also some of the specific institutions that both mediate and are shaped by these dynamics. The information presented in section 2.2 on medium- and long-term commodity price dynamics should particularly inform the discussion of peak phosphorus debates in chapter 3. As we shall see, fears of resource shortages are often prompted by price spikes, but the relationship between geophysical resource availability and prices is far less straightforward than this.

Another obvious point here is that for all that higher commodity prices are detrimental to consumer nations' welfare, producers can stand to benefit provided they possess the appropriate institutional capacity. Having explained in section 2.3 that state ownership and control is one of many means by which resource-rich countries avail of their mineral wealth, this section should place chapter 4's treatment of Morocco's OCP Group in a global-historical context. A point of primary interest in this literature is the efficiency with which NECs extract and market mineral resources – in other words, their commercial supply behaviour – relative to their private-sector counterparts. The concern of this thesis is both broader and different in focus, however: here, NECs are treated as one of an array of institutional types responsible for both directing and managing the distribution of national resource wealth.

The second half of the thesis (chapters 5 and 6) are concerned with commodity price *formation*, or the processes by which observable price behaviour is produced. This part of the thesis describes market institutions, structures, and geographies for commodities both with and without a financial component. Chapter 5 pursues the former agenda – which, as this chapter has pointed out, has been done relatively infrequently in the literature on commodities. While chapter 6 does not take a single

specific commodity as its focus, it is in a sense narrower in its concerns with the ‘financial’ component of price formation.

Yet at the same time, the financialization of commodity markets is but one corner of a larger picture painted by those who fear the outsized influence of the financial sector on the ‘real economy’. This chapter could not hope to do justice to the wider financialization project in the brief outline presented here. However, it did offer a supplement in the form of a window on a parallel debate within the mainstream of economics and finance: here, the nature of the value of derivatives trading is not precisely agreed upon. Finally, whether a given commodity market has a financial component or not, this chapter has argued that the notion of ‘perfect’ information in markets is both problematic in practice, and a conceptually interesting issue to be problematized.

Inchoate as all of these issues may appear at first glance when laid out side by side, together they begin to give a sense of the extent to which commodity markets leave few areas of social and economic activity untouched. Reviewing the concepts laid out in the foregoing sections is a prerequisite to a deeper and more holistic understanding of the material to follow.

## CHAPTER 3 | ‘Peak’ phosphorus? The implications of phosphate scarcity for sustainable investors

### 3.1 Introduction

In 2007-08, the price of phosphate rock shot up by 800 per cent, drawing widespread attention to a commodity that had hitherto largely escaped notice. Elemental phosphorus is essential to sustaining all forms of life; as a limiting nutrient in crop growth, it is a key ingredient in fertilizers. First developed in 1841, inorganic phosphate-based fertilisers have done much to alleviate the grave problem of global hunger. In particular, inorganic fertilisers have played a particularly important role in realising gains from the Green Revolution of the 1950s and 1960s, thereby helping to fuel and sustain the 4.2 billion-person increase in the world’s population since the mid-20<sup>th</sup> century (Déry and Anderson 2007; Cordell et al. 2009, 294; Elser and White 2010). Yet these gains have also come at the expense of a critical dependence on a finite mineral resource.

Given the vital biological role of this non-renewable, non-substitutable resource and its importance in sustaining modern food production, phosphorus is a commodity of great strategic importance. This issue takes on added urgency given the geographic concentration of remaining phosphate rock reserves in relatively few, often geopolitically sensitive, regions of the world. Such considerations have given rise to widespread fears of a medium-term phosphorus shortage, and ultimately depletion, on a global scale – a phenomenon most commonly dubbed *peak phosphorus*. According to various projections, current economic global reserves of phosphate rock, approximately 90 per cent of which is used to manufacture chemical fertilisers, are

diminishing and will be depleted within as few as 40-150 years, with critical supply shortfalls likely to begin from around the year 2030. This would pose a grave threat to global food security in the longer term, since ‘[w]e are effectively addicted to phosphate rock’ (Cordell et al. 2009, 294).

Of course, phosphorus is not the first natural resource to which the concept of ‘peaking’ has been applied: peak oil, no doubt a familiar concept, is its immediate conceptual ancestor – and this framing was undoubtedly chosen deliberately. However, much like the idea of peak oil before it, the peak phosphorus claim is equally proving to be a double-edged sword. By now it runs the risk of degenerating into stale technical debates about the timing and speed of resource depletion, at the expense of the manifold problems associated with the (mis)management of a scarce resource – just as has been the case with oil. Put differently, peak phosphorus narratives generally tend not to distinguish between long-term concerns about one day ‘running out’ of phosphate rock and the more immediate, multi-dimensional effects of poor resource management. As the chequered history of the peak oil concept illustrates, this strategy has shown itself time and again to have the end result of fatalism and inaction as one apocalyptic ‘peaking’ prediction after another has proven premature. Thus, the extension of one contentious (if not entirely discredited) metaphor so far beyond its original remit well and truly risks dooming the peak phosphorus concept to becoming Bridge and Wood’s (2010) ‘proverbial hollow drum’.

Esoteric as this distinction may appear to those in the investment community, the manner in which commodity market-related risks are framed is vitally important

(Wójcik and McGill 2012). At a time of unprecedented economic, geopolitical, ecological, and demographic transformation, the financial sector has come to view investment in commodities as a significant source of risk-adjusted return and portfolio diversification. Yet at the same time, the industry is discovering that it can no longer afford to ignore, or even merely manage, negative externalities in its portfolios. Sustainable investing (SI)<sup>13</sup> requires that asset owners and managers take a more proactive, long-term approach to investing – including, among other measures, holding ‘justified’ beliefs to underpin their investment strategies (Clark et al. 2012). In this vein, an uncritical acceptance of peak phosphorus narratives will likely have the perverse effect of encouraging a myopic tendency on the part of relevant stakeholders to view the issue solely in terms of physical supply risks, and accordingly join a zero-sum ‘scramble for resources’. At the other extreme, a wholesale dismissal of the peakists’ message as no better than scaremongering ignores ‘situated risks’ – large, complex problems that develop gradually over time and only reach a crisis point when it is too late for reversal or mitigation. This chapter argues that a deeper and more nuanced understanding of the problem of resource scarcity in all its various dimensions, outlined in greater detail below, can reveal both risks and longer-term opportunities to contribute to positive solutions to the problem and to avoid compromising – if not indeed enhancing – financial returns. Such a view should by now be familiar to scholars and practitioners of SI. Less familiar are the risks associated with the concentration of remaining phosphate reserves in a handful of geopolitically sensitive countries. Further, these reserves are largely under the control of state-capitalist corporations – a type of institution that has largely escaped

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<sup>13</sup> This paper borrows Clark et al.’s (2012, 5) definition of ‘sustainable investing’: ‘long-term investing which is efficient and inter-generationally sound’.

notice within SI research. Yet investors must begin to confront these issues, given their growing significance.

The paper proceeds as follows. Section 3.2 discusses the implications of the phosphorus scarcity issue for institutional investors. Section 3.3 summarizes peak phosphorus narratives uncritically as they are typically presented. Following this, an alternative optimist's view of the phosphorus situation is outlined, including more generous reserve estimates and an overview of recent phosphate industry activity. Section 3.4 provides a critical assessment of peak phosphorus narratives vis-à-vis those concerning peak oil, drawing parallels between the ways both discourses have deployed the Hubbert curve as a tool for predicting peak resource supply. It is argued that the Hubbert curve is a device that, having outlived both its technical and symbolic uses, is even more problematic for phosphorus than for oil. Consideration is given to more refined conceptions of phosphorus scarcity – and by extension, natural resource scarcity – which are only now beginning to take shape. Section 3.5 considers key implications of peak phosphorous debates for investors and some areas for future research. Section 3.6 concludes.

### **3.2 Investing in commodities: beyond peaks and prices**

Natural resource scarcity has become a mainstream issue for investment strategy, yet the term 'resource scarcity' itself remains poorly understood. For investors in particular, it is more or less shorthand for the on-going secular trend of burgeoning demand for commodities from emerging economies – demand which, for a wide variety of ecological, economic, and institutional reasons, will easily outstrip supply

under status quo resource governance conditions (Nair 2011). Far from dismissing such fears as ‘Malthusian’, as had been their historical tendency, erstwhile market optimists now widely consider resource scarcity as a key source of both risk and opportunity. The global financial crisis and on-going market upheaval have provided a further imperative for portfolio diversification and a search for risk-adjusted returns from less conventional assets such as commodities.

As mentioned in the introduction, the manner in which an issue is framed has important implications for how decision-makers respond to them. Extensive research in behavioural finance has shown that investors’ responses to risk and uncertainty can be based more on instinctive reactions to short-term trends and single events than on rational cost-benefit analyses. Perception, in other words, can often trump reality in judging risk and uncertainty (Wójcik and McGill 2012, 50). It is therefore not surprising that on one level, in the eyes of investors as well as environmentalists, the 2008 phosphate price spike has taken on much the same significance that the 1973 oil embargo has had for peak oil proponents. This has not only given rise to serious concerns about ecological degradation, as the sections to follow will show; it has also exacerbated a dangerous tendency among many investors to become preoccupied with short-term price movements. Prices, however, are far from a perfect indicator of long-term resource scarcity.

In the case of phosphorus, there is strong consensus that the 2008 price spike was largely the result of industry supply-and-demand fundamentals rather than the definitive sign of a peak. Huang (2009), in line with the assessments of many other observers, asserts that ‘The significant ups and downs of the market in 2008 can serve

as a textbook example of supply-and-demand analysis in price determination'. A lack of investment in short-term capacity coupled with China's imposition of a 135 per cent tax on its exports led to tighter supplies. Marked growth in consumption in the developing world has also been a major contributing factor, and the resulting increase in global trade has been facilitated by the depreciation of the US dollar against many currencies since 2005, which 'has made imports from the United States cheaper and lessens the true impact of the rise in world prices' (FAO 2008, 2-3). Higher fuel and shipping costs placed further upward pressure on prices (Cordell 2010, 87; FAO 2008; Fertilisers Europe 2009; Heffer and Prud'homme 2010; Huang 2009; Kenkel 2009; Ulrich et al. 2009, 7). It should also be pointed out that, as a general matter, phosphate (and potassium) fertiliser demand is more elastic compared to nitrogen (Heffer and Prud'homme 2010, 2), and phosphate rock prices are relatively volatile (Kenkel 2009). In fact, global phosphorus consumption *dropped* by 10.5 per cent between 2008 and 2009 in response to both the 2008 price spike and the global recession (Fertilisers Europe 2009, 7; Heffer and Prud'homme 2010). One significant additional factor discussed further in section 3.5 below was the apparent decision by Morocco's state phosphate producer, the Office Chérifien des Phosphates (OCP), to raise prices.

It should also be made clear at this point that, for market-specific reasons, the problem of attributing much significance to price volatility is less pronounced for phosphate than for commodities such as oil. Investors can generally gain exposure to commodity price movements via four asset classes: derivatives, physical commodities, real productive assets, and the equity of public companies (Knoepfel 2011). However, neither phosphate rock nor fertilisers are currently traded as physical

commodities or in ‘financialized’ form; rather, prices are negotiated directly between producers and industrial users.<sup>14</sup> Exposure to the investment risks and opportunities associated with phosphorus scarcity thus comes largely via equity investments. Yet investors are still at risk of becoming distracted by narrow, technical arguments about absolute geophysical resource finiteness, to the extent that they will simply become caught up in a short-term ‘scramble for resources’. Such a zero-sum strategy which entails, for example, investing in companies whose strategic advantage comes at the expense of ESG criteria, is self-evidently neither ecologically nor economically sustainable in the long run.

At another level, however, what has turned out to be a short-lived (if extreme) instance of price volatility has not distracted from an overall long-term secular trend of rising commodity demand, driven by emerging markets, coupled with a number of short- to long-term supply challenges. An exhaustive discussion of *all* aspects of the phosphorus problem lies well beyond the scope of this paper; after all, the phosphorus governance issue is very much an emerging area of research and debate.

The multidimensionality of ‘resource scarcity’ entails a lengthy list of issues which sustainable investors might consider, not least because the distinctive nature of phosphorus means that the commodity effectively spans three sectors: mining, chemicals, and agriculture. Suffice to say that the commodities supercycle is but one imperfect manifestation of these challenges. Put differently, resource scarcity is represented by more than a simple proxy such as pricing, or indeed Hubbert’s peak.

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<sup>14</sup> However, in July 2011 the Chicago Mercantile Exchange (CME) began offering diammonium phosphate (DAP) fertilizer futures contracts.

### 3.3 Peak phosphorus narratives

#### 3.3.1 *The peakist party line*

While the phosphate price spike of 2008 ultimately brought the issue of phosphate rock depletion into broader public consciousness, it was Déry (2007) who first applied peak resource analysis to global phosphate reserves. Using United States Geological Survey (USGS) data, Déry applied the Hubbert linearization (Hubbert 1954) to US and global historic phosphate rock production figures and found that both have already peaked (in 1988 and 1989, respectively). To test the robustness of his methods, he then conducted a retrospective analysis of the well-known case of the Pacific island of Nauru, which was once a major phosphate rock producer but virtually depleted its reserves by 2005,<sup>15</sup> and found that the model corresponded closely to historical production trends: peak production was estimated to occur between 1971 and 1978 and actually occurred in 1973.

Déry's results were subsequently published on *Energy Bulletin Online* (Déry and Anderson 2007). It is difficult to assess the impact this article might have had on its own, though it is plausible that, much as the 1973 oil embargo fuelled peak oil discourses, the commodity price spike of 2008 has led to heightened interest in phosphorus availability.<sup>16</sup> In any case, the issue received attention in a number of

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<sup>15</sup> A 21-square-kilometer island republic, Nauru was once rich in deposits of guano, its only significant resource. Although its economy came to depend on mining, both its colonial rulers and its post-1968 independence government failed to manage phosphate revenue sustainably. The country has become something of a poster child for how *not* to manage natural resource wealth (*Economist* 2001; Cordell 2010).

<sup>16</sup> One point often glossed over by peak phosphorus proponents is that phosphorus has a less direct relation to consumer markets than does oil: for example, Cohen et al. (2011) estimate

news features<sup>17</sup> and reports from 2008 onwards, including a European Commission report entirely devoted to the subject (Schröder et al. 2010) and mention for the first time in the UNEP Year Book (UNEP 2011). In addition, at least two academic initiatives are now devoted to the goals of ‘phosphorus security’ and ‘sustainable P’.<sup>18</sup>

While peak phosphorus narratives vary widely in the degree of alarmism they convey, they share a core of common elements. Estimates of peak phosphorus production dates and timelines for final depletion vary, but generally conclude that the resource will not last much longer than a century and a half. The most widely cited analysis, conducted by Cordell et al. (2009), suggests that peak phosphate production could occur as soon as 2033, after which, the authors argue, the world will experience significant shortages in supply. Déry (2007) is far more pessimistic and believes that the peak already occurred in 1988. Even relative optimists such as the USGS and the International Fertiliser Industry Association (IFA) have stated that current reserves will last for roughly 125 years based on predicted demand growth rates of 2.5-3 per cent per annum (Gilbert 2009). Even if the precise date of a peak is not known, the argument continues, there is broad consensus within the industry as well as among scientists that reserve quality is declining in terms of both concentrations of phosphorus and the amount of radioactive, carcinogenic, and otherwise ecotoxic byproducts of the mining process (Cordell 2010, 86-7).

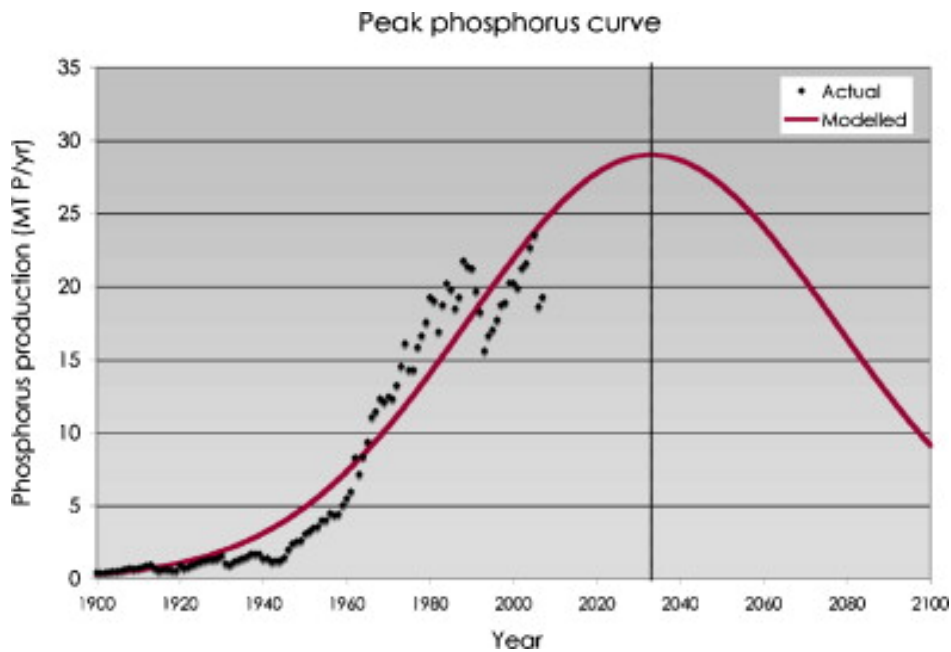
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that rising fertilizer and energy prices *combined* accounted for about 15 per cent of the food price spike of 2008.

<sup>17</sup> In addition to the pieces cited throughout this article, see e.g. Cummins 2009; Rosemarin et al. 2009; Clabby 2010; Schmundt 2010.

<sup>18</sup> See [phosphorusfutures.net](http://phosphorusfutures.net) and [sustainablep.asu.edu](http://sustainablep.asu.edu), respectively.

**Figure 2: Indicative peak phosphorus curve**



(Source: Cordell et al. 2009)

In the shorter term, there is an added geopolitical dimension to phosphorus scarcity: only 30 countries currently produce phosphate rock for domestic and international consumption, and the world's top five producers – Morocco, China, South Africa, Jordan, and the US – hold 90 per cent of remaining reserves (Elser and White 2010). Moreover, production has already begun to shrink in the US, and many reserves are concentrated in a handful of geopolitically sensitive countries. Morocco, which has been dubbed the 'Saudi Arabia of phosphorus', poses a particular problem: while it currently supplies approximately 40 per cent of the world market, virtually all of its reserves – which, by the most generous estimates, account for up to 85 per cent of the world's total recoverable resources (van Kauwenbergh 2010) – are concentrated in the politically contested region of Western Sahara. Certain producer countries are also increasingly seen as potential troublemakers: China, for instance, temporarily imposed a 135 per cent export tariff on phosphate fertilisers in response to the 2008 price spike (in line with other recent policies on exporting domestically produced

strategic resources such as rare earth minerals). As a result, and coupled with the fact that in many cases it is in these very countries where demand is expected to increase most dramatically, phosphorus is coming to be viewed as a ‘geostrategic ticking time bomb’ (Vaccari, 2009), with fears that ‘The geographic concentration of phosphate mines...threatens to usher in an era of intense resource competition’ (Elser and White 2010).

**Table 1: Estimates of lifetime of current world phosphate rock reserves by different authors**

Author	Estimated lifetime of reserves	Estimated year of depletion *	Assumptions
Tweeten [16]	61 years	2050	Assumes 3.6% increase in demand; in [19]
Runge-Metzger [17]	88 years	2083	Assumes 2.1% increase, based on 1992 World Bank/FAO/UNIDO/ Industry Fertilizer Working Group
Steen [18]	60–130 years	2058–2128	Based on range of 2–3% increase demand rates, plus a ‘most likely’ 2% increase until 2020 and 0% growth thereafter if efficiency and reuse measures are implemented.
Smil [7]	80 years	2080	At ‘current rate of extraction’
Fixen [19]	93 years	2102	At 2007–2008 production rates
Smit <i>et al.</i> [20]	69–100 years	2078–2109	Assuming 0.7–2% increase until 2050, and 0% increase after 2050.
Vaccari [15]	90 years	2099	At ‘current rates’
Van Kauwenbergh [13]	300–400 years	2310–2410	At ‘current rates’

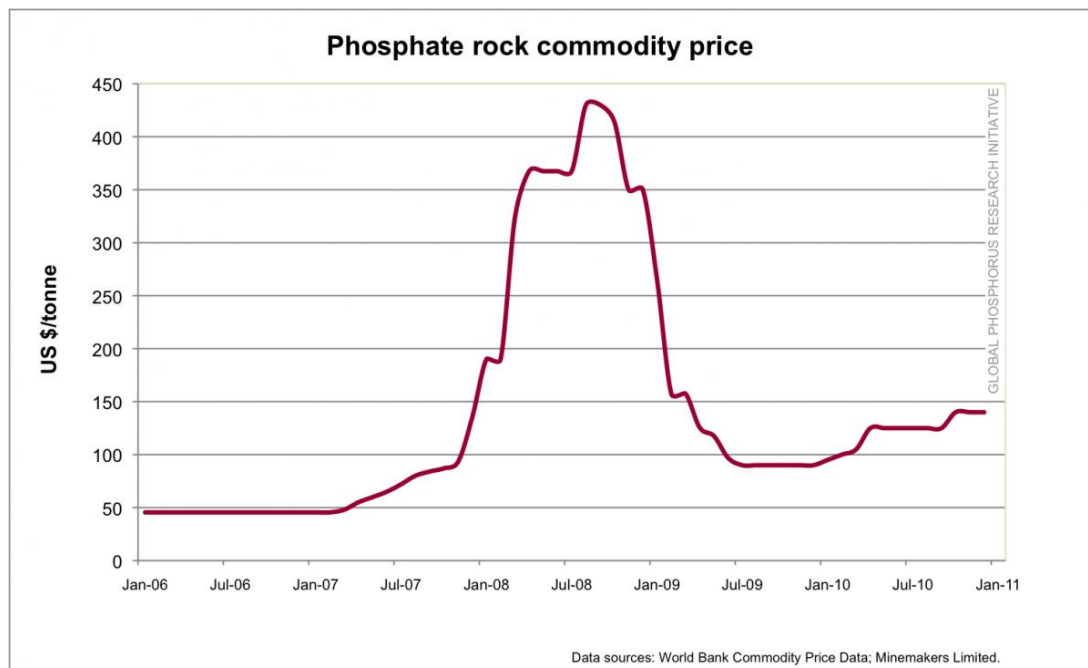
\* year of depletion assumes lifetime estimated from date of publication.

(Source: Cordell and White 2011)

On the demand side, access to fertilisers is already far from equitable (Christiaensen and Demery 2007): for example, the prices paid for fertilisers by farmers are two to six times higher in Africa than in Europe (Runge-Metzger 1995 cited in Cordell 2010, 88). Peak phosphorus will only exacerbate this problem: as the quality of remaining reserves declines and the energy intensity required to mine, process, and transport them increases, ‘cheap fertilisers will soon become a thing of the past’ (Cordell *et al.* 2009; Cordell 2010, 87). While some analyses have shown that global phosphate consumption peaked in 1988-9 due to increased efficiency of fertiliser use in

developed countries (Smil 2000; Ward 2008), this trend is expected to reverse itself. Changing global demographics will only exert further pressure on supplies in two important respects. First, absolute population growth will at minimum bring a commensurate increase in demand for food. Second, with the emergence of a new global middle class of up to three billion consumers, not only will worldwide consumption of food increase, but so too will demand for more phosphorus-intensive foods such as meat and dairy products (FAO 2008; Cordell et al. 2009; Cordell 2010). Global demand for non-food crops, including biofuels, is also expected to increase. These factors will exert still further upward pressure on fertiliser and food prices, with disastrous consequences for millions of farmers and others whose livelihoods are already marginal (Elser and White 2010; see also Cordell 2010).

**Figure 3: Phosphate rock price, January 2006-January 2011**



(Source: <http://globalpnetwork.net>)

At the same time, the argument continues, the production and end-of-life disposal of phosphate fertilisers results in a number of negative environmental impacts at nearly every stage of its life cycle. The mining of phosphate rock produces toxic by-products

such as cadmium, uranium, chromium, arsenic, and lead (Vaccari 2009, 56), as well as very large quantities of phosphogypsum, a radioactive waste (Cordell 2010, 87). Like other forms of strip mining, too, phosphate rock extraction leaves behind severely eroded landscapes (Ulrich et al. 2009, 5). What is more, as remaining reserves decline in quality and become increasingly inaccessible, extraction, along with the processing and transport of phosphate fertilisers, will become increasingly energy-intensive (Cordell 2010, 86-7).

Yet the anthropogenic phosphorus cycle is also characterised by enormous waste. A systems flow analysis conducted by Cordell et al. (2009) shows that up to 80 per cent of phosphorus is lost at some point along the food production chain, ‘from mine to field to fork’ and beyond. Natural biogeochemical cycles recycle phosphorus in soil via ‘in situ’ decay of dead plant matter, a process replicated in premodern agriculture, which reused plant, animal, and human waste as fertiliser. Modern agriculture, by contrast, removes crops before they decay and also accelerates soil erosion through ploughing and tilling (Cordell et al. 2009, 295; Vaccari 2009). Further exacerbating this problem, agricultural best practices developed decades ago dictated that fertilisers be applied to land at rates now known to be orders of magnitude higher than necessary, thus wasting resources as well as contributing to water pollution (Smil, 2000a, 52). The modern agro-economic regime treats excess phosphorus as a pollutant: runoff of fertiliser, animal waste, and urban sewerage, as well as industrial effluent, finds its way into waterways, resulting in eutrophication. Enormous waste in the global food distribution and consumption system also accounts for a significant fraction of phosphorus losses.

Humankind has thus broken the global phosphorus cycle. Ideally, the solution would be to ‘close the loop’ on anthropogenic interferences in the cycle by using only organic (and therefore low-grade) recycled sources, but the world’s population is orders of magnitude too large for this to be possible (Smil 2000a, 51; Vaccari 2009, 59). The solution to the problem of peak phosphorus, then, includes a number of supply- and demand-side measures, including greater efficiency of use, genetic engineering of crops to optimize phosphorus uptake, reduced demand for phosphorus-intensive foods such as meat and dairy products, and the introduction of recycling technologies in wastewater treatment and agricultural operations. While this would not entirely break humanity’s ‘addiction’ to phosphate rock in the foreseeable future, it would have the dual advantage of forestalling the date of final depletion and of eliminating the negative environmental impacts which are the result of the fertiliser production process. Conversely, failure to begin taking action now will have dire consequences. In the medium term, more myopic national responses would include the imposition of export quotas (Ulrich et al. 2009, 5). The most pessimistic warn that ‘humanity faces a Malthusian trap of widespread famine on a scale that we have not yet experienced. The geopolitical impacts of such disruptions will be severe, as an increasing number of states fail to provide their citizens with a sufficient food supply’ (Elser and White 2010).

### *3.3.2 Counter-narratives and evidence: an emerging debate*

While the peak phosphorus claim has not engendered anything remotely like the divisiveness which characterised peak oil debates in the past, it is not without its detractors. In general, although most ‘phosphate optimists’ accept that the quality of

reserves is declining sharply, they are not concerned that final resource exhaustion is imminent. Smil's (2000b, 81) sanguine view is characteristic of this camp: he has calculated that ultimately recoverable reserves (URR) of phosphate rock will last for well over a century, if not for several centuries. Like his fellow resource optimists, he is confident that higher prices will lead to more economic opportunities to extract lower quality land ores and sediments on continental shelves and seamounts, 'which contain enough [phosphorus] to last for millennia'.

Some more recent updates to phosphate rock reserve data tend to support the optimists' view. Industry projections put global phosphate rock production capacity growth at 20 per cent by 2014; the only region expected to decline in output is North America. This expansion of supply will come from 'a combination of expansions at existing operations, new mines opened by current producers, and new capacity added by emerging suppliers' (Heffer and Prud'homme 2010, 7). The USGS has updated its Minerals Yearbook to reflect the opening of new sources of supply: a new mining operation began in Peru in July 2010, and mine expansion projects in Algeria, Brazil, China, Israel, Jordan, Syria, and Tunisia, as well as development of new mines in Australia, Kazakhstan, Namibia, and Russia, is expected to increase global production capacity to 228 million tons by 2015 (Jasinski 2011; see also Ulrich et al. 2009, 6). The FAO (2004) also anticipates that future production could come from Iraq, Guinea-Bissau, and Mauritania, as well as from offshore deposits off the coasts of Chile, Mexico, New Zealand, and Peru, and in the Congo River delta once on-shore reserves decline significantly. The International Fertiliser Development Centre's (IFDC) frequently cited projections, while identifying the dual peak of global phosphate production at 1987-8 and 2008, suggest that global resources of phosphate

rock should prove adequate to meet fertiliser demand for the next 300-400 years (van Kauwenbergh 2010).

Recent activity in the phosphate mining and fertiliser industries also appears to belie the idea that depletion is not far off. Indeed, both industries are preparing to take full advantage of continued demand intensification: they are now in the process of re-investing the windfall profits from 2008 into expanding mid- to long-term capacity. Moreover, a number of mergers and acquisitions have taken place over the past few years, and vertical integration between the two industries has deepened (Blas 2010a; *Economist* 2010). Although the effects of the financial crisis (reduced demand and prices) dampened industry-wide investment somewhat (Heffer and Prud'homme 2010, 5), in the medium term, the picture that emerges is one of abundance (or at least adequacy). Indeed, apart from the declining quality of remaining reserves, the main potential obstacles to growth in the medium term are thought to be rising energy prices, state-imposed restrictions on trade, and more stringent environmental standards (ibid.).

### **3.4 Assessment: 'peak' P?**

In many significant respects, proponents of peak phosphorus have been careful not to repeat the rhetorical mistakes commonly made by previous generations of resource peakists. They readily acknowledge that 'those who argue phosphorus will never "run out" are not "wrong" in the sense that there is a fixed and relatively abundant amount of elemental phosphorus in the earth's crust' (Cordell 2010, 115). Others go further, arguing that 'as we know from peak oil analysis, *trouble begins not when we "run*

*out” of a resource, but when production peaks.* From that point onward, the resource becomes more difficult to extract and more expensive’ (Déry and Anderson 2007; emphasis in original). Thus, the socioeconomic, environmental, and geopolitical signs of a peak will appear long before physical resource exhaustion (Cordell 2010; Elser and White 2010). When pressed to give a precise explanation of the term ‘peak phosphorus’, then, peakists and optimists alike tend to concur with this definition. Thus, just as Campbell and Laherrère (1998) proclaimed ‘the end of cheap oil’, it is now all but universally agreed that ‘cheap fertilizers will soon become a thing of the past’ (Cordell et al. 2009, 299). Indeed, recent fears and debates about the ‘end’ of the commodities supercycle notwithstanding, the era of cheap *commodities* ended some time ago.

By contrast, phosphorus *scarcity* (or shortage) occurs, in the broadest and most succinct formulation, ‘when the rate of supply cannot meet the rate of demand within a defined temporal and geographical boundary’ (Cordell 2010, 116; Cordell and White 2011, 2029). It is therefore crucial to make a clear distinction between *peak* natural resources and natural resource *scarcity* – something which is rarely done in practice. Yet it turns out that the seemingly straightforward notion of ‘scarcity’ is fraught with complexity and nuances that may be implicit in most neo-Malthusian narratives but are typically confused and misunderstood. To clarify the confusion around the concept of resource scarcity, Cordell (2010) delineates ‘five dimensions of scarcity’; of these five, only one refers to the physical dimension (i.e. shortage), the decrease within a civilisational timeline in ‘concentrated and easily accessible sources of phosphorus such as high grade phosphate rock’ (Cordell 2010 115). First, *economic scarcity* is consonant with the ‘distributionist’ view (Homer-Dixon 1999)

that scarcity is primarily a question of socioeconomic equity. Apart from issues surrounding local market access conditions, ‘Financial scarcity on the supply side can occur when investments in new capacity (such as phosphate rock mines) and commercial production do not keep up with market demand for the resource’, as was the case in 2008. Second, *managerial scarcity* signifies waste along the entire production and consumption system, ‘from mine to field to fork’ and beyond. Third, *institutional scarcity* refers to the idea that ‘there is a substantial lack of policies and actors explicitly governing global phosphorus resources to ensure availability and accessibility for food security, both in the short- and long term. Further, there are ‘no structures for monitoring and evaluating the situation and no effective feedback loop designed to correct the system’. Finally, *geopolitical scarcity* is simply the concentration of phosphate rock deposits in only a handful of countries (Cordell 2010, 117-8). Inherent in this fivefold formulation is the idea that scarcity, be it physically ‘real’ or in any way ‘socially constructed’, contains spatial, temporal, and scalar dimensions – an important point so often lost in the cognitive dissonance between neo-Malthusians and their ideological adversaries.

In practice, however, these socio-economic dimensions tend to be confounded to the point where they are subsumed under a grander narrative about absolute physical scarcity. Paradoxically, then, by invoking more restricted technical claims about imminent phosphate depletion, peak phosphorus proponents undermine their well-justified and more urgent concerns about the negative environmental, socioeconomic, and geopolitical consequences of heavy dependence on a finite resource. In other words, in some crucial respects their strategy follows a similar pattern to that of previous generations of resource pessimists – tactics which, of course, have only been

met with limited success at best, and deeply polarised debates at worst – and thus do much to undermine their core message.

Cordell and White (2011, 2037) explicitly acknowledge that peak phosphorus analysis has a number of limitations. First, much as is the case with oil, a lack of ‘reliable, transparent, independent data on phosphate rock reserves, resources, time series price trends and production’ severely hinders efforts to predict both short- and long-term supply trends and to estimate remaining resource size (Cordell 2010, 31; see also Cordell and White 2011). Apart from the geologic uncertainties inherent in any estimate, the two primary sources of data – national governments and mining companies – tend to treat these numbers as ‘privileged information’ that could harm the commercial interests of the entities that generate them (Gilbert 2009; Steén 1998). Further, much as in the oil industry, a lack of standardized accounting practices on such data as the extent of geologic exploration and measures to determine the current and potential economic viability of production (Steén 1998) adds still further to the uncertainty surrounding the data. Nonetheless, the USGS gathers this very data from other governments and does not independently verify it (Cordell 2010). Similarly, IFA collects data on its members’ existing reserves as well as their potential future capacity, which are impossible to verify independently because they are supplied by state-owned or private commercial entities (Gilbert 2009). Thus ‘the number of “ifs” and “buts” suggest that more substantive effort is needed to collect [and] make available data on phosphorus sources’ (Bondre 2011, 17; see also Cordell and White 2011). By contrast, data on investment in new projects may be more revealing than official published reserve estimates.

Perhaps even more important than the issue of geologic data completeness is the contested nature of the very device underpinning the concept of peak resources. Questions about the robustness of the Hubbert curve have plagued it since its inception as a tool for peak oil analysis. Peak sceptics are quick to point out a number of flaws in the model even apart from its assumption of accurate knowledge of total ultimate recoverable reserves. First, it does not account for ‘above-ground’ factors, or supply-and-demand dynamics – whether these are driven by market, regulatory, or geopolitical forces. Second, it makes insufficient adjustments for the possibility of future technological advances which might render the extraction of lower-grade ores technically as well as economically viable. Third, in reality mineral commodity production does not follow a symmetrical bell curve shape over a given period of time, and thus the Hubbert curve cannot pinpoint the year of peak production. Finally, in the case of oil, for these and other reasons the model has repeatedly failed to predict peaks in oil production outside of the lower 48 US states, the (rather limited) scope of its initial application (Lynch 2003; Smil 2008; Cordell and White 2011).

More recently, peak oil proponents have taken many of these criticisms on board – and to some extent, peak phosphorus proponents have followed suit. Recognising that a bell curve implies that the decline of global oil production will occur at the same rate as the lead-up to the peak, a number of peak oil proponents have attempted to refine Hubbert’s methods. For example, the assumption of a symmetric curve has largely been relaxed (Bridge 2010). Esser (2005) and Jackson (2009) have even hedged that rather than a single peak, world oil production will follow the trajectory of an ‘undulating plateau’ before entering into terminal decline, and since the publication of the IEA’s World Energy Outlook 2010, it is talk of a plateau rather

than a peak that has gained traction (Cordell and White 2011). But of course, such a model leaves itself open to a similar charge as before: if a curve has multiple peaks, it is impossible to know which will prove to be the last one (Lynch 2003). Such efforts inevitably run up against an insurmountable obstacle, first pointed out by some of Hubbert's original critics: that *accurately* forecasting long-term production levels based on an analysis of past trends and available data is extremely difficult. Even the staunch peak oil proponent Matthew Simmons (cited in Aleklett et al. 2003) has conceded this point: 'peaking is one of these fuzzy events that you only know clearly when you see it through a rear view mirror, and by then an alternate resolution is generally too late'.

To many, then, these overly generous assumptions render the model inadequate as a predictive tool. This view is more than an ideological judgement or a scientific opinion; it is a reality of geologic practice. In the case of the oil industry, aggregated estimates of reserves within specific regions have generally supplanted Hubbert's mathematical model (Bridge 2010, 526). In fact, 'Divisions in the peak oil debate occur not just between economists and geologists but also, as in climate change, between modellers and field researchers... [T]he knowledge of geologists is as much intuitive as quantitative, derived from exploration in the field' (Barry 2008, 2). It has never been known precisely what statistical methods underlie Hubbert's original prediction. To Deffeyes (2001, 135), this suggests that 'like everyone else, [he] reached his conclusion first and then searched for the raw data and methods to support his conclusion'.

If so much scientific and market uncertainty surrounds phosphate (to say nothing of oil) reserve and production estimates, does the idea of ‘peak’ resources, underpinned by Hubbert’s model, still have a place in debates about the proper management of phosphate resources – and of scarce natural resources more broadly? Writing specifically on the subject of peak oil, Bridge (2010) and Bridge and Wood (2010) argue – with caveats – that it does. To these and many other observers, ‘peak oil’ can best be understood loosely: as shorthand for a socio-environmental crisis – a point neatly elaborated elsewhere by Bridge (2010, 526): ‘By drawing the debate over peak oil into the realm of political choices rather than geophysical constraints, a space has been opened into which questions of need, value and justice may be introduced’. In other words, if peak oil no longer merely denotes a narrow set of technical claims but instead serves as an heuristic for the decline of a socio-economic order based on cheap oil consumption, it can have a powerful galvanising force as a call to ‘envisioning a post-carbon world’ (see also Balaban and Tsatskin 2010, 1342). In this view, the real peak resources question then becomes, ‘Will mineral depletion threaten the future welfare of society and make modern civilisation as we know it unsustainable?’ (Tilton 2003a, 33). Balaban and Tsatskin (2010) refine this line of reasoning. For them, peakist and anti-peakist narratives alike serve an important function as a persuasion mechanism: ‘It is reasonable to assume that those who use predictions as a means to obtain a result are attempting to enhance their influence, either on the oil market or on the market of alternative sources of energy’ (1341). On this reading, the peak calculations conducted by Cordell et al. (2009) serve less to make hard-and-fast technical forecasts than to introduce a sense of urgency into the manifold issues surrounding the production, distribution, and consumption of phosphates.

A greater concern with peak phosphorous debates however, is that their inordinate focus on the ‘peaking’ of phosphate rock resources often overlooks perhaps *the* salient feature of phosphorus that sets it apart from oil: namely, that *there is nothing inherently geophysically ‘finite’ or ‘scarce’ about elemental phosphorus.*

Biogeochemical cycles ensure sufficient ‘recycling’ of elemental phosphorus provided anthropogenic processes do not significantly interfere; rather, it is *phosphate rock* that is considered non-renewable (Cordell and White 2011, 2030). Even more important in this context, there already exist a number of managerial techniques, innovative phosphate recovery technologies, and even agricultural geoengineering solutions which, over time, may collectively provide a technical solution to the scarcity problem. Yet in choosing to conceptualise the scarcity problem as they have, most peakists frequently miss the opportunity to problematise open-ended (as opposed to closed-loop) resource consumption and disposal as environmentally and socially harmful in the most explicit manner possible. In this way, there is a certain disconnect between the choice of framing device and the defining point of the overall peak phosphorus narrative.

The ‘eschatological inclination’ (Mabro 2006) on display in many peak natural resource narratives can only mean that a ‘peak’ is no longer the galvanising force advocated by Bridge and Wood (2010); rather, the spectre of a ‘looming crisis’ can only encourage fatalism and inaction. Rather, the phrase ‘peak phosphorus’ has become a ‘rhetorically potent yet surprisingly empty signifier: the proverbial hollow drum’ (Bridge and Wood 2010, 566).

### **3.5 Implications for the practice of sustainable investing**

What insights for sustainable investing, then, can be gleaned from peak phosphorus debates – and indeed, from ‘peak’ natural resource debates more broadly? As the sections above have argued, the question of ‘how much phosphorus is left?’ should be less of an immediate concern than the more complex issue of how best to manage a scarce, unevenly distributed resource from an economic, political, social, and environmental standpoint. Some of the challenges entailed here are common to other resources. For example, in the case of finite mineral resources, the challenges facing the phosphate mining industry are broadly shared by the extractive sector writ large. The decline of remaining reserve quality brings with it a need for greater sophistication in exploration and extraction technologies, as well as greater environmental damage, while the rise of resource nationalism entails significant commercial and political risks – all of which have contributed to dramatic cost increases (Dobbs et al. 2011, 156-7; Humphreys 2012). Further down the supply chain, in light of rising commodity prices across the board, the concept of ‘resource productivity’, far from being dismissed as a solely environmental concern, is rapidly becoming a mainstream corporate strategy with an increasingly clear business case (Dobbs et al. 2011). In this vein, industry has already begun to at least pay lip service to the problem of highly inefficient phosphate production and consumption, with, for example, many fertilizer companies proclaiming in their corporate sustainability reports their commitment to working with agricultural customers to promote resource efficiency and conservation efforts.

Of course, resource productivity measures are not in and of themselves a panacea for the problem of long-term scarcity. Peakist debates implicitly acknowledge that unlike fossil fuels, elemental phosphorus itself is not a geophysically non-renewable resource: much like other ecological modernisationists, the core of their proposed solution to the phosphate dependency issue is an end to current ‘decoupling’ of production and consumption – including, among other things, a strategic partnership between fertiliser producers and waste management entities. However, the mismatch between the phosphorus recovery rates possible through the technical sophistication and cost competitiveness of existing recovery technologies, coupled with the challenge posed by ensuring global food security, mean that it will only make a relatively modest contribution to filling a potential supply gap (Cordell and White 2011). This is not to discount potential long-term opportunities in this area: to cite but one example, there already exist a number of technologies for the recovery of phosphates from municipal and agricultural sources, only a handful of which are in full-scale commercial operation to date.

Yet these issues, among many others, are already familiar because they are common to other scarce resources. If one key element of the resource scarcity problem has been chronically overlooked, it lies at the intersection between the market and geopolitics. As a point of departure, consider some of the more ambitious proposed solutions to the global phosphorus governance issue. Cordell (2010, 123) has called for a ‘new global goal’ of *phosphorus security*, which would ensure ‘that all the world’s farmers have access to sufficient phosphorus in the short and long term to grow enough food to feed a growing world population, while ensuring farmer livelihoods and minimising detrimental environmental and social impacts’. As one

way of kick-starting this transition to sustainability, phosphorus (or more specifically, fertiliser) management should be explicitly included on the agendas of various international governance institutions responsible for such related issues as food security. This solution presumes the continuing relevance of an international governance regime devised under the logic of a 20<sup>th</sup>-century world order, in which global problems can be resolved through multilateral institutions dominated by a handful of Western countries. Yet this ignores the ‘geopolitical scarcity’ of phosphorus – the restriction of access to phosphorus resources ‘due to political or geopolitical circumstances such as monopolies or oligopolies controlled by governments or corporations’ (Cordell 2010, 117). Dramatically increased demand from large emerging nations has long been more or less universally anticipated; but the fact that phosphate resources are so geographically concentrated – with Morocco, China, South Africa, and Jordan in control of 80 per cent of the world's reserves of currently economic reserves, and the EU importing 90 per cent of its supplies (Schmundt 2010) – is also a matter of great concern.

Given the high geographic concentration of phosphorus resources in a handful of regions, coupled with the commodity’s strategic importance, it is surely this aspect of phosphorus scarcity which deserves a far greater share of investors’ attention than has been suggested by the geophysical focus of most narratives. There are strong indications, for example, that Morocco is prepared to take full advantage of its status as the ‘Saudi Arabia of phosphate’, particularly in light of recent upward revisions in global reserve estimates that put that country’s share of the resource as high as 85 per cent (see Borrell and Grushkin 2010). Perhaps most revealing of that country’s growing awareness of its potential market power is the following statement by Ahmed

Nabzar, executive vice president of Morocco's OCP Group: 'In 2008 we asked ourselves a strategic question: "If we are really the market leaders then why don't we try to increase the price?" And so we did and it worked.' Even given the drop in the wake of the global recession relative to the peak of 2008, prices have remained high, which, Nabzar continued, 'is still good news because the level of prices right now is so much better than the \$35 we had before, and other global phosphate producers are glad that we raised the price bar' (interview with Manama, 2009). At the same time, a small handful of cartels, whose role is similar to OPEC's in the oil market, exert pricing power by coordinating supply to match demand (Blas 2010b). Until recently<sup>19</sup> three cartels – the Canadian Canpotex, the joint Russian-Belarusian Belarusian Potash Co., and the North America-based PhosChem – together control 70 per cent of global phosphate and potash trade (ibid.), and Morocco's OCP markets virtually all of that country's product internationally (Ulrich et al. 2009, 6).

Thus, while efforts to reframe the phosphorus problem in terms of a 'global goal of phosphorus security' (Cordell 2010) clearly speaks to the social justice concerns of resource 'distributionists' (Homer-Dixon 1999), the wider concept of 'ecological security' (Pirages and Cousins 2005) carries its own baggage of long association with Cold War-era national security doctrines. If there is a dilemma here it is that, like all high-minded global goals which assume 'we are a unitary and not a differentiated "we"' (Taylor and Buttel 1992, 406), and the universal security ideal crashes headfirst into the sharply geographically differentiated reality of resource distribution. It would be misguided to believe that any producer country would choose to pursue resource

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<sup>19</sup> In the summer of 2013, Belarusian Potash Co. collapsed due to a disagreement over strategy: one of the two members, Uralkali, unilaterally decided to increase production and subsequently withdrew from the cartel.

‘security’ in universalist, altruistic terms rather than out of self-interest. The same can be said of corporations which stand to profit from higher prices and new sources of supply – and which play a role many orders of magnitude greater than has been acknowledged, let alone explored, in peak phosphorus discourses. Indeed, as the passage above serves to illustrate, a basic understanding of the institutional, political and geographic structure of the phosphate market represents an enormous gap in our understanding of the phosphorus governance system.

One possible response suggests itself by analogy to another geostrategic commodity class: rare earth elements. As much as China’s medium-term lock on rare earth supply – it currently accounts for over 95 per cent of global production (Tse 2011) – coupled with its dramatic tightening of export restrictions in 2010, has provoked much hand-wringing on the part of industry and policy-makers alike, it has also begun to prove something of an impetus for the development of a recycling industry in export-dependent countries (Mogi and Kirschbaum 2010). By the same token, the crucial distinction between phosphate rock and elemental phosphorus – the former subject to so-called ‘peaking’ in the narrower technical sense, the latter in principle both abundant and recyclable – suggests a long-term future role for the nutrient recovery technologies mentioned above in a sustainable resource governance system. Herein lies an enormous opportunity for sustainable investors: one which would satisfy both ecologically aware and security-minded actors – in other words, to borrow Cordell’s terminology once again, which would begin to address both the managerial and geopolitical scarcity problems.

But in the nearer term, the corporate-geopolitical problem points to a little-discussed challenge for institutional investors: how to confront and engage with state-capitalist institutions. It is all very well to advocate governance reform of listed corporations, and indeed to broaden discussions to various asset classes beyond publicly-traded equities; yet very few SI proponents stop to consider just how much of the world economy is run by state-owned enterprises and financial institutions. Transparent data on the phosphate industry is extremely difficult to come by; but the fact that the OCP currently produces 40 per cent of global phosphate supply and controls up to 75-85 per cent of global reserves is in and of itself revealing. A more familiar example comes, yet again, from the oil industry: collectively, multinational corporations currently produce only 10 per cent of the world's oil and hold 3 per cent of global reserves – in contrast to national oil companies' (NOCs') 75 per cent (Bremmer 2010). This raises a number of uncomfortable questions: for example, how to balance political or normative considerations with purely financial imperatives, or how to engage in meaningful dialogue with national extractive companies (NECs). Already certain investors are cognizant of this normative aspect of the global phosphate market. For example, as of 2010 at least six Scandinavian investors were known to have engaged with fertilizer companies that source phosphate from Western Sahara, with mixed results (Western Sahara Resource Watch 2010). Equally, the corporate-geopolitical problem raises questions about whether state-capitalist financial institutions such as sovereign wealth funds will broadly prove an obstacle to the mainstreaming of SI, given the recent concerns raised over their participation in Western financial markets (e.g., Gilson and Milhaupt 2008; Kimmit 2009). Together these broad concerns form an agenda for future research.

### 3.6 Conclusion

Phosphorus scarcity began to receive widespread public attention in the wake of the fertiliser price spike of 2008. Those keen to further raise awareness of this problem were able to borrow Hubbert's techniques and draw on the readily available meme of peak oil to promote their message. At the same time, they were also careful to highlight many of the features that made phosphorus unique, or at least distinct from oil and other strategic commodities – in particular, its critical role in sustaining the food system and its geographic concentration in a handful of regions, not all of which have good relations with consuming nations – to add further urgency to their message. This paper has argued, however, that peak phosphorus narratives, in addition to committing some of the same conceptual errors as their peak oil predecessors, risk diverting attention to already-stale debates and away from the highly complex environmental and social problems associated with open-ended phosphate production and consumption. Indeed, given the track record of the peak concept, it is puzzling why it might be believed effective to extend the heuristic to phosphorus. The rather mechanistic trajectory of rapid decline suggested by Hubbert's peak serves to distract from the manifold physical and socioeconomic dimensions of natural resource scarcity. By contrast, a nuanced understanding of resource scarcity reveals that the (not unrelated) issues of final resource depletion, on the one hand, and environmental damage, socioeconomic injustice, and geopolitical instability, on the other, have merged into a nebulous whole in the public imagination.

Moreover, these narratives reflect the wider conditions which produced them: a time of financial upheaval and renewed fears about resource limits to economic growth in

the face of burgeoning demand from an emerging global middle class. Peak phosphorus debates are therefore also illustrative of wider lessons that apply across a range of natural resources. They suggest that natural resource scarcity is at the best of times not necessarily a sign of impending geologic depletion but of under-investment in production; of political, economic, or regulatory constraints on exploration of new prospects; of market manipulation by producer countries; or of geopolitical shocks. More to the point, they illustrate the importance of a proper understanding of the distinctions between peak resource analysis (a technical scenario-building tool), the concept of peak resources (a related but looser heuristic), and resource scarcity (a multi-dimensional phenomenon which manifests itself differently across different scales and locations) (Cordell and White, 2011). This paper has shown that an epistemological shift can shed light on the difficult question of whether current natural resource management regimes are equitable, efficient, and sustainable – in both the short term and the more distant future – in a way that peak debates did not allow, and thus point to a range of risks and opportunities. But this also requires extensive research: in the case of phosphate in particular, not enough is widely known about the geographic and institutional structure of phosphate and fertilizer markets; the phosphate price discovery process; and developments in forward-looking recovery technologies and the policies that facilitate their development and adoption.

A better understanding of the nature of resource scarcity also shows the geopolitical problem that is particular to phosphorus to be a fundamental challenge to sustainable investors. That is to say, that control of remaining global phosphate reserves lies increasingly in the hands of opaque state-capitalist institutions represents a widely ignored – and potentially severe – limitation to the hoped-for expansive reach of SI.

This raises uncomfortable questions: Should investors simply treat state-capitalist institutions as immovable obstacles that defy any attempts at engagement? Or should they attempt to open the ‘black box’ of state capitalism? And if they choose to do so, how should they begin to construct a meaningful understanding of the phenomenon of state capitalism in relation to SI – what features distinguishing state capitalism from market capitalism might facilitate or hinder the adoption of sustainable investing practices? Should investors simply assume that, just as certain financial norms such as modern portfolio theory have in the past generally been adopted by institutions seeking greater legitimacy and integration with global markets, sustainability will eventually come to be accepted as global best practice? Or at the least optimistic extreme, will SI itself eventually be swamped by the worst features of state capitalism? It has not only been beyond the scope of this paper to address these questions in depth – they have rarely if ever been posed, let alone considered in depth, and thus constitute a major area of future SI research.

It is worth stressing once more that this paper shares concerns about global phosphorus management – that is, the manner in which the resource is extracted and produced for human consumption and ultimately disposed – writ large. Any discussion of certain aspects of the peak phosphorus narrative, therefore, must not be construed as outright rebuttal, but rather as sympathetic critique. The aim here has simply been to call for a departure from the ideological stagnation of the past and to begin to consider the ways in which self-interested states and markets might ‘organise scarcity’ (Bridge and Wood 2010) – and thus prove a limit to human development in the 21<sup>st</sup> century.

## CHAPTER 4 | OCP, the state, and corporate value creation: an experiment in hybrid capitalism

### 4.1 Introduction

As discussed in chapter 3 of this thesis, one of the most frequently cited matters of concern arising from the peak phosphorus problem is the concentration of so much of the resource in one particular country, Morocco. Already a market maker, OCP has the long-term potential to become the world leader in both production and exports. Beyond the simple fact of the geographic concentration of the majority of remaining phosphate reserves in a single country, of more specific geostrategic interest is that control of Morocco's phosphate resources rests exclusively with the state-owned phosphate company, the Office Chérifien des Phosphates (OCP) Group. While the conjectures about the supply behaviour of OCP – and state-owned extractive companies more generally – were raised in the previous chapter, fieldwork conducted subsequent to its publication suggested another important aspect of the geopolitics of control over mineral resources: the use of national mineral wealth for socio-economic development.

Founded in 1920 under the French protectorate, OCP and its subsidiaries are responsible not only for mining; they also account for a significant amount of downstream fertilizer production and marketing. At the same time, as a majority state-owned mining interest, OCP has long been regarded within Morocco as a company with significant *de facto* societal obligations, not least in the areas of employment, worker compensation, and community engagement. Yet despite the company's preeminent global and domestic positions alike, it is only within the past decade that it

has begun to realise its potential as an engine of national growth. In 2006, the company came under new leadership and shortly thereafter adopted an ambitious reform programme which commenced with a change in legal status from a government *administration* (bureau) to a *société anonyme* (S.A., or private company in French law), coupled with the externalisation of its considerable pension liabilities. Subsequently OCP has undertaken a large-scale investment programme encompassing capacity expansion, cost-cutting measures, product innovation and diversification, a new sales strategy, and development of human resources, as well as a number of social investment projects. Today phosphate accounts for 93 per cent of mining production in Morocco (Bank Al-Maghrib 2012). Meanwhile, OCP is a source of 20,000 jobs alone, or one-third of the state sector total (OCP Group 2013b). Seven years on, the apparent progress of the reform programme is such that it has been hailed in some quarters as a ‘management lesson from the [global] South’ (Croset 2012), piquing the interest of international management researchers. While OCP’s reform programme may well be on its way to becoming a business-school case study, the focus of this chapter is not on management *qua* management but on the role of state-owned corporations in optimising the generation and distribution of natural resource wealth.

The concept of ‘value creation’ has long been a vexed one in the private sector. For many years now, corporations have been called to account not only to minimise the negative social and environmental externalities associated with their operations, but also to take a more proactive role in creating value for stakeholders in addition to their shareholders. This is particularly true of the extractive industry, given its long history of socialising enormous costs while privatising considerable gains (McElroy 2012). In

parallel, economic value creation in the state-owned corporate sector has historically entailed a distinct suite of challenges, given that the governance of state-owned enterprises (SOEs) typically blends elements of corporate governance, public administration, and regulation to varying degrees (Hults 2012, 69).

This chapter takes OCP as a test case of these dynamics. It draws on primary research in the form of key informant interviews with approximately 20 current OCP executives and managers, as well as the analysis of public and internal corporate documents, and places it in the context of three fields of scholarly inquiry: the political economy of national extractive companies (NECs)<sup>20</sup>; corporate social and environmental accountability; and the use of natural resource wealth for socio-economic development. The chapter finds that for OCP, ‘economic value creation’ for NECs is a uniquely expansive concept, and one in times beset by internal contradiction. On one hand, it faces much the same dilemma as its peers in the global extractive industry in defining and delivering on its societal responsibilities without sacrificing financial profitability. In the process of carrying out its reform programme, the company is finding the need to (re)define ‘economic value creation’ in a manner consistent with its own strategic objectives as well as Morocco’s evolving political-economic context. At the same time, its desire to enhance its internationally competitive position means it will increasingly be subject to global corporate governance norms which prioritise financial returns to shareholders first and foremost.

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<sup>20</sup> Recall from chapter 2 that for our purposes, a ‘national extractive company’ (NEC) is best thought of as an umbrella term for a mining company in which states have varying degrees of involvement and which may carry out a wide range of commercial and non-commercial functions (Victor et al. 2012, 3-4).

More broadly, the chapter argues that state ownership in the extractive industries presents a particular nexus of principal-agent problems. Specifically, the fact of state ownership changes the nature of the principal-agent relationship: the ‘principal’ might be conceived narrowly as the government or broadly as the populace writ large, and so the scope of the corporation’s activities which may be considered beneficial to the shareholder widens. This is particularly true of extractive companies, which have long been viewed as stewards of the national patrimony (in the form of hydrocarbon or mineral resources) regardless of their ownership. As such, the fact of majority state ownership simultaneously enhances two long-established and apparently conflicting arguments about the social role of business: on the one hand, that by the very fact of its pursuit of profit through its core operations the company contributes to growth and development; on the other hand, that business has an obligation to the society in which it operates not only to offset the negative externalities it generates, but also to make a net positive contribution to its stakeholders’ well-being.

The chapter proceeds as follows. The next section gives an overview of some of the challenges faced by NECs in balancing commercial and non-commercial objectives. Here it will be shown that whereas the nature of a mining company’s shareholder base (i.e. public vs. private) is of only secondary importance as a determinant of economic efficiency, it is of key importance in the company’s ability to define and justify its extra-financial investments. Section 4.3 explores the concept of shared value as it applies in the private-sector context. Section 4.4 introduces OCP, sketching out a brief history of its post-2006 transformation process and outlining its formal institutional changes. Section 4.5 describes the various ways in which the company creates value

for the Moroccan economy: not only its fiscal and macroeconomic contributions and programmes with a more direct business case for OCP, but also its social investments. The penultimate section considers the future trajectory of OCP's place in Morocco's socioeconomic development. Section 4.7 concludes.

## **4.2 NECs and economic development**

What, if anything, is special or distinct about state as opposed to private ownership in the mineral sector? One of the key differences between NECs and private companies is that the former often have a mandate to pursue non-commercial as well as commercial objectives – particularly those related to regional or national socioeconomic development. These include creating or maintaining employment, local procurement, regional economic development, and earning foreign exchange revenue (Al Rawashdeh 2008; Victor et al. 2012). For Stevens (2008), these objectives can be collectively referred to as the 'national mission' and may include three components in addition to promoting economic development: protecting national mineral wealth, promoting the state's political interests abroad, and in some cases, bolstering the state's legitimacy and/or popular mandate to rule. In a word, NECs do not always prioritise profit maximisation. As such, balancing financial and extra-financial imperatives entails significant tradeoffs – and by extension, governance challenges. In the past, such practices were a unanimous source of critique; but more recently a certain level of debate surrounding the extent and manner in which the pursuit of non-commercial goals has arisen.

For those of the old school, the most serious charge against NECs' pursuit of public policy objectives relates to resultant inefficiencies described in chapter 2. Moreover, pursuing public policy goals often means sustaining or increasing output in a market down-cycle in order to maintain employment levels or foreign exchange revenue (Al Rawashdeh 2008). Moreover, many NECs are low-cost producers with access to high-grade mineral reserves or subsidised production inputs, both of which allow them to maintain profitability provided their marginal cost does not exceed the prevailing market price. However, this also means that NECs many not respond to market signals (Dobozi 1993 cited in Al Rawashdeh 2008). Maximising output is inefficient from a firm-level perspective in the long run: for market-making players it may depress global prices and thus revenue.

Similarly, unsuccessful attempts to 'balance' two sets of economic objectives often proves self-defeating in the long run. For instance, while it is true that NECs provide employment opportunities and often skills training for locals, the overall inefficiency of the enterprise may negate these gains to the economy as a whole. Instead, more appropriate public policy measures might have been deployed to create employment (Radetzki 2008, 183-4). Even if such efforts appeared to be effective, assessing the contributions of NECs to national and regional economic development via objective measures is fraught with difficulty (see Stevens 2008 for a discussion).

Others have found, however, that an appropriate balance between commercial efficiency and responsiveness to stakeholders is attainable. Without denying that the pursuit of non-commercial objectives renders efficient capital allocation more difficult (Jaffe and Soligo 2007), proponents argue that institutional structures exist to

correct for this tendency. In essence, this is a question of clearly articulating and assigning roles and responsibilities to all relevant actors in management and government through both regulation and managerial organisation (Jaffe and Soligo 2007). A few national oil companies (NOCs) in particular serve as case studies here, notably Saudi Aramco of Saudi Arabia, Statoil of Norway, and Petronas of Malaysia. Based on such experiences, more detailed guidelines have been laid out in a handful of codes of ‘best practice’ for both NECs (e.g. Lahn et al. 2007) and SOEs generally (e.g. OECD 2005, 2010).

For NECs the conceptual foundation for the difficulty in balancing commercial and non-commercial objectives can be found through principal-agent analysis. As discussed in chapter 2, one particularity of the principal-agent problem as manifested in NECs lies in identifying the principal. Here, though, the fundamental difficulty lies not in delineating the different actors within the government – the focus of much of the literature on NECs cited here – but in conceptualising the twofold nature of ‘the state’ as the shareholder. On the face of it, the government – or one of its constituent institutions, often the Ministry of Finance – is by definition the NEC’s owner.

However, the nation as a whole could equally be conceived as the ultimate beneficial owner, (at least nominally) represented by the government as it is. This is particularly true given that one explicitly stated mandate of many NECs is the enhancement of the national economy, be it through profit-maximising behaviour or non-commercial initiatives.

This has implications for assessing the ways in which NECs create economic value. Yet missing from many discussions of ‘best practice’ for balancing commercial and

non-commercial objectives is a clearer delineation of the ways in which NECs contribute to national development. Economic value creation by NECs may be said to occur in three ways: the maximisation of fiscal contributions (financial profit), the creation and strengthening of productive (backward and forward) linkages with the rest of the economy (Stevens 2008), and direct investment in local and regional development projects outside the realm of the NEC's commercial activities. The first of these, fiscal revenue generation, is fairly self-explanatory, though it should be clarified that the salient focus here is on the collection rather than the spending side, the latter being the government's province (Eifert et al. 2003). Indeed, for Aharoni and Ascher (1998), the fiscal regime is 'of fundamental importance in establishing a sound basis for government-SOE relations' because of its potential impact on other aspects of state-corporate relations (206). While an in-depth discussion of this point lies beyond the scope of this chapter, suffice to note here that, on the one hand, there is a normative argument to be made for financial flows to be controlled by the government, which in principle is both more publically accountable and possesses the requisite policy expertise (ibid., 207). On the other side is the more practical point that while politicians are more responsive to short-term considerations, professional managers are more likely to prioritise longer-term investment goals.

It is the other two contributions that might be called 'non-commercial' and so, to one degree or another, shade into what might be referred to as 'shared value' initiatives in a private-sector context. First, the more obviously 'non-commercial' contributions to development are to be found in a broad range of social investments benefiting not only employees but also, in many cases, local communities or even entire regions. Such investments may occur in areas such as non-employee education and training,

healthcare, small business development, environmental sustainability, and infrastructure. Second, less indirectly commercial is the creation of productive linkages with other sectors of the economy occurs both upstream and downstream. In the former case, ‘backward linkages’ are created with material and labour inputs from the rest of the economy and so contribute to post-depletion economic sustainability. In the latter case, ‘forward linkages’ are supplied by the extractive sector back to the economy: these include not only material outputs but also well-trained employees and examples of business ‘best practice’ (Stevens 2008). While all of these linkages have direct commercial benefits to the NEC, cultivating them may require additional investment in a weak economic and institutional context. This type of value creation is akin to Porter and Kramer’s (2006, 2011) well-known concept of ‘shared value’, as will be discussed below.

### **4.3 Corporate governance and value creation: parallels in the private sector**

#### *4.3.1 Shared value I: the corporate objective function vs. shared value*

In re-articulating its societal responsibilities, and in designing and implementing new programmes to realise them, OCP also enters the fray against a backdrop of extensive academic and industry debates about the nature and extent of social accountability in the private sector. Here scholarly work and corporate practice alike fall under rubric of ‘corporate social responsibility’ (CSR). CSR initiatives can be thought of as a means to address the lag between the rapid growth of corporations and state responses to the consequences thereof (McElroy 2012). The crux of debates surrounding the

normative and practical justifications for CSR is the issue of whether the corporation has obligations towards entities other than its shareholders.

For Friedman (1970) and his intellectual heirs, the sole legitimate responsibility of business is the pursuit of financial profit: anything more than this is the purview of the state. Indeed, the pursuit of profit has the serendipitous effect of contributing to wider social welfare through, for example, increasing employment, producing goods and services to fulfil consumer demands, and generating tax revenue. This position has been formalised – indeed, epitomised – by Jensen’s (2001) ‘corporate objective function’, whereby ‘social welfare is maximised when each firm in an economy maximises its total market value’ (297). This is not merely a normative position but a matter of practicality, for ‘any organisation must have a single-valued objective as a precursor to purposeful or rational behaviour’ (300). Yet because it is objectively impossible to maximise simultaneously for more than one objective, fully answering to multiple stakeholders *in addition to* shareholders finds no justification in this framework.

Here Jensen is explicitly reacting to stakeholder theory, one of the normative foundations for the position that business does indeed bear responsibilities towards constituencies other than its shareholders. Stakeholder theory (Freeman 1984) advocates balancing the interests of claimants such as employees, creditors, suppliers, customers, local communities, and even the environment (Donaldson and Preston 1995). In the broadest sense, ‘stakeholders’ can be conceived of as ‘persons or groups that have, or claim, ownership, rights, or interests in a corporation and its activities, past, present, or future’ by virtue of their ‘transactions with, or actions taken by, the

corporation' (Clarkson 1995, 106). Indeed, it is possible to take the stakeholder as an analytic starting point and conceive of the corporation as a network of (primary) stakeholders, or corporate 'constituents', around whose claims a CSR strategy can be developed (ibid.).

Note that missing from Jensen's account is that there is nothing in stakeholder theory which calls for *maximising* for multiple corporate objectives; indeed, the crux of stakeholder theory is the search for an appropriate *balance* between various stakeholder claims. On the other hand, Jensen raises the entirely separate, and legitimate, charge that stakeholder theory offers no guidance on *how* to balance competing claims from different stakeholder groups. Where the stakeholder theory framework falls short is in acknowledging that there may be significant tradeoffs between stakeholder interests. In principle, much of this literature recognises the normative value of all stakeholders. Yet if each stakeholder entity possess its own intrinsic value – 'that is, each group of stakeholders merits consideration for its own sake and not merely because of its ability to further the interests of some other group, such as the shareowners' (Donaldson and Preston 1995, 67) – the idea of a company making trade-offs between competing stakeholder claims becomes fundamentally problematic (Smith 2003).

The issue of trade-offs – so antithetical to the 'win-win' ethos evident in much CSR discourse – has proven intractable. Indeed, because it comes laden with such baggage, and because of an overall reluctance to politicise it, CSR as a concept has been rejected in theory by many scholars and in practice by many companies (such as OCP) alike. In recent years, one of the most influential attempts to break with this

intellectual legacy has been the concept of ‘shared value’ (Porter and Kramer 2006, 2011). Shared value creation occurs in three ways: ‘by reconceiving products and markets, redefining productivity in the value chain, and building supportive industry clusters at the company’s locations’ (Porter and Kramer 2011, 7). While informed by stakeholder theory in a normative sense, shared value ultimately conforms to the neoclassical economic paradigm of the firm: ‘improving value in one area gives rise to opportunities in the others’ (ibid.) and so ultimately contributes to long-term corporate profitability.

In effect, Porter and Kramer have cherry-picked their evidence to develop a ‘theory’ that is rife with internal contradiction. Specifically, they fail to address head-on a fundamental problem with the rationale underlying CSR which have been explicitly problematised by Smith (2003): namely, that it can be difficult to distinguish between enlightened self-interest and pure altruism. As the authors themselves admit, ‘most corporate social choices involve balancing competing values, interests, and costs’ (2006, 4). From this it can only be concluded that, although the relationship between business and society may at times be one of mutual dependence, it does not follow that it is universally symbiotic.

#### *4.3.2 Shared value II: shared value vs. CSR/social investment*

Despite its focus on the stakeholder, the shared value concept sidesteps a twofold dilemma. Beyond the initial task of identifying all entities that might be considered stakeholders in the first place, there remains the much thornier normative question of which stakeholders should be taken into account in corporate decision-making.

Nowhere is this issue more apparent than where matters of socio-economic development are concerned. Although Porter and Kramer (2006) believe that business is the best-placed entity to raise standards of living, they also acknowledge that ‘No business can solve all of society’s problems or bear the cost of doing so. Instead, each company must select issues that intersect with its particular business’ (ibid., 9). From this it must follow that even with effective CSR initiatives in place, business activity is not necessarily a rising tide that lifts all boats. Indeed, by addressing some social problems while ignoring others, it can serve to create or exacerbate socioeconomic inequalities.

This dilemma is accentuated in the context of the extractive industry, characterised as it is by the ‘enclave’ nature of economic development. Hydrocarbon and mineral extraction tends to dominate local economies due to the generation of high revenues; it thus attracts labour from other, lower-wage sectors, skews local income distributions, and causes price inflation (Renouard and Lado 2012). CSR in the mining industry has long been viewed as one potential preventative measure against these and other manifestations of the ‘resource curse’ (Auty 1993; Sachs and Warner 1995, 2001). However, private-sector mining firms can only go so far in serving as instruments of economic development: not only do they lack the internal capacity to do so, they also run the risk of ‘corporate paternalism’, or supplanting the government in providing social services (McElroy 2012).

Indeed, it might be more appropriate to take this point a step further: while in principle the shared value concept distinguishes between the initial step of identifying stakeholders and then selecting those whose interests it is best placed to serve (in

particular instances), it may be that the very act of setting priorities disqualifies some entities from being considered ‘stakeholders’ at all. As Clarkson (1995, 100) has put it, ‘It is necessary to distinguish between stakeholder issues and social issues because corporations and their managers manage relationships with their stakeholders and not with society’. The stakeholder framework is particularly problematic as an approach to socioeconomic development through enterprise because development *is* a social issue. Yet neither legal rights, moral obligations, nor business reasons compel the inclusion of the economically marginalised in private-sector considerations (Blowfield and Frynas 2005, 508) – and so, ‘Almost by definition, the poor are those who do not have a stake’ (Jenkins 2005, 540).

In sum, through a strong tendency to downplay the possibility of serious conflicts of interest among certain groups, stakeholder theory depoliticises business. Conventional wisdom on the respective roles of the public and private sectors would have it that ‘a particular society and its polity determine what is a social issue, and, when it is considered necessary, legislation and regulations are enacted’ (Clarkson 1995, 104). All of these conditions are further contingent on strong host-country legal, political, and institutional frameworks to protect domestic stakeholders’ interests. Yet more recently, it has been openly acknowledged that in reality, ‘Business plays a political role, not by “playing politics”, but as an actor in the public sphere whose impact on its stakeholders changes their living conditions, sometimes substantially’ (Renouard 2012, 65). In this vein Saad (2013) believes that corporate social responsibility *must* be politicised in light of the corporation’s ‘undeniable political role’.

As in the private sector, there is something of a tension as well as a complementarity between the three ways in which NECs may contribute to national economic development. Herein lies the significance of the nature of the shareholder: given both the simple fact of public as opposed to private ownership *and* the blurred distinction between ‘principal-as-government’ and ‘principal-as-populace’, the nominal distinctions evident in the private sector between CSR and public policy are blown apart. It also implies that (to misquote Friedman) the business of state-controlled business can indeed include not only business but also national development. Moreover, if the extractive sector raises a distinctive set of social expectations, then the fact of state ownership expands their scope considerably. Indeed, if anything the rationale for expanding the scope of who may be considered a ‘stakeholder’ is only strengthened in the case of national *extractive* companies: the natural resource in question is typically seen from a political and economic perspective as a source of national wealth. For NECs social investments thus occur, if not directly at the behest of the shareholder (i.e. the state), then at least with their consent, oversight, or even collaboration.

Existing frameworks for assessing corporate value creation therefore have limited applicability to the present case, for NECs have greater normative scope to choose between the two stylised options of maximising or balancing ‘economic value’ writ large. Put differently, on the face of it, the charge of ‘corporate paternalism’ cannot be so easily levelled against state-owned firms, even in light of the charge of inefficiency. On the other hand, it is *a priori* easier for high-performing NECs than it is for privately owned companies to justify a singular goal of profit maximisation as a satisfactory contribution to national development. Indeed, for all of the reasons cited

above, and echoing Friedman (1970) and Jensen (2001), Radetzki (2008, 183) has argued that ‘The social welfare effects would no doubt improve if the firms were simply required to maximise profits, and if the government established more appropriate institutions for the work towards social goals’. For example, social investments by NECs may supplant state functions and thus resemble CSR initiatives or public policy measures, raising the practical issue of the NEC’s capacity to execute these programmes. As we shall see, a number of forces have made this logic increasingly compelling for OCP.

#### **4.4 OCP Group: transformation, governance, and relationship with the state**

##### *4.4.1 Phosphate in the Moroccan economy; beginning of the transformation*

Phosphate mining has played a role in the Moroccan economy for nearly a century. Phosphate deposits were first discovered in Morocco in 1907; the Office Chérifien des Phosphates was founded in 1920 under the French protectorate. At the time of the appointment of the current chairman, OCP was still an *office*, to use the French term denoting a division of a government ministry – in this case the Ministry of Finance. As a de facto *administration* rather than a corporation, it was both owned and managed by the state, with the role of the president of the board of directors typically filled by Morocco’s prime minister. OCP’s balance sheet was part of the state’s, and as such it could not become bankrupt. Because it contributed to the state budget primarily through mining royalties, which were levied on a per-tonne basis, the company operated on a purely volume-based strategy. Further contributing to this under-performance were prevailing global market conditions of the previous 30 years

(1976-2006), when phosphate prices remained steady at around US\$30-40 per tonne. In an otherwise cyclical industry, OCP's revenue remained flat during these 30 years. Low commodity prices discouraged investment across the industry; in the case of OCP, new investments ceased in the 1980s with the rehabilitation of the export hub of Jorf Lasfar. A decline in prices in the latter half of the 1980s also contributed to Morocco's budget deficit, which reached US\$13bn in 1990 (Mezran 1998, 3).

Adding still further to OCP's lack of competitiveness were its social liabilities. As one of Morocco's largest companies, OCP has historically played an important role as an employer, not only because of the number of jobs with essentially lifelong tenure it was able to offer at its various sites but also in terms of the generous social benefits provided to employees. These included not only benefit packages of pension and healthcare provision which were generous by Moroccan standards, but also ancillary benefits such as subsidised housing and company-built and –managed schools for current employees' children. Additionally, OCP was frequently compelled by the state to fund a range of projects and events removed from its core business interests.

For all of these reasons, by 2006 OCP's balance sheet was, in the words of one interviewee, 'catastrophic'. Recognising the need for reform, the king appointed Mustapha Terrab, the MIT-trained former CEO of Maroc Telecom, the state telecommunications firm. The following year, consolidated accounts were produced at the request of new chairman, albeit with great difficulty given both a dearth of financial information and a lack of harmonisation across OCP's constituent companies. When it was finally completed, the audit revealed negative equity of MAD 15.9 billion (US\$1.94 billion) and an operating loss of MAD 12.2 billion

(US\$1.49 billion) (Croset 2012). With the newfound will to transform the company from a parastatal to an internationally competitive business, external consultants were brought in to assess OCP's current state and to chart a way forward. A master report prepared by Oliver Wyman<sup>21</sup> and known internally as the 'Livre Blanc' ('White Book') represented the culmination of these efforts. By all accounts, the Livre Blanc pointed to the need for a wholesale transformation or 'clean break' with the past rather than a managed transition. Two meetings of OCP's executive committee were convened to discuss the findings and recommendations of the Livre Blanc. Following these meetings, as one interviewee related, it was now clear to Terrab that a transformation of the company must also begin with another type of 'clean break' with business as usual: the replacement of the company's existing top management personnel with those capable of dealing with strategic questions.<sup>22</sup> From the end of 2007 through early 2008, a series of voluntary departures took place. Additionally, staff numbers at OCP's Casablanca headquarters was cut from 1400 to 600.

The reform programme was implemented at the global level beginning in 2007 (Croset 2012). Beyond the change of staff, the proposed foundation for the institutional transformation was twofold: OCP would at once externalise its pension liabilities and register as a S.A. under Moroccan company law. From here, a new strategy could be implemented – and as we shall see, would be greatly facilitated by the phosphate price spike (in OCP's terms, the 'fly-up') of 2007/08.

#### *4.4.2 Transformation I: formal and institutional 'best practice'*

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<sup>21</sup> Subsequent strategic advice, including the 2007-08 change to OCP's pricing policy, was also provided by McKinsey.

<sup>22</sup> In less charitable terms, according to this same person, 'Le poisson pourrit par la tête' ('[A] fish rots from the head').

OCP's legal privatisation, regarded as the lynchpin of its transformation, follows a trend among NECs in particular which began in the 1980s. As Hults (2012, 69) notes, NEC governance typically blends elements of corporate governance, public administration, and regulation to varying degrees, though in principle incorporation alters the relationship between the NEC and the state in two key respects. First, legal privatisation shields both NECs from political influence and the state from politically unpopular decisions (Hults 2012, 69). The legal separation from the apparatus of the state means that NECs are subject to commercial rather than administrative law, and do not enjoy special privileges or protections from the state. Second, the relationship between the state (i.e. the shareholder) and the NEC is mediated by the board of directors, as well as by audits, financial disclosure, and other forms of information sharing.

OCP's incorporation as a S.A. came into effect in 2008 under a law approved by Parliament (Revenue Watch 2013). Under this legislation, the state must directly own at least 92 per cent of the company's shares. In 2007, OCP's need to raise capital compelled it to sell a 5.86 per cent stake to the Banque Populaire, a co-operative bank that is 20 per cent state-owned. Thus the company is now 94.12 per cent directly owned by the Moroccan state. The 2008 legislation also specifies that OCP is now subject to bankruptcy law – a seemingly obvious point for a private company but, as mentioned, a major departure from past state financial guarantees, and a sharp contrast to NEC governance practices common elsewhere.

Moroccan corporate governance law is derived from the French legal system. As in France, concentrated ownership, along with majority-stakeholder control over the processes of appointing board members and directors, is common. Morocco introduced a substantial reform to company law in 2001 (see Quinn 2014). The country's commercial laws were up to that point based upon the French commercial code of 1866: having gained independence in 1956, the Moroccan legal system had not been influenced by the French company law reform of 1966. Among other reforms, the modernisation of company law introduced requirements for the S.A. – the closest civil-law equivalent to the Anglo-American publicly held corporation – including increased shareholder information rights and greater accountability to auditors (ibid.). As in French law, S.A. companies in Morocco may now choose between a one-tier and a two-tier board structure; OCP has a one-tier, non-executive board, or *conseil d'administration*. At least half of the members of one-tier boards are legally required to be non-executive directors (EBRD 2013, 31-2). While there is no legally binding specification of directors' fiduciary duties, the Corporate Governance Code lays these out according to international best practice (EBRD 2013, 32).

In OCP's case, all 14 board members are government ministers. One interviewee argued that this arrangement was an improvement on the past, when each ministry was instead represented on the board by its secretary-general. Another saw advantages to the current arrangement in that 'we are interested to hear what they are thinking'. However, this person also admitted, 'To be honest, it was not our decision' to have ministers as board members: in effect, it was something of a concession on the part of OCP in its efforts to maximise its managerial autonomy from the state. On the other hand, while the board approves company accounts and budgets and has a say

in strategic affairs, it was also argued to have shown a willingness to delegate day-to-day operations to management. Moreover, whereas the company's board was previously comprised of the secretaries-general of various ministries, now the Ministers themselves sit on the board. As a result, one interviewee argued, the board is now 'more in touch with on-the-ground issues that are relevant to OCP'.<sup>23</sup>

When asked about the challenge of ensuring that the board act as fiduciaries of the company rather than in their political capacity, interviewees tended to respond that the ministers were there 'as persons, not as ministers'. In theory, they wore 'different hats' in each capacity, though in practice, as one interviewee tactfully put it, 'People are people'. However, it was stressed that ultimately the Chairman's duty is to remind board members that 'they are there for the interests of the company'.<sup>24</sup> This model would appear to be typical of the French model of corporate governance, which relies on a strong chief executive (Weimer and Pape 1999; Hopt 2011). In OCP's case, again as is common under the French model, the company president is chosen from the board and is also the CEO. In this vein, another interviewee noted that OCP's model of executive decision-making depends on a Chairman/CEO with 'enormous amounts of skill and diplomacy'.

Openness about the details of the channels of communication between OCP and the government varied considerably among interviewees. One virtually universal refrain I heard time and again, however, was that OCP enjoys operational and strategic

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<sup>23</sup> It should also be noted that a reshuffle of the government took place in the autumn of 2013, with the result that OCP has four new directors. Interviewees did not believe that this would have a significant impact on OCP's operations or strategic direction.

<sup>24</sup> It was also stated that there have been high-level discussions between OCP and the government about the possibility of bringing in non-official as well as international board members (though this interviewee claimed not to be privy to the discussions).

autonomy, pays taxes and dividends, and is audited ‘just like any other private company’. It was stressed that through his considerable diplomatic and leadership skills, the Chairman has been able to convince the government to turn over the day-to-day running of OCP to professional managers because doing so will maximise the long-term financial value of the company for both the government and the wider economy.

If the importance of the change in formal governance structure for OCP’s corporate performance is not entirely clear, the change to private company status *has* had important effects in two key areas, as described in the section to follow: while the first is symbolic and tied to the specific form of the S.A., the second relates more concretely to the management of the company’s finances vis-à-vis those of the state.

#### **4.5 Shared value at OCP: heuristics and practice**

##### *4.5.1 Shared value initiatives I: microeconomic*

At one level, the change in legal status has had symbolic significance for the way in which OCP conceives its societal role. There is a striking awareness at OCP of the stylised distinction between ‘Anglo-American’ and ‘continental European’ modes of capitalism. Echoing assertions common in academic literature on varieties of corporate governance (see Clark and Wójcik 2007), a near-universal theme across interviews with OCP staff was the idea that nationally contrasting modes of corporate ownership structure have important implications for the treatment of the firm’s stakeholders other than its shareholders. Anglo-American financial-market norms

would have it that the primary, if not indeed sole, fiduciary responsibility of companies governed by common law is argued to be the maximisation of shareholder value – which, in practice, amounts to short-term financial profits. By contrast, companies operating in CME jurisdictions are legally required to act ‘in the interests of the enterprise as a whole’ (Hopt 2011, 8; see also Shleifer and Vishny 1997; Weimer and Pape 1999). By some interpretations, this means that they also accountable to various constituencies other than their shareholders: employees, suppliers, customers, creditors, and so on. According to this logic, the shareholder-versus-stakeholder dichotomy implies a fundamental difference in focus on short-term financial returns, in the former case, and long-term competitiveness in the latter (Bauer et al. 2008). Accordingly, the S.A. legal form has become a key element in OCP’s internal and external discourses about its identity as a socially accountable company.

This sense of social responsibility was said not to be unique to OCP among Moroccan companies. One interviewee cited the example of the corporate foundation attached to the ONA (*Omnium Nord Africain*) group, the government-owned investment entity. However, the ongoing challenge of institutionalising the principle of shared value within the company was readily acknowledged. Particularly at the beginning of the ‘transformation’ period, it was difficult to impress upon OCP employees and local communities alike that the corporate handouts to which they had become accustomed are ultimately unsustainable for all parties involved. At mining sites in particular, OCP’s license to operate had long stemmed from locals’ perception of the company as the provider of something of a social safety net. By contrast, its various social investment programmes were said to be ‘designed so that all actors have a strategy

aligned around OCP' – and that OCP's competitiveness was a prerequisite to their success.

This cultural-legal rationale is bolstered by OCP's identity as a member of the extractive industry. Social accountability was also said in interviews to be especially important for mining companies such as OCP, given the far-reaching impact of their operations on the local communities; the company was thus argued to have a particular obligation to the stakeholders at its mining sites. This was often expressed in aphorisms, typically borrowed from the Chairman, such as 'We don't want to be an oasis of wealth in a desert of poverty' and '[Shared value is] a win-win [*sic*] that is short-term, medium-term, and long-term'. More than one interviewee contrasted the shared value ideal with the concept of CSR: whereas the latter was argued to be no better than a 'tax', shared value initiatives were said to tend to reinforce corporate strategy.

Much as for other NECs, 'shared value' may be described in three overlapping ways. Two of these – productive linkages with the rest of the economy and investments for socio-economic development – were much discussed by interviewees and will be described below. The third form of shared value – fiscal contributions generated from mining rents – were frequently alluded to in the context of OCP's competitiveness and will be discussed in the following sub-section.

As part of its transformation process, OCP is investing heavily in creating productive (backward and forward) linkages with the Moroccan, and indeed regional (West African), economy. This includes three areas with both clear ancillary social benefits

as well as a more direct business case for OCP. First is in the area of local procurement. Although OCP has formed joint ventures with a number of international corporations at its industrial sites, notably Jacobs Engineering and DuPont, it is attempting to create industrial clusters of which domestic companies comprise a higher proportion of firms, thus increasing the proportion of production inputs sourced locally. Second, OCP provides ongoing training for its current employees. As well as offering a range of courses in-house, it also has partnerships with MIT's Sloan School of Management and HEC in Paris, where it regularly sends upper-level management to take part in executive education programmes. Interviewees stressed that in both cases, the company viewed itself as contributing to the competitiveness of the national workforce as a whole. Third, in addition to these domestic programmes, OCP has begun to focus on the rest of the African continent, particularly West Africa, as the region with the greatest growth potential as a new fertilizer market. This includes not only investing in R&D to develop specialty fertilizers suited to African soils, but also significant market research; developing agricultural extension-style education programmes in a number of countries (e.g. Nigeria and Mali); cultivating relationships with local distributors; and, eventually, producing a 'soil fertility map' of the whole of Africa.

In addition to these types of shared value with a clear business case, OCP has also undertaken a number of social investments at the local and regional levels. As already mentioned, OCP has historically had a national reputation as a provider of well-paid jobs as well as of social services for its employees and their families. Direct investments are taking place primarily in two areas: youth skills development and green urban development.

OCP Skills was created in 2011 in the wake of the Arab Spring, as a response to protests and demands for greater employment.<sup>25</sup> As is common in the mining industry, OCP's sites of operation are characterised by lack of economic diversity, high unemployment, and a weak civil society. The programme is thus intended to improve the employment prospects of local youth (age 16-30) and to serve as an incubator for business start-ups. It includes three components: the recruitment of 5800 potential new OCP employees (selected from approximately 90,000 applicants); vocational training for 15,000 young people resident at OCP's sites of operation; and support for business start-ups. OCP Skills was designed in collaboration with Canadian, Belgian, and US companies and is staffed by OCP employees trained specifically for their new roles. The programme can point to a number of key performance indicators to date, including the creation of 76 new start-ups in its first year and the opening of five 'Skills Centres' by the end of 2014 to act as local hubs for its initiatives. This programme thus addresses two interrelated public policy goals: improved vocational education opportunities and youth unemployment.

OCP's green development subsidiary, *Société d'Amenagement et Développement Verte* (SADV), is responsible for two separate urban development projects. The US\$937m Mine Verte (Green Mine), an 'eco-friendly' resort in the mining town of Khouribga, is being constructed on a 300-hectare rehabilitated mine site. Intended to attract foreign investors and visitors, the Mine Verte includes both business and leisure facilities. The Ville Verte (Green City), a carbon-neutral development in

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<sup>25</sup> This point was openly acknowledged in several interviews: OCP was not immune from protests during the Arab Spring, a handful of them characterized by moderate violence. For instance, one skills training centre was bombed, and at least two attempts were made to bomb each of the two pipelines transporting phosphate slurry from mining sites to the ports of Jorf Lasfar and Safi respectively.

Benguérir, is being constructed according to LEED ND<sup>26</sup> standards and will accommodate up to 90,000 inhabitants. At the heart of the Ville Verte is a new research and education hub, the King Mohammed VI Polytechnic University. The University enrolled its first students in the 2013-14 academic year and, when it reaches capacity, will graduate 12,000 students per year. Like OCP Skills, the main aim here is to address an education deficit in Morocco; though in addition, its sponsors hope that the university will become a regional, if not indeed continental, leader in higher education.

On the subject of whether these shared value initiatives at the community level have a business case for OCP as well as clear socio-economic benefits for its stakeholders, particularly local communities, interviewees generally concluded that there is indeed a symbiotic economic relationship between the two entities. In the words of the head of entrepreneurship development, ‘If I am OCP, does it help to have vibrant economy around me? Does it help to have less unemployment? Does it help to have a local economy that is varied, diverse, not reliant on me? Yes – [it helps to have a local economy that is] *linked to* but not *dependent on* OCP’.

#### *4.5.2 Shared value initiatives II: Fiscal and macroeconomic contributions*

While the change to the specific S.A. corporate form has at minimum had great symbolic significance for OCP’s objective of equitable resource wealth distribution,

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<sup>26</sup> LEED, or Leadership in Energy and Environmental Design, is a green building certification programme run by the US Green Building Council and recognized internationally. LEED ND, or Neighbourhood Development, is one of five rating systems designed for specific project types, and applies to new residential or mixed residential/non-residential projects (US Green Building Council 2015).

the privatisation process more generally has had great significance for the company's finances. Indeed, arguably *the* key factor distinguishing OCP Group S.A. from the old *Office* is its dividend policy. Previously OCP was obliged to pay royalties on extraction to the state on a per-tonne basis, as well as export taxes. In 2008, however, both types of payment were abolished, and the company now pays a standard corporation tax of one-third of gross revenue to the Ministry of Finance as well as a dividend to the Treasury. The company's dividend policy relies on a formula linked to the phosphate price as well as the capital investment cycles. Effective from 2012, OCP is obliged to pay a dividend of no higher than 15 per cent of net profit, a ceiling that will be raised stepwise up to a maximum of 40 per cent by 2017. Negotiated by the Chairman with the support of the palace, the shift from a volume- to a value-based model was argued to allow the government to maximise long-term revenue from the company even as it necessitated permitting OCP to retain a certain amount of capital for medium-term investments.

Again with respect to financing, apart from the fiscal arrangements with its majority shareholder, the change in legal status has also improved OCP's ability to raise outside capital. At a minimum, the fact of being a private company has conveyed a certain legitimacy in the eyes of international lenders. To date OCP has been able to obtain external financing from two sources: domestic bond markets and international development banks. OCP issued its first bond in September 2011, seeking MAD 2bn (US\$244m) in financing (Reuters 2011); the issuance was over-subscribed sevenfold. Development finance institutions offer loans on favourable terms; as can be seen from Table 2, to date all but one of these have been used in the area of infrastructure improvement. Though the effects on the company will only be discernible with time,

it has been observed that one factor that can encourage efficiency in NECs is the potential to access to foreign capital, which imposes the requirement of ‘creditworthiness’ on the enterprise (Aharoni and Ascher 1998). One early potential indication of OCP’s creditworthiness came in April 2014, when Standard and Poor’s assigned the company a credit rating of BBB-.

**Table 2: List of loans to OCP from international development institutions**

ISSUER	DATE	AMOUNT (US\$)	PURPOSE
African Development Bank (AfDB)	May 2012	\$250m	Construction of chemical facility in Jorf Lasfar
Agence Française du Développement (AFD)	May 2012	\$237m	Desalination plants and other water infrastructure (various locations)
European Investment Bank (EIB)	October 2012	\$175.7m	Infrastructure upgrades
Islamic Development Bank	May 2013	\$150m	Development of Jorf Lasfar port
KfW Banking Group	October 2013	\$271m	Desalination plants and other water infrastructure (various locations)

*(Source: Author based on Daragahi 2012; El Mouden 2012; Jeune Afrique 2013; Nazih 2013; observation from fieldwork, December 2013)*

The growth in OCP’s fiscal contributions has been attributed to these reforms, coupled with the dramatic increase in phosphate prices since 2007/08. Phosphate product sales had a value of MAD 48 billion (US\$5.85 billion) in 2012 (Bank Al-Maghrib 2012) and accounted for 22.9 per cent of Morocco’s exports (behind remittances and tourism) (OCP Group 2013b). OCP Group’s average net contribution to Moroccan GDP over the period 2006-12 was 3.8 per cent (ibid.).<sup>27</sup> During this time

<sup>27</sup> Its gross contribution over this period was 4.7 per cent; imports of energy, ammonium, and sulphur inputs (the last two of which are key feedstocks in the fertilizer manufacturing

it also made an average net contribution of 15.6 per cent to Morocco's foreign exchange reserves, a figure that reached 27 per cent in 2012 (ibid.).

One challenge for OCP has been to resist pressure from the state to contribute to its short-term budgetary needs.<sup>28</sup> In the past, the government tended to rely on OCP to shore up its finances, which remain weak. Interviewees believed that in recent years, the diplomatic skills of the new Chairman have enabled OCP to retain sufficient profits to continue with its long-term investment programme. Here more than one person noted a certain irony that it is the government that favours short-term value maximisation in the form of the old royalty payment system. Nonetheless, it seems reasonable to assume that one significant point of leverage in the Chairman's arguments is the wider macroeconomic contributions of phosphate mining and fertilizer production.

#### **4.6 Discussion: a 'Southern' model?**

As noted in sections 4.2 and 4.3, the ambiguous nature of the principal in majority state-owned companies – regardless of their corporate form – allows a degree of normative scope in balancing commercial and non-commercial objectives. Yet despite the apparent early successes of OCP's shared value initiatives, a certain degree of ambivalence about the concept of shared value was apparent among interviewees. For

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process), all of which Morocco lacks domestic sources, account for much of the discrepancy. On the other hand, while figures for the contribution of beneficiation activities (backward and forward linkages) were not available, it seems reasonable to assume that these will only grow in significance.

<sup>28</sup> One interviewee was of the opinion that OCP would retain its autonomy even more easily, and receive even more support in fostering a climate conducive to its ongoing operations and long-term investment programme, if more politicians came from a private-sector background. Many Moroccan politicians tend to be professors, lawyers, and teachers.

example, the issue of finding suitable metrics for shared value was raised. Managers were said not to be able to relate to the concept of shared value, though in a few specific cases appropriate key performance indicators (KPIs) are relatively easy to identify (e.g. the number of successful start-ups created under the entrepreneur development programme). One interviewee believed that shared value is simply not definable by ‘Western’ metrics. In this vein Daewoo and Samsung were cited as two examples of companies that had succeeded in deploying non-financial metrics to help create shared value for their host country, South Korea. On the other hand, another interviewee stated that OCP plans to adopt the Balanced Scorecard (BSC) approach to measuring social and environmental sustainability.

More fundamentally, however, there was a tacit acknowledgement that although shared value initiatives are necessary up to a point for OCP’s license to operate, it is not always the case that all stakeholders involved are willing to trade short-term losses for long-term gains.<sup>29</sup> Thus despite the importance of shared value initiatives to OCP, senior management were said to be in the process of rethinking the boundaries of the company’s core business. In this respect, both OCP Skills and SADV will be spun off in 2014 to the company’s newly created foundation, which has its own endowment. Similarly, OCP’s funding to Mohammed VI Polytechnic University will be phased out in favour of R&D contracts, and of sponsorship by third parties such as pension funds. A need to retain the company’s investment grade was also raised as a key justification for doing so. Regarding its investments in industrial clusters and other local infrastructure projects, senior management argued that OCP cannot

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<sup>29</sup> This is a criticism commonly leveled at Porter and Kramer’s (2006) hypothesis, as noted in section 4.3. Indeed, the Chairman himself was said only to deploy the phrase for lack of a better term, given its connotations of a focus beyond the company’s core business (observation from fieldwork, December 2013).

continue funding that which exceeds its core business needs or capacities, and that other actors – be they the state or private entities – should show greater willingness to invest. Crucially, however, these same interviewees do not regard a shift in focus to OCP's core business operations as a retreat from its societal responsibilities. Quite the contrary, they stated that simplifying the firm's corporate mandate will allow it to maximise revenue for the state.<sup>30</sup>

Note that OCP's identity as a 'continental' firm has very little bearing on these deliberations. As one interviewee acknowledged, although CME companies in principle have a higher degree of accountability to various stakeholder constituencies, in reality even managers in CME jurisdictions will not act to the detriment of the very shareholders by whom they are appointed. In any case, as Weimer and Pape (1999) note, compared to other types of CME firms, notably those in Germany, shareholders have greater power in French corporations.

As for the legal obligations of CME firms, note that the term 'stakeholder' has quite different connotations here than it does for Freeman (1984) and his intellectual heirs. Rather than the literal, wide-ranging sense of all those who have a direct stake in the firm's activities, this treatment generally takes a narrower view of stakeholders as only those with some commercial or pecuniary relationship with the firm. Here a further distinction can be made between investing and non-investing stakeholders, with the latter category encompassing employees, suppliers, and customers.

Moreover, all of these stakeholder groups have at least nominal representation on the

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<sup>30</sup> Compare to Aharoni and Ascher (1998). However, in the presence of weak institutions, the mere fact of tax revenue generation cannot be accepted uncritically as socially responsible behaviour (Renouard and Lado 2012, 472).

supervisory boards of those companies with a two-tier board structure (Dore 2000). Yet while this structure is the norm in Germany, the supervisory board is optional in other CME jurisdictions such as France – and by extension, Morocco. Indeed, due to the power of the PDG, the board has less power in French companies relative to those in other CME jurisdictions (Aste 1999).

As mentioned above, closely overlapping with the proposition that a S.A. is better suited to adopting a shared value ethos is Croset's (2012) idea of a 'Southern' (i.e. one suited to the institutional and cultural contexts of countries in the 'global South') model of corporate governance. When asked to elaborate on what they believed this concept means in practice, however, few interviewees were able to offer more in-depth insights. One person did, however, express a belief that in developing-country contexts there is often a lag in sophistication between some companies and the states in which they operate, but that such companies can indirectly lead their host countries to implement more comprehensive development strategies. By contrast, one executive vice-president was particularly sceptical of Croset's thesis, diplomatically referring to his book as 'a view' or 'a part' of the picture and arguing that ultimately 'there is not really a [single or alternative] model' of non-Western corporate governance. Rather, OCP's overriding concern is remaining competitive in a global market, which may entail adaptation rather than emulation of its competitors' behaviour.

That said, it seems reasonable to expect that the domestic imperatives of path dependency will ensure that OCP does not retreat entirely from its social investments. In addition to the ambiguous nature of the principal, three constraining factors (to borrow a term from Campbell 2007) will ensure the continuation to one degree or

another of the company's shared value initiatives. First is the issue of ensuring long-term profitability. Given a relatively weak economic and institutional environment, in the shorter term OCP may have little choice but to continue its investments in local industrial ecosystems around each of its sites of operation. Second is OCP's source of legitimacy as a national mining company. The company's longstanding socio-political legacy as a provider of social benefits to its employees and other stakeholders forms part of the basis of its social license to operate and so cannot be easily shed. Finally, and adding to this, wider political discontentment with high unemployment rates in Morocco, particularly among youth, has been compounded since the Arab Spring in early 2011 and placed further demands – from both the state and the public – on OCP to continue providing both a social safety net and socio-economic opportunity at its sites of operation.

#### **4.7 Conclusion**

Although the phosphate industry has long played a key role in the Moroccan economy, its national mining and fertilizer company has until recently significantly under-performed its global competitors and thus fallen short of its full potential as a generator of national wealth. With the 2007 adoption and ongoing implementation of a corporate turnaround under the aegis of a new chairman, however, the phosphate industry now figures prominently in Morocco's national development strategy in two key respects. More obviously, the already dramatically improved profitability of the company has made greater contributions to the state budget. At the same time, rapidly growing revenues from phosphate exports are being used to finance a number of large-scale economic development projects, internal and external education and skills

programmes, and environmental sustainability improvements. For the company's leadership and, increasingly, its management, such a level of social accountability is not so much a matter of public policy as an integral component of OCP's corporate strategy. In promoting a socially responsible ethos, the chairman chose Porter and Kramer's (2006, 2011) concept of 'shared value' as loose shorthand in company discourse.

OCP is an important test case of the role of the state sector in optimising the generation and distribution of national mineral resource wealth. In negotiating the change in legal status with the government, OCP's chairman argued that the privatisation of the firm would be for the long-term financial benefit of the state, and by extension for the national economy as a whole. Yet in addition to the obvious goal of the maximisation of the financial profitability of the company for its shareholder (i.e. the Moroccan state), NECs such as OCP can be said to have a second important objective which stems from the first: optimising the distribution of mining benefit on behalf of the state.

Here the privatisation process has been integral in shaping how OCP balances commercial and non-commercial objectives. Even as the state has retained majority ownership of OCP, the adoption of the S.A. corporate form has been important not only in practical terms for the professionalization and global competitiveness of the firm, but also for its construction of its self-image as a modern, socially responsible corporation. However, the chapter also argues that, contrary to company rhetoric, the adoption of this specific corporate form has less significance than the overall tension between OCP's dual identity as a state-owned but formally private company. On the

face of it, reform has allowed OCP to narrow its focus to profit maximisation, following Jensen's (2001) maxim that a simple firm is better than a complex one. Yet while the simple fact of state ownership can in principle allow an NEC such as OCP to justify pure profit-maximising behaviour as being in the national interest, in reality these companies are subject to a distinct suite of principal-agent problems. As this chapter has argued, this stems from a difficulty in clearly identifying the principal: not only as particular actors within government, as much existing literature on the subject contends, but more importantly as 'the state' writ large as opposed to 'the national interest' in the first place.

In exploring these various complementarities and tensions, the chapter suggests two stylised scenarios for the institutional evolution of OCP. On the one hand, OCP's desire to be a modernised firm while remaining highly socially accountable – and in so doing, create a self-styled 'Southern' model of corporate governance (Croset 2012) – fulfils both domestic political imperatives and responds to growing demands from other developing nations for alternative modes of capitalist development. On the other hand, as OCP increasingly looks to norms, standards, and financing set by an international market which is in turn driven by Anglo-American imperatives of shareholder capitalism, this alternative source of legitimacy will bring pressures to bear on its shared value ethos (cf. Clark et al. 2013).

Either path will have important ramifications for the global phosphate industry. Situated as it is at the nexus of such wide-ranging concerns as mineral availability, global food security, extractive-industry social accountability, and corporate geopolitics, OCP's transformation process is of interest for more than its supply

behaviour in international commodity markets. Its market position, coupled with its ongoing transformation, makes it an important test case of the future of natural resource stewardship.

## CHAPTER 5 | An anatomy of global phosphate markets

### 5.1 Introduction

Nearly four decades ago, Douglass North (1977) expressed much-quoted bemusement that ‘the literature on economics...contains so little discussion of the central institution that underlies neoclassical economics: the market’. Since that time, a proliferation of studies both within the mainstream of economics and beyond it continue to remark upon this omission even as the body of literature intended to address it grows. Implicit in these often overlapping and complementary, if methodologically quite different, research agendas is the view that markets are aggregators and disseminators of information as well as venues for exchange. While Hayek (1945) is often credited with the idea that prices convey valuable information, it was the seminal works of Akerlof (1970), Spence (1973), and Stiglitz (1977), *inter alia*, which first gave formal substance to this insight.

Much of this work concerns itself with securities markets. This is understandable: such markets possess the twin virtues of abundant, readily available data to facilitate empirical examination, and the theoretical curiosity of representing the intersection between finance and the ‘real economy’. Yet the question still arises: what of markets without a financial component? Such ‘non-financialized’ markets for pure goods have been all but neglected by mainstream theorists and empiricists alike; and this omission is particularly apparent in the literature on commodities. Again, this is hardly without reason: most major extractive commodities are, after all, traded on centrally cleared exchanges, and as such data on prices and traded volumes is readily available. On the other hand, basic commodity industries are often characterised by

oligopolistic and/or oligopolistic competition – a type of market structure that is, if anything, an obstacle to the development of centrally cleared trading. What, then, are we to make of a case without a centralised and standardised trading mechanism?

Phosphate, as it happens, is one such case. The purpose of the paper is therefore to explain how companies in the phosphate sector make pricing decisions given a number of peculiar features: in particular, the lack of both competition on the supply side of the market and centrally cleared trading.<sup>31</sup> Doing so requires the construction of an ‘anatomy’ of the market.<sup>32</sup> Based on a survey of relevant literature, the paper posits that a market anatomy can be defined as a vocabulary to describe two broad categories of market elements: the overall structure of the industry and the form of pricing mechanism – the former being one key determinant of the choice of the latter. However, this choice also reflects transactors’ decisions to balance price stability and price flexibility (Rogers and Robertson 1987) – decisions that may change as price dynamics evolve over time.

This study is also timely given recent controversies and misconceptions surrounding the 2007/08 phosphate and fertilizer price spikes discussed in chapter 3 of this thesis. While similar exercises have been performed at least in part by others, these authors did not systematically lay out a framework covering both industry structure and price formation. The anatomy of the phosphate market presented here is thus not based on a single canonical source but instead is drawn from (partial) anatomies by Al

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<sup>31</sup> As Çalışkan (2010, 241) notes, ‘The price and the market are synonymous’ to many traders, at least in everyday parlance, much as it is in standard microeconomic theory. In this paper we maintain the semantic distinction between ‘prices’ and ‘markets’, much as we distinguish carefully between ‘industries’ and ‘markets’, even if the latter distinction is not always apparent in the literature (compare Carlton and Perloff 2005).

<sup>32</sup> The term ‘anatomy’, along with many elements of the framework posited in sections 5.2 and 5.3, comes from Fattouh’s (2011) anatomy of the crude oil pricing system.

Rawashdeh and Maxwell (2011, for phosphate), Ott (2012) and Weber et al. (2014, both for fertilizers), Radetzki (1978, for bauxite, copper, and iron ore), Fattouh (2011, for crude oil), and Sugakawa (2010) and Wilson (2012, both for iron ore). It also draws on Ansar's (2010) work on contracting in the market for infrastructure services. These sources were selected for their merits as informal studies of a given (typically extractive) commodity market.

The paper is also part of a larger scholarly agenda examining the structural, institutional, and geographic conditions and micro-processes that produce prices for pure goods.<sup>33</sup> Barring important developments in, for example, the field of market microstructure, the mechanics of trading have tended to be relegated to the 'black box' of economics (O'Hara 1995). While the paper's contribution comes mainly through the empirical investigation of a special case, it also raises the broader question: what does a price in fact signify? Following Çalışkan (2010), it argues, first, that greater weight is often attributed by market theorists to a single notional 'market price' or 'clearing price' as *the* definitive expression of the value of a commodity; and second, that price discovery is a continuous, iterative *process* – of which various prices are an integral part – rather than a series of discrete *outcomes* (cf. also Crocker and Masten 1991). Borrowing broadly from Tversky and Kahneman (1974) as well as Hayek (1937, 1945), it conceives of prices as anchoring devices: meaningful not as

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<sup>33</sup> In this vein, it should be noted that the opacity of the micropolitics of negotiation and exchange that ultimately produce phosphate prices prevents us from adopting undoubtedly valuable insights about the importance of face-to-face contact (Storper and Venables 2004) or individual economic agency and power relationships (Callon 1998; Bathelt and Glücker 2011) in anything more than a superficial way. Coupled with the primacy of organisations, primarily in the form of producer and consumer companies, as opposed to individual traders in price-setting – as is the case for exchange-traded commodities such as the case of cotton which forms the basis of Çalışkan's (2010) study – the particulars of the subject-matter at hand have compelled us to adopt a somewhat different lens.

representations of value, but rather as approximations or heuristics that guide market decision-making.

The paper proceeds as follows. Section 5.2 provides the first of a two-part framework for constructing an anatomy of the phosphate market, outlining various elements that together constitute the structure of the industry. Section 5.3 lays out the second part of the framework with a discussion of private bilateral contracting. Sections 5.4 and 5.5 apply this framework to the case of global phosphate markets by describing the structure of the industry and the price formation process, respectively. Section 5.6 synthesises key insights about phosphate price formation and its relationship to industry structure and offers concluding remarks.

## **5.2 A framework for a commodity market anatomy, part I: Industry structure and geography**

As the wider literature on industrial organisation suggests, industry structure has important implications for the efficiency and transparency of price formation. Price instability for mineral commodities generally has its origins in the demand side of the market, as opposed to shifts in supply as is the case for agricultural commodities (Rogers and Robertson 1987). Price levels and volatility, in turn, have critical implications for producer profitability and consumer welfare alike. For mineral commodities the issues of geography and corporate ownership structure take on particular salience. Here industry structure has also been shown to influence short- and long-term price behaviour: for instance, market concentration is associated with higher price levels, while more frequent trading activity is positively related to spot

market volatility (Slade 1989, 1991; Slade and Thille 2006). The issues of monopoly (or monopsony) pricing, collusion, and other anticompetitive measures are, in turn, of particular interest to regulators (Carlton and Perloff 2005).

Radetzki's (1978) analysis of three metal markets suggests that industry structure has important implications for the relative bargaining power and thus the division of commodity trade benefits, broadly defined as both financial profits as well as non-pecuniary components of the trading relationship (ibid., 118), between buyers and sellers of a commodity. However, he is sceptical of the predictive power of formal modelling, arguing instead that any conclusions here 'will have to rely on commonsense rather than on available theoretical constructs, or on unequivocal results of empirical investigations and economic experiments' (Radetzki 1978, 120). While developments in the fields of industrial organisation and game theory have gone a considerable way in blunting this critique, Radetzki's (1978) work remains relevant insofar as he was an early, if implicit, advocate of a descriptive approach but few have since followed his example. Ultimately, more than three decades later it remains the case that 'With presently available evidence we are limited to such statements about *possibilities*; not enough is known to make confident judgments about *probable* patterns' (Scherer 1970, 252 cited in Radetzki 1978, 119; emphasis in original).

In this spirit of pragmatism and empiricism, therefore, we may proceed to list some key structural conditions that help determine the pricing mechanisms used in a (non-financialized) commodity industry. This part of the market anatomy presented in this paper is justified by reference to three pillars. First, since a grounded approach does

not – indeed should not – entirely eschew reference to theory, insights from industrial organisation theory (Porter 1980; Caves 1987; Schmalensee and Willig 1989; Carlton and Perloff 2005) provides a degree of scaffolding to support the empirical subject matter. However, the aim here is not to quantify, or otherwise evaluate, industry performance (Bain 1951, 1956; Schmalensee 1989; Carlton and Perloff 2005): these approaches must by their very nature privilege the widest possible (if not universal) applicability over empirical realism. By contrast, here theory serves the primary purpose of providing a lens for examining the subject-matter at hand, rather than as an end in itself (Monk and Monk 2007, 17-18).

As such, the second pillar of the approach taken in this paper is its consideration of industry particulars. This is fundamentally important for commodities in particular, for two reasons. At a general level, it is taken for granted that the extractive industries are characterised by spatial fixity of supply, economies of scale, high up-front capital investments, and long payback timescales. For the latter two reasons, investment is considered relatively high risk. Moreover, a high degree of capital intensity implies a greater amount of investment required to adjust production levels – and thus a longer lag time in production (Slade and Thille 2006, 235).

More specifically, the market institutions associated with each type of commodity has its own unique attributes, knowledge of which sheds a great deal of light on how the market in question functions. In this case, phosphate is not special only by virtue of its links to both agricultural and mineral supply-demand dynamics, but also of its particular price-setting mechanisms. This recognition is consonant with the significance economic geographers attribute to instances (i.e. specific cases). In this

vein, again in common with economic geography approaches, the third pillar of the paper's approach is its reliance on insights gained from field research (see chapter 1). Specifically, while somewhat less granular than economic geography or economic sociology approaches, much of the paper's empirical insights are derived from semi-structured and close dialogue interviews with OCP staff as well as the analysis of publicly available and confidential documents.

Building on these three pillars, it is possible to identify three basic categories of conditions that together can be said to describe the basic structure of the phosphate industry as it will be described in section 5.4.

To begin with, the *geography of supply and demand* is, in Carlton and Perloff's (2005) terms, a 'basic condition' of an industry. In other words, and in contrast to the other factors listed here, geography is typically considered exogenous to industry structure. The issues of location decisions and spatial organisation are typically subject to a range of exogenous and endogenous considerations that vary widely across different manufacturing and service industries, and as such form the backbone of much empirical research (Clark et al. 2000; Walker 2002). By contrast, the spatial organisation of the extractive sector is essentially a function of geology and thus relatively uncontroversial.<sup>34</sup> Nonetheless, geography is a key factor in determining the number, scale, and scope of producer and consumer firms, and of trade patterns.

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<sup>34</sup> Notwithstanding geographers' important observations that production sites are not 'given' but 'produced' by technological changes on the supply side as well as demand growth (Hanink 2002).

Second, the closely overlapping concepts of *concentration* and *integration* describe, in the broadest possible sense, the number and size of firms that account for total market share, across two dimensions. The first of these is the degree of *corporate concentration*, otherwise known as *horizontal integration*: the extent to which a relatively small number of firms control a given market. Corporate concentration increases a firm's bargaining power (Porter 1980), and is believed to be an important determinant of both price levels and price stability (Slade 1991). It has generally been shown that corporate concentration contributes to price stability, i.e. that oligopolistic competition decreases volatility (ibid.). However, evidence of the nature of the relationship between firm concentration and price levels is inconclusive (see Carlton and Perloff 2005 for a discussion). The obverse of corporate concentration is *market density*, which refers to the effective number of firms on both the buyer and the seller sides of a given market and thus the probability that a given agent will find a willing transaction partner within a given timeframe (McLaren 2003, 1). Increased market density is believed to lead to less vertical integration and more cooperative interfirm relationships (Ansar 2010, 301-2).

The second dimension of the concepts of concentration/integration is the degree of *vertical integration*, or the extent to which all stages of the production process for a given commodity are part of the same firm. Vertical integration may result from technological economies of integration; it is also regarded as a means of reducing the transaction costs associated with the search for and processing of information (Williamson 1979, 1985; Perry 1989). It represents the 'make' of the stylised 'make or buy' decision facing many firms, and as such is the subject of an extensive literature inspired by the work of Coase (1937). However, as we shall see, vertical

integration is regarded as unambiguously advantageous in the phosphate fertilizer industry due to significant efficiency gains in the production process.

A third broad category of phosphate industry features comprises those factors that either alleviate or exacerbate market frictions. *Market friction* refers to the relative difficulty associated with market exchange. It is an expansive concept essentially synonymous with ‘transaction costs’ (Williamson 1979) and includes, most importantly for our purposes, such considerations as incomplete or asymmetric information, non-standardised contracts (discussed in sections 5.3 and 5.5), geographic fragmentation of trade, taxes, domestic (here, agricultural) subsidies, and trade policy distortions such as export subsidies and import tariffs (Ansar 2010, 302-3). One important source of friction comes from international trade patterns. Here, the percentage of total global production traded across international borders determines the degree of *market integration*, or the extent to which there exists a single (here, global) price for a given good. Since many commodities, such as phosphate and iron ore, are traded largely or exclusively within discrete regions, there may exist different benchmark prices (cf. Sukagawa 2010).

A final word is in order about *intermediary trading institutions*, though in this case they are notable mainly for their absence. Most notable here are futures and other organised exchanges on which forward trading takes place (UNCTAD 2006). By extension, the presence of so-called speculators which participate in exchange trading is also key here: speculation has generally been shown to be a stabilising influence on prices, although this finding has been disputed in the past (see Slade 1991 for a discussion) and more recently (see chapter 6). Commodity trading houses and

investment banks belong in the category of intermediaries, though neither has received much academic treatment. The foregoing remarks on speculators notwithstanding, the presence of an intermediary is generally regarded as reducing overall market friction. It is also symptomatic of a lesser degree of vertical integration in an industry. Finally, the presence of a market maker, or an intermediary willing to transact with any party on either side of the market, increases market density on both the buyer and seller sides (Ansar 2010, 302).

These elements together constitute the primary structural determinants of the pricing mechanism(s) employed in phosphate markets. Note that it is not intended to be an exhaustive checklist of structural elements for mineral commodities generally: it omits – among other constituent elements which are not always universally present in all commodity markets – any discussion of storage costs (Pindyck 1990, 2001; Williams and Wright 1991; Deaton and Laroque 1996), as well as the dependence on exports of producer countries and the dependence on imports of consumer countries (Radetzki 1978). Note, too, that in contrast to some formal models of price formation, it neglects consideration of potential impacts of fiscal and monetary policy (see Frankel and Rose 2010 for a discussion). Indeed, given the heterogeneity of market structure across commodities, and more importantly the dynamic interrelatedness of the different dimensions, may make this an impossible task.<sup>35</sup> With these provisos in mind, the next section proceeds to discuss the second important aspect of market structure: the mechanisms by which prices are realised.

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<sup>35</sup> Nor does the paper explicitly discuss two areas of central interest in industrial organization – competition or market entry (Bain 1951, 1956; Porter 1980; Baumol et al. 1982), and market exit (Porter 1980; Clark and Wrigley 1997) – although both are of implicit concern here.

### **5.3 Framework for an anatomy, part II: Bilateral contracts as a pricing mechanism**

In principle, the ‘optimal’ pricing system is one that balances transparency, stability, and flexibility for buyers and sellers. In this vein, implicit assumptions are evident in much of the literature not only on commodities but on securities markets generally that pricing follows a ‘natural evolution’ in sophistication, with futures trading as the apogee of the evolutionary process given that, in principle, it fulfils all three of these criteria (see Radetzki 2013b; Hume 2014; see also chapter 6). However, Slade (1989, 211) has argued that no single pricing mechanism works ‘best’ for all commodities; rather, a pricing system is largely determined by industry structure (see also Caves 1987).<sup>36</sup>

As commodity markets become more globally integrated and competitive, futures exchanges have proliferated in recent years, often operating in conjunction with alternative pricing mechanisms (UNCTAD 2006; Radetzki 2013b). Although most studies of commodity price formation have focused on markets with a forward trading component, for which data are much more readily available, a number of alternative methods of price discovery are commonly used (see Radetzki 2013b). ‘Administered’ systems are more opaque and include transfer pricing, posted prices, and (in rare instances) user-dictated prices. More common is private bilateral contracting, discussed at length in this section.

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<sup>36</sup> Like industry structure, the prevailing pricing mechanism in a given market has implications for the price formation process (Slade 1989; O’Hara 2005; Radetzki 2013b). As these authors note, there is considerable debate surrounding the relationship between industry structure and the choice of pricing mechanism as well as how both variables, whether independently or together, influences the price discovery process and price behaviour.

For our purposes, private bilateral (or non-intermediated) contracting is the most salient means of price determination. Bilateral contracting brings together a pair of agents who agree to the terms of a given transaction, or set of transactions, between them (Radetzki 2013b). Historically the norm in commodity markets, it remains the prevailing price-setting mechanism for many industrial minerals and minor metals, and overall commodity volumes traded via private contracting still exceeds that which takes place on organised exchanges (ibid.). Bilateral contracts are commonly concluded on a forward-looking basis. Such long-term contracts (LTCs) govern multiple transactions spanning several months or even years. The explicit terms of all contracts include the commodity grade, quantity, price, and the time and location of delivery. However, rather than being ‘firm once chosen’, the prices specified in relational contracts are regarded as ‘little more than starting points for future negotiations’. As such the terms of these contracts are often vague or ambiguous (Crocker and Masten 1991, 95). As such, LTCs may be considered as a form of ‘relational’ contract (MacNeil 1980; Grossman and Hart 1986; Baker et al. 2002). Parties to LTCs generally ‘attempt to strike a balance between flexibility and opportunism in a variety of ways’ (Crocker and Masten 1991, 73; see also Goldberg 1980, 1985). Uncertainty about conditions at the time of contractual performance is conducive to flexibility, while a high probability of opportunism – or alternatively, confidence about future economic conditions – encourages ‘more precise but rigid agreements’ (Crocker and Masten 1991, 96).

The main trade-off entailed by long-term contracting for buyers and sellers alike has thus been characterised by Rogers and Robertson (1987) as ‘stability at the expense of flexibility’. On the one hand, sellers benefit from guaranteed market access while

buyers are assured of security of supply, obviating the need for backward integration (Klein et al. 1978; Williamson 1985; Goldberg and Erickson 1987). For buyers and sellers alike, long-term contracts are particularly important in the context of asset specificity, i.e. those investments in which transactions with a single specific upstream or downstream firm yield the greatest benefits (Klein et al. 1978; Williamson 1985; Joskow 1985, 1987, 1988). On the other hand, ‘There are times when the issue of market stability is in conflict with the need for an orderly readjustment of the market’ (Rogers and Robertson 1987, 18). Because these contracts generally occur in the context of relationship-specific investments, they create *de facto* oligopoly-oligopsony trading relationships (Hubbard 2001). Somewhat paradoxically, too, the very flexibility and ambiguity of LTCs which in many respects benefits individual market participants also means that they are non-standardised, and as such non-tradable (i.e. illiquid) (compare Telser 1981). Thus friction will be higher overall in markets governed by LTC-determined pricing.

For commodities in particular, these frictions may have crucial knock-on effects for price formation. While LTCs do have the advantage of hedging against downside risk, they also have at least two significant drawbacks. First, they can prove problematic where market prices change significantly enough within a relatively short time period to negatively impact the profitability of one contracting party. Failure to agree on a price can delay shipments and, in the case of commodities that undergo further processing (such as phosphate rock and phosphoric acid), disrupt downstream production. Critically, stalled negotiations between two parties can have dramatic knock-on effects for the entire market. In the case of negotiations that serve to set a

reference price for other market players, these actors may also delay agreeing a new price, thus further disrupting global supply (Radetzki 2013b).

Second, information problems – whether information asymmetries or uncertainty about future cooperation between buyers and sellers – are common in the absence of intermediating devices (Ansar 2010, 323-4). By definition, pricing transparency is generally low for private bilateral contracting. In many cases, however, two (or more) pricing mechanisms may be used concurrently. As such, prices can often be determined by reference to a benchmark set elsewhere, such as on a futures exchange. A benchmark is a well-defined grade of a given commodity, the price of which is used as a basis for pricing other grades from or into the same supply-demand region. Criteria for a robust benchmark include stable short-term production levels; high long-term production levels; a liquid secondary market; and access to production by multiple players. Benchmarks serve two primary functions: they facilitate both price discovery and risk management for a specific grade of a commodity traded within a particular region; and in cases where different grades of a commodity vary significantly across regions, they are used to price these various grades based on factors such as differences in quality. In the latter case the benchmark price acts as the basis for pricing formulae in contracts and tenders (Leaver 2011; see also Fattouh 2010, 2011).

In the case of many commodities with no such reference point – such as phosphate, as we shall see, as well as iron ore and manganese – a benchmark of sorts is set in bilateral negotiations between a major supplier and its customers for the rest of the industry (Radetzki 2013b). Further, for most commodities specialised price reporting

agencies (PRAs) publish pricing developments, though as discussed below, PRAs are private companies whose pricing methodologies are proprietary, and whose reports are generally available on a subscription basis (observation from fieldwork, December 2013). The problem of limited price transparency is exacerbated in contexts with high transaction costs – particularly where one side of a LTC transaction is organised, or concentrated, and the other side is not (Ansar 2010, 324), as is the case in the OCP-India negotiations, discussed below.

Issues of transparency aside, it has been suggested elsewhere that the significance attached to a single benchmark price as a definitive representation of value may be problematic. Çalışkan (2010) has noted that the ‘market price’ is distinct from the prices at which actual transactions take place. Indeed, he takes this thinking a step further, arguing that prices are ‘realised’ through a complex and interdependent set of processes. Of interest here is not so much the implicit view of markets as relational (compare Bathelt and Glücker 2011); crucially, it is that even apart from institutions and agents, prices are also continually shaped by multiple types of market data presented in a variety of ways. In his terms, these ‘prostheses’, which can include supply and demand tables, market reports, and price indices, interact with market agents in a variety of ways. This also means that the pricing and exchange routines ‘are simultaneous and interdependent processes’ (46).

Çalışkan’s (2010) observations relate to his study of cotton trading, which occurs through centralised clearing mechanisms. Yet they are perhaps more pertinent still to the case at hand: whereas cotton markets are characterised by a high degree of market density, liquidity, and transparency, and as such search costs are low, none of these

conditions are present in phosphate markets. Here, however problematic market opacity may be, the examples of other commodities cited above suggest that market agents have a way of devising alternative ‘coping mechanisms’ through which they may anchor their expectations about market conditions even where transparency is low (compare Tversky and Kahneman 1974).

Of course, there may be junctures in time where status quo arrangements can no longer accommodate participants’ usual means of forming expectations. Yet if prices themselves are part and parcel of the price formation process, it stands to reason that substantial ‘exogenous’ changes in price dynamics can prompt market agents to alter their choice of pricing mechanism. These points will become apparent in the empirical sections to follow.

#### **5.4 An anatomy of the global phosphate industry**

By applying the framework laid out in section 5.2, it becomes apparent that the structure of the global phosphate industry has four main characteristics, each of which will be described in the subsections below: geographic concentration of reserves; geographic fragmentation (i.e. lack of integration) of trade; a relatively high and increasing level of vertical integration; and an increasing level of horizontal integration (i.e. firm-level concentration).

##### *5.4.1 Geography of supply*

Phosphate markets comprise three segments. Phosphate rock ( $P_2O_5$ ) is the main naturally occurring form of phosphorus. It is the basic raw material for phosphate fertilizers; at least 85 per cent of global production is used in fertilizers, with the remaining 15 per cent split roughly evenly between other food-related uses (e.g. additives in animal feed, food processing) and non-food industrial uses (e.g. lithium phosphate batteries). Phosphoric acid is an intermediate product which is prepared by combining sulphuric acid with phosphate rock. Finally, finished phosphate fertilisers are produced by concentrating phosphoric acid and adding ammonia ( $NH_3$ ). The two most common phosphate fertilizers are monammonium phosphate (MAP) and diammonium phosphate (DAP).

The global geography of phosphate rock supply is relatively concentrated. Resources are heavily concentrated in the Middle East/North Africa, China, and the United States, with other significant deposits found in Australia, Peru, Russia, and South Africa (Jasinski 2014). As Table 3 shows, the top five producers in 2013 accounted for approximately 80 per cent of total supply, while the top three producers – China, the US, and Morocco – accounted for two-thirds (PotashCorp 2013). China is the largest producer of phosphate rock, but it exports only trivial amounts: in 2010, for instance, it exported 655 KT to South Korea (Weber et al. 2014).<sup>37</sup> Its industry is quite opaque, though it is known that the producer side consists of four major players alongside many smaller ones. The country is a net producer-exporter of finished fertilizers, but due to the seasonality of fertilizer application, it imports small amounts during the peak planting season of November to June. Morocco is the largest exporter

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<sup>37</sup> China's reported production of phosphate rock was roughly 60 MT in 2012 (observation from fieldwork, July 2013). However, data on Chinese production is regarded with special scepticism by market participants.

of phosphate rock, with approximately one-third of market share. The combined market share of the second- and third-largest exporters – Egypt and Jordan, respectively – is roughly equal to that of Morocco (PotashCorp 2013).

**Table 3: Top phosphate rock producing countries, 2012/13**

Country	Mine Production		Reserves <sup>4</sup>
	2012	2013 <sup>e</sup>	
Algeria	1,250	1,500	2,200,000
Australia	2,600	2,600	870,000
Brazil	6,750	6,740	270,000
Canada	900	300	2,000
China (* large mines only)	95,300	97,000	3,700,000
Egypt	6,240	6,000	100,000
India	1,260	1,270	35,000
Iraq	200	350	430,000
Israel	3,510	3,600	130,000
Jordan	6,380	7,000	1,300,000
Kazakhstan	1,600	1,600	260,000
Mexico	1,700	1,700	30,000
Morocco & Western Sahara	28,000	28,000	50,000,000
Peru	3,210	3,900	820,000
Russia	11,200	12,500	1,300,000
Saudi Arabia	3,000	3,000	211,000
Senegal	1,380	920	50,000
South Africa	2,240	2,300	1,500,000
Syria	1,000	500	1,800,000
Togo	870	900	30,000
Tunisia	2,600	4,000	100,000
United States	30,100	32,300	1,100,000
Other Countries	5,500	5,630	520,000
<b>World Total (rounded)</b>	<b>217,000</b>	<b>224,000</b>	<b>67,000,000</b>

(Source: US Geological Survey, 2014)

Production of phosphoric acid is concentrated in Morocco, North America, China, Tunisia, and Brazil. For DAP, China is the world's top producer and second-largest exporter, behind the US. Along with the next-largest DAP producers – India, Morocco, Russia, and Tunisia – these six countries account for approximately 85 per cent of global production (Weber et al. 2014, 279). Finished fertilizer supply comes overwhelmingly from China, the US, India, Morocco, Russia, and Tunisia, which together account for 85 per cent of global production

China accounts for about a quarter of global phosphate fertilizer production and consumption (Liu et al. 2008 cited in Weber et al. 2014, 279); because most of this is internally generated, the country is considered its own separate market. In the past decade, combined DAP and MAP exports from China have not exceeded 6MT (PotashCorp 2013). Phosphate fertilizers are considered a strategic resource, and so the government imposes export tariffs during the peak season. The tariff rate had previously stood at 35 per cent but was temporarily increased to 135 per cent in 2008 (Weber et al. 2014, 288). However, in late 2013 China lowered its export tax, which some observers view as an early (if tentative) indication of a sufficiently large increase in domestic output to mark its entry into world markets as a significant player (observation from fieldwork, December 2013).

Since the 2008 price spike the geography of new and potential future supply has shifted. Most increases in export-oriented production are expected to come from Morocco's OCP and Saudi Arabia's Ma'aden (PotashCorp 2013). As well as increased production of all three products in Morocco [see chapters 2 and 4], significant new supply will also come from Saudi Arabia, which has an estimated 211 MT of reserves and produced 3MT of phosphate rock in 2013 (USGS 2014). Ma'aden, the Saudi national mining corporation, has further competitive advantages in that it benefits from substantial domestic sources of sulphur, ammonium, and energy, as well as from subsidised transport and substantial export capacity. Saudi Arabia is projected to expand production capacity of DAP to 3 MT by the end of 2016 (Ma'aden 2013). Due to its geographic proximity to India, it is becoming a major supplier to that market. Apart from Morocco and Saudi Arabia, new supply will also

come from Australia and Latin America, notably Brazil and Argentina. Although significant offshore deposits of phosphate rock have been discovered in a number of regions, notably New Zealand and Namibia, production from such resources has the disadvantage of requiring dechlorination.

The proportion of reserves under state ownership is among the highest of all mineral commodities: 66 per cent at the global level (30 per cent excluding China) (Ericsson and Gylasjö 2012, 3). As Al Rawashdeh and Maxwell (2011, 16) point out, this is due not only to the legacy of socialism in China and the former Soviet Union but also a belief in the benefits of state ownership in other significant producers including Morocco, Jordan, Tunisia, Senegal, and Togo. While it has been claimed that ‘supply and demand of phosphate rock are less and less a solely economic matter’ (HCSS 2012, 42), in truth, phosphate markets have historically been characterised by concentration, interventionist government policy, and a high proportion of state ownership. Imbalances in global supply and demand of mineral commodities during the 2000s led to the implementation of a variety of trade barriers in many countries.

**Table 4: Top phosphate rock producing companies in 2009**

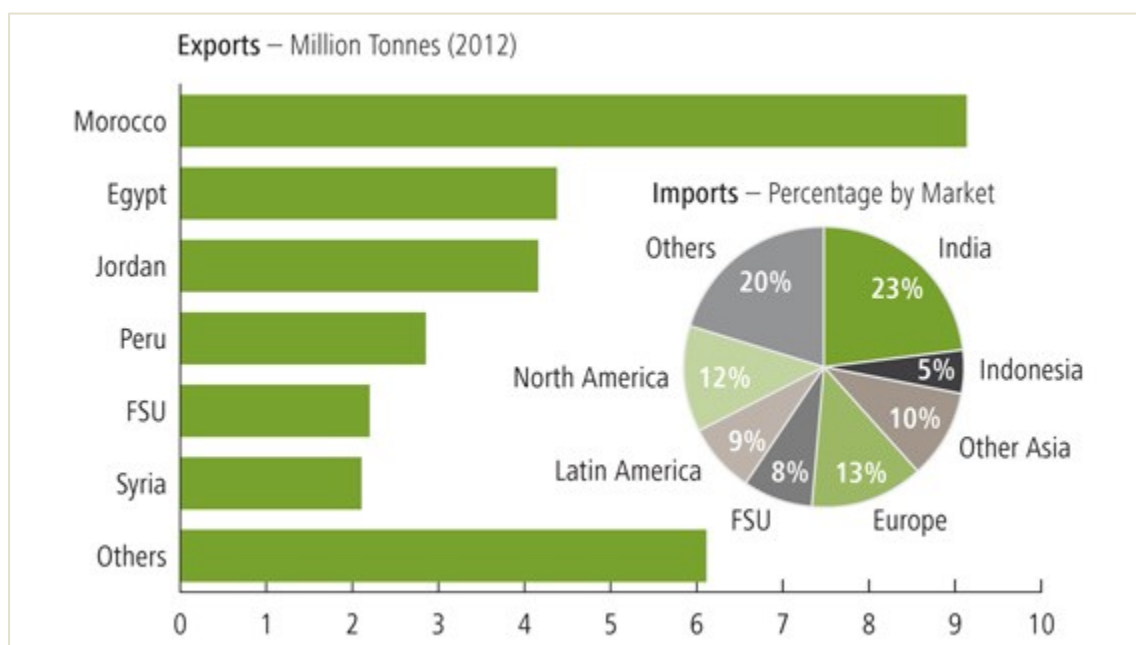
<b>World Rank</b>	<b>Company Name</b>	<b>State Ownership?</b>	<b>Country</b>	<b>Controlled Production</b>	<b>Share of World</b>
2009				2009 (Mt)	2009 (%)
1	OCP	Yes	Morocco	24.0	14.46
2	Mosaic Co, The		USA	14.1	8.52
3	Cie de Phosphate des Gafsa	Yes	Tunisia	7.0	4.22
4	Potash Corp of Saskatchewan		Canada	6.7	4.03
5	Jordan Posphate Mines Co	Yes	Jordan	6.0	3.61
6	Bunge Ltd		USA	3.0	1.83
7	General Co for Phosphates and Mines	Yes	Syria	3.0	1.81
8	CF Industries Holdings Inc		USA	2.8	1.69
9	Millennium Investments Elad		Israel	2.7	1.62
10	State of Egypt	Yes	Egypt	2.5	1.51
11	Foskor	Yes	South Africa	2.3	1.39
12	Incitec Pivot Ltd		Australia	2.0	1.20
13	JR Simplot Co		USA	2.0	1.20

14	Agrium Inc		Canada	1.9	1.14
15	Entr. National de Fer et des Phosphates	Yes	Algeria	1.8	1.08
16	Yara International ASA	Yes	Norway	1.2	0.70
17	Monsanto Co		USA	1.0	0.60
18	Anglo American plc		UK	0.8	0.50
19	Office Togolaise des Phosphates	Yes	Togo	0.8	0.48
20	Ste Senegalaise des Phosphates	Yes	Senegal	0.7	0.42

(Source: Ericsson and Gylesjö 2012)

That said, while the global extractive sector as a whole witnessed a resurgence of resource nationalism in response to the super-cycle of the 2000s as producer nations sought to capture a greater proportion of the value of their resource wealth (HCSS 2012, 44), trends in the phosphate industry have tended slightly more towards privatisation. Specifically, against a history of joint public and private ownership (Al Rawashdeh 2008), full privatisation of companies in which the state had held a stake has become more prevalent (Al Rawashdeh and Maxwell 2011, 16).

**Figure 4: Major Importers and Exporters of Potash**



(Source: PotashCorp 2013)

While phosphate reuse does not yet pose a challenge to phosphate mining, market participants acknowledge that technological advances in recycling remain a distinct possibility in the long term.

#### *5.4.2 Geography of demand and trade*

Demand for phosphate fertilizers, as for all mineral and other commodities, is directly related to changes in income. As a general matter, phosphate demand follows an inverted U-shaped curve, since usage is also related to a country's stage of economic development: beyond a certain level of per capita income, technological improvements and other efficiency and recovery measures will be employed to reduce the intensity of fertilizer application (Al Rawashdeh and Maxwell 2011, 19).

Historically the short-run price elasticity of demand for phosphates was – in contrast to most minerals – relatively high, although elasticity appeared to decrease significantly during the 2007/08 price spike (ibid., 20).

Government subsidies are also a critical determinant of phosphate demand. In India, for example, fertilizer subsidies accounted for over 1 per cent of GDP from the mid-1970s to the early 1990s (Al Rawashdeh and Maxwell 2011, 21). Reductions in Indian fertilizer subsidies led to reduced demand in 2011-12, although the government increased this subsidy again by \$400m in 2013. Given the critical importance of agricultural inputs such as fertilizer to rural livelihoods, a complete elimination of the subsidy programme is widely considered politically untenable, not only in India but also elsewhere in the developing world. On the other hand, nutrient management plans have been introduced in many developed countries to reduce the

environmental impact of over-application of fertilizers, and in future it is reasonable to expect that many emerging economies (notably China) will follow suit. Biofuels have also accounted for a share of fertilizer demand growth in recent years.

The top three phosphate fertilizer consumers – China, the US, and India – together accounted for 58 per cent of global demand in 2008 (Liu et al. 2008 cited in Weber et al. 2014, 279). Asia accounts for nearly 60 per cent of total global phosphate consumption, of which China accounts for half (PotashCorp 2013). This is due not only to the absolute size of the market but also to the prevalence of phosphate-intensive fruit and vegetable cultivation (ibid.). India is the largest importer of phosphate rock, which it sources from Jordan, Morocco, Egypt, Togo, and Vietnam (Weber et al. 2014, 279). Latin America's significance as both a producer and a consumer is growing. Currently 45 per cent of phosphate production is consumed within the region. However, Brazil has become a major market for finished fertilizers. Peru, once the region's only globally significant phosphate rock exporter, is now a major agricultural exporter, and so an increasing share of that country's output is consumed domestically.

Global trade in phosphates is not spatially integrated. Relatively little global phosphate rock production – only 30 of the approximately 200MT produced annually – is traded internationally. Here again, the supply side is quite concentrated, with the top six exporters accounting for roughly three-quarters of international trade (see Figure 4 above). Trading is not only relatively thin but also geographically fragmented. Since transport costs account for a relatively high proportion of traded rock's value, supplier-consumer proximity is an important determinant of trade

patterns (Rawashdeh and Maxwell 2011, 24). At the same time, in recent years rising demand coupled with declines in reserve sizes and grades means that many large exporters, such as the US and China, are increasingly relying on imports (HCSS 2012, 43). Similarly, only a small proportion of phosphoric acid is traded. This is due to the limited number of buyers: not only is the number of plants limited, at 200-300 globally, but much of this stage of production is also integrated within mining firms. Transport costs, while variable, are also an important factor in shaping the geography of finished fertilizer trade, particularly given the high energy prices of the past decade (Weber et al. 2014, 288). As will be discussed below, production in all three markets is following a trend towards greater vertical as well as horizontal concentration, both of which will contribute to greater geographic fragmentation of trade.

#### *5.4.3 Industry structure – vertical integration*

Historically, most phosphate rock miners exported their raw product to consuming countries for processing. Only in the past two decades has trade in processed phosphates grown (Al Rawashdeh and Maxwell 2011, 23). However, the ‘natural’ tendency of the industry is towards vertical integration. Given that approximately nine-tenths of global phosphate rock supply is used in fertilizer production, vertical integration yields efficiency gains in the form of economies of scale, as well as the minimisation of wastage, and hence also environmental benefits (HCSS 2012, 47).<sup>38</sup> At times of high prices for phosphate rock and other feedstocks, vertical integration is still more advantageous as it entails significant producer cost savings (PotashCorp 2013). Price volatility also encourages vertical integration, as ownership of

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<sup>38</sup> However, relative to many other mineral commodities the value added of processed phosphate products is not high (see Al Rawashdeh and Maxwell 2011, 24).

downstream assets allows producers to hedge more easily against price fluctuations. This strategy was followed by several upstream producers in, for example, the late 1980s (Al Rawashdeh and Maxwell 2011, 23).

Currently 70 per cent of the phosphate market is vertically integrated (Potash Corp 2013), a proportion that is set to increase still further in the coming years. That the phosphate fertilizer industry is *not* more integrated is something of an accident of history. From a producer perspective, there are efficiency gains to be had from investing in phosphoric acid production facilities, which require lower capital expenditure relative to fertilizer production. In addition, because phosphoric acid is essentially a more concentrated form of phosphate, exports require lower transportation and storage costs than for phosphate rock. However, India, the largest global fertilizer importer, offered a subsidy for phosphoric acid imports. The market for phosphoric acid has thus been described as an ‘artificial segment created by’ Indian policy (observation from fieldwork, December 2013).

The rise in phosphate prices since 2007/08 has, however, encouraged many market players to move from phosphate rock purchases to direct fertilizer purchases. Mosaic, for instance, previously exported approximately 10 MT of phosphate rock per year, but since entering the finished fertilizer market in 2010 has imported 1-2 MT/year.<sup>39</sup> Other companies such as OCP, Norway’s Yara, and Egypt’s OCI have made foreign acquisitions (HCSS 2012, 47).

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<sup>39</sup> This is also due in part to a decline in domestic phosphate rock production: apart from falling reserve grades, there are also licensing constraints on new reserves in the US because of the potential impacts of mining activity on wetlands (observation from fieldwork, December 2013).

Vertical integration will have three main consequences for global phosphate markets. Apart from the positive development of efficiency gains in the overall production process, integration has also made supply chains ‘more vulnerable to international shocks’ (Ott 2012, 16). Indeed, the emerging landscape of the global supply chain has been compared to a ‘just-in-time’ manufacturing model, in which production is completed close to the time of sale to lower inventory costs. Finally, global integration is leading to greater competition by placing pressure on the downstream end of the market. Lower availability of raw phosphate rock may place pressure on companies that already own phosphate beneficiation infrastructure. For instance, OCP’s increased market share in downstream production may place pressure on non-integrated fertilizer companies that source high-quality Moroccan phosphate rock (PotashCorp 2013). Some players, particularly in the US, have already disappeared.

#### *5.4.4 Industry structure – horizontal integration/market concentration*

On a global level, despite the geographic concentration of resources and phosphate rock production, and despite the presence of large players such as OCP and Mosaic, corporate concentration of phosphate rock mining is not particularly high outside of China and Russia (neither of which publishes data on mine ownership) (Ericsson and Gylesjö 2012, 3). Downstream, corporate concentration is particularly evident in certain regions. For instance, within the US, there exist only seven phosphoric acid producers, of which three account for four-fifths of total production (Huang 2009, 10). Moreover, there has been some consolidation of the industry in recent years. It is widely believed that China is in the process of consolidating its domestic industry, though very few details of this process are known even within the rest of the industry

(observation from fieldwork, December 2013). Market consolidation in the US has further increased recently with the acquisition of CF Industries' phosphate operations by Mosaic in October 2013 (Traganida and Milam 2013). Within other major producers such as Morocco, Russia, Tunisia, and Saudi Arabia, not only is extraction already the exclusive preserve of a state-owned monopoly; many of these companies are expanding output of finished fertilizers. Most notably, OCP plans to triple domestic fertilizer production by 2020. On a global level, rising input costs will further contribute to geographic concentration as production will locate close to sources of raw materials and energy (Weber et al. 2014, 288).

Until recently there did exist one phosphate cartel, PhosChem, which was responsible for marketing the output of North America's two largest phosphate rock exporting companies, PotashCorp of Saskatchewan and Mosaic. Its sales accounted for 60 per cent of North American and 10 per cent of overseas trade (Nickel 2013). Along with two potash cartels – Canpotex, the North American producers' association, and the two-member Belarusian Potash Co. (BPC), which had fallen apart in the summer of 2013 with the exit of Belaruskali, the Belarusian state-owned producer – PhosChem accounted for 70 per cent of global phosphate and potash trade. In October 2013, however, it was announced that PhosChem would be disbanded: since PotashCorp accounted for 93 per cent of its sales but was increasingly marketing its own output directly, and since Mosaic had formed a joint venture with Ma'aden to gain more direct access to the Indian market, the cartel was deemed to have lost its relevance (Donville 2013; Nickel 2013).

Market concentration makes phosphate rock and phosphoric acid vulnerable to anti-competitive pricing. As the sections below will describe, this is one of several factors contributing to the opacity of the price formation process in both markets.

## **5.5 The phosphate price formation process**

### *5.5.1 History of price behaviour*

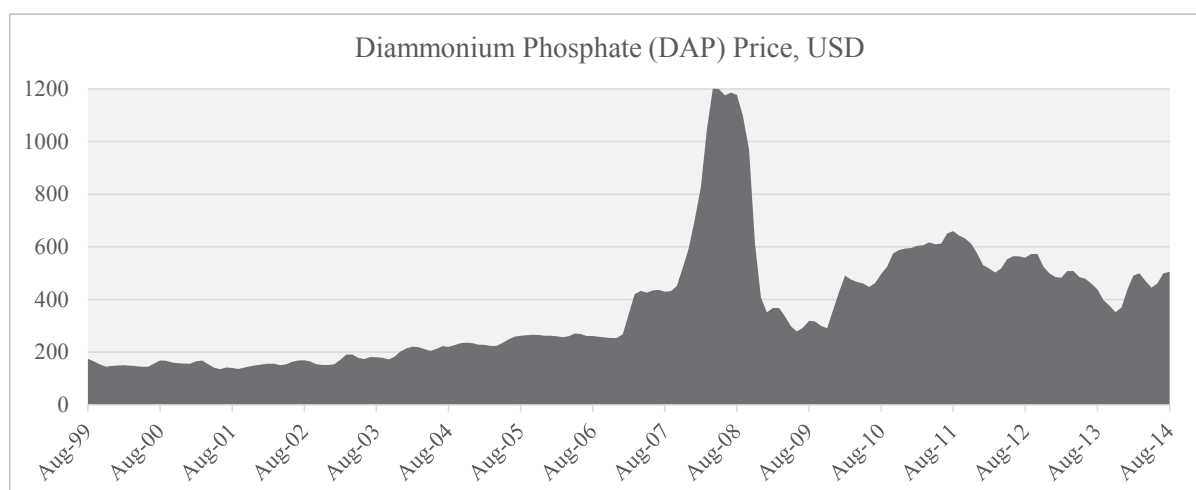
Phosphate markets have not witnessed such upheaval since the mid-1970s when, in the aftermath of the 1973 oil embargo, Morocco decided to emulate the apparent success of the Gulf oil producers by using its ‘quasi-monopoly’ power to force a fourfold increase in phosphate prices. However, in both oil and phosphate markets price rises had similar effects, encouraging as they did the entry of higher-cost producers into the market and thus driving down prices. This strategy suffered a further setback with the onset of a global recession which, coupled with higher prices, discouraged farmers from applying phosphate fertilizers (Crowson 2006 cited in Al Rawashdeh and Maxwell 2011, 16, n.2; Joffé 2009).

Over the 30 years (1976-2007) following phosphate prices – though still characterised by volatility – remained relatively stable, ranging between US\$30-50 in nominal terms (Weber et al. 2014, 280). Perhaps the most notable event during this period was the fall of the Soviet Union in 1989: not only did fertilizer production fall as a result, the move to a market-based economy in former USSR nations meant that fertilizers were no longer subsidised, leading to reduced demand as well. Over the next 15 years existing large producers such as Morocco and China gained market share, while capacity was added in other nations, including Australia, which became a significant

producer (Al Rawashdeh and Maxwell 2011, 16). However, low prices also encouraged producer complacency and sowed the seeds of the 2007/08 price spike. Fertilizer prices began rising in 2002 (Ott 2012, 8); by this point, a supply-demand gap was already apparent due to a failure to invest in capacity expansion to meet accelerating emerging-market demand (see chapter 3 of this thesis). Higher energy prices also contributed to higher production and transport costs (Al Rawashdeh and Maxwell 2011, 22). In turn, higher grain prices – also the consequence of supply pressures, notably adverse weather shocks in 2007 – encouraged farmers to increase crop plantings (Ott 2012, 14).

The resulting further intensification of demand for fertilizers proved to be the decisive factor that caused prices to skyrocket. As shown in Figure 5, DAP prices quadrupled from \$300/tonne in 2006 to nearly \$1200/tonne two years later. The spike in phosphate rock prices was still more pronounced: from a previous equilibrium of about \$50/tonne, the price rose eightfold over the same period (see chapter 3). Prices began dropping sharply in late 2008 as lower crop prices and tighter credit availability in the aftermath of the global financial crisis led to softening demand (Weber et al. 2014, 283). DAP prices have since moderated at around \$700/tonne, while phosphate rock prices have held relatively stable at \$150-170 tonne – in both cases, well below the 2007/08 peak but dramatically higher than previous equilibria.

**Figure 5: DAP Price 1999-2014**



(Data: World Bank, per IndexMundi, 2014)

In addition to this change in price levels, volatility has also increased since 2008.

Annual phosphate rock price volatility has more than doubled from 12 to 28 per cent, while DAP prices, which had previously fluctuated by about 20 per cent, now vary by 40 to 50 per cent (observation from fieldwork, December 2013). On the whole, however, phosphate rock and phosphoric acid prices are relatively stable, particularly since the move in 2008 to quarterly rather than annual price negotiations (see below). In one quarter, rock and acid price variability is now typically \$15/tonne, whereas for fertilizers it may be as high as \$80/tonne (observation from fieldwork, December 2013). Volatility is driven by fundamentals, particularly factors related to the structure of the industry. Short-term supply of fertilizers is determined by plant capacity, which in most cases runs close to 100 per cent. In the longer term, there is a three- to five-year lag between the decision to invest in new capacity and the commencement of production. Farther down the supply chain, most fertilizer producers keep low inventories of inputs, particularly if they are reliant on imports; the length of global supply chains makes the market still more vulnerable to shocks (Weber et al. 2014, 282).

Whether these new price dynamics represent a ‘new normal’ is not clear. In the longer term, demand growth for phosphate fertilizers is projected to continue at a rate of 1.9 per cent per annum to the end of this decade (IFA 2014). Despite the slowdown in global economic growth in the wake of the 2008 global financial crisis, demand for agricultural products from emerging economies is expected to remain strong (Weber et al. 2014, 282). Conditions on the supply side, on the other hand, are subject to greater uncertainty. While expanded capacity from major producers such as Morocco and Saudi Arabia, as well as the entry of higher-cost producers may drive down prices in the medium term, a sufficiently steep drop in prices may force these new producers out of the market. The opacity of the Chinese industry makes such long-term forecasting particularly difficult.

#### *5.5.2 Pricing conventions*

Phosphate rock is thinly traded: as noted above, only about 15 per cent of total global production is traded internationally. Phosphoric acid trade is similarly concentrated: India accounts for over 50 per cent of global phosphoric acid trade, with Moroccan imports meeting roughly half of its requirements. In both cases the market structure is oligopolistic-oligopsonistic. There is very little spot trading; most transactions occur via long-term bilateral contract, usually between specific phosphate mines and industrial users (von Horn and Sartorius 2009, 50). Previously these were long-term (one- to three-year) contracts negotiated on an annual basis, with prices determined by a formula based on phosphate rock production costs and negotiations mainly concerned with managing exogenous changes such as inflation. These trading arrangements have been likened to a ‘gentleman’s agreement’ between buyers and

sellers (observation from fieldwork, December 2013). Since 2008, however, contractual negotiations take place on a quarterly basis, with prices for both phosphate rock and phosphoric acid are set by finished fertilizer prices, as will be discussed below.

Fertilizer markets are more competitive, with prices determined to a greater degree by supply and demand. Demand, in turn, is driven by grain prices. More specifically, the cost of fertilizer production sets a price floor, while farmers' willingness to pay sets a price ceiling; subsidies and externalities account for the remainder of the price dynamics. Unlike phosphate rock and phosphoric acid, a spot market exists, though it is not organised; instead, spot-market transactions form the basis for price indices. Price may fluctuate on a weekly or even daily basis.

There is no officially recognised price benchmark for either phosphate rock or phosphoric acid, given that trade is geographically fragmented and there exist many different grades of rock. However, the market has certain reference points for both commodities: for phosphate rock, Casablanca f.o.b. (free on board, i.e. before taxes and transport and insurance costs) serves this purpose, and for phosphoric acid, the India price is considered sufficiently representative given the size of the market. For finished fertilizers, there exist two or three indices: Tampa f.o.b. (free on board) and Baltic Sea f.o.b. for DAP (given that exports from the former once represented 60 per cent of global trade), and prices for OCP-India transactions.<sup>40</sup> Historically, given the importance of the US market, prices determined in the US Gulf for phosphates have

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<sup>40</sup> Attempts are also underway in South Africa to construct an index (observation from fieldwork, December 2013).

been considered a reference point, although the importance of the US has waned in recent years (Ott 2012, 11).

There is no financial component to phosphate rock or phosphoric acid markets. Although there have in the past been three attempts to introduce fertilizer futures contracts, none has succeeded. Most recently, in 1991 futures contracts for DAP were introduced on the Chicago Board of Trade (CBOT). However, trading ceased within three years due to low volume, a lack of liquidity, and low participation (Bollman et al. 2003). On the whole, therefore, the degree to which ‘financialization’ (see chapter 6) affected phosphate fertilizer prices is likely very limited, since the only input to the production process with a financial component is natural gas. Moreover, ‘because many commodity indices and financial products based on these indices do not have fertilizers or phosphorous in their portfolio, the influence of the financial sector on the price of these commodities is probably low (Ott 2012).<sup>41</sup> On the other hand, in recent years there have been limited attempts to introduce centrally cleared hedging mechanisms for fertilizers. Most notably, the Chicago Mercantile Exchange (CME) introduced cash-settled (i.e. no physical delivery) swap futures for DAP in 2011 (Williamson 2011). In Europe, over-the-counter (OTC), cash-settled swaps for DAP were introduced in 2011 and are offered through two brokers (Ott 2012, 21-2).<sup>42</sup>

Phosphate rock and fertilizer prices are assessed by private third-party price reporting agencies, including Fertecon, CRU, and Fertilizer Monthly Bulletin. These entities employ ‘reporters’ who are assigned as points of contact with individual producer

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<sup>41</sup> For a more detailed discussion of the relationship between fertilizer markets and other commodities, see Ott 2012; Weber et al. 2014.

<sup>42</sup> A study by Ott (2012) shows that ‘There is no sign of volatility increasing since the introduction of fertilizer swaps’ (22).

companies on a daily or weekly basis to verify price data. Based on this intelligence-gathering, PRAs publish daily, weekly, and monthly market assessments. They do not produce forward-looking analyses; only one PRA, CRU, publishes a quarterly market outlook. The information generated by PRAs is proprietary, available to market actors only on a subscription basis. It allows individual players to build market intelligence and read the behaviour of other players. Typically companies subscribe to more than one publication in order to cross-check information, or in some instances average the data produced by multiple sources; indeed, one OCP interviewee compared this process to reading different newspapers to gain a more comprehensive and accurate view of current affairs (observation from fieldwork, December 2013). While OCP interviewees described the PRAs' analyses of phosphoric acid and fertilizer markets as reasonably accurate, they noted that assessments of the phosphate rock market are 'more challenging' due to significant information asymmetries. OCP thus takes strategic decisions in this market without reference to the information published by PRAs (observation from fieldwork, December 2013).

The main change to the price formation process for phosphate rock and phosphoric acid has been the duration of supply contracts (and hence the frequency with which they are negotiated). These new arrangements appear to have been instigated by OCP. In late 2007, the company adopted a strategic decision to demand a much higher premium on its phosphate rock contracts with Indian buyers than the few percentage points higher than the previous year which had been customary. It had two main reasons for doing so. First, as outlined in chapters 1 and 4, OCP had newfound ambitions to expand production and thus needed financing for a large-scale capital expenditure programme. Second, the changing market conditions described above

necessitated a more effective means of managing price volatility – not only for OCP and other suppliers, but also for their customers. Rapidly rising prices provided further cover for the requested increase. The company’s ultimate aim was to capture and retain a greater share of all three phosphate markets.

As related by Croset (2012, 56-8), OCP’s commercial director thus entered into the benchmark-setting India negotiations in early 2008 with a mandate to request a price increase of \$130/tonne, rather than the \$15/tonne in line with past practice. This proposal would prove highly disruptive to that year’s round of negotiations: OCP’s Indian buyers quickly left the negotiating table, returning only after a mutually agreed three-week hiatus. However, OCP successfully obtained an increase of \$105/tonne – a premium which, as in previous years, set a precedent for the rest of the market. Since this watershed period, the duration of contracts for both phosphate rock and phosphoric acid has shortened: most are now set on a quarterly basis, though in some cases the duration may be as short as one month or as long as nine months.<sup>43</sup> This change reflects the needs of producers and consumers alike to hedge against greater price volatility. The 2007 DAP price spike, while beneficial to producers in the short term, also gave rise to fears of a subsequent price collapse. Lock-in to long-term contracts was therefore desirable to neither producers nor consumers.<sup>44</sup> Additionally, according to OCP, rather than a ‘cost-plus’ pricing model, contracts for both phosphate rock and phosphoric acid are now based on a ‘fertilizer-minus’ formula.<sup>45</sup>

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<sup>43</sup> For example, in mid-2009 OCP adopted monthly phosphoric acid contracts with Indian customers as a short-term response to lower and more unstable prices (Nash 2009).

<sup>44</sup> That said, it is not clear whether shorter-term contracts were initially imposed on the market by OCP or adopted as a mutually amenable strategy for managing price volatility.

<sup>45</sup> If this is indeed the case, it is unclear whether higher margins entailed a new formula from the outset, or whether this was adopted later.

## 5.6 Implications and conclusions

As discussed in chapter 3 of this thesis, the 2007/08 phosphate price spike revealed something of a blind spot in our knowledge of global fertilizer markets: how prices for this important commodity are determined, and how this process has evolved over time. The purpose of this paper was therefore to open the ‘black box’ of the price formation process for phosphate rock and its main derivative products. In order to do so, it has been necessary to construct an anatomy of global phosphate markets: a description of the structure of the industry; the means by which its outputs are priced; and how the former, among other factors, influences the latter.

To begin this task, the paper has posited three methodological ‘pillars’ upon which to base a description of a commodity market: first, a selection of broad insights from theoretical literature on industrial organization and market microstructure; second, a concern with instances or particular cases; and third, reliance on insights gained firsthand from field research. Building upon these three pillars, the paper has been able to explore, in a more holistic manner than has been attempted in many previous descriptive studies of commodity markets, some of the interrelationships between industry structure, pricing mechanism(s), and indeed price dynamics themselves. It has been shown that in the case of phosphate, changing price dynamics may be considered a third, quasi-‘exogenous’ variable which may force change upon both industry structure and the institutions of the price formation process. The paper’s findings are consonant with past research to the effect that the price formation process in any market is in no small part the result of path dependency and spatial organisation.

In the case described here, it has been shown that changes in supply and demand conditions and the resulting 2007/08 price spike had two knock-on effects for the mechanisms by which phosphate products are priced. First, to borrow Rogers and Robertson's (1987) phrase, by shortening the duration of contracts, market participants opted for flexibility at the expense of stability. At least for the nearer term, adjustments in contractual form to a somewhat more 'spot-like' arrangement, coupled with hybrid forward/physical hedging strategies by major producers, have created mechanisms for coping with price volatility without bringing the market any further along the notional evolutionary continuum towards exchange-based futures trading. In other words, this hybrid solution represents a second-best that is a function of the 'natural' concentration of the industry and of geography splitting the stages of fertilizer production.

Second, the points of reference by which phosphate is priced have shifted. It was already the case that rather than a single benchmark price, agents rely on a handful of reference points when making pricing decisions. If it is indeed the case that prices for raw materials (phosphate rock and phosphoric acid) are now set by reference to an end product (DAP), this would suggest that the uncertainty surrounding near-term supply and demand dynamics is such that market participants lack confidence not only in the stability but also in the depth of phosphate rock and acid markets, in contrast to the relatively more liquid and transparent market for DAP. On the face of it, such a convention might seem curious, not least because it is unprecedented among commodities. Moreover, 'anchoring' in this way has been shown to be subject to cognitive bias among individual agents (see Tversky and Kahneman 1974).

Yet the lack of a readily identifiable reference price for phosphate (akin to Brent or WTI for oil in a given region) does not seem particularly problematic: market participants appear to regard the more relational nature of price discovery for phosphate as a ‘satisficing’ solution to the ‘problem’ of the lack of an atomistic market structure with a central clearing-house. In this way, much as Hayek (1937, 1945) suggests, market prices have far less significance as definitive expressions of value than as ‘symbols’ – or alternatively, as anchoring devices – which can at best approximate aggregated market knowledge in abbreviated form. This insight is consonant with Çalışkan’s (2010) finding that the notion of a single ‘market price’ is problematic, and that instead the pricing and exchange routines ‘are simultaneous and interdependent processes’ (46).

As commodities go, phosphate is an unusual case: not only for the degree of concentration and opacity of trading practices, but also for the extent to which the financial sector has thus far remained removed from its involvement in production and trade alike. The final substantive chapter of the thesis takes up this issue, and so in an important sense approaches the topic of commodity trading from an entirely different angle – and perhaps offers a glimpse at some of the forces that may come to bear on phosphate markets in the future.

## CHAPTER 6 | The financialization thesis revisited: Commodities as an asset class

### 6.1 Introduction

Long a subject of interest in economics, commodity price dynamics have attracted a great deal of interest across the social sciences over the past decade. It is increasingly recognised that commodity prices are an expression of medium-term supply and demand factors, and thereby a driver rather than a direct reflection of absolute physical resource scarcity (Krautkraemer 1998). At the same time, short-, medium-, and long-term commodity price behaviour have important and varying implications for macroeconomic growth in producer and consumer regions alike, as well as for market agents.

Commodity markets experienced an unprecedented price boom beginning in 2002, punctuated by a sharp drop in the wake of the global financial crisis in 2008 but subsequently recovering, or at least approaching, previous highs. The boom is widely considered an instance of a *super-cycle*: a strong and sustained rise in (primarily industrial) commodity prices driven by demand from emerging market economies, in this case led by China. For certain commodities, notably oil, price volatility has also been unusually pronounced during this period, potentially due to a variety of factors including those driving the boom. Much has been written about the super-cycle and the ways in which it reflects short-term, cyclical, and structural dimensions of commodity prices. While there is little dispute that the super-cycle represents an unusually strong and long-lasting upswing, for a great many observers, the price

dynamics of the past decade cannot entirely be accounted for by reference to ordinary cyclical supply and demand factors.

From roughly the same time as the beginning of the upswing in the super-cycle, financial investors such as pension funds, hedge funds, endowments, and sovereign wealth funds have injected enormous amounts of capital into commodities, as evidenced not least (if indirectly) by the rapid growth in the volume of contracts traded on futures exchanges – a figure that increased roughly sevenfold between 2000-2010 (UNCTAD 2011, 15). This trend strongly suggests to many observers that price movements, if not price levels, are shaped not only by supply shocks, burgeoning emerging-market demand, or indeed any other changes in fundamentals. Instead, commodity markets are said to have become ‘financialized’. These suspicions have only been heightened by dramatic commodity price spikes, most notably the apparent oil price bubble from 2006-2008 and food price rises in 2008 and 2010. While these two trends – high prices and record volatility (at least in oil markets) on the one hand, and dramatic investor interest in commodities on the other – have roughly coincided, definitively proving causation between them in either direction is exceedingly difficult (UNCTAD 2011; Bos and van der Molen 2013, 4). Nonetheless, because of the actors involved and their suspected effects on prices of such critical resources as oil and basic foodstuffs, financial investment in commodities has become a political hot-button issue. Accordingly, an enormous volume of quantitative empirical studies as well as academic and policy-making commentary seeking or offering an explanation has been produced. Yet to date there is no firm consensus on whether, let alone how, such investment shapes prices.

Of course, derivatives trading has been of long-standing interest to market theorists, constituting as it does part of the wider project on financialization. In the broadest sense, the financialization project has proposed a governing logic that has encouraged the growth of the financial sector and the spread of so-called financial innovation and, in turn, infused firms and industries – not to mention individuals, households, and entire economies (French et al. 2011, 799). However, Muellerleile (2009) has observed that ‘On the whole, the concept of financialization as studied in the social sciences remains imbued with an almost atmospheric quality, omnipresent but absent of context or cause’, and empirical case studies have been few and far between (French et al. 2011).<sup>46</sup> At the same time, for all that natural resources and financialization alike have been on the social science research agenda for some time, the intersection between commodities and financial markets has received less in-depth treatment (but see Labban 2010 for a notable exception). The case of commodities therefore offers a rich and timely opportunity to match conceptual foundations with empirics.

This paper argues that, while not entirely misplaced, critiques of financialization in commodity markets are problematic in several important respects. At their most crude, they reflect a wider suspicion of market agents – whether financial or otherwise – which in turn glosses over the complexities of the commodity price formation process. Such suspicion of commodity trading is far from new, being what Miller (1997) has called ‘standard visceral reactions against middlemen and speculators’. Further contributing to a lack of clarity is the semantic and conceptual

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<sup>46</sup> Muellerleile (2009) himself provides one notable exception; see also Pike and Pollard (2010) as well as contributions to the November 2013 special issue of the *Cambridge Journal of Regions, Economy and Society*.

ambiguity evident in many other analyses. At its best, the financialization thesis recognises the central importance of expectations in setting prices. Fundamentally, however, in this context the term ‘financialization’ is still misleading for characterizing the new realities of the commodity price formation process as inherently problematic. Rather than attempting to demarcate ‘purely’ financial investment in commodities from commercial trading, the salient distinction lies in the time horizon over which trading occurs. In this view, the term ‘financialization’ should refer to the growth of ‘hyper’ or very short-term trading that occurs in commodity markets. At the same time, the commodity price dynamics of the 2000s cannot be characterised as a typical asset bubble much like those experienced in other markets in 2008. Put differently, by reducing discussions to a binary between an asset bubble and a cyclical upswing – albeit an unusually strong and long-lasting one – controversies surrounding financialization are in their own way short-sighted. While a modified financialization thesis may help shed a certain amount of light on behaviour of commodity prices in the short term, it has less to say about the long term, overlooking as it does debates about additional, and more profound, systemic changes in commodity markets.

The paper proceeds as follows. The next two sections outline the financialization thesis as it appears across a spectrum of scholarly opinion: while section 6.2 focuses upon perspectives from a number of strands of political economy literature, section 6.3 sketches out the development of commodities as an asset class and outlines controversies about the impact of financial investment on commodity prices as presented in ‘mainstream’ economics and finance literature. The following two sections take the form of a ‘critique of the critique’ of the financialization thesis.

Section 6.4 explores a number of conceptual and semantic difficulties apparent in the literature. Section 6.5 argues that what is ultimately at stake is a suspicion of short-termism in financial markets, and thereafter presents an alternative picture of what precisely is meant by ‘the financialization of commodity markets’. The penultimate section then makes the link to long-term price dynamics in order to demonstrate the misleading nature and limited scope of the financialization thesis. Finally, concluding thoughts are offered.

## **6.2 The financialization thesis and derivatives trading**

Lee et al. (2009) have identified seventeen overlapping (and at times conflicting) conceptualisations of ‘financialization’, all of which overtly or implicitly describe a hegemonic process, logic, or system. As articulated by Epstein (2005, 3), financialization refers to ‘the increasing role of financial markets, financial motives, financial actors, and financial institutions in the operation of the domestic and international economies’. At its heart, financialization is believed to be no less than the totalising realisation of neoclassical finance and economics theory, as (arguably) epitomised in Merton and Bodie (2005). More than simply a pervasive logic, ‘financialization alters behaviour and values in the economy, in society and in governmental institutions and policy regimes. ... [I]t has been aided and abetted by Western states driven to open up markets and globalise their economies’ (Christopherson et al. 2013, 352). While seldom discussed explicitly in relation to commodity production and trading (see O’Neill 2001; Labban 2010 for exceptions), financial logic has arguably pervaded commodity markets at all points along the supply chain, as we shall see. Of primary interest here, however, is that strand of the

literature concerning itself with the proliferation of trade in futures contracts and other financial instruments since the 1970s (Pryke and Allen 2000; Krippner 2005).

The heterodox account of derivatives trading covers a wide spectrum of opinion but can be summarised briefly as follows. The Marxist tradition condemns outright the very existence of financial instruments in all markets as a form of ‘fictitious capital’ (Harvey 1982, 2010). Derivatives, in this view, are conceived as spatially and temporally displaced representations of physical goods, if not a direct replacement of them. At the outset, derivatives have two strikes against them: not only does the exchange of goods in general lack intrinsic value, but because derivatives are no more than abstract representations of an underlying asset, they themselves have no economic worth. At one level, then, this school of thought offers a heterodox theory of value for derivatives which itself has more profound systemic implications. The trading of financial derivatives represents a divorce between the ‘real economy’ and a ‘financial economy’ constituted entirely by ‘disembodied’ or fictitious capital. As such, financial markets have their own ‘space-time logic’ that has no direct bearing on ‘real’ markets (Harvey 2006; Mann 2006 cited in Christophers 2012; see also LiPuma and Lee 2004). Much like credit, derivatives create value through financial channels before the value of the underlying commodity can be realised in production and exchange (Harvey 2006; see also Krippner 2005). As such, their sole (de facto) purpose is believed to be a more rapid and lucrative generation of profit for an elite rentier class. In a word: *‘Finance finances itself, but does not finance investment’* (Duménil and Lévy 2004 cited in Labban 2010, 548, emphasis in original).

It is not difficult to see the salience of this argument to the case of commodity derivatives markets; indeed, oil futures contracts have been dismissed in more than one account as mere ‘paper barrels’ (O’Sullivan 2009; Labban 2010). The sheer number of derivatives traded on a given day in relation to the volume of underlying assets in productive circulation is commonly cited as proof of the ‘fictitious capital’ thesis (Labban 2010; see also O’Sullivan 2009). For instance, figures from UNCTAD (2011) suggest that at the end of 2010, the total number of outstanding contracts on organised exchanges alone exceeded the global total number of barrels of oil produced worldwide by a factor of 2.5. Labban (2010) takes this ‘fictitious capital’ thesis to its logical conclusion. Because commodity prices are governed by a parallel financial logic, ‘circulation of value can precede its production in the labour process and realisation in the market’ (Labban 2010, 550). This, in turn, lays the foundations for a crisis: in the medium term, the bursting of an asset bubble. In the very long term, he obliquely suggests, the financialization of commodity markets may temporarily disguise the ultimate resource crisis: the depletion of oil reserves (551). Implicit here is the idea that the ‘growth machine’ of capitalism, let alone finance capitalism, cannot continue indefinitely, whether due to natural limits (the ‘second contradiction of capital’ (O’Connor 1998) or otherwise (see Harvey 2010).

A less hard-line approach, which both overlaps with the Marxist critique and is shared beyond the heterodox tradition, is concerned not so much with the widespread use of futures contracts per se but with their ‘abuse’ by ‘speculators’ – a term that is rarely defined explicitly but, in contradistinction to hedging, is sometimes implicitly conflated with gambling (Bryan and Rafferty 2006). Less dramatically, the spread of derivatives trading has fundamentally altered economic agents’ conception of risk

such that their ‘focus [is] on risk-reward ratios rather than on absolute risk’ (LiPuma and Lee 2004, 45; see also Pryke and Allen 2000; Bryan and Rafferty 2006).

However, whereas the broad-brush approach accepts unequivocally that the term encompasses *all* trade in financial instruments, which are ‘targets for speculative investment’ (Harvey 2010, 83) apparently by their very nature, the softer critique is somewhat hazy on precisely what types of activities constitute ‘speculation’. What is clear in this view is that, because of the dominance of finance-led capitalism and the ‘time-space compression’ it allows, speculation has a major destabilising effect on commodity markets – and the global economy writ large – in that it contributes to both volatility and asset bubbles. Indeed, financial trading exacerbates the very volatility it is intended to smooth out. Precisely *because* derivatives trading lowers transaction costs, it encourages short-termism and gives rise to price volatility, which in turn wastes resources and shortens the planning horizons of firms and investors (Harvey 2010; Labban 2010, 546; see also Miller 1997). Moreover, this very volatility is what makes derivatives trading profitable (Swyngedouw 1996 cited in Labban 2010, 546). In the medium term, too, financialization accelerates and amplifies the boom-bust cycles that characterise capitalism (Harvey 2006).

Evident here is a condemnation of the short-termism that characterises much of contemporary financial markets. Such alarm is far from new (cf. Strange’s (1986) account of ‘casino capitalism’), though it has certainly been heightened in the wake of the global financial crisis (see Sinn 2010). What is notable is that the association made here between short-termism and contemporary financial markets finds parallels in the ‘mainstream’ of economics and finance. As summarised by Kay (2012), short-termist market behaviour is a twofold phenomenon, at once myopic for its failure to

invest for the creation of durable economic value and hyperactive for its propensity to trade in ever-briefer intervals. It is driven by both human behavioural biases (Clark 2011) and a suite of wider market incentives (see Blood and Gore 2012; Kay 2012). Short-termism in markets is typically associated with the pursuit of self-interested gains, which disrupts the transfer of savings into investment for economic growth. This is particularly true of long-duration projects which ‘yield the highest long-term (private and social) returns and hence offer the biggest boost to future growth’ (Haldane and Davis 2011, 14).

Ultimately, therefore, for its critics financialization is not simply a socially redundant activity in and of itself; it produces deleterious side-effects in that it detracts scarce capital resources from productive investment. Even more than that, in so doing it also creates a governing logic which leads to the mispricing of assets. As we shall see below, this generic argument appears to resonate perfectly in the case of commodity derivatives markets – the archetypical bridging-point between finance and the ‘real economy’.

### **6.3 Commodity trading and the financialization thesis**

#### *6.3.1 The development of an asset class*

The influence of financial markets has, along with supply and demand factors, become the third pillar of discussions about commodity price behaviour of the past decade. The issue of financialization in commodity markets is relatively new in and of itself, even though commodities have been regarded as a component of a well-

diversified portfolio for some time (Greer 1978; Bodie and Rosansky 1980 both cited in Parsons 2010), and deep suspicion of ‘speculators’ in commodity markets dates back centuries. However, it has deeper significance in two respects. On one level, it represents the latest flashpoint in a decades-long debate over causes and remedies for commodity price instability (see Radetzki 2008). On another level, the very problems perceived to have been caused by financialization have taken place against the backdrop of the global financial crisis and the widespread scepticism of finance that has attended it (described in the previous section). The roots of the issue can be traced back to the rise of institutional investors and ‘shareholder capitalism’ ideology beginning in the 1970s, both of which have dramatically increased both the size of financial players and the scope of their reach into new markets (Pike and Pollard 2010). These markets were largely ‘constructed’ in order to satisfy investors’ rate of return targets, a process which can be briefly sketched out as follows.

At the same time as pension funds face growing liabilities, portfolio returns have proven disappointing over the past fifteen years or more, due to both the collapse of the equity market premium of the past 50 years and the long-term decline in discount rates on returns (see Clark and Monk 2013). The bursting of the equity-market bubble in 2000 precipitated this process. The ensuing search for returns led investors into a range of ‘marginal’ markets, both in the sense of alternative asset classes (Leyshon and Thrift 2007) and also of peripheral geographic regions (Clark and Monk 2013). Along with the 2003 decision by the US Federal Reserve to allow banks to invest in physical commodity production, transport, and storage infrastructure, financial deregulation of derivatives markets during the 1990s and early 2000s – notably the Gramm-Leach-Bliley Act of 1999, which partially dismantled the Glass-Steagall Act

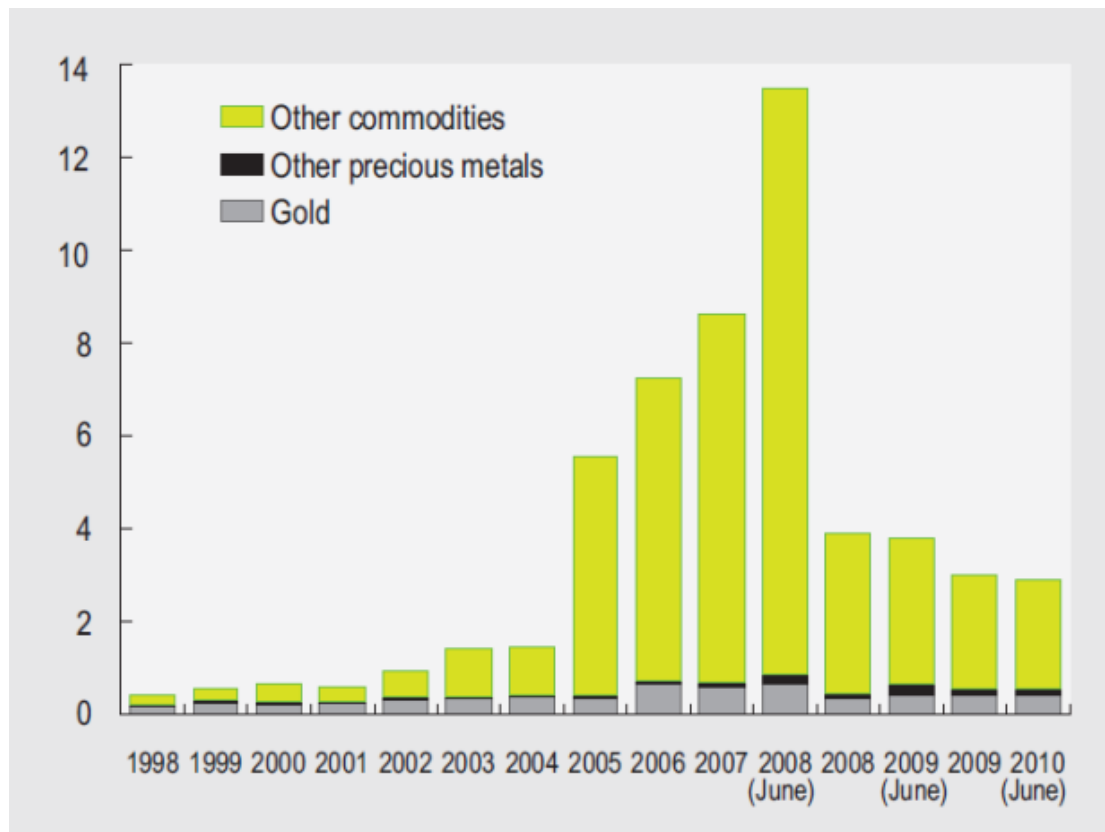
by allowing bank holding companies' involvement in commodity markets, and the Commodity Futures Modernisation Act of 2000, which removed over-the-counter (OTC) derivative trading from regulatory oversight – helped accelerate the development of commodities as one such 'alternative asset class' (Clapp and Helleiner 2012; Valiante 2013).

Market conditions at the beginning of the 2000s were thus ripe for the accelerated development of commodities as an asset class. In a narrower sense, the foundations for the current wave of investment were arguably laid with the creation of the Goldman Sachs Commodity Index (GSCI, now the S&P GSCI), an investment product that has been closely replicated many times over by other financial institutions, in 1991. Beginning around 2003, however, institutional investors bought *en masse* into academic research (notably Groton and van Rouwenhurst 2004) which found a negative correlation between commodity and stock returns (see Tang and Xiong 2010, 9). In essence, they were subscribing to a narrative about global growth and natural resource scarcity: the rise of emerging economies, led by China (and to a lesser extent, India, Brazil, and Russia), was creating burgeoning and unprecedented demand for commodities across the board, driving up their prices to an extent that this market offered an opportunity to earn outsize returns. Investing in commodities thus represented a direct investment in emerging markets: one that promised not only outsized returns but also a means of portfolio diversification and a hedge against inflation. With the onset of the global financial crisis in 2008, this narrative only gained further traction, as returns in 'traditional' asset classes remained disappointing while the long-term growth prospects for the largest and most resource-hungry

economies appeared brighter than for mature markets (if less robust than they had prior to 2008).

While comprehensive and reliable data on financial trading of commodities, including volumes and the number, sizes, and identities of market participants, is lacking, there exists strong indirect evidence of a dramatic increase in financial participation. For example, as already noted, the volume of both exchange-traded and OTC derivatives has risen sharply since 2004: while the number of futures and options contracts traded on exchanges globally has increased from an initial US\$15m to over \$60m in 2010, the notional value of outstanding OTC derivatives grew from less than \$2m to nearly \$14m in mid-2008 (UNCTAD 2011, 15). Total financial investment in exchange-traded commodity derivatives is also estimated to have grown markedly from \$80m in 2005 to \$375m in 2010 (*ibid.*, 16).

**Figure 6: Notional amount of outstanding over-the-counter commodity derivatives, December 1998 – June 2010 (US\$ trillion)**



(Source: BIS 2011)

Financial investors gain exposure to commodities primarily through four channels (UNCTAD 2011, 14-15). Commodity indices, which have attracted the lion’s share of capital (and, accordingly, controversy) are composites of futures contracts on a given range of commodities traded on exchanges. They are largely provided by investment banks: among the best known are the S&P-GSCI (Standard and Poor’s-Goldman Sachs Commodity Index), the Reuters/Jeffries CRB Index, and the Dow Jones-AIG Index. Investors buy into these indices by entering into a swap or other bilateral financial agreement with the index provider, which hedges its exposure through exchange-traded commodity futures contracts. Crucially, and in contrast to more ‘conventional’ speculation on commodity futures markets, these indices comprise only long positions, which are ‘rolled over’, or replaced with longer-dated contracts, close to the date of expiration of the contract. Index investing is considered to be a

passive, longer-term strategy, although indices are typically weighted and re-weighted to capture prices with relatively stronger outlooks. This strategy rests on the assumption that commodities are a discrete asset class with a unique risk premium. In order to be profitable, the market in question must be in backwardation (i.e. the spot price must be higher than the futures price) – a condition implying low inventory levels and a positive convenience yield (Domanski and Heath 2007, 56; Östensson 2012).<sup>47</sup>

A second, and more active, trading strategy entails taking both long and short positions in futures and options contracts. This is more short-termist and somewhat more risky. Exchange-traded products (ETPs), a third type of instrument, have begun to raise concerns because relatively new versions of them are backed by physical commodities, rather than using futures contracts as collateral. Recent market conditions (specifically risk aversion and low interest rates) have only enhanced the popularity of physically-backed ETPs. Finally, structured products, used since 2006, ‘typically combine an underlying asset with a derivative’. Beyond these channels, some banks have entered physical markets as producers (UNCTAD 2011, 42; Valiante 2013).

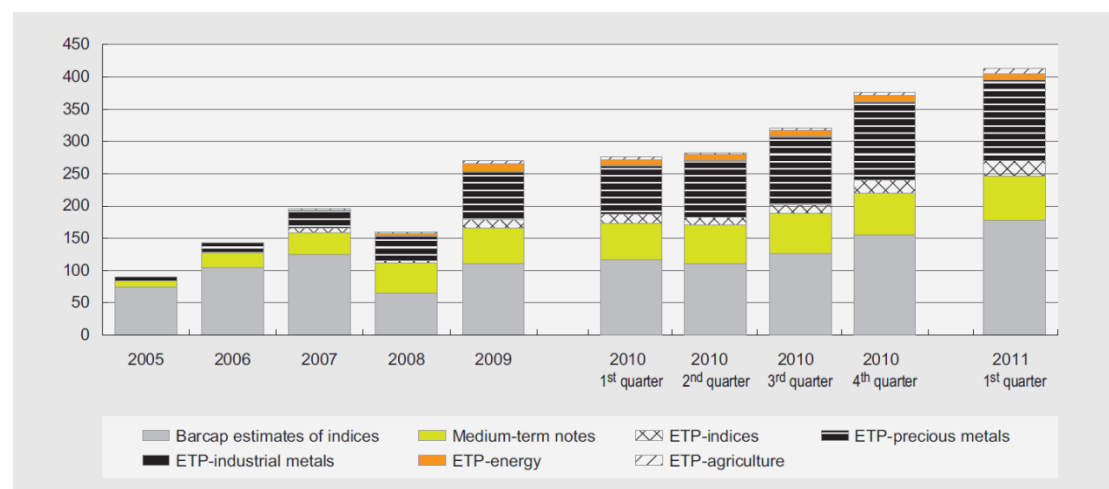
Since the global financial crisis of 2008, investment patterns in the overall asset class also appear to be shifting. At the onset of the crisis, both financial investment in commodities and commodity prices fell in tandem, suggesting to many critics that financial participation had given rise to a bubble which burst along with ‘speculative’

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<sup>47</sup> Investors can gain exposure to commodity index returns via three other financial instruments: commodity index swaps, exchange traded funds, and exchange traded notes. See Tang and Xiong (2010, 6, n.9).

bubbles in other asset classes (UNCTAD 2009, 55). Interest in commodities has, however, not only rebounded and even surpassed previous levels; investors are increasingly pursuing more active strategies and more ‘innovative’ products. Evidence reviewed by UNCTAD (2011, 28) suggests not only that financial investment in commodities has increased still further since mid-2010; the relative share of passive investments in indices has declined from 65-85 per cent in 2005-2007 (the run-up to the crisis) to 45 per cent in 2010.

**Figure 7: Financial investment in commodities, assets under management, by product, 2005-2011 (US\$ billion)**



(Source: UNCTAD 2011)

### 6.3.2 The commodity financialization thesis and antithesis

In this context, therefore, the term ‘financialization’ does *not* denote the trading of derivatives per se, as even ‘genuine’ commercial hedgers use financial instruments (Baffes and Hanriotis 2010). Rather, it refers to the growing and significant presence and influence of participants without a direct commercial interest in a given derivatives market. These actors, which include pension funds, endowments, and hedge funds, trade commodity futures not on the basis of supply and demand

fundamentals but on *short-term* considerations related to managing their own portfolios, including price movements in other asset classes such as equities and bonds (Mayer 2009, 1; UNCTAD 2011, 13). As well as actors on the buy side of the securities industry, entities on the sell side – particularly investment banks – also dramatically increased their participation in both physical and financial commodity markets during the period under discussion.<sup>48</sup> Macroeconomic factors unrelated to commodity supply and demand have thereby come to influence decisions to invest in commodities to an unprecedented degree. Although overall portfolio allocations to commodities remain only a small percentage of total financial-market investments,<sup>49</sup> they are large relative to overall commodity production (Domanski and Heath 2007, 53). Ultimately, though, the proportion of financial participants to commercial actors is thought to be relatively unimportant, as even a comparatively small share of financial trades can conceivably change the behavior of other traders and impact prices (Maugeri 2009, 159-60; Fattouh et al. 2012, 6). The presence of financial investors has thus further promoted the central role played by expectations in price formation (Kemp 2012).

It must be mentioned here that the term ‘speculation’ has typically been used interchangeably with ‘financialization’, although this tendency has lessened of late. Broadly speaking, speculation has been defined as the purchase of a commodity or related derivative in anticipation of profiting from future price changes. It can take

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<sup>48</sup> The role of the sell side was not often explicitly considered in discussions on financialization in commodity markets until relatively recently. While critically important and increasingly controversial, the changing institutional landscape of commodity trading constitutes another sense in which the term ‘financialization’ may be used in this context and thus lies outside the primary scope of this paper (but see Wójcik (2012) for a general discussion of the power of investment banks).

<sup>49</sup> In 2005, commodity futures and options accounted for only 8 per cent of all derivatives contracts traded globally (UNCTAD 2006).

place in physical markets through hoarding and manipulation as well as in financial markets (Baffes and Haniotis 2010). It is, however, extremely difficult to articulate a definition of speculation that is not in some way tautological or at least redundant. Even in the narrower sense of ‘financial speculation’ for which it is often shorthand, the term loses much of its significance – a point that will be revisited below.

This point aside, what is ultimately at stake in controversies about financialization is less the definition of the term than the nature of the influence of financial trading on prices – if, indeed, such an influence exists at all. This is because the relationship between so-called financial investment and futures prices is not well understood (Irwin and Sanders 2010). Nor is the relationship between physical and financial prices well established, despite at least a half-century’s worth of efforts to do so.<sup>50</sup>

Various econometric analyses have yielded evidence in support of both arguments (see Baffes and Haniotis 2010 for a review). While a handful of these studies tend to be heavily cited as strong evidence (if not quite definitive proof) of one side or the other, it is often forgotten that each is making only a relatively modest claim based on a comparatively narrow set of parameters. Nonetheless, both positions can be briefly summarised as follows.

On one side, many observers have found the financialization hypothesis to be counterintuitive and empirically unsound on a number of counts. They believe supply and demand fundamentals to be adequate to explain price dynamics of the past decade, given factors such as the rate of industrialization in China and long lead times on the supply side (Östensson 2012). Moreover, they rightly point out the

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<sup>50</sup> Bos and van der Molen (2013, 4) provide a brief overview of this literature; see also Mabro (2008); Fattouh (2010, 5).

fundamental difference between supply and demand dynamics in futures as opposed to pure goods markets: namely that the supply and demand for futures contracts does not correspond directly to the supply and demand for the underlying commodity, and each position in a futures market must be offset against an equal and opposite position. In this instance, the large demand for futures contracts from investors via index funds must be offset by an equal volume of short positions – and as such, there is no net effect of investment in futures contracts on prices. While it is true that dramatic growth in commodity index investment coincided with sharp price rises, correlation has often been uncritically accepted as a clear indicator of causation (Irwin and Sanders 2010, 3), as exemplified by the highly influential US Congressional testimony of former hedge fund manager Michael Masters (2008). Nor is financial investment in and of itself a particularly convincing explanation for price volatility, since volatility has been experienced to similar degrees in commodity markets without a financial component (Frankel and Rose 2010, 10).

In a normative sense, too, financial investment in commodity markets is not only unobjectionable to these observers; it also has a number of beneficial effects. Futures markets tend to function more effectively with the participation of a greater number of actors – provided they do not engage in herding behaviour. Further, many larger institutions in particular bring superior market intelligence to bear on their trading activities. Perhaps more importantly than market depth, financial investors also provide a degree of liquidity that had previously been lacking (Radetzki 2008; Baffes and Haniotis 2010; UNCTAD 2011; Östensson 2012; Sandor 2012).

For their part, critics of financialization assert that the enormous influx of fund activity from 2005-06 has led to a breakdown in the relationship between commodity inventories and prices (Humphreys 2009).<sup>51</sup> This has been shown in various studies to have had three effects. First, price comovement – both across commodity sectors (Baffes 2009) and between commodities and other asset classes (Baffes and Haniotis 2010) – has been observed. While conventional wisdom had previously held that comovement could not completely be accounted for by fundamentals and that ‘excess’ comovement was caused by herding behaviour on the part of traders (Pindyck and Rotemberg 1990), it now appears more likely that supply and demand variables – most notably the greater share of energy input costs in the production of other commodities – are a sufficient explanation (Ai et al. 2006). As for the observed closer correlation between commodity prices and other asset classes, market-wide changes in risk appetite simultaneously affect demand for apparently unrelated assets in the wake of the global financial crisis (Bank of Japan 2011). Both the degree of correlation and the extent to which it is a lasting phenomenon, rather than simply a byproduct of the extraordinary events of the global financial crisis, remains a matter of dispute (see Büyüksahin et al. 2008), although there is evidence to suggest that algorithmic trading can exacerbate correlations over short periods (Bicchetti and Maystre 2012). Such correlation across asset classes can in principle limit investors’ ability to hedge financial risk.

Second, financialization is alleged to have exacerbated the pronounced price volatility attendant to the commodities super-cycle of the past decade. Commodity market

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<sup>51</sup> As Bryan and Rafferty (2006) point out, some critics argue that financial prices rather than fundamentals are now driving spot prices (see e.g. Tang and Xiong 2010), while others have found the reverse (see e.g. Fattouh and Mahadeva 2012; others). Yet as the discussion above suggests, causality is not unidirectional or indeed linear.

volatility is accepted as inevitable to a certain degree, given that supply and demand are highly inelastic in the short run. Trade on organised exchanges generally reduces price volatility due to greater liquidity and transparency – a point that is borne out not only in principle but by reference to comparisons of price data for traded and non-traded commodities such as iron ore or molybdenum (Humphreys 2009). However, the presence of large participants such as financial institutions or commodity funds can potentially move short-term prices due to their sheer weight in markets – an effect that has been exacerbated by the increasing prevalence of high-frequency trading (UNCTAD 2011). Financial investment is also feared to have volatility spillover effects from other asset classes, or across different commodities (Tang and Xiong 2010).<sup>52</sup>

Volatility is undesirable from a macroeconomic perspective because of its deleterious effects on the terms of trade and fiscal stability of commodity-dependent economies (Cashin and McDermott 2001, 25). Above a certain threshold it can also ‘contaminate’ the price discovery process. Without price stability, hedging for smaller commercial participants becomes more costly, reducing their involvement in the market. Producer and consumer planning also become subject to greater uncertainty, leading to risk aversion and lack of productive investment – and ultimately, further negative repercussions for macroeconomic growth. In these respects, volatility is more salient for policy-makers than long-term price trends (Baffes and Haniotis 2010). It is, however, a difficult problem to manage: any given episode may be driven

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<sup>52</sup> On the other hand, a seminal study by Cashin and McDermott (2001) finds that volatility has increased since the dismantling of the Bretton Woods system of fixed exchange rates, which suggests that commodity price variability may be linked to fluctuations in exchange rates between the US dollar and other currencies (since commodities are priced in US dollars). Domanski and Heath (2007, 64) suggest that volatility has decreased since 2002 in some futures markets, such as crude oil, while increasing in others, such as copper.

by a number of factors, including sensitivity to supply shocks, tighter interdependencies between demand for individual commodities, and (less plausibly) inflation. Moreover, it is known that volatility in futures markets can lead to spot price volatility (Bos and van der Molen 2013, 5).

Finally and most importantly, financial involvement in commodity markets is also widely feared – by financial-market ‘insiders’ and critics alike – to exacerbate boom-bust cycles. Like volatility, bubbles are accepted as inevitable for commodities as well as other markets. Commodity markets are characterised by various types of uncertainty, including medium- to long-term supply forecasts (not least due to uncertainty surrounding URR of finite mineral commodities); incomplete or unreliable inventory data; and incomplete or unreliable data on global supply and demand dynamics. As such, their participants are already subject to herd behaviour (UNCTAD 2011, 60, n.17). The presence of financial investors has been a further important factor in altering the commodity price formation process in such a way that it is driven by expectations formed in conditions of heightened uncertainty. In these circumstances investors attach greater weight to present conditions, and so futures prices will closely track spot prices (Fattouh and Scaramozzino 2011). In more practical terms, one upshot of this breakdown in confidence is that the price formation process is driven largely by short-termist, myopic incentives and therefore prone to herding behaviour and the formation of asset bubbles (Parsons 2010; UNCTAD 2011). Momentum trading has also become a common strategy, with hedge funds and others using statistical analysis to follow or even predict market movements (*ibid.*). Since 2008, algorithmic or high-frequency trading (HFT) has also become more prevalent (Bicchetti and Maystre 2012).

The upshot is that financialization generates unreliable price signals, which causes futures markets to overshoot because financial markets can (over)react to new information more quickly than physical markets can (Dornbush 1976 cited in Mabro 2008). It creates greater overall market uncertainty and sends incorrect signals to producers and consumers. The end results include ‘an immense misallocation of resources’ and, from time to time, asset bubbles (ibid., 34). More problematic still, ‘an imperfect pricing system can continue to survive unchallenged for a long time until a powerful shock or a series of small shocks exposes its weaknesses and limitations and most importantly alters the balance of power (or perceived power) among the main players’ (Fattouh 2006, 95).

#### **6.4 Critique of the critique I: some conceptual problems**

Before proceeding any further with a discussion of what financialization may be, however, it is necessary to clarify what it categorically is *not*. First, it is necessary to debunk the assumption underpinning the ‘fictitious capital’ thesis and the speculation thesis alike: as should be apparent at this point, it does not follow that derivatives are a form of fictitious capital simply because the volume of futures contracts traded is orders of magnitude larger than the volume of physical commodities in ‘productive’ circulation. Unlike in markets for pure goods, the quantity of futures contracts in a given market reflects speculators’ and arbitrageurs’ demand and does not match the supply of the underlying asset one-to-one (Radetzki 2008, Irwin et al. 2009; Smith 2012). Expanded trading in part reflects market expectations of greater price changes (Östensson 2012, 21). On another level, the volume of futures contracts outstanding

can grow so large because margin requirements for exchanges are only a fraction – typically about five per cent – of a given participant’s overall position. In the case of swap markets, the nominal dollar amounts of outstanding swaps are merely ‘notional values’ and ‘bookkeeping conventions’ (Miller 1997); and the difference between two given commodity prices is traded with swaps. In this vein, ‘cornering’ futures markets is not tantamount to cornering in physical markets (Irwin and Sanders 2010, 8) since each position on an exchange must be matched by an equal and opposite position. Thus more trading does not imply more waste: on the contrary – at least in principle – it is a means of price discovery in that traders aggregate disparate information (Miller 1997; Östensson 2012, 21). For all these reasons, the perceived dichotomy between finance and the ‘real economy’ is, as Pike and Pollard (2010) suggest, specious.

Commodity futures trading has been plagued by popular suspicion at least since the founding of the Chicago Board of Trade in 1848, and more recently have been a reaction against the state’s withdrawal from commodity markets beginning in the 1970s in favour of market forces (Radetzki 2008; Sandor 2012). A number of reasons for this popular suspicion, few of which stand up to scrutiny, have been suggested. The transparency of organised exchanges makes price volatility highly visible, while at the same time, these exchanges are perceived to hold a monopoly on information and economic power (Jacks 2001). Such concerns are easily rebutted by reference to work showing that price volatility is lower for commodities with centralised trading (Headey and Fan 2008; Irwin et al. 2009 cited in Irwin and Sanders 2010). In some respects more compelling has been popular ‘indignation over the handsome profits generated by agents’ (Jacks 2001), echoed in the folk assumption that trading exists in part to generate outsized profits for an elite rentier class (see section 6.2 above).

However, such a view confounds two separate normative issues. The implicit critique of the institutional arrangements that permit profits to grow large in the first place is certainly part of a broad-church effort to curb financial trading profits more generally (e.g. European Commission 2013). In this respect, the tide has turned against Miller's (1997) once-orthodox explanation that 'The prospect of trading profits is the 'bribe', so to speak, that society uses to motivate the collection, and ultimately the revelation, of the dispersed information about supply and demand'.<sup>53</sup>

On the other hand, popular suspicion of trading also overlooks the societal benefits of futures exchanges in the form of greater ease of trade and more stable, transparent prices. Early work on the costs and benefits of futures trading tended to focus on these welfare effects (Newbery and Stiglitz 1981; Turnovsky 1983, both cited in Pennings and Leuthold 2000), noting that derivatives trading transmits information to 'promot[e] economically desirable adjustment of commodity stocks, thereby reducing price fluctuations' (Working 1953, 342; see also Pindyck 2004). From the perspective of private gains, the literature further assumes that hedging is motivated by exchange participants' need to balance risk and return (Pennings and Leuthold 2000). Contrast these assumptions with the 'paper barrels' view of derivatives contracts, which fail to consider them as representing a service. Indeed, Miller (1997) has dismissed wholesale critiques of derivatives as a form of 'modern-day Physiocracy', rooted in an 18<sup>th</sup>-century belief that 'the ultimate source of national wealth [is] in the production of *physical* commodities'.

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<sup>53</sup> How large this 'bribe' should be, important and contentious an issue as it is, lies outside the scope of this paper.

A related if somewhat softer assumption commonly conflates financialization with ‘speculation’, and so this latter term has typically been liberally used yet ill defined even in the financial economics literature. Perhaps as a matter of convenience, econometric studies tend to adopt the CFTC’s distinction between commercial and non-commercial traders to divide hedgers from speculators, though these two categories are widely recognised as somewhat arbitrary. Serious attempts to categorise what types of trading activity properly constitute speculation as opposed to hedging typically remain unresolved, as evidenced, for example, by continuing controversy surrounding the CFTC’s re-classification in 2009 of various categories of traders (CFTC 2009). Speculative activities may also reflect a diversity of motivations, and accordingly, the term has both positive and normative dimensions (Fattouh et al. 2012, 3).

It would seem that while there is a great deal of overlap between the terms ‘speculation’ and ‘financialization’, the former more often than not is meant to denote the latter. Even as a matter of convenience this is unhelpful due to the complexities of, and blurry boundaries between, physical and financial trading: many market participants now engage in both physical production and logistics as well as various types of trading (Baffes and Haniotis 2010, 36). But more to the point, crudely equating speculation with trading in futures contracts, as much of the heterodox critique does, is not simply misleading but downright tautological, as ‘Future pricing is by definition speculative’ (Zalik 2010, 554).

## **6.5 Critique of the critique II: short-termism (and costs thereof) as problematic**

If neither semantic distinction – between hedging and speculation, or between physical and financial trading – can be satisfactorily made outside a textbook, it is because both overlook the rapidly evolving temporal dimension to financialization alluded to in section 6.2 above. It is equally possible to make ‘the important, though not clear-cut, distinction’ between ‘investment’ on the basis of an appreciation of the ‘fundamental value’ of the asset and ‘trading’ on the basis of expectations of short-term price movements (Kay 2012, 11). Short-termism, in this context, may be considered a form of hyperactive arbitrage, and being present in such relatively large volumes in commodity markets as it is, current levels may be sufficiently high to hinder the effective functioning of futures markets (ibid.). Of course, one must not be too quick to draw a bright line between short-term trading and long-term investment, be it in ‘real’ productive assets such as the equity of producer companies or in physical assets, or indeed in futures markets. Where this distinction is illuminating, however, is in the fact that short-term trading is not (or is no longer) the exclusive preserve of financial participants.

In a sense, the overuse of the term ‘speculation’ underscores the central role played by expectations about future supply and demand conditions in the price formation process in both physical (spot) and futures markets (Working 1942 cited in Fattouh et al. 2012). Even many critics of financialization tend to acknowledge that a certain amount of speculation in this sense is beneficial to, and indeed necessary for, the proper functioning of commodity futures markets, as speculators offer both greater liquidity and more sophisticated hedging instruments. Crucially, however, this participation is beneficial only if financial investors are not simply engaging in herding behaviour or noise trading, as this creates the conditions for a speculative

bubble to form (Radetzki 2008). While such bubbles are in turn often mistaken for manipulation, ‘the beliefs driving a bubble can gain traction without there being any identifiable individuals behind it’ (Parsons 2010, 109). It is therefore essential to identify different types of financial participants, as well as their trading strategies and tactics (Fattouh 2010, 1; Sandor 2012, 550).

For these reasons, as Working (1963, 22-23) pointed out over 50 years ago, proving or disproving that speculative futures trading causes price instability is impossible without empirical evidence of the drivers of speculative behaviour. In Smith’s (2012) words, ‘the channel by which financial trading might impact commodity prices is anything but transparent’. However, this is not only because real-time data on commodity prices as well as production, inventories, and trade is incomplete and often of questionable accuracy. While this is certainly problematic for studies of the possible impacts of financial investors on prices, it is also true that critics of the financialization thesis have the impossible task of proving a negative (Jarecki 2011, 10), and so in an important sense, no amount of high-quality data will prove their case. In any case, it is doubtful whether greater volumes of more reliable data on physical markets would eliminate the problems that financialization is believed to cause. In all trading environments, ‘fixing’ information asymmetry is tantamount to creating conditions for information overload (Kay 2012, 71-2; see also Fattouh and Allsopp 2009, 2). Yet even if individual traders had ‘sufficient’ information on supply and demand fundamentals *and* other traders’ motivations at the moment each trade is executed, it is their *perceptions* and expectations that ‘move their “animal spirits”’ to translate this information into a given price (Mabro 2008, 3; see also Akerlof and Shiller 2009).

More to the point, financial trading's effect on commodity prices is so difficult to discern because comprehensive information about investor motivations and behaviour is simply unavailable (Radetzki 2008; Humphreys 2009). Yet neither this data nor econometric 'proof' of financialization is necessary for financial investors to shape markets. Recall once again the centrality of expectations in commodity price formation, financialization or no. When coupled with existing institutional arrangements that incentivise short- over long-term gains not only for financial investors but for 'commercial' producers, consumers, and traders (see Kay 2012; Towers Watson 2012; Clark 2013) – in other words, 'genuine hedgers' – such an environment in turn exacerbates the innate human tendency to short-term thinking (Kay 2012; Clark 2013). As we have seen in section 6.3, this amounts to attaching outsize weight to present and near-term conditions even though commodity prices are also determined by cyclical (medium-term) and structural (long-term) supply and demand factors. Given that financial investors have been a sizable presence in commodity markets for a decade at the time of writing, it can be expected that, as in other financial markets, greater volumes of trading activity have further enhanced this effect (Kay 2012, 40).

Conceivably, the very suspicion on the part of a sufficient proportion of *all* traders that prices reflect information from other asset classes as well as commodity supply and demand fundamentals will shift their short-term expectations accordingly (UNCTAD 2011, 29; Smith 2012). This belief has, in some cases, found its way into the underpinnings of the forecasts and strategies employed by physical traders (UNCTAD 2011; Terazono 2012). If this is indeed the case, the price formation

process for exchange-traded commodities can be said to have taken on the character of Keynes's 'beauty contest', or more formally Allen et al.'s (2006) 'iterated expectations', in which prices reflect participants' expectations about others' expectations ad infinitum (Allsopp and Fattouh 2011). In this sense, the identities of trading parties is only of secondary importance at best as motivations and tactics become homogenised. Instead, their models have a more complex and intimate relationship to the very phenomenon they ostensibly do no more than describe (see Barry and Slater 2005). Put differently, in the manner described by Akerlof and Shiller (2009, 54 cited in Fattouh 2011), participants' beliefs or 'stories' have become 'a real part of how the economy functions', and so 'The stories no longer merely explain the facts; they are the facts'.

## **6.6 Implications for the commodity financialization thesis**

At the heart of the suite of critiques of financialization in commodity markets, then, is an objection to short-termism and its role in distorting the expectations on which trading decisions are based. Yet characterising financialization as a tyranny of short-termism is misleading for two reasons. Note, first, that the presence of financial investors is acknowledged as only one of several factors that have contributed to a breakdown in confidence in the commodity price formation process. In this respect, it will be apparent that no less than a pillar of modern financial theory – namely, the efficient market hypothesis (EMH) – is at stake in debates about financialization. Arguments against the significance of financialization rest upon the two related assumptions that the EMH holds in its strong form, and that all market players are 'atomistic' or small enough relative to the overall size of the market not to move

prices, whether inadvertently or intentionally. Conversely, implicit in critiques of financialization is a certain scepticism about the applicability of the EMH to contemporary commodity markets, characterised as they are by incomplete data, expectations-driven pricing, and power asymmetries (UNCTAD 2011; Kay 2012; Bos and van der Molen 2013). The financialization of commodity markets thus resembles many similar tendencies in other securities markets (see Kay 2012).

Second, and more to the point, while financialization has important implications for short-term prices, its relevance to the cyclical and structural components of prices is less clear. The irony of the financialization thesis is that in treating the commodity price dynamics of the past decade as a financial bubble (or series of smaller bubbles), critics in their own way remain as transfixed by short-term price movements as the very market agents to whom they attribute so much power. Yet as Humphreys (2009) has argued, financial investors could only properly be said to have contributed to a bubble if the price dynamics of the 2000s were indeed no more than a cyclical phenomenon. Even in the half-decade since the apparent puncturing of the ‘bubble’, however, the rebound in prices has raised questions about the extent to which high prices are symptomatic of a super-cycle, or indeed a more lasting structural shift.<sup>54</sup>

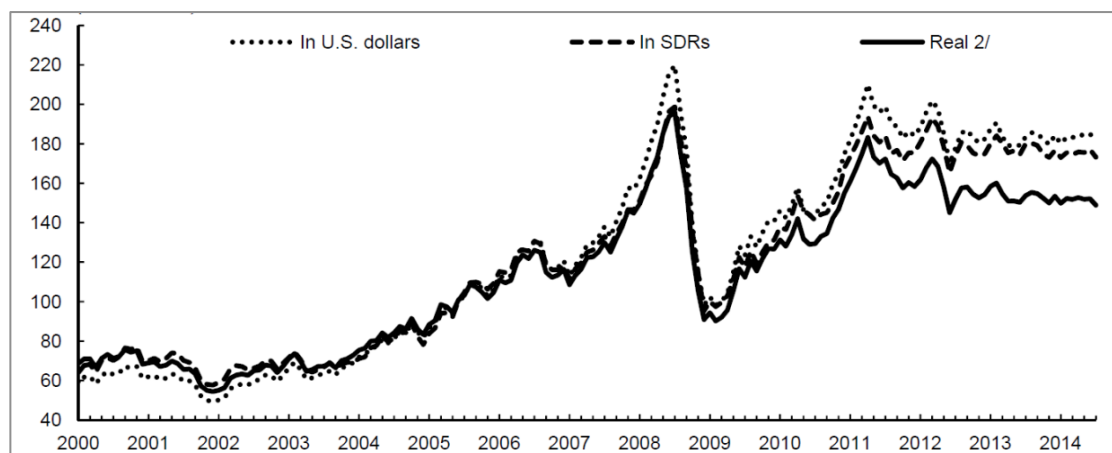
The current super-cycle began with a demand shock from strong global macroeconomic performance, which at an average of 4.7 per cent per year from 2000-2007 represented the strongest and most sustained period of growth since 1970 (Humphreys 2009). This was fuelled largely by rapid industrialisation and urbanisation in emerging markets. Chinese demand has been the primary driver here,

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<sup>54</sup> Monetary policy, specifically quantitative easing, has also played a role in pushing up prices (Valiante 2013).

accounting for 80 per cent of global metal demand growth and 40 per cent of oil demand growth. The demand shock is regarded as the principal driver of the cycle, but supplies have also been constrained due to low investment in production capacity in the previous decade (Radetzki et al. 2008, 127). Low inventories and a continuing reliance on ‘just-in-time’ production models along the supply chain initially exacerbated the supply crunch (Radetzki 2006, 61), and lags persisted somewhat longer than usual as the extractive industry collectively encountered a bottleneck in expansion resulting from a shortage in equipment and skills (Humphreys 2009).

**Figure 8: IMF Indices of commodity prices weighted by trade value (2005 = 100)**

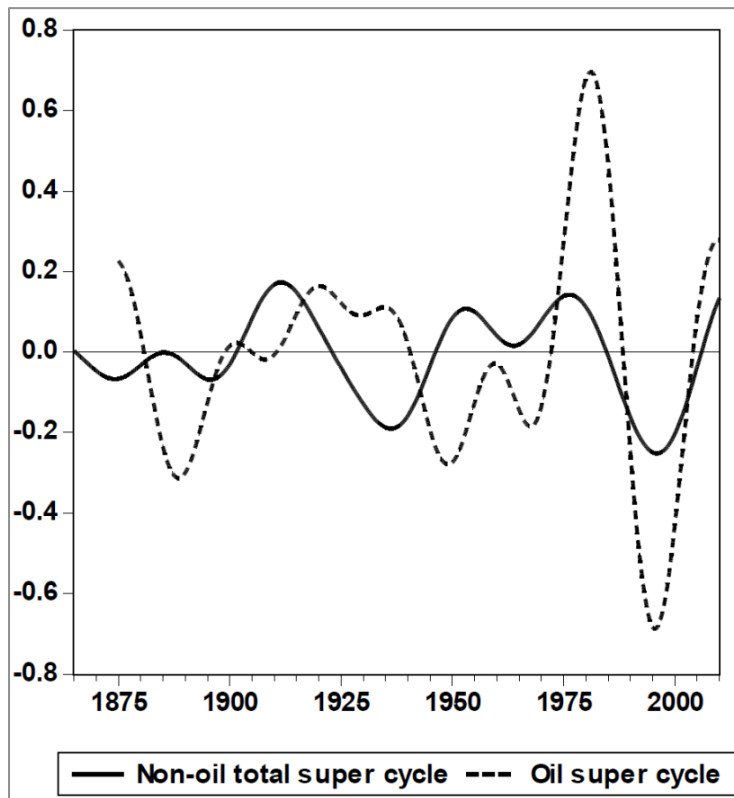


(Source: IMF)

While the super-cycle is not unique in strength in real terms, it has been both the longest and the broadest in a century (Baffes and Haniotis 2010). It can also be distinguished to a degree by its effects on different types of commodities. Mineral and energy commodity prices more than doubled from 2003-2008 in real terms, with metal prices attaining near-historic highs (Erten and Ocampo 2012). Note, however, that agricultural commodity prices have *not* been as dramatically affected by rapid GDP growth in China and other emerging economies during this period, instead reversing a 20-year downward trend (Radetzki 2008; Erten and Ocampo 2012; Jacks 2013). The current super-cycle may therefore be more precisely classified as a

mineral commodity boom (Erten and Ocampo 2012; Radetzki et al. 2008). One further unusual feature of this cycle has been its resilience: despite a global economic downturn in the wake of the 2007-08 financial crisis and the ongoing eurozone crisis, commodity prices began to recover from a precipitous drop in late 2009 and by 2010 had nearly reached previous highs. However, the historical trajectory suggests that the cycle is approaching or has already passed its high point at the time of writing – and prices have indeed dropped modestly in the short term at the time of writing.

**Figure 9: Super-cycle components for non-oil and oil prices**



(Source: Erten and Ocampo 2012)

Opinion is divided on whether market participants should accordingly be braced for the end of the super-cycle. Most obviously, this is a proxy for a bet on the sustainability of China’s programme of aggressive industrialisation and urbanisation. But several factors on the supply side are also at work here: the super-cycle thesis equally rests on the assumption that the extractives sector will continue to have

difficulty attracting the necessary investment in capacity expansion to bring prices back down, despite high profits, over the course of one, two, or even three decades (Radetzki 2008). In effect, this is a divide between an implicit faith in the cyclical nature of the resource extraction business on the one hand, and the rather Malthusian fear of an end to the long-run downward trend in real commodity prices. The Prebisch-Singer hypothesis – more formally, that the terms of trade of commodity exports relative to manufactured goods have declined over the long run (Singer 1950; Prebisch 1950) – has long been cited, with broad empirical justification, in support of arguments against imminent resource depletion. Periodic reassessments of the hypothesis have generally shown it to withstand the test of time (Grilli and Yang 1988; Erten and Ocampo 2012; Harvey et al. 2012). However, it has also had occasional detractors, notably Slade’s (1982) forecast that long-run metal prices would follow a U-shaped curve, and a growing body of updated analysis has yielded much weaker support (e.g. Arezki et al. 2013; Jacks 2013; Yamada and Yoon 2013).

Under such conditions of heightened uncertainty, the nature of investors’ contribution to the past decade’s price dynamics stems from the impossibility of matching longer-term expectations about future supply and demand conditions with the short-term imperatives that govern investor behaviour (Kay 2012; Clark 2013). In this respect, the financialization thesis has, ironically enough, succumbed to the very myopia of which it accuses contemporary markets. The ‘real economy’ of which commodities are a consummate representation is primarily governed by more durable cyclical and indeed structural factors far removed from the supposed hegemony of the financial sector. If anything, the historically unprecedented rise of emerging economies and the super-cycle to which it has given rise are not only first-order determinants of

commodity prices in and of themselves; at times they form the backbone of the narratives that drive even short-term price dynamics. Thus while hyperactive traders may amplify the cycle in the short term, depending on their expectations of its duration, their influence on longer-term trends is by nature more limited.

## **6.7 Conclusions and implications**

A close reading and synthesis of various versions of the financialization thesis reveals many disagreements, most obviously over the societal value of futures trading. This is particularly true in the wake of the global financial crisis: the strong normative expectation of commodity trading on the part of society mirrors or coincides with evident societal expectations of banking and financial intermediaries. However, there is also much overlap between the heterodox and orthodox accounts: in particular, a concern that financial investment exacerbates both commodity price volatility and boom-bust cycles. Here it may be tempting to conclude that financialization has created both a new governing logic and an economic space more or less independent of ‘the real economy’.

However, semantic and conceptual ambiguity and confusion are all too common across the board, and this paper has attempted to clarify some key issues. What *can* ultimately be gleaned from this exercise is that the strong presence of financial investors in these markets has promoted an enhanced short-termist, expectations-driven approach to pricing. Given the loss of faith in the price formation process stemming from these and other sources of uncertainty, it is not surprising that financial participation in commodity markets should find itself a scapegoat once more

and be reviled as mere ‘speculation’. However, it has been argued here that the ‘transformation’ of commodities into an asset class, while not unproblematic, is far from the only source of uncertainty in these markets. As such, financialization cannot be single-handedly responsible for promoting expectations-driven pricing and the short-termism it entails. Rather, it is simply part of a ‘new normal’ in commodity markets. Yet no version of the financialization thesis has had much to say about the long-term price dynamics that have sustained the boom and investors’ role in it. This paper has instead argued that commodity price behaviour over the past decade cannot entirely be conceived of either as a purely cyclical phenomenon or as a conventional financial bubble, as has been common.

For critics, that financialization might have deleterious effects on commodity markets themselves is of equal concern beside the fear because commodity markets increasingly resemble other financial markets, they might be a source of systemic *financial* rather than *resource* risk. In this respect, commodity markets are but one source of post-crisis anxiety about macroeconomic and financial stability – if not, indeed, nostalgia for a supposedly more stable, orderly era when financial markets satisfactorily performed their ‘proper’ functions of raising capital for productive investment, transferring risk, and safeguarding savings (Kay 2012). Yet financialization is not necessarily a historically unprecedented, or indeed permanent, phenomenon (Krippner 2005, 199). Moreover, as Kindleberger (1978), Minsky (1977, 1992), and their intellectual heirs have long observed, regulation and oversight, while going a considerable way to smooth out peaks and troughs in economic cycles, cannot entirely eliminate them.

None of this is to dismiss out of hand the long-lasting relevance of financialization in commodity markets. Whatever about the purported end of the super-cycle, commodities continue to hold their relevance for investors as a proxy for the long-term material growth prospects of emerging markets. As already suggested, commodities continue to evolve as an asset class, with innovations in products directly linked to physical markets. At the same time, it is reasonable to expect that an increasing number of commodities will be traded through financial instruments, and that financial investors will be present in these markets as well.<sup>55</sup> Moreover, new or prospective US and EU regulations governing commodity trading may well prove more significant for the institutional composition of these markets than for trading volumes: at the time of writing, the very threat of higher capital requirements and regulatory scrutiny has begun to prompt the exit of investment banks from the sector, with commodity trading houses stepping into the breach. This growing concentration of power in the hands of a few large institutions will have importance for the transparency and effective functioning of trading. Future research on financialization in commodity markets should therefore explore the increasingly active participation by such supposed ‘intermediating’ institutions (Wójcik 2012).

Ultimately, however, by attaching outsized importance to financial trading – by characterising the impact of financialization as a totalising, transformative force – critics have, ironically enough, lost sight of both the long term and the ‘real’ components of commodity markets. Whatever about the prospects of an economic slowdown in China in the medium term, the scale and nature of global demand have

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<sup>55</sup> The market for iron ore is one prominent example of a commodity that is beginning to follow the ‘natural evolution’ towards organised exchange trading (Hume 2014a; see also Sandor 2012; Radetzki 2013b).

irrevocably changed. Coupled with faltering confidence about the sustainability and security of supply, growth in emerging economies has been more than sufficient to reshape pricing expectations. While not untouched by financialization, then, commodity markets can never entirely succumb to its logic.

## CHAPTER 7 | Conclusion

### 7.1 Introduction

This research originally began in late 2010, when media coverage of the issue of ‘peak phosphorus’ piqued my curiosity. Over the course of the past four years, interest in the twin topics of resource constraints and resource wealth has waned. There appear to be several reasons for this: most obviously, commodity prices have moderated and many observers have called an early end to the super-cycle. Yet it could also be said that wider factors are at play. On the economic side, stagnation in the US and EU; slowed economic growth in large developing nations, particularly China; and more recently, even fears of asset bubbles in many markets have at least temporarily obviated fears of resource limits to economic growth. Indeed, many societies with high consumption rates have demographic profiles that suggest that it will be high dependency ratios that curb growth.

On the ecological side, for better or worse, ‘climate change’ has arguably become a metonymic for *all* environmental issues in the public imagination (McGill 2013) – and so it may be the repeated failure of the UN climate negotiations, particularly in the context of ongoing economic and financial crises, which has engendered cynicism and waning interest in the environment writ large. For all of these reasons, too, whether directly or indirectly, the case for commodities as an asset class no longer seems as compelling as it did ten years ago. As returns have become increasingly correlated with those of other asset classes, commodity investments have lost their appeal as a hedge against inflation. More importantly, a drop in Chinese GDP growth in 2013 seems to many to presage a prolonged period of lower mineral demand. Yet

as history has repeatedly shown, the ghost of Thomas Malthus has a way of returning to haunt humanity time and again. Whether warranted or not, some trigger – be it high prices, supply embargoes, or otherwise – will in future once again prompt discussions of resource scarcity. More to the point, regardless of the future trajectory of prices, the economic institutions that channel and benefit from resource wealth have already undergone significant changes. The issues raised in this thesis will therefore retain their salience well after the specific events of the 2000s super-cycle have passed.

This final chapter of the thesis summarises the ideas and findings presented in the preceding six chapters, while placing them in the context of the developments sketched out briefly above. The chapter proceeds as follows. The next section summarises the main findings of each of the chapters individually, as well as their respective contributions to the wider scholarly literature on commodities. Section 7.3 enumerates some broader, mainly policy-related, implications of the thesis. Finally, section 7.4 proposes several areas for future research.

## **7.2 Summary of findings and contributions to the literature**

*Chapter 1* set the stage for the thesis as a whole. It provided important context for the changes in global commodity markets over the past decade and a half or more, particularly the geophysical and geopolitical realities surrounding the availability of mineral resources. It introduced two central ideas which underpin the thesis. First, the super-cycle of the 2000s – whatever its duration ultimately turns out to be – has permanently altered the landscape of commodity markets not only in terms of trade patterns, but also in terms of the reciprocal effects that prices, trade, and market

institutions have on each other. Second, for all the attention paid to price rises and supply constraints, all largely driven by Chinese economic development, the obverse of this picture is that the super-cycle has also been a source of great wealth and benefit to many producer nations and institutions. This first chapter also offered a preview of the rest of the thesis. Further background to the issues can be found in *chapter 2*, which reviews some of the theoretical literature underpinning the substantive chapters of the thesis.

*Chapter 3* took as its starting point a discursive analysis of the issue of phosphorus scarcity, which had received widespread public and academic attention in the wake of a dramatic phosphate fertilizer price spike in 2007/08. Various projections calculated at the time estimated that global phosphate rock reserves would be depleted within 40-150 years – a phenomenon dubbed *peak phosphorus*. For those ‘peakists’ concerned by these projections, the issue of peak phosphorus was argued to be of great importance because while inorganic phosphate-based fertilisers have done much to boost global agricultural yields, these gains have come at the expense of a critical dependence on a finite mineral resource. The peakists borrowed much from peak oil discourse – particularly Hubbert’s curve as both a calculative device and an heuristic – while at the same time stressing phosphate’s defining features as a commodity – particularly its essential role in sustaining agricultural production and its geophysical concentration in relatively few regions.

The chapter argued that much like its conceptual ancestor, peak oil, the peak phosphorus concept tends not to distinguish between concerns about the longer-term exhaustibility of phosphate rock and more urgent, multi-faceted socio-economic

causes and effects of poor natural resource management. Consequently, these socio-economic aspects tend to become subsumed under discourses about absolute physical scarcity. The end result is similar to previous iterations of the resource pessimist narrative: narrow technical claims about imminent mineral resource depletion detract from well-founded concerns about the negative environmental, socioeconomic, and geopolitical consequences of critical dependence on a finite resource.

The chapter posited that even as they fit a pattern of neo-Malthusian thought, peak phosphorus debates are also very much a product of the *zeitgeist* of the early 21<sup>st</sup> century, characterised as it was by concerns about resource limits to economic growth in the face of unprecedented, accelerated demand. Indeed, peak phosphorus narratives can serve as something of a template for many other types of resources. They illustrate crucial distinctions between peak resource analysis (a technical scenario-building tool), the concept of peak resources (a related but looser heuristic), and resource scarcity (a multi-dimensional phenomenon which manifests itself differently across different scales and locations) (Cordell and White, 2011). In contrast to peak debates, this chapter showed how an epistemological shift can expand productive focus to whether current natural resource management regimes are equitable, efficient, and both environmentally and economically sustainable. This has practical implications for the practice of sustainable investing, in that it can help to better identify long-term risks and opportunities.

If the geopolitics of phosphate supply, particularly Morocco's influence over it, is one matter of concern raised repeatedly in peak phosphorus discourses, it is equally apparent how little is known (at least in the English-speaking world) about Morocco's

phosphate industry. *Chapter 4* therefore undertook a case study of the Moroccan state-owned phosphate company, OCP Group. The chapter chose to examine how the company conceives its societal role in generating and distributing national mineral wealth – a fundamental issue related to the governance of natural resources. The most important contribution of this chapter was empirical, informed as it was by the collection of primary data through field research. Based on this case study, the chapter also made a twofold contribution to the literature. First, it contributed to a wider scholarship on state ownership and control in the extractive sector. Second, it offered a fresh take on the problematic of societal value creation by corporations.

Field research – specifically, key informant (elite) interviews and site visits – supplemented by analysis of company documents and (mainly Francophone) media coverage, revealed that OCP adopted a wide-ranging reform programme in 2006/07. This ‘transformation’ began with the conjoined externalisation of its pension liabilities and legal privatisation, albeit with the state retaining sole (if not fully direct) ownership. Among the many pillars of the reform process has been a refocusing of the company’s social accountability initiatives – shorthand by OCP managers and employees as ‘shared value’, a term borrowed from work by Porter and Kramer (2006, 2011) but which turns out on closer examination to have a much more expansive meaning. It was found that there exist three ways in which OCP creates socio-economic value for Morocco: its fiscal contributions (i.e. contributions of profits and dividends to the state budget) at the macro level; its creation of productive (backward and forward) linkages in the national economy (Stevens 2008); and, in some cases, its investments in specific projects, be they large- (e.g. infrastructure) or small-scale (e.g. community development).

As the literature on NECs stresses, state-owned companies often simultaneously pursue commercial and non-commercial objectives. While doing so serves a number of public policy and political objectives, it falls to the NEC to balance the two. OCP offers a particularly interesting illustration of these dynamics. On one hand, the privatisation process has (in principle) made for a much clearer delineation of roles and responsibilities with respect to the balance between commercial and non-commercial objectives. Yet at the same time, that the state remains the *de facto* sole shareholder creates a distinct principal-agent dynamic: one which allows a degree of ambiguity in which types of activities ‘count’ as being in the public interest. On one hand, this chapter has argued that the simple fact of state ownership can allow an NEC such as OCP to justify pure profit-maximising behaviour as being in the national interest. On the other hand, somewhat paradoxically, OCP’s status as a ‘Continental European’ *société anonyme* (S.A., as opposed to an ‘Anglo-American’ corporation) is an important building block of its self-image as a company with an important societal role not only in the communities in which it operates, but for the Moroccan economy and indeed for global food security.

The chapter concluded with two stylised scenarios for the future of OCP’s shared value ethos. More recent developments, not least OCP’s efforts to raise capital via international bond markets, have compelled the company to reconsider the scope of its core businesses – on the face of it, to bring them more in line with ‘Anglo-American’ standards of shareholder (as opposed to stakeholder) accountability. However, the chapter also hypothesised that ultimately OCP’s distinct identity as an extractive company, coupled with the its heritage as a pillar of the Moroccan

economy and the realities of contemporary domestic politics, will together act to ensure its continued involvement as a lynchpin of local socio-economic development.

Another under-researched area exposed in chapter 3 is taken up in *chapter 5*, which conducted an empirical investigation of the phosphate price formation process and how it relates to the structure of the industry. A key question here was how companies in the phosphate sector make pricing decisions given the lack of competition on the supply side of the market, as well as a lack of ‘formal’ pricing channels such as futures exchanges. This is particularly important given that there is little explicit consideration of the origins of reference prices in the literature. In particular, while a great deal of this literature has increasingly focused on securities markets and their relationship to ‘pure’ goods markets, this paper asks how markets without a financial component (in contrast to most similar markets) function.

In order to conduct such an exposition, it is first necessary to produce an ‘anatomy’ of global phosphate markets. The paper thus has borrowed broad insights from two mainstream (industrial organization and market microstructure theory) and two non-orthodox (economic sociology and economic geography) literatures in order to explore, in a more holistic manner than has typically been attempted in previous studies of commodity markets, the complex interrelationships between industry structure, pricing mechanism(s), and indeed price dynamics themselves. It was shown that in the case of phosphate, changing price dynamics may be considered a third, quasi-‘exogenous’ variable which may force change upon both industry structure and the institutions of the price formation process.

In contrast to treatments of the *role* of information in commodity markets (UNCTAD 2011), the ends of which is price discovery, this paper is about the *production* of information, of which prices are themselves also a constituent part, by market agents. Similarly, our concern here is less with the *outcomes* of pricing negotiations than with the *process* of price discovery itself. The paper thus regards markets and prices alike as information-aggregating mechanisms (O’Hara 1995; Madhavan 2000). The study undertaken here has served to underscore two related important, if under-appreciated, points. First, rather than attaching great significance to a single ‘market price’, it is more useful to recognise that there exists a handful of reference prices against which transactions occur. Second, insofar as reference prices can be said to exist, they should be thought of as just that: *reference* points against which buyers and sellers ‘anchor’ their expectations, rather than expressions of absolute value. Thus in iterative fashion, prices are themselves inputs to the price formation process. Implicit here, too, are the most rudimentary insights from past work that socially embedded institutions, path dependency, and geography matter.

Roughly coinciding with the onset of the super-cycle of the 2000s was an influx of investment by financial institutions in commodity derivatives markets. This ‘financialization’ of commodity markets has given rise to an enormous amount of debate – scholarly and otherwise – surrounding the nature of the influence of investors on commodity prices. *Chapter 6* examined these debates and found two distinct levels of argument. First, the financialization of commodity markets can be placed in the context of a wider scholarship on financialization, broadly defined as the influence of the financial sector on the ‘real’ economy. Second, within a large volume

of empirical studies quantifying the impact of financial investment on commodity prices, opinion is divided as to whether any impact can be detected at all.

The chapter finds a number of problematic assumptions underpinning discourses on financialization. At one level, they often reflect a wider suspicion of market agents – whether financial or otherwise – as superfluous, if not parasitic. Overlapping with this idea is the semantic ambiguity surrounding the term ‘financialization’ itself, most often evident in the way in which it is used interchangeably with ‘speculation’. At its best, the financialization thesis recognises the central importance of expectations in setting prices, and that this adds a further significant layer of complexity to the commodity price formation process. However, the term ‘financialization’ still carries with it implicit assumptions that the new institutional realities of the commodity price formation process are inherently problematic.

The chapter also found that drawing a bright line between ‘purely’ financial investment and commercial trading of commodities is an impossible task, given the complexities of the connections between the financial sector and the ‘real economy’. While thus recognising that any attempt to recast the concept of financialization in commodity markets cannot yield a watertight definition, it proposed that the term could instead refer to the growth of ‘hyper’ or very short-term trading. Ultimately, however, further questions remain about the overall importance of financial investment in long-term commodity price dynamics relative to other structural changes in commodity markets.

### **7.3 Broader implications of the thesis**

If the thesis can be said to be bound together by a single overarching question, it might well be: ‘What does the case of phosphate illustrate about commodities in general?’ The most basic answer is that, for all that phosphorus is a unique commodity, the lessons it imparts are very similar to those one can derive from observing other commodities. Yet what I have found perhaps most striking, having traced the level of global interest in phosphorus even over the relatively short four-year span of this research project, is that for all that phosphorus, more than any other commodity, lies directly at the nexus of a host of socioeconomic, environmental, and geopolitical problems, general perceptions of the urgency of so many of these problems seems strongly correlated with a single measure: the market price of phosphate fertilizers. After all, ‘peak phosphorus’ first emerged as a matter of concern precisely in the months when prices began to climb, in late 2007-2008.

Yet as we have seen time and again throughout this thesis, commodity prices tend to be cyclical in nature. The upshot has been that interest in ensuring that phosphate production and consumption become more environmentally sound; that the benefits of resource extraction be shared more equitably; that trading mechanisms function more effectively to reflect supply and demand conditions; and that resource-poor regions secure consistent access to the commodity, are all prioritised by relevant stakeholders at times of high prices but can be quickly abandoned when prices fall. This myopia is not particularly surprising, though it does not bode well for commodities whose production, trade, and consumption are similarly bound up with wide ranging socio-environmental issues. The clearest example is, once again, oil: if the speed with which concerns about peak oil were replaced with interest in the ‘golden age of gas’ (IEA

2011) was startling, witness the anticipated consequences of the ongoing fall in oil prices that began in the summer of 2014. While there will of course be benefits for energy consumers, low prices have become a sudden and unexpected threat for a range of actors, from producer governments running the risk of politically destabilising spending deficits to climate change activists and clean energy producers who depend on a high oil price for cost-competitive fuel alternatives.

Beyond these overarching insights, as stated in chapter 1, the aim of this thesis has been threefold: to recast the relationship between geophysical resource supply – the animating narrative behind the super-cycle – and prices and markets (and to recast the relative importance of each) (chapter 3 and 6); to examine some of the economic and financial institutions that channel and benefit from resource wealth (chapters 4 and 6); and to ‘open the black box’ of the commodity price formation process (chapters 5 and 6). While each of these research objectives has implications for theory, as demonstrated in section 7.2, they also bring much to bear on a number of policy concerns. A non-exhaustive consideration of these wider implications of the thesis follows.

### *7.3.1 Objective 1: to recast the relationship between geophysical resource supply, prices, and markets*

One assumption underpinning chapter 3 was that the manner in which an issue is framed is often instrumental to the responses it provokes. Indeed, the chapter went so far as to argue that perception often trumps reality in shaping market expectations. In this way, it has been argued that for peak phosphorus proponents and market

observers alike, the 2008 phosphate price spike is emblematic much like the 1973 oil embargo once was for peak oil proponents and in oil markets. Short-term price movements have thus taken on outsized, if not warped, significance. More generally, an uncritical acceptance of peak phosphorus narratives will likely have the unintended consequence of encouraging consumers and investors to engage in a myopic, zero-sum ‘scramble for resources’. On the other hand, to dismiss peak narratives out of hand would be to overlook ‘situated risks’ – large, complex problems that worsen over time and only reach a crisis point when it is too late for reversal or mitigation. The chapter argued that an understanding of resource scarcity as a multi-dimensional problem can reveal both risks and longer-term opportunities to contribute to positive solutions to the problem and to avoid compromising – if not indeed enhancing – returns.

The ‘dimension of scarcity’ of greatest concern in the first half of the thesis, the geopolitics of mineral supply, has also been shown to have outgrown its Cold War-era connotations while also going well beyond China’s brand of resource diplomacy. Since chapter 3 was drafted, ‘sustainable phosphorus’ has become a policy goal of the European Union, which lacks significant supplies of its own. On the face of it, the EU has directly tied ecological concerns about mineral finiteness and the environmental damage caused by phosphate over-use to its geopolitically weak position as an importer to advocate for sustainability measures such as conservation and recycling (European Sustainable Phosphorus Platform 2013). That phosphate has recently been added to the EU’s Critical Raw Materials list (European Commission 2014) points in a different policy direction, however.

A parallel case, and perhaps no better example of this tension between competing conceptions of ‘sustainability’, can be seen in the contrasting responses of the EU and the US to anticipated supply constraints on strategic/critical minerals such as rare earth elements (REEs). The EU Raw Materials Initiative ostensibly comprises three pillars of equal significance: more robust resource diplomacy abroad, accompanied by greater efforts to promote more environmentally and socially sustainable extraction; development of ‘domestic’ European mines; and a greater commitment to recycling through measures such as urban mining. However, as many critics have pointed out, the policy document itself focuses heavily on the first of these three pillars while paying only lip service to the others. In Africa in particular, it is feared that, just as many governments on the continent are beginning to demand a greater share of mining benefit from foreign investors, they still lack the capacity to respond effectively to an assertive resource diplomacy that emphasises self-interested ends rather than gentler means. By contrast, at least in the market for rare earth elements (REEs), the US has demonstrated a greater level of commitment to recycling and recovery technologies, for example through substantial federal research grants.

### *7.3.2 Objective 2: to examine some of the institutions that channel and benefit from resource wealth*

The creation and allocation of mineral resource wealth are among the most enduring and wide-ranging matters of interest to policy-makers and researchers alike. While it has been well beyond the scope of this thesis to consider these issues holistically, at least two of the chapters each considered them from a particular angle. Chapter 4 in particular suggests that a company such as OCP offers a test case of a much broader

question: which features of corporate governance suggest about whether there may be said to exist a ‘best’ form of capitalism (Clark and Wójcik 2007) with respect to both commercial efficiency and stakeholder accountability. It has become something of a cliché to say that capitalism is facing a crisis of legitimacy: while this agenda has taken on added urgency in the wake of the global financial crisis, such concerns have been raised for at least the past two decades (see e.g. Schoenberger 1997). Such angst is in no small part a byproduct of the collapse of Communism: without the foil of centrally planned economies, free-market capitalism began to lose much of its moral and geopolitical dimensions as a force for good in the world. Perhaps to fill this vacuum, the spectre of ‘state capitalism’ was raised in recent years (Bremmer 2010).

In parallel, as chapter 4 explained, the issue of corporate social accountability is particularly salient to extractive companies in their endeavours to define and fulfil their societal responsibilities without sacrificing financial profits. In many important respects, OCP is grappling with the same questions about balancing stakeholder interests with profit maximisation as MNCs with a discernable social responsibility ethos. At the same time as OCP’s ownership by the state does afford it a greater degree of normative scope for social investments, these wide-ranging programmes are a conscious adoption, and adaptation, of strategies employed elsewhere in the extractive sector to meet the challenge of socialising the benefits as well as the costs of mining. The ongoing transformation process can thus be said to represent an experiment in ‘hybrid capitalism’: a test of whether an NEC can match or surpass the commercial performance of its global competitors while remaining socially accountable at home, and which specific institutional arrangements can help it achieve this.

While Chapter 6 did not explicitly consider what types of financial institutions or asset owners ultimately profit from investment in commodity futures markets, or detail how organised derivatives exchanges and other market intermediaries benefit, it did explain why the idea that ‘speculators’ do profit at the expense of ‘the real economy’ is an animating force behind critiques of financialization. Since the paper was completed in late 2013, the popularity of commodities as an asset class has waned, due in no small part to the ongoing re-regulation of commodity derivatives markets. Both the 2010 Dodd-Frank financial reform law in the US and the EU’s Markets in Financial Instruments Directive (MiFID) II emerged amid political pressure to crack down on ‘speculators’ and increase market transparency. Without commenting directly on the potential effects of these regulations on price dynamics, suffice to mention that one of their anticipated side-effects may be to push commodity derivatives trading further towards hubs such as Switzerland and Singapore, and towards increasingly powerful entities such as commodity trading houses, over-the-counter (OTC) exchanges, and high-frequency trading (HFT) platforms. In other words, geographic and institutional power asymmetries in commodity markets are once again shifting.

At the same time, the thesis does suggest that the significance of short-term traders is both lesser and greater than has typically been assumed: lesser in the sense that speculators most probably could not single-handedly have caused price spikes such as that in oil markets in 2006/08; but greater in that, once again, Keynes’s insight about ‘beauty contests’ has been reaffirmed through the response of many traders and other market participants, which has been to form pricing expectations *as if* others’

investment portfolio considerations already mattered. One striking finding of this research is that despite the widespread condemnation of short-termism in markets – not just for commodities but other types of securities as well – remarkably little has been done to articulate precisely why this is a problem, let alone advance constructive policy solutions to it (but see Haldane 2011; Kay 2012). By the same token, while it is widely acknowledged that the ‘ideal’ level of short-term ‘speculation’ results in a balance between providing liquidity and exacerbating price volatility (UNCTAD 2011), for the moment debates about commodity financialization have simply petered out without resulting in a productive debate about the societal value of short- as opposed to long-term trading.

### *7.3.3 Objective 3: to ‘open the black box’ of the commodity price formation process*

If the exploration of commodity price-setting in chapters 5 and 6 highlighted a larger point, it is perhaps just how far from the joint ideals of transparency and liquidity most commodity trading is in reality. In and of itself, this should hardly be a revelation; what the chapters have done by way of contribution is to identify a selection of the particular institutions of the price formation process and to explain their arrangement, thereby to illustrate how the flows of both trade and information occur among them. As it turned out, two under-investigated institutions discussed in chapter 5 in particular became subject to public controversy during the writing-up process. First, price reporting agencies (PRAs) play a pivotal role in aggregating and disseminating market data; yet their very significance, let alone the opacity of their practices, is only recently beginning to gain commensurate appreciation. At the time of writing, however, the European Union has drafted a directive on commodity

benchmarking in the wake of an alleged price-rigging involving Platts, an important oil PRA, and several major oil companies.

Second, and closely related, is the issue of benchmarking. While chapter 5 stressed that the lack of a universally agreed benchmark (or set of benchmarks) need not be fundamentally problematic, for those markets that do rely on such a guiding post, a pricing procedure that remains in private hands can inevitably raise questions about the integrity of the results. A prime example, one that has again been topical during the write-up of this thesis, is the set of ‘fixes’ in precious metals markets, most notably gold. Whether by PRAs, a ‘fix’, or otherwise, the proprietary nature of price-setting is clearly recognised as one factor contributing to market opacity. A further related point here is that, as with the issue of short-termism discussed above, both chapters 5 and 6 also suggest that while a lack of transparency is indeed an impediment to proper commodity market function, the task of identifying an ideal degree of transparency is less straightforward than might be assumed.

Chapters 5 and 6 also draw out an assumption so tacit in the literature on price-setting that it has only rarely been articulated: that the development of the price formation process – and by extension, the overall structure of a given market – follows a clear progression in sophistication: ‘Call it a theory of evolution for commodities. First, prices are set on long-term contracts; then indexation and the spot market take over. Then derivatives emerge’ (Hume 2014a). Not least because most major commodities – particularly extractive commodities – have followed this ‘evolution’, it is presumed that any remaining types which are priced by alternative means will follow along this ‘relentless progress’ towards futures trading as (one of) their main means of price

discovery (Radetzki 2013b). Futures exchanges are implicitly understood as the apogee of this evolutionary process. Thus in the evolutionists' way of thinking, markets that retain alternative trading conventions – even for commodities that are widely traded – remain 'stuck' in an evolutionary cul-de-sac. In reality, of course, we have seen that there remain a number of alternative means of price discovery. All, however, suffer from a lack of transparency, low liquidity, or both. The deeper significance of the supposed evolutionary continuum of price-setting mechanism appears to lie, therefore, in the relative ease with which information can be gathered and disseminated to market participants via a single venue. Yet as we have seen, for a variety of structural and historical reasons, not all commodities lend themselves to this type of trading. By contrast, the field research undertaken for this thesis found that this point appears self-evident within the industry itself (Hume 2014b).

#### **7.4 Future research**

To write a thesis on a topic as expansive as commodity market evolution is, by necessity, to curate a plethora of political-economic issues, each with their own tangled and at times controversial history – and history of thought. It is also to chase a rapidly moving target. This project was thus envisioned, from the beginning, as the germ of a much longer-term research agenda: at once a scoping of boundaries and a delving into a handful of specific but deliberately chosen case studies. This final section of the thesis maps out those areas which most immediately suggest themselves for future research.

While both peak oil and peak phosphorus debates have quieted down since chapter 3 was drafted, history suggests that such neo-Malthusian narratives consistently recur over time (McGill 2011). The future significance of peak resources debates therefore should not be underestimated. Beyond this, one aim of chapter 3 was to highlight areas for further empirical research on phosphate production and trade. A handful of these were taken up directly in subsequent chapters of the thesis: notably, the geographic and institutional structure of the phosphate and fertilizer industries and the phosphate price discovery process are described in broad terms in chapter 5. A more sensitive and complex suite of questions surrounding the geopolitics of phosphate (and mineral) supply, while addressed obliquely in chapter 4, was largely left to a future research agenda. In particular, the supply behaviour of NECs is surely worthy of continuous monitoring. Fieldwork undertaken for chapters 4 and 5 revealed that this must go beyond conventional assumptions based on historical experience of, for instance, OPEC and other cartels, or state-sponsored supply cuts even as recent as Gazprom's to Ukraine in 2006, 2008, 2009, and 2014; equally important may be major producers' choice between margin- and volume-based strategies. To illustrate, contrast OCP's decision to pursue the latter by tailoring phosphate fertilizer supply to tightly match demand with that by Uralkali to adopt the latter, thereby flooding potash markets, driving down prices, and forcing marginal producers out of the market. In the medium term, each strategy has strong yet highly contextual cyclical impacts on prices, and geographically differentiated impacts on supply.

Although an enormous volume of literature has been written on the 'resource curse' (Auty 1993; Sachs and Warner 1995), the body scholarship on harnessing natural resource wealth is still taking shape. While chapter 4 was intended serve as a small

contribution to the latter line of inquiry, it also left open a number of avenues for future research. More case studies on state ownership and control in extractive industries would be an obvious starting point. From this, further theoretical insights could be developed on the nature of the principal-agent dynamics outlined in the chapter.

In this vein, new institutional forms are emerging to take advantage of national resource wealth. Mineral-abundant nation-states and regions are increasingly availing of sovereign wealth funds (SWFs), or state-sponsored investment vehicles to manage surplus fiscal revenue, including that from natural resources (Clark et al. 2013). These funds are generally intended for inter-temporal surplus revenue management, whether to manage commodity price volatility, encourage counter-cyclical spending (so-called ‘rainy day’ funds), or promote intergenerational equity. SWFs have grown in size and number in the wake of the super-cycle. Moreover, whereas the majority of funds have historically sought to diversify their investment targets in foreign capital markets, some SWFs, including Singapore’s Temasek, New Zealand’s Superannuation Fund (NZSF), and Nigeria’s Sovereign Investment Authority (NSIA), have begun to direct their capital to domestic assets in order to promote national economic development. Such sovereign development funds (SDFs) represent one promising avenue for empirical research. At the company level, corporate foundations have also emerged as a significant institutional response by the extractive sector to address socio-economic development challenges. In contrast to SDFs, their focus is primarily at the local level. McElroy (2012) has made a substantial contribution to research here; in future these efforts could be continued to monitor the evolution of corporate foundations governance and performance.

All of these institutional forms should be of interest to scholars of varieties of capitalism (VoC) (Hall and Soskice 2001), who could expand their geographic focus to the economies of non-OECD countries to examine the adoption of Western institutional forms in non-Western contexts. The adoption of foreign institutional forms has become increasingly common not only due to globalisation imperatives, but also due to inter-state competition for power and influence on the world stage (Clark et al. 2013). At the same time, VoC has yet to consider the institutional form of the state-owned company, having hitherto focused on distinctions between and within liberal market economy (LME) and coordinated market economy (CME) typologies. In view of the highly mixed performance track record of NECs, scholars of public policy have attempted to identify an ideal-type governance model as well as a set of best practices. This, however, would depend upon a long list of contextual and continually evolving factors (Lahn et al. 2007). Such a finding accords with work elsewhere in the social sciences which cautions against uncritical acceptance of the existence of a single ‘best practice’ model of corporate governance, much less the possibility that such a model could be universally adopted without local modifications (Gertler 2001).

In addition to the areas mentioned in section 7.3 above, chapters 5 and 6 together make the case for monitoring the ongoing evolution in commodity trading – as a set of geographical patterns, formal institutions, and practices. The shifting of trading activities from West to East, following Asian demand growth, is perhaps the most palpable change. Likewise, since this research project was conceived, a number of areas of the industry have come under regulatory scrutiny: from public listings of

trading houses such as Glencore, to attempts to bring over-the-counter trading onto centrally cleared exchanges, to investigations of Platts and other price reporting agencies over allegations of price-rigging, to changes in the gold and silver ‘fixes’. Yet these entities are also of scholarly interest because the lines between the financial sector and the ‘real economy’ blur in myriad ways, of which chapter 6 was only one demonstration. A study of the financialization of the ‘buy side’ of the securities industry – the involvement of investment banks in physical commodity production and trade – would neatly complement that chapter, even as investment banks have retreated from the sector. In sum, the shifting patterns of vertical integration and disintegration make for a rich seam of future inquiry, if a highly dynamic and challenging one.

The concept of ‘embeddedness’ in more than one of its various dimensions could be used to expand upon the work undertaken in chapters 4, 5, and 6. Chapter 4’s study of the very early stages of OCP’s formal privatisation relates to both institutional and cultural processes: institutional in that the company became disembedded rather abruptly from one legal regime and embedded in another, which also happened to be relatively new; cultural in the sense that the new business practices and management techniques adopted by OCP represented a transition to modernity and global ‘best practice’. Over time, this transition process could be examined in depth, through participant observation and key informant interviews.

Chapter 5’s overview of the changing institutions governing phosphate production and trade may represent an instance of how a market becomes ‘disembedded’ from one set of practices and embedded in another. While the processes surrounding the

agreement of a transaction (or series of transactions) may only sometimes be ‘cultural’ in the conventional sense, there certainly exists an established, if often tacit, set of norms, procedures, practices, and understandings surrounding each pricing mechanism. An example is what one of my OCP interviewees casually referred to as the ‘gentleman’s agreement’ that prevailed in phosphate rock and phosphoric acid price negotiations until 2007 (see pp.170-171): it was customary or established practice for producers and consumers *not* to press for substantial price changes (after accounting for factors such as inflation) regardless of prevailing supply and demand conditions. Going forward, the transition to more liquid trading will bring with it a new set of norms and practices in which phosphate markets will become embedded – a contrast described in the literature comparing discrete and relational contracting.<sup>56</sup> A more detailed, longitudinal study of the changing price formation process, again entailing participant observation and key informant interviews, could shed light on these issues.

Finally, as mentioned, Chapter 6 implicitly sympathises with a substantivist as opposed to formalist account of financialization, much in line with Polanyi (2001 [1944]) and his disciples in economic sociology: that is to say, a view of economic processes as an empirically grounded and socially embedded object of study. Indeed, it might be said that Shiller (2000) and Akerlof and Shiller’s (2009) view that stories become facts in financial markets also aligns with the concept of embeddedness: financialization is not an effect that can be captured definitively in formal modelling, but instead is the product of trader psychology – which is, in turn, shaped by a wider

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<sup>56</sup> Of course, it is equally likely that culture (in the conventional sense of the term) – or more precisely, cultural differences – have a bearing on these negotiations, given the number of nationalities involved in the transactions.

macroeconomic and business environment. More specifically, in this case commodity traders have altered their ‘cognitive frames’ or fundamental assumptions about price formation, which is now viewed by many as driven predominantly by dynamics in financial markets unrelated to commodity demand and supply fundamentals. The survey of trader sentiment about the financialization of commodity markets carried out by UNCTAD (2011) and cited many times throughout this thesis is a promising template for future such studies.

Last but certainly not least, the recently revived interest in long cycles in commodity prices should be sustained. The studies highlighted in chapters 2 and 6 of this thesis remain few and far between to date, even as the financial press was for a time abuzz with debate as to whether a dip in commodity prices heralded the end of the super-cycle of the 2000s. There remain important questions surrounding the extent to which high prices are symptomatic of supply as opposed to demand drivers (Humphreys 2009) – questions which, while ultimately only answerable in retrospect, must not be lost sight of in the larger agenda of effective natural resource governance.

## REFERENCES

- Adelman, M. 1990. Mineral depletion, with special reference to petroleum. *Review of Economics and Statistics* 72(1): 1-10.
- Aleklett, K., Campbell, C.J., and Meyer J., 2003. Matthew Simmons Transcript. Proceedings of the 2nd International Workshop on Oil Depletion, May 26–27, 2003. Paris: The Association for the Study of Peak Oil and Gas. [online] Available at: <http://www.peakoil.net/iwood2003/MatSim.html>
- Aharoni, Y. and Ascher, W. 1998. Restructuring the arrangements between government and state enterprises in the oil and mining sectors. *Natural Resources Forum* 22(3): 201-213.
- Akerlof, G.A. 1970. The market for ‘lemons’: quality uncertainty and the market mechanism. *Quarterly Journal of Economics* 84(3): 488-500.
- Akerlof, G.A. and Shiller, R.L. 2009. *Animal Spirits: How Human Psychology Drives the Economy, and Why It Matters for Global Capitalism*. Princeton, NJ: Princeton University Press.
- Al Rawashdeh, R.O. 2008. The supply behaviour of state mining enterprises: a case study of the Jordanian phosphate industry. *Resources Policy* 33(4): 196-202.
- Al Rawashdeh, R.O. and Maxwell, P. 2011. The evolution and prospects of the phosphate industry. *Mineral Economics* 24: 15-27.
- Aleklett, K. and Campbell, C.J. 2003. The peak and decline of world oil and gas production. *Minerals and Energy* 18(1): 5-20.
- Allen, F. and Santomero, A.M. 2001. What do financial intermediaries do? *Journal of Banking and Finance* 25: 271-294.
- Allen, F., Morris, S., and Shin, H.S. 2006. Beauty contests, bubbles and iterated expectations in asset markets. *Review of Financial Studies* 19: 719-752.
- Allsopp, C. and Fattouh, B. 2011. Oil and international energy. *Oxford Review of Economic Policy* 27(1): 1-32.
- Ansar, S.A. 2010. ‘New Departures’ in Infrastructure Provision: An Ongoing Evolution Away from Physical Assets to User Needs. DPhil. University of Oxford.
- Arezki, R., Hadri, K., Loungani, P., and Rao, Y. 2013. Breaking the dynamic of relative primary commodity prices in levels and volatilities since 1650. In IMF Seminar, *Understanding International Commodity Price Fluctuations*. Washington, D.C., 20-21 March. Washington, D.C.: International Monetary Fund.
- Aste, L.J. 1999. Reforming French corporate governance: a return to the two-tier board? *George Washington Journal of International Law and Economics* 32(1): 1-72.
- Auty, R.M. 1993. *Sustaining Development in Mineral Resource Economies: The Resource Curse Thesis*. London: Routledge.

- , 2000. *The Geopolitics of Mineral Resources*. Mining, Environment and Development Paper series, no. 1. Geneva: United Nations Conference on Trade and Development (UNCTAD).
- Baffes, J. 2009. More on the energy/non-energy commodity price link. World Bank Working Paper No. 4982. Washington, DC: World Bank.
- Baffes, J. and Haniotis, T. 2010. Placing the 2006/08 commodity boom in perspective. World Bank Policy Research working paper no.5371. Washington, DC: World Bank.
- Bain, J.S. 1951. Relation of Profit Rate to Industry Concentration: American Manufacturing, 1936-1940. *Quarterly Journal of Economics* 65(3): 293-324.
- , 1956. *Barriers to New Competition: Their Character and Consequences in Manufacturing*. Cambridge, MA: Harvard University Press.
- Baker, G., Gibbons, R., and Murphy, K.J. 2002. Relational contracts and the theory of the firm. *Quarterly Journal of Economics* 117: 39-84.
- Balaban, O. and Tsatskin, A., 2010. The paradox of oil reserve forecasts: The political implications of predicting oil reserves and oil consumption. *Energy Policy* 38: 1340-1344.
- Bank Al-Maghrib. 2012. *Rapport Annuel [Annual Report]*. Rabat: Bank Al-Maghrib.
- Bank of Japan. 2011. *Bank of Japan Review: Recent Surge in Global Commodity Prices – Impact of financialization of commodities and globally accommodative monetary conditions*. Tokyo: Bank of Japan.
- Barry, A. 2008. Between geoscience and economics: the political metrology of oil reserves. In *Annual Meeting of the American Association of Geographers*, Boston, MA, 15-19 April.
- Barry, A. and Slater, D. 2005. *The Technological Economy*. Oxford: Routledge.
- Bathelt, H. and Glückler, J. 2011. *The Relational Economy: Geographies of Knowing and Learning*. Oxford: Oxford University Press.
- Bauer, R., Braun, R. and Clark, G.L. 2008. The emerging market for European corporate governance: the relationship between governance and capital expenditures, 1997–2005. *Journal of Economic Geography* 8(4): 441-469.
- Beckert, J. 2007. The great transformation of embeddedness: Karl Polanyi and the new economic sociology. MPIfG Discussion paper 07/1. Cologne, Germany: Max Planck Institute for the Study of Societies.
- , 2010. How do fields change? The interrelations of institutions, networks, and cognition in the dynamics of markets. *Organisation Studies* 31(5): 605-627.
- Berg, B.L. 2001. *Qualitative Research Methods for the Social Sciences*. Boston: Allyn

and Bacon. 4<sup>th</sup> ed.

- Bicchetti, D. and Maystre, N. 2012. The synchronised and long-lasting structural change on commodity markets: evidence from high-frequency data. MPRA paper no. 37486. Munich: Munich Personal RePEc Archive.
- Blas, J. 2010a. Fertiliser groups set to mark rebound from crisis with spate of acquisitions. *Financial Times* 4 March.
- . 2010b. End looms for fertilizer cartels. *Financial Times* 19 August.
- . 2011. Commodities trade finance crisis deepens. *Financial Times* 16 December.
- . 2012a. A less-super commodities super-cycle. *Financial Times* 29 May.
- . 2012b. Miners digging hole on mega-projects. *Financial Times* 4 November.
- . 2013. Kloppers' legacy – iron ore price reform. *Financial Times* 27 February.
- Blowfield, M., and Frynas, J.G. 2005. Setting the agenda: critical perspectives on corporate social responsibility in the developing world. *International Affairs* 81(3): 499-513.
- Bollman, K., Garcia, P., and Thompson, S. 2003. What killed the diammonium phosphate futures contract? *Applied Economic Perspectives and Policy* 25(2): 483-505.
- Bondre, N. 2011. Phosphorus: how much is enough? *Global Change* 76: 14-17.
- Borrell, B. and Grushkin, D. 2010. Phosphate: Morocco's White Gold. *Bloomberg BusinessWeek* 4 November. [online] Available at: [http://www.businessweek.com/magazine/content/10\\_46/b4203080895976.htm](http://www.businessweek.com/magazine/content/10_46/b4203080895976.htm)
- Bos, J.W.B. and van der Molen, M. 2013. A bitter brew? Speculation and commodity prices. Maastricht University working paper RM/12/044.
- Boscheck, R. 2007. The governance of oil supply: an institutional perspective on NOC control and the questions it poses. *International Journal of Energy Sector Management* 1(4): 366-389.
- Boyer, R. 2000. Is a finance-led growth a viable alternative to Fordism? A preliminary analysis. *Economy and Society* 20(1): 111-145.
- Bradshaw, A.M. and Hamacher, T. 2012. Nonregenerative natural resources in a sustainable system of energy supply. *ChemSusChem* 5: 550-562.
- Bradshaw, M.J. 2009. The geopolitics of global energy security. *Geography Compass* 3(5): 1920-1937.
- Bremmer, I. 2010. *The End of the Free Market: Who Wins the War Between States and Corporations?* New York: Portfolio.
- Bridge, G.J. 2008. Global production networks and the extractive sector: governing

- resource-based development. *Journal of Economic Geography* 8(3): 389-419.
- , 2010a. Past peak oil: political economy of energy crises. In Peet, R., Robbins, P. and Watts, M., eds. *Global Political Ecology*. Ch. 14.
- , 2010b. Geographies of peak oil: the other carbon problem. *Geoforum* 41(4): 523-530.
- , 2011. Resource geographies 1: Making carbon economies, old and new. *Progress in Human Geography* 35(6): 820-834.
- Bridge, G.J. and Wood, A. 2010. Less is more: spectres of scarcity and the politics of resource access in the upstream oil sector. *Geoforum* 41(4): 565-576.
- Bronck, R. 2013. Hayek on the wisdom of prices: a reassessment. *Erasmus Journal for Philosophy and Economics* 6(1): 82-107.
- Bryan, D. and Rafferty, M. 2006. *Capitalism With Derivatives: A Political Economy of Financial Derivatives, Capital and Class*. Basingstoke: Palgrave Macmillan.
- Büyüksahin, B., Haigh, M.S., and Robe, M. 2008. *Commodities and equities: a 'market of one'?* Washington, DC: Commodity Futures Trading Commission.
- Caldwell, B. 2010. *Hayek's Challenge: An Intellectual Biography of F.A. Hayek*. Chicago: University of Chicago Press.
- Çalışkan, K. 2010. *Market Threads: How Cotton Farmers and Traders Create a Global Commodity*. Princeton, NJ: Princeton University Press.
- Callon, M. 1998. *The Laws of the Markets*. Oxford: Blackwell.
- Campbell, C.J., and Laherrère, J. 1998. The End of Cheap Oil. *Scientific American*, March 1998.
- Campbell, J.L. 2007. Why would corporations behave in socially responsible ways? An institutional theory of corporate social responsibility. *Academy of Management Review* 32(3): 946-967.
- Carlton, D.W. and Perloff, J.M. 2005. *Modern Industrial Organization*. 4<sup>th</sup> ed. Boston: Pearson Addison-Wesley.
- Cashin, P. and McDermott, C.J. 2001. The long-run behaviour of commodity prices: small trends and big variability. IMF Working Paper no. 01/68. Washington, DC: IMF.
- Cashin, P., McDermott, C.J., and Scott, A. 2002. Booms and slumps in world commodity prices. *Journal of Development Economics* 69(1): 277-296.
- Caves, R.E. 1987. *American Industry: Structure, Conduct, Performance*. Englewood Cliffs, NJ : Prentice-Hall. 6th ed.
- CFTC. 2009. Disaggregated commitments of traders report: explanatory notes.

Washington, DC: Commodity Futures Trading Commission. [online] Available at: <http://www.cftc.gov/ucm/groups/public/@commitmentsoftraders/documents/file/disaggregatedcotexplanatorynot.pdf>

- Christiaensen, L., and Demery, L., 2007. Down to Earth: Agriculture and Poverty Reduction in Africa. Washington, D.C.: World Bank. [online] Available at: [http://siteresources.worldbank.org/INTPOVERTY/Resources/335642-1130251872237/DownToEarth\\_final.pdf](http://siteresources.worldbank.org/INTPOVERTY/Resources/335642-1130251872237/DownToEarth_final.pdf)
- Christophers, B. 2011. Follow the thing: money. *Environment and Planning D: Society and Space* 29(6): 1068-1084.
- Christopherson, S., Martin, R., and Pollard, J. 2013. Financialization: roots and repercussions. *Cambridge Journal of Regions, Economy and Society* 6(3): 351-357.
- Clabby, C. 2010. Does peak phosphorus loom? *American Scientist* 98(4): 291.
- Clark, G.L. 1998. Stylised facts and close dialogue: methodology in economic geography. *Annals of the Association of American Geographers* 88(1): 73-87.
- 2011. Myopia and the global financial crisis: context-specific reasoning, market structure, and institutional governance. *Dialogues in Human Geography* 1(4): 4-25.
- 2013. The Kay Review on long-horizon investing: a guide for the perplexed. *Rotman International Journal of Pension Management* 6(1): pp.58-63.
- Clark, G.L., Dixon, A.D., and Monk, A.H.B. 2013. *Sovereign Wealth Funds: Legitimacy, Governance and Global Power*. Princeton: Princeton University Press.
- Clark, G.L., Feldman, M.P., and Gertler, M.S. 2000. *The Oxford Handbook of Economic Geography*. Oxford: Oxford University Press.
- Clark, G.L. and Monk, A.H.B. 2013. Financial institutions, information, and investing-at-a-distance. *Environment and Planning A* 45(6): 1318-1336.
- Clark, G.L., Urwin, R., Allen, M., Wójcik, D., Molinari, C., and McGill, S., 2012. Project Telos: Addressing the challenges of transformation through sustainable investing. Report prepared for *Project Telos* (Towers Watson project on sustainable investing).
- Clark, G.L. and Wójcik, D. 2007. *The Geography of Finance: Corporate Governance in the Global Marketplace*. Oxford: Oxford University Press.
- Clark, G.L. and Wrigley, N. 1997. Exit, the firm, and sunk costs: reconceptualising the corporate geography of disinvestment and plant closure. *Progress in Human Geography* 21(3): 338-358.
- Clarkson, M.B.E. 1995. A stakeholder framework for analyzing and evaluating corporate social performance. *Academy of Management Review* 20(1): 92-117.
- Coase, R. 1937. The nature of the firm. *Economica* 4(16): 386-405.

- Cooper, J., Lombardi, R., Boardman, D., and Carliell-Marquet, C. 2011. The future distribution and production of global phosphate rock reserves. *Resources, Conservation and Recycling* 57: pp.78-86.
- Cordell, D., 2010. The story of phosphorus: sustainability implications of global phosphorus scarcity for food security. PhD thesis. Linköping University.
- Cordell, D., Drangert, J.O., and White, S. 2009. The story of phosphorus: global food security and food for thought. *Global Environmental Change* 19: 292-305.
- Cordell, D. and Neset, T.S. 2014. Phosphorus vulnerability: a qualitative framework for assessing the vulnerability of national and regional food systems to the multi-dimensional stressors of phosphorus scarcity. *Global Environmental Change* 24: 108-122.
- Cordell, D. and White, S. 2011. Peak phosphorus: clarifying the key issues of a vigorous debate about long-term phosphorus security. *Sustainability* 3: 2027-2049.
- Crang, M. 2005. Analysing qualitative materials. In Flowerdew, R. and Martin, D., eds. *Methods in Human Geography: A Guide for Students Doing Research*. 2<sup>nd</sup> ed. Harlow, UK: Pearson Education Limited. Ch. 13.
- Crocker, K.T. and Masten, S.E. 1991. Pretia ex machine? Prices and process in long-term contracts. *Journal of Law and Economics* 34(1): 69-99.
- Croset, P. 2012. *L'ambition au cœur de la transformation: une leçon de management venue du Sud*. Paris: Dunod.
- Crotty, J. 2005. The neoliberal paradox: the impact of destructive product market competition and 'modern' financial markets on nonfinancial corporation performance in the neoliberal era. In Epstein, G.A., ed. *Financialization and the World Economy*. Cheltenham: Edward Elgar. Ch.4.
- Cuddington, J.T. and Jerrett, D. 2008. Super cycles in real metals prices? *IMF Staff Papers* 55(4): 541-565.
- Cummins, D., 2009. Peak Phosphorus: a more important 'peak' than oil? Landmark Magazine, June 2009. [online] Available at: <http://www.wsrw.org/index.php?cat=105&art=1216>
- Daragahi, B. 2012. Morocco secures \$250m loan to upgrade phosphate industry. Financial Times beyondbrics blog [blog] 15 May. Available at: <http://blogs.ft.com/beyond-brics/2012/05/15/morocco-secures-250m-loan-to-upgrade-phosphate-industry/>
- Deaton, A. 1999. Commodity prices and growth in Africa. *Journal of Economic Perspectives* 13(3): 23-40.
- Deaton, A. and Laroque, G. 1996. Competitive storage and commodity price dynamics. *Journal of Political Economy* 104(5): 896-923.
- Deffeyes, K.S., 2001. *Hubbert's Peak: the impending world oil shortage*. Princeton:

Princeton University Press.

Denning, L. 2012. Falling off the commodity super-cycle. *Wall Street Journal* 12 March.

Dequech, D. 2003. Cognitive and cultural embeddedness: combining institutional economics and economic sociology. *Journal of Economic Issues* 3(2): 461-470.

Déry, P. and Andersen, B. 2007. Peak phosphorus. *Energy Bulletin*. [online] Available at: <http://www.energybulletin.net/node/33164>

Déry, P. 2007. Pérenniser l'Agriculture. Groupe des recherches écologiques de la Batture. [online] Available at: <http://www.caaq.gouv.qc.ca/userfiles/File/MEMOIRE%281%29/02-07-Saguenay-Dery,Patrick.pdf>

Dobbs, R. et al. 2011. Resource Revolution: Meeting the world's energy, materials, food and water needs. McKinsey Global Institute/McKinsey Sustainability and Resource Productivity Practice. [online] Available at: [http://www.mckinsey.com/features/resource\\_revolution](http://www.mckinsey.com/features/resource_revolution)

Dobozi, I. 1993. State enterprises, supply behaviour and market volatility. *Resources Policy* 18 (3): 40–50.

Donaldson, T. and Preston, L.E. 1995. The Stakeholder Theory of the Corporation: Concepts, Evidence, and Implications. *Academy of Management Review* 20(1): 65-91.

Donville, C. 2013. US phosphate export venture Phoschem is disbanded. *Bloomberg* 2 October. [online] Available at: <http://www.bloomberg.com/news/2013-10-02/u-s-phosphate-export-venture-phoschem-is-disbanded.html>.

Dore, R. 2000. *Stock Market Capitalism: Welfare Capitalism: Japan and Germany versus the Anglo-Saxons*. Oxford: Oxford University Press.

EBRD. 2013. Commercial Laws of Morocco: An Assessment by the EBRD. London: European Bank for Reconstruction and Development. [online] Available at: <http://www.ebrd.com/downloads/sector/legal/morocco.pdf>

Eifert, B., Gelb, A., and Tallroth, N.B. 2003. The Political Economy of Fiscal Policy and Economic Management in Oil-Exporting Countries. In Davis, J.M., ed. *Fiscal Policy Formulation and Implementation in Oil-Producing Countries*. Washington, D.C.: International Monetary Fund.

El Mouden, W. 2012. OCP: des milliards et des projets. *Tel Quel* 23 May. [online] Available at: [http://telquel.ma/2012/05/23/OCP-des-milliards-et-des-projets\\_523\\_2783/523](http://telquel.ma/2012/05/23/OCP-des-milliards-et-des-projets_523_2783/523)

Elser, J., and White, S. 2010. Peak phosphorus, and why it matters. *Foreign Policy* 20 April. [online] Available at: [http://www.foreignpolicy.com/articles/2010/04/20/peak\\_phosphorus?page=0,0](http://www.foreignpolicy.com/articles/2010/04/20/peak_phosphorus?page=0,0)

- Elwood, S. 2010. Mixed methods: thinking, doing, and asking in multiple ways. In DeLyser et al., eds. *The Sage Handbook of Qualitative Geography*. Ch. 6.
- Epstein, G.A. 2005. Financialization and the world economy. In Epstein, G.A., ed. *Financialization and the World Economy*. Cheltenham: Edward Elgar. Ch. 1.
- Ericsson and Gylesjö 2012. Phosphate and potash as examples for non-metallic raw materials markets. POLINARES working paper no. 21. European Commission [online] Available at: [http://www.polinares.eu/docs/d2-1/polinares\\_wp2\\_chapter9.pdf](http://www.polinares.eu/docs/d2-1/polinares_wp2_chapter9.pdf)
- Ericsson, M. and Löf, F. 2011. Overview of State Ownership in the Global Minerals Industry. Extractive Industries for Development Series #20. Washington, D.C.: World Bank. [online] Available at: <http://siteresources.worldbank.org/INTOGMC/Resources/GlobalMiningIndustry-Overview.pdf>
- Erten, B. and Ocampo, J.A. 2012. Super-cycles of commodity prices since the mid-nineteenth century. UN-DESA Working Paper no. 110. New York: United Nations.
- Esser, R. 2005. The oil industry growth challenge: expanding production capacity. Testimony to the House Energy and Air Quality Subcommittee, US House of Representatives. 7 December 2005. Available at: <http://energycommerce.house.gov/108/Hearings/12072005hearing1733/Esser.pdf>
- European Commission. 2011. Tackling the Challenges in Commodity Markets and on Raw Materials. Brussels: European Commission. [online] Available at: <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2011:0025:FIN:en:PDF>
- European Commission. 2013. Proposal for a Council Directive implementing enhanced cooperation in the area of financial transaction tax. European Commission COM(2013) 71 Final. Brussels: European Commission. [online] Available at: [http://ec.europa.eu/taxation\\_customs/resources/documents/taxation/com\\_2013\\_71\\_en.pdf](http://ec.europa.eu/taxation_customs/resources/documents/taxation/com_2013_71_en.pdf)
- European Commission. 2014. 20 critical raw materials – major challenge for EU industry. [press release] 26 May 2014. [online] Available at: [http://europa.eu/rapid/press-release\\_IP-14-599\\_en.htm](http://europa.eu/rapid/press-release_IP-14-599_en.htm)
- European Phosphorus Platform. 2013. Overall conclusions ESPC 2013. 1st Annual European Sustainable Phosphorus Conference, Brussels, Belgium, 6-7 March 2013. [online] Available at: [http://www.phosphorusplatform.eu/images/download/Conclusions\\_ESPC2013.pdf](http://www.phosphorusplatform.eu/images/download/Conclusions_ESPC2013.pdf)
- Fama, E.F. 1970. Efficient capital markets: a review of theory and empirical work. *Journal of Finance* 25(2): 383-417.
- FAO. 2004. Use of phosphate rock for sustainable agriculture. Rome: Food and Agriculture Organization of the United Nations. [online] Available at: <ftp://ftp.fao.org/docrep/fao/007/y5053e/y5053e00.pdf>

- FAO. 2008. Current world fertilizer trends and outlook to 2010/11. Rome: Food and Agriculture Organization of the United Nations. [online] Available at: <ftp://ftp.fao.org/agl/agll/docs/cwfto11.pdf>
- Fattouh, B. 2006. The origins and evolution of the current international oil pricing system: a critical assessment. In Mabro, R., ed. *Oil in the 21st Century: Issues, Challenges and Opportunities*. Oxford: Oxford University Press. Ch. 3.
- 2007. The drivers of oil prices: The usefulness and limitations of non-structural model, the demand-supply framework and informal approaches. SOAS Centre for Financial and Management Studies Discussion paper 71. London: School of Oriental and African Studies.
- 2010. An anatomy of the oil pricing system. OIES Energy Comment September 2010. Oxford: Oxford Institute for Energy Studies.
- 2011. An anatomy of the oil pricing system. OIES WPM 40, January 2011. Oxford: Oxford Institute for Energy Studies.
- Fattouh, B. and Allsopp, C. 2009. The price band and oil dynamics. Oxford Energy Comment July 2009. Oxford: Oxford Institute for Energy Studies.
- Fattouh, B., Kilian, L., and Mahadeva, L. 2012. The role of speculation in oil markets: what have we learned so far? OIES WPM 45. Oxford: Oxford Institute for Energy Studies.
- Fattouh, B. and Mahadeva, L. 2012. Financialization in oil markets: lessons for policy. Oxford Energy Comment December 2012. Oxford: Oxford Institute for Energy Studies.
- Fattouh, B. and Scaramozzino, P. 2011. Uncertainty, expectations, and fundamentals: whatever happened to long-term oil prices? *Oxford Review of Economic Policy* 27(1): 186-206.
- Fertilizers Europe. 2009. *Annual Report*. [online] Available at: [http://www.efma.org/documents/Final-Fertilizers%202009\\_v4%281%29.pdf](http://www.efma.org/documents/Final-Fertilizers%202009_v4%281%29.pdf)
- Filipelli, G.M. 2011. Phosphate rock formation and marine phosphorus geochemistry: the deep time perspective. *Chemosphere* 84(6): 759-766.
- Findlay, R. and O'Rourke, K. 2001. Commodity market integration, 1500-2000. NBER Working Paper 8579. Cambridge, MA: National Bureau of Economic Research, Inc.
- Frankel, J.A. 2010. The natural resource curse: a survey. NBER working paper no. 15836. Cambridge, MA: National Bureau of Economic Research.
- Frankel, J.A. and Rose, A.K. 2010. Determinants of agricultural and mineral commodity prices. John F. Kennedy School of Government Working Paper Series rwp 10-038. Cambridge, MA: Harvard University.
- Freeman, R.E. 1984. *Strategic Management: A Stakeholder Approach*. Boston: Pitman.

- French, S., Leyshon, A., and Wainwright, T. 2011. Financializing space, spacing financialization. *Progress in Human Geography* 35(6): 798-819.
- Friedman, M. 1970. The social responsibility of business is to increase its profits. *New York Times Magazine* 13 September.
- Gertler, M.S. 2001. Best practice? Geography, learning and the institutional limits to strong convergence. *Journal of Economic Geography* 1(1): 5-26.
- 2003. Tacit knowledge and the economic geography of context, or the undefinable tacitness of being (there). *Journal of Economic Geography* 3(1): 75-99.
- Gilbert, N. 2009. The disappearing nutrient. *Nature* 461(8): 716-718.
- Gilson, R.J. and Milhaupt, C.J., 2008. Sovereign wealth funds and corporate governance: a minimalist response to the new mercantilism. Rock Center for Corporate Governance, Stanford University, working paper series no. 26. Palo Alto, CA: Rock Center for Corporate Governance.
- Glassman, J. 2011. The geo-political economy of global production networks. *Geography Compass* 5(4): 154-164.
- Goldberg, V.P. 1980. Relational exchange: economics and complex contracts. *American Behavioural Scientist* 20(3): 337-352.
- 1985. Price adjustment in long-term contracts. *Wisconsin Law Review* (1985): 527-543.
- Goldberg, V.P. and Erickson, J.R. 1987. Quantity and price adjustments in long-term contracts: a case study of petroleum coke. *Journal of Law and Economics* 30(2): 369-398.
- Gordon, R.B., Bertram, M., and Graedel, T.E. 2006. Metal stocks and sustainability. *Proceedings of the National Academy of Sciences* 103(5): 1209-1214.
- Gorton, G. and Rouwenhurst, K.G. 2004. Facts and fantasies about commodity futures. NBER Working Paper No. 10595. Cambridge, MA: National Bureau of Economic Research, Inc.
- Granovetter, M. 1985. Economic action and social structure: the problem of embeddedness. *American Journal of Sociology* 91(3): 481-510.
- Grantham, J. 2011. Resource limitations 2: separating the dangerous from the merely serious. *GMO Quarterly Letter*, July.
- Grilli, E.R. and Yang, M.C. 1988. Primary Commodity Prices, Manufactured Goods Prices, and the Terms of Trade of Developing Countries: What the Long Run Shows. *World Bank Economic Review* 2(1): 1-47.
- Grossman, S.J. and Hart, O.D. 1986. The costs and benefits of ownership: a theory of vertical and lateral integration. *Journal of Political Economy* 94(4): 691-719.

- Grossman, S.J. and Stiglitz, J.E. 1980. On the impossibility of informationally efficient markets. *American Economic Review* 70(3): 393-408.
- Haas, P.M. 1992. Epistemic communities and international policy coordination. *International Organisation* 46(1): 1-35.
- Hall, P.A. and Soskice, D.W. 2001. *Varieties of Capitalism: The Institutional Foundations of Competitive Advantage*. Oxford: Oxford University Press.
- Hanink, D.M. 2002. Resources. In Sheppard, E. and Barnes, T.J., eds. *A Companion to Economic Geography*. Oxford: Blackwell. Ch. 14.
- Harvey, D. 1974. Population, resources, and the ideology of science. *Economic Geography* 50(3): 256-277.
- , 2006. *The Limits to Capital*. London: Verso.
- , 2011. *The Enigma of Capital and the Crises of Capitalism*. London: Profile.
- Harvey, D., Kellard, N., Madsen, J.B., and Wohar, M.E. 2012. Trends and cycles in real commodity prices: 1650-2010. Australian National University Centre for Economic History Discussion Papers No. 10.
- Hayek, F.A. 1937. Economics and knowledge. *Economica* 4: 33-54.
- Hayek, F.A. 1945. The use of knowledge in society. *American Economic Review* 35(4): 519-530.
- HCSS 2012. *Risks and Opportunities in the Global Phosphate Rock Market: Robust Strategies in Times of Uncertainty*. The Hague: Centre for Strategic Studies.
- Headey, D., and Fan, S. 2008. Anatomy of a Crisis: The Causes and Consequences of Surging Food Prices. *Agricultural Economics* 39: 375-391.
- Heap, A. 2005. *China – The Engine of a Commodities Super-cycle*. New York: Citigroup Smith Barney, 1-24.
- Heffer, P. and Prud'homme, M. 2010. Fertilizer Outlook 2010-2014. In *78th IFA Annual Conference*, Paris, France 31 May-2 June 2010. Paris: International Fertilizer Industry Association.
- , 2014. Fertilizer Outlook 2014-18. Paris: International Fertilizer Association [online] Available at:  
[http://www.fertilizer.org/imis20/images/Library\\_Downloads/2014\\_ifa\\_sydney\\_summary.pdf](http://www.fertilizer.org/imis20/images/Library_Downloads/2014_ifa_sydney_summary.pdf)
- Homer-Dixon, T. 1999. *Environment, Scarcity, and Violence*. Princeton: Princeton University Press.
- Hopt, K.J. 2011. Comparative corporate governance: the state of the art and international regulation. *American Journal of Law* 59(1): 1-74.

- Huang, W. 2009. Factors Contributing to the Recent Increase in U.S. Fertilizer Prices, 2002-08. Agricultural Resources Situation and Outlook no. AR-33. [online] Available at: <http://www.ers.usda.gov/publications/ar33/>
- Hubbard, T.N. 2001. Contractual form and market thickness in trucking. *The Rand Journal of Economics* 32(2): 369-386.
- Hubbert, M.K. 1956. Nuclear energy and the fossil fuels. *Spring Meeting of the Southern District, Division of Production, American Petroleum Institute*. San Antonio, TX, 7-9 March.
- Hults, D.R. 2012. Hybrid governance: state management of national oil companies. In Victor, D.G., Hults, D.R., and Thurber, M.C., eds. *Oil and Governance: State-Owned Enterprises and the World Energy Supply*. Cambridge: Cambridge University Press.
- Hume, N. 2014a. Iron ore derivatives see growth spurt. *Financial Times* 10 February.
- 2014b. BHP hits resistance on coking coal prices. *Financial Times* 4 April.
- Humphreys, D. 2009. The great metals boom: a retrospective. *Resources Policy* 35(1): 1-13.
- 2012. Mining investment trends and implications for minerals availability. POLINARES working paper no. 15. European Commission. [online] Available at: [http://www.polinares.eu/docs/d2-1/polinares\\_wp2\\_chapter3.pdf](http://www.polinares.eu/docs/d2-1/polinares_wp2_chapter3.pdf)
- Humphreys, M., Sachs, J.D., and Stiglitz, J.E. 2007. *Escaping the Resource Curse*. New York: Columbia University Press.
- IEA. 2011. *World Energy Outlook 2011*. Paris: International Energy Agency.
- Irwin, S.H. and Sanders, D.R. 2010. The impact of index and swap funds on commodity futures markets: preliminary results. OECD Food, Agriculture and Fisheries Working Papers, No. 27. Paris: OECD Publishing.
- Irwin, S.H., Sanders, D.R., and Merrin, R.P. 2009. Devil or angel? The role of speculation in the recent commodity futures price boom (and bust). *Journal of Agricultural and Applied Economics* 41: 393-402.
- Issler, J.V., Rodriguez, C., and Burjack, R. 2014. Using common features to understand the behaviour of metal-commodity prices and forecast them at different horizons. *Journal of International Money and Finance* 42: 310-335.
- Jacks, D.S. 2001. Populists vs. theorists: futures markets and the volatility of prices. *Explorations in Economic History* 44: 342-362.
- 2013. From boom to bust: a typology of real commodity prices in the long run. NBER Working Paper No. 18874. Cambridge, MA: National Bureau of Economic Research, Inc.
- Jacks, D.S., O'Rourke, K.H., and Williamson, J.G. 2009. Commodity price volatility and

- world market integration since 1700. NBER Working Paper 14748. Cambridge, MA: National Bureau of Economic Research, Inc.
- Jackson, P. 2009. *The future of global oil supply: understanding the building blocks*. Cambridge, MA: IHS-CERA.
- Jaffe, A.M. and Soligo, R. 2007. The changing role of national oil companies in international energy markets. Baker Institute Policy Report no. 35. Houston, TX: James A. Baker III Institute for Public Policy of Rice University [online] Available at: <http://bakerinstitute.org/files/420/>
- Jarecki, H.G. 2011. The relationship between commodity futures trading and physical commodity prices. Lecture given on 5 April. [online] Available at: <http://www.cmegroup.com/trading/agricultural/files/Dr-Henry-G-Jarecki-Lecture-on-Commodity-Futures-Trading-and-Prices.pdf>
- Jasinski, S.M. 2011. Phosphate Rock. Mineral Commodity Summaries. United States Geological Survey. [online] Available at: [http://minerals.usgs.gov/minerals/pubs/commodity/phosphate\\_rock/mcs-2011-phosp.pdf](http://minerals.usgs.gov/minerals/pubs/commodity/phosphate_rock/mcs-2011-phosp.pdf)
- , 2014. Phosphate rock. US Geological Survey Mineral Commodity Summaries, February 2014. United State Geological Survey. [online] Available at: [http://minerals.usgs.gov/minerals/pubs/commodity/phosphate\\_rock/mcs-2014-phosp.pdf](http://minerals.usgs.gov/minerals/pubs/commodity/phosphate_rock/mcs-2014-phosp.pdf)
- Jenkins, R. 2005. Globalization, Corporate Social Responsibility and poverty. *International Affairs* 81(3): 525-540.
- Jensen, M. 2001. Value maximisation, stakeholder theory, and the corporate objective function. *Journal of Applied Corporate Finance* 14(3): 8-21.
- Jerrett, D. and Cuddington, J.T. 2008. Broadening the statistical search for metal price super cycles to steel and related metals. *Resources Policy* 33(4): 188-195.
- Jeune Afrique. 2013. Maroc: l'allemand KfW prête 271 millions de dollars à OCP. Jeune Afrique 11 October. [online] Available at: <http://economie.jeuneafrique.com/entreprises/entreprises/mines/20056-maroc-lallemand-kfw-prete-271-millions-de-dollars-a-ocp.html>
- Joskow, P.L. 1985. Vertical Integration and Long-term Contracts: The Case of Coal-burning Electric Generating Plants. *Journal of Law, Economics and Organization* 1(1): 33-80.
- , 1987. Contract Duration and Relationship-Specific Investments: Empirical Evidence from Coal Markets. *American Economic Review* 77(1): 168-85.
- , 1988. Price Adjustment in Long-term Contracts: The Case of Coal. *Journal of Law and Economics* 31(1): 47-83.
- Kama, K. 2013. *Unconventional Futures: Anticipation, Materiality, and the Market in Oil Shale Development*. Unpublished DPhil thesis. University of Oxford.

- Kay, J. 2012. *The Kay Review of UK Equity Markets and Long-term Decision-Making*. London: Department for Business, Innovation and Skills.
- Kearns, R. 2010. Being there: research through observing and participating. In Hay, I., ed. *Qualitative Research Methods in Human Geography*. Ch. 6.
- Kenkel, P. 2009. Causes of fertilizer price volatility. Oklahoma Cooperative Extension Fact Sheets no. AGECE-261. [online] Available at: <http://agecon.okstate.edu/coops/files/agece-261.pdf>
- Kimmit, R. 2008. Public footprints in private markets, sovereign wealth funds and the world economy. *Foreign Affairs* (January-February). [online] Available at: <http://www.foreignaffairs.com/articles/63053/robert-m-kimmit/public-footprints-in-private-markets>
- Kindleberger, C. 1978. *Manias, Panics, and Crashes: A History of Financial Crises*. New York: Basic Books.
- Klare, M.T. 2012. *The Race for What's Left: The Global Scramble for the World's Last Resources*. New York: Metropolitan Books.
- Klein, B., Crawford, R., and Alchian, A. 1978. Vertical integration, appropriable rents, and the competitive contracting process. *Journal of Law and Economics* 21(2): 297.
- Knoepfel, I. 2011. Responsible investment in commodities: The issues at stake and a potential role for institutional investors. Zurich: onValues Investment Strategies and Research. [online] Available at: [http://www.unpri.org/files/RI\\_commodities\\_Jan2011.pdf](http://www.unpri.org/files/RI_commodities_Jan2011.pdf)
- Kondratiev, N.D. 1984 [1925]. *The Long Wave Cycle*. New York: Richardson and Snyder.
- Krautkraemer, J.A. 1998. Nonrenewable resource scarcity. *Journal of Economic Literature* 36(4): 2065-2107.
- , 2005. The economics of natural resource scarcity: the state of the debate. Resources for the Future discussion paper 05-14. Washington, D.C.: Resources for the Future.
- Krippner, G.R. 2005. The financialization of the world economy. *Socio-Economic Review* 3: 173-208.
- Krugman, P.R. 2010. The finite world. *New York Times* 26 December.
- Labban, M. 2010. Oil in parallax: scarcity, markets, and the financialization of accumulation. *Geoforum* 41(4): 541-552.
- Lahn, G., Marcel, V., Mitchell, J., Myers, K., and Stevens, P. 2007. *Good Governance of the National Petroleum Sector*. London: Chatham House.
- Le Billon, P. 2001. The political ecology of war: natural resources and armed conflicts. *Political Geography* 20: 561-584.

- Leaver, T. 2011. DME and the role of oil price benchmarks. In DIFC (Dubai International Financial Centre), *DIFC Oil Trade and Finance Conference*. Dubai, 28 March. Dubai, UAE: Dubai International Financial Centre.
- Lee, B., Preston, F., Kooroshy, J., Bailey, R., and Lahn, G. *Resources Futures: A Chatham House Report*. London: The Royal Institute of International Affairs.
- Lee, R., Clark, G.L., Pollard, J., and Leyshon, A. 2009. The remit of financial geography – before and after the crisis. *Journal of Economic Geography* 9(5): 723-747.
- Lewis, L. 2008. Scientists warn of lack of vital phosphorus as biofuels raise demands. *The Times (London)* 23 June.
- Leyshon, A. and Thrift, N. 2007. The capitalisation of almost everything: the future of finance and capitalism. *Theory, Culture and Society* 24(7-8): 97-115.
- LiPuma, E. and Lee, B. 2004. *Financial Derivatives and the Globalisation of Risk*. Durham, NC: Duke University Press.
- Lynch, M.C., 2003. The new pessimism about petroleum resources: debunking the Hubbert model (and Hubbert modellers). *Mining and Energy*, 18(1). 21-32.
- Ma'aden. 2013. Driving Development: Annual Report 2013. Riyadh: Saudi Arabian Mining Company. [online] Available at: <http://www.maaden.com.sa/download/2013-Annual-Report-En.pdf>
- Mabro, R. 2006. The Peak Oil Theory. Oxford Energy Institute. [online] Available at: [http://www.oxfordenergy.org/pdfs/comment\\_0906-2.pdf](http://www.oxfordenergy.org/pdfs/comment_0906-2.pdf)
- , 2008. The oil price conundrum. *Oxford Energy Forum* 74: 12-14.
- Macneil, I.R. 1980. *The New Social Contract: An Enquiry into Modern Contractual Relations*. New Haven, CT: Yale University Press.
- Madhavan, A. 2000. Market microstructure: a survey. *Journal of Financial Markets* 3: 205-258.
- Maddison, A. 1991. *Dynamic Forces in Capitalist Development*. Oxford: Oxford University Press.
- Manama, A.B., 2009. Morocco's OCP to near double phosphate capacity. Reuters 28 October. [online] Available at: <http://af.reuters.com/article/investingNews/idAFJOE59R0M820091028>
- Marcel, V. 2006. *Oil Titans: National Oil Companies in the Middle East*. Washington, D.C.: Brookings Institution.
- Masters, M.W. 2008. *Testimony before the Committee on Homeland Security and Governmental Affairs*. Washington, DC: United States Senate, 20 May.
- Maugeri, L. 2009. Understanding oil price behaviour through an analysis of a crisis. *Review of Environmental Economics and Policy* 3(2): 147-166.

- Mayer, J. 2009. *The Growing Interdependence Between Financial and Commodity Markets*. UNCTAD Discussion Papers No. 195. New York and Geneva: United Nations Conference on Trade and Development.
- McElroy, C.A. 2012. *Corporate Foundations in the Mining Industry: Institutional Challenges to Private Sector Involvement in Development*. DPhil. University of Oxford.
- McGill, S.M. 2011. *'Running Out' of Phosphorus? The Geopolitics of Mineral Resource Scarcity*. MPhil thesis. University of Oxford.
- , 2013. *Natural Resource Scarcity: An Overview of the Issues and the Contributions of the Investor Community to Sustainable Business and Finance*. Report commissioned by the Rothschild Foundation, London. Oxford: University of Oxford.
- McKee, A. 2003. *Textual Analysis*. London: Sage.
- McLaren, J. 2003. Trade and market thickness: effects on organizations. *Journal of the European Economic Association* 1(2-3): 328-336.
- McNeish, J.A. 2010. Rethinking resource conflict. *World Development Report 2011* background paper. Washington, DC: World Bank.
- Meggison, W.L. and Netter, J.M. 2001. From state to market: a survey of empirical studies of privatisation. *Journal of Economic Literature* 39: 321-389.
- Mezran, K. 1998. Maghribi foreign policies and the international security dimension. *Journal of North African Studies* 3(1): 1-24.
- Miller, M.H. 1997. *Merton Miller on Derivatives*. New York: Wiley.
- Minsky, H.P. 1977. A theory of systemic fragility. In Altman, E.I. and Sametz, A.W., eds. *Financial Crises: Institutions and Markets in a Fragile Environment*. New York: John Wiley and Sons.
- , 1992. The financial instability hypothesis. SSRN [online] Available at: [http://papers.ssrn.com/sol3/papers.cfm?abstract\\_id=161024](http://papers.ssrn.com/sol3/papers.cfm?abstract_id=161024)
- Mitchell, L.E. 2007. *The Speculation Economy: How Finance Triumphed Over Industry*. San Francisco: Berrett-Kohler Publications.
- Mogi, C. and Kirschbaum, E., 2010. Japan and Germany seek rare earth recycling as hedge. *Reuters* 10 November. [online] Available at: <http://uk.reuters.com/article/2010/11/10/uk-japan-rare-earths-idUKLNE6A901K20101110>
- Monk, A.H.B. and Monk, C.S. 2007. Economic geography: the rising star of the social sciences. *Oxonomics* 2(1-2): 16-20.
- Morris, M., Kelly, V.A., Kopicki, R.J., and Byerlee, D. 2007. *Fertilizer Use in African Agriculture: Lessons Learned and Good Practice Guidelines*. Washington, DC:

World Bank.

- Muellerleile, C.M. 2009. Financialization takes off at Boeing. *Journal of Economic Geography* 9(5): 663-667.
- Musacchio, A. and Lazzarini, S.G. 2012. Leviathan in business: varieties of state capitalism and their implications for economic performance. Harvard Business School working paper 12-108. Cambridge, MA: Harvard Business School.
- Nair, C. 2011. *Consumptionomics: Asia's Role in Reshaping Capitalism and Saving the Planet*. Oxford: Infinite Ideas.
- Nash, M. 2009. Morocco's OCP will become phosphates powerhouse - execs. ICIS 29 June [online] Available at: <http://www.icis.com/resources/news/2009/06/29/9228101/morocco-s-ocp-will-become-phospates-powerhouse-execs/>
- Nazih, A. 2013. L'OCP décroche 150 millions de dollars de la BID. *L'Economiste* 28 February. [online] Available at: <http://www.leconomiste.com/article/903970-l-ocp-d-croche-150-millions-de-dollars-de-la-bid>
- Newbery, D.M. and Stiglitz, J.E. 1981. *The Theory of Commodity Price Stabilization: A Study in the Economics of Risk*. Cambridge: Clarendon Press.
- Nickel, R. 2013. US phosphate export group PhosChem disbands. Reuters 2 October [online] Available at: <http://www.reuters.com/article/2013/10/02/phosphate-phoschem-idUSL1N0HS0T420131002>
- North, D.C. 1977. Markets and other allocation systems in history: the challenge of Karl Polanyi. *Journal of European Economic History* 6: 703-716.
- O'Hara, M. 1995. *Market Microstructure Theory*. Cambridge, MA: Blackwell Business.
- O'Neill, P. 2001. Financial narratives of the modern corporation. *Journal of Economic Geography* 1(2): 181-199.
- OCP Group. 2011. *Value Creation and Social Commitment: OCP Annual Report 2011*. Casablanca, Morocco: OCP Group.
- , 2013a. Leadership. [online] Available at: <http://www.ocpgroup.ma/en/group/vision/leadership>.
- , 2013b. *Macroeconomics and OCP Contributions*. Casablanca: OCP Group.
- OECD. 2005. Guidelines on Corporate Governance of State-Owned Enterprises. Paris: OECD [online] Available at: <http://www.oecd.org/daf/ca/corporategovernanceofstate-ownedenterprises/34803211.pdf>
- , 2010. *Accountability and transparency: a guide for state ownership*. Paris: OECD.
- Östensson, O. 2012. The 2008 commodity price boom: did speculation play a role?

*Mineral Economics* 25: 17-28.

- Ott, H. 2012. *Fertilizer markets and their interplay with commodity and food prices*. European Commission Joint Research Centre report no. EUR 25392 EN. Luxembourg: Publications Office of the European Union.
- Parsons, J.E. 2010. Black gold and fool's gold: speculation in the oil futures market. *Economia* 10(2): 81-116.
- Peet, R. and Watts, M. 2004. *Liberation Ecologies*. 2<sup>nd</sup> ed. London: Routledge.
- Pennings, J.M.E. and Leuthold, R.M. 2000. The motivation for hedging revisited. *Journal of Futures Markets* 20(9): 865-885.
- Perry, M.K. 1989. Vertical integration: determinants and effects. In Schmalensee, R. and Willig, R., eds. *The Handbook of Industrial Organisation*. Vol. 1. Amsterdam: North-Holland. Ch. 4.
- Pike, A. and Pollard, J. 2010. Economic geographies of financialization.
- Pindyck, R.S. 1990. Inventories and the short-run dynamics of commodity prices. NBER working paper no. 3295. Cambridge, MA: National Bureau of Economic Research.
- , 2001. The dynamics of commodity spot and futures markets: a primer. *The Energy Journal* 22(3): 1-29.
- , 2004. Volatility and commodity price dynamics. *Journal of Futures Markets* 24(11): 1029-1047.
- Pindyck, R.S. and Rotemberg, J.J. 1990. Do Stock Prices Move Together Too Much? NBER Working Papers 3324. Cambridge, MA: National Bureau of Economic Research, Inc.
- Pirages, D., and Cousins, K., 2005. *From Resource Scarcity to Ecological Security: Exploring New Limits to Growth*. Cambridge, MA: MIT Press.
- Polanyi, K. 2001 [1944]. *The Great Transformation: The Political and Economic Origins of Our Time*. Boston: Beacon Press. 2<sup>nd</sup> ed.
- Porter, M.E. 1980. *Competitive Strategy: Techniques for Analysing Industries and Competitors*. New York: The Free Press.
- Porter, M.E. and Kramer, M.R. 2006. Strategy and Society: The Link Between Competitive Advantage and Corporate Social Responsibility. *Harvard Business Review* December 2006.
- , 2011. Creating shared value. *Harvard Business Review* January 2011.
- PotashCorp. 2013. Overview of PotashCorp and its Industry. [online] Available at: [http://www.potashcorp.com/overview/upload/pdf/PotashCorp\\_Industry\\_Overview.pdf](http://www.potashcorp.com/overview/upload/pdf/PotashCorp_Industry_Overview.pdf)

- Prebisch, R. 1950. *The Economic Development of Latin America and Its Principal Problems*. New York: United Nations.
- Prior, T., Giurco, D., Mudd, G., Mason, L., and Behrisch, J. 2012. Resource depletion, peak minerals and the implications for sustainable resource management. *International Society for Ecological Economics (ISEE) 11<sup>th</sup> Biennial Conference*. Oldenburg/Bremen, Germany, 22-25 August.
- Pryke, M. and Allen, J. 2000. Monetised time-space: derivatives – money’s ‘new imaginary’? *Economy and Society* 29(2): 264-284.
- Quinn, S. 2014. The value of corporate governance for bank finance in an emerging economy: evidence from a natural experiment. *Journal of Law, Economics, and Organisation* 30(1): 1-38.
- Radetzki, M. 1978. Market structure and bargaining power: a study of three international mineral markets. *Resources Policy* 4(2): 115-125.
- Radetzki, M. 1983. *State Enterprise in International Mineral Markets*. Laxenburg, Austria: International Institute for Applied Systems Analysis.
- , 2006. The anatomy of three commodity booms. *Resources Policy* 31: 56-64.
- , 2008. *A Handbook of Primary Commodities in the Global Economy*. Cambridge: Cambridge University Press.
- , 2013a. The perseverance of the ongoing metal and mineral boom. *Mineral Economics* 25(2): 83-88.
- , 2013b. The relentless progress of commodity exchanges in the establishment of primary commodity prices. *Resources Policy* 38(3): 266-277.
- Radetzki, M. et al. 2008. The boom in mineral markets: how long might it last? *Resources Policy* 33: 125-128.
- Renouard, C. 2012. The private sector and the fight against poverty. In Ménascé, D., ed. Field Action Science Reports (FACTS) Special issue 4: Fighting Poverty, Between Market and Gift. [online] Available at: <http://factsreports.revues.org/1573>
- Renouard, C. and Lado, H. 2012. CSR and Inequality in the Niger Delta. *Corporate Governance* 12(4): 472-484.
- Reuters. 2011. Morocco’s OCP prices maiden bond issue. Reuters 21 September. [online] Available at: <http://es.reuters.com/article/idUKLDE78K03C20110921>
- Revenue Watch. 2013. Morocco – Resource Governance Index. [online] Available at: <http://www.resourcegovernance.org/countries/middle-east-and-north-africa/morocco/overview>
- Rogers, C.D. and Robertson, K. 1987. Long-term contracts and market stability: the case of iron ore. *Resources Policy* 13(1): 3-18.

- Rosemarin, de Bruijne and Caldwell. 2009. The next inconvenient truth: peak phosphorus. *The Broker* 4 August. [online] Available at: <http://www.thebrokeronline.eu/en/Magazine/articles/Peak-phosphorus>
- Runge-Metzger, A. 1995. Closing The Cycle: Obstacles To Efficient P Management For Improved Global Food Security. SCOPE 54 Available at: <http://www.icsu-scope.org/downloadpubs/scope54/3runge.htm>
- Saad, A.I. 2013. *Contesting Corporate Social Responsibility: Public Challenges to the Modern Corporation in the 21<sup>st</sup> Century*. DPhil. University of Oxford.
- Sabin, P. 2013. Betting on the apocalypse. *New York Times* 7 September.
- Sachs, J. D. and Warner, A. M. 1995. Natural resource abundance and economic growth. NBER working paper no 5398. Cambridge, MA: National Bureau of Economic Research.
- , 2001. The Curse of Natural Resources. *European Economic Review* 45: 827-838.
- Sandor, R. 2012. *Good Derivatives: A Story of Financial and Environmental Innovation*. Hoboken, NJ: Wiley.
- Scherer, F.M. 1970. *Industrial Market Structure and Economic Performance*. Chicago: Rand McNally.
- Schmalensee, R. 1989. Inter-industry studies of structure and performance. In Schmalensee, R. and Willig, R., eds. *The Handbook of Industrial Organisation*. Vol. 2. Amsterdam: North-Holland. Ch. 16.
- Schmalensee, R. and Willig, R. 1989. *The Handbook of Industrial Organisation*. Amsterdam: North-Holland.
- Schmundt, H. 2010. Essential element becoming scarce: experts warn of impending phosphorus crisis. *Spiegel Online International* 21 April. [online] Available at: <http://www.spiegel.de/international/world/essential-element-becoming-scarce-experts-warn-of-impending-phosphorus-crisis-a-690450.html>
- Schoenberger, E.J. 1997. *The Cultural Crisis of the Firm*. Oxford: Blackwell.
- Schröder, J.J., Cordell, D., Smit, A.L & Rosemarin, A. 2010. Sustainable Use of Phosphorus (European Union tender project ENV.B.1/ETU/2009/0025). Report 357. Wageningen, The Netherlands: Plant Research International, Wageningen University and Research Centre. [online] Available at: [http://ec.europa.eu/environment/natres/pdf/sustainable\\_use\\_phosphorus.pdf](http://ec.europa.eu/environment/natres/pdf/sustainable_use_phosphorus.pdf)
- Shleifer, A. and Vishny, R.W. 1997. A survey of corporate governance. *Journal of Finance* 52(2): 737-783.
- Simmons, M.R. 2006. *Twilight in the Desert: The Coming Saudi Oil Shock and the World's Economy*. Hoboken, NJ: Wiley.
- Singer, H.W. 1950. The distribution of gains between investing and borrowing countries.

- American Economic Review* 40: 473-485.
- Sinnott, E., Nash, J., and de la Torre, A. 2010. *Natural Resources in Latin America and the Caribbean: Beyond Booms and Busts?* World Bank Latin American and Caribbean Studies 55550. Washington, D.C.: World Bank.
- Slade, M.E. 1989. The two pricing systems for non-ferrous metals. *Resources Policy* 15(3): 209-220.
- . Market structure, marketing method, and price instability. *Quarterly Journal of Economics* 106(4): 1309-1340.
- Slade, M.E. and Thille, H. 2006. Commodity spot prices: an exploratory assessment of market structure and forward-trading effects. *Economica* 73(290): 229-256.
- Smil, V., 2000a. *Feeding the World: A Challenge for the Twenty-First Century*. Cambridge, MA: MIT Press.
- . 2000b. Phosphorus in the Environment: Natural Flows and Human Interferences. *Annual Review of Energy and the Environment* 25: 53-88.
- Smil, V. 2008. *Oil* (beginner's guides). Oxford: Oneworld Publications.
- Smith, J.L. 2012. Does speculation drive oil prices? *Resources* 181: 34-39. Washington, DC: Resources for the Future.
- Smith, N.C. 2003. Corporate social responsibility: whether or how? *California Management Review* 45(4): 52-76.
- Spence, M. 1973. Job market signalling. *Quarterly Journal of Economics* 87(3): 355-374.
- Steén, I. 1998. Phosphorus availability in the 21st century. Phosphorus and Potassium 217. London: Natural History Museum. [online] Available at: <http://www.nhm.ac.uk/research-curation/research/projects/phosphate-recovery/p&k217/steen.htm>
- Stevens, P. 2008. *A Methodology for Assessing the Performance of National Oil Companies*. Washington, D.C.: World Bank.
- Stigler, G.J. 1961. The economics of information. *Journal of Political Economy* 69(3): 213-225.
- Stiglitz, J.E. 1977. Monopoly, non-linear pricing and imperfect information: the insurance market. *Review of Economic Studies* 44(3): 407-430.
- Storper, M. and Venables, A.J. 2004. Buzz: face-to-face contact and the urban economy. *Journal of Economic Geography* 4(4): 351-370.
- Sukagawa, P. 2010. Is iron ore priced as a commodity? Past and current practices. *Resources Policy* 35(1): 54-63.
- Svedberg, P. and Tilton, J. 2006. The real, real price of nonrenewable resources: copper

- 1870-2000. *World Development* 34(3): 501-519.
- Tang, K. and Xiong, W. 2010. Index investment and financialization of commodities. NBER Working Papers 16385. Cambridge, MA: National Bureau of Economic Research, Inc.
- Taylor, P.J. and Buttel, F.H. 1992. How do we know we have global environmental problems? Science and the globalization of environmental discourse. *Geoforum* 23(3): 405-416.
- Telser, L.G. 1981. Why there are organised futures markets. *Journal of Law and Economics* 24(1): 1-22.
- Terazono, E. 2012. Commodities traders lose physical edge. *Financial Times* 2 May.
- The Economist*. 2001. Nauru: paradise well and truly lost. *The Economist* 20 December. [online] Available at: <http://www.economist.com/node/884045>.
- The Economist*. 2010. Mergers in the fertilizer industry: a growth business. *The Economist* 18 February. [online] Available at: <http://www.economist.com/node/15549105>
- Tilton, J.E. 2003a. Assessing the threat of mineral depletion. *Minerals and Energy* 18(1): 33-42.
- , 2003b. *On Borrowed Time? Assessing the Threat of Mineral Resource Depletion*. Washington, D.C.: Resources for the Future.
- , J.E. 2006. Outlook for Copper Prices—Up or Down? *Mining Engineering* (August): 16-20.
- , 2013. The terms of trade debate and the policy implications for primary product producers. *Resources Policy* 38(2): 196-203.
- Tilton, J.E. and Lagos, G. 2007. Assessing the long-run availability of copper. *Resources Policy* 32: 19-23.
- Traganida, S. and Milam, M. 2013. US phosphate industry sees major changes. ICIS Fertilizer Market Intelligence Report, 2013.
- Tse, Pui-Kwan. 2011. China's rare-earth industry. U.S. Geological Survey Open-File Report 2011-1042. United States Geological Survey. [online] Available at <http://pubs.usgs.gov/of/2011/1042>.
- Tversky, A. and Kahneman, D. 1974. Judgment under uncertainty: heuristics and biases. *Science* 185(4157): 1124-1131.
- UN. 2004. *World Population to 2300*. New York: United Nations.
- UNCTAD. 2006. *Overview of the World's Commodity Exchanges*. New York and Geneva: United Nations Conference on Trade and Development.

- 2009. The financialization of commodity markets. In *Trade and Development Report 2009*. New York and Geneva: United Nations Conference on Trade and Development. Ch. 2.
- 2011. *Price Formation in Financialized Commodity Markets: The Role of Information*. New York and Geneva: United Nations Conference on Trade and Development.
- UNEP. 2011. Phosphorus and food production. In *The UNEP Year Book 2011: Emerging Issues in our Global Environment*. Nairobi, Kenya: United Nations Environment Programme. 34-45.
- US Green Building Council. 2015. *LEED*. [online] Available at: <http://www.usgbc.org/leed>
- Vaccari, D. 2009. Phosphorus Famine: the threat to our food supply. *Scientific American* June 2009. [online] Available at: <http://www.scientificamerican.com/article.cfm?id=phosphorus-a-looming-crisis>
- Valentine, G. 2005. Tell me about...: Using interviews as research methodology. In Flowerdew, R. and Martin, D., eds. *Methods in Human Geography: A Guide for Students Doing Research*. 2<sup>nd</sup> ed. Harlow, UK: Pearson Education Limited.
- Valiante, D. 2013. *Price Formation in Commodities Markets: Financialization and Beyond*. Brussels: Centre for European Policy Studies.
- Van Kauwenbergh, S. 2010. *World Phosphate Reserves and Resources*. Washington, DC, USA: International Fertilizer Development Centre (IFDC).
- Van Kauwenberg, S. et al. 2010. *World phosphate rock reserves and resources*. Muscle Shoals, AL: International Fertilizer Development Corporation.
- Van Vuuren, D.P., Bouwman, A.F., and Beusen, A.H.W. 2010. Phosphorus demands for the 1970-2100 period: a scenario of resource depletion. *Global Environmental Change* 20(3): 428-439.
- Victor, D.G., Hults, D.R., and Thurber, M.C. 2012. *Oil and Governance: State-Owned Enterprises and the World Energy Supply*. Cambridge: Cambridge University Press.
- Von Horn, J. and Sartorius, C. 2009. Impact of supply and demand on the price development of phosphate (fertilizer). In Ashley, K., Mavinic, D., and Koch, F., eds. *International Conference on Nutrient Recovery from Wastewater Streams: May 10-13, 2009*. London: IWA Publishing.
- Walker, R.A. 2002. The geography of production. In Sheppard, E. and Barnes, T.J., eds. *A Companion to Economic Geography*. Oxford: Blackwell. Ch. 8.
- Weber, O., Delince, J., Duan, Y., Maene, L., McDaniels, T., Mew, M., Schneidewind, U., and Steiner, G. 2014. Trade and finance as cross-cutting issues in the global phosphate and fertilizer markets. In Scholz, R.W., Roy, A.H., Brand, F.S., Hellums, D.T., and Ulrich, A.E., eds. *Sustainable Phosphorus Management: A Global*

- Transdisciplinary Roadmap*. Dordrecht, The Netherlands: Springer. Ch. 7.
- Weimer, J. and Pape, J. 1999. A taxonomy of systems of corporate governance. *Corporate Governance: An International Review* 7(2): 152-166.
- Western Sahara Resource Watch. 2010. European banks divest from unethical Sahara fertiliser industry. Western Sahara Resource Watch. [online] Available at: <http://www.wsrw.org/a159x1704>
- Whatmore, S. 2003. Generating materials. In Pryke, M., Rose, G., and Whatmore, S., eds. *Using Social Theory*. London: Sage. Ch. 7.
- Williams, J. 1986. *The Economic Function of Futures Markets*. Cambridge: Cambridge University Press.
- Williams, J.C. and Wright, B.D. 1991. *Storage and Commodity Markets*. Cambridge: Cambridge University Press.
- Williamson, L. 2011. Fertilizer swap futures, a good sign for the market. ICIS [online] Available at: <http://www.icis.com/resources/news/2011/08/08/9483443/fertilizer-swap-futures-a-good-sign-for-the-market/>
- Williamson, O.E. 1979. Transaction-cost economics: the governance of contractual relations. *Journal of Law and Economics* 22(2): 233-62.
- Williamson, O.E. 1985. *The Economic Institutions of Capitalism*. New York: Free Press.
- Wilson, J.D. 2012. Chinese resource security policies and the restructuring of the Asia-Pacific iron ore market. *Resources Policy* 37: 331-339.
- Wójcik, D. 2012. The end of investment bank capitalism? An economic geography of financial jobs and power. *Economic Geography* 88(4): 345-368.
- Wójcik, D., and McGill, S. 2012. Evolving realities. In Clark, G.L., Urwin, R., Allen, M., Wójcik, D., Molinari, C., and McGill, S. 2012. Project Telos: Addressing the challenges of transformation through sustainable investing. Report prepared for Project Telos (Towers Watson project on sustainable investing).
- Working, H. 1953. Futures trading and hedging. *American Economic Review* 43(3): 314-343.
- 1963. Futures markets under renewed attack. *Food Research Institute Studies* 4(1): 13-24.
- Yamada, H. and Yoon, G. 2013. When Grilli and Yang meet Prebisch and Singer: piecewise linear trends in primary commodity prices. In IMF Seminar, *Understanding International Commodity Price Fluctuations*. Washington, D.C., 20-21 March. Washington, D.C.: International Monetary Fund.
- Zalik, A. 2010. Oil 'futures': Shell's Scenarios and the social constitution of the global oil market. *Geoforum* 41(4): 553-564.

Zhdannikov, D. 2012. Oil majors see boosting output by fifth by 2020. Reuters 27 June [online] Available at: <http://in.reuters.com/article/2012/06/27/oil-exploration-growth-idINL6E8HRFZX20120627>

Zukin, S. and DiMaggio, P. 1990. *Structures of Capital*. Cambridge: Cambridge University Press.

## **APPENDIX A | Summary of fieldwork experiences**

Having undertaken previous literature-based research on the global phosphate mining and fertilizer industry for both my MPhil and DPhil research, it became apparent to me that there exists a significant gap in empirical work on this topic: little is publicly known about the governance and market position of the world's single largest phosphate reserve holder and exporter, the Moroccan state-owned Office Chérifien des Phosphates (OCP) Group. While broad-brush insinuations of political interference and cartel-like behaviour are common in most mentions of OCP in the literature, it appeared that very little if any primary research of the company had been conducted, and so most available 'information' came from the relatively few official company documents that are publicly available or else outright speculation. It was therefore clear to me that in order to form a grounded empirical perspective of OCP, it would be necessary to undertake field research within the company itself, through extensive key informant interviews as well as site visits. At the same time, it appeared that this could serve as a case study contributing to the academic literature on state ownership and control in the extractive sector – and more broadly, on both natural resource geopolitics and 'state capitalism'.

The initial challenge of finding an 'in' was resolved with an introduction to a colleague of my supervisor, Professor Najat El Mekkaoui, who happens to be a Moroccan national and personally knew several OCP executives. During an initial conversation, Prof El Mekkaoui offered to provide e-mail introductions to four of these executives and organised interviews with them at OCP's Casablanca headquarters. These interviews, which were semi-structured and each lasted between one and two hours in duration, took place over a four-day period in July 2013 (see

**Error! Reference source not found.**) and served to determine the scope and content of a potential research project. Each interview concluded with an invitation to return for a more extensive visit, as well as an offer to provide whatever supplementary information (either in documentary form or through personal communication) I might require. In addition to scheduled interviews, being on-site also allowed for informal contact with several other employees, thus providing supplementary insight into what issues are most salient to the company.

*Table 5: Schedule of July 2013 interviews*

DATE/TIME	NAME	POSITION
1 July, 11:00-12:00	Mr Mohammed Soual	Chief Economist
2 July, 13:00-14:30	Mr Mohammed Soual Mr Mehdi Aboulfadl	Chief Economist Macroeconomist
3 July, 12:00-14:00	Mr Marouane Ameziane	Head of Cabinet
3 July, 16:30-18:00	Mr Amar Drissi	Executive Vice President of Industrial Operations

Following the success of this initial visit, OCP's Head of Cabinet, Mr Marouane Ameziane, volunteered one of his staff members to arrange an extensive tour of OCP's main mining, processing, and export sites as well as a return to company headquarters for further interviews. Due to seasonal conditions (Ramadan took place from 8 July-8 August, and high summer temperatures precluded site visits through the end of September) and to organisational hurdles (the drafting and approval of a memo addressed to OCP's chairman detailing my proposed project, the Oxford DPhil thesis examination process, and assurances of confidentiality measures as well as the

institutional support of my department; negotiations over the contents of a non-disclosure agreement between OCP and the University's Office of Research Services; and the challenge of coordinating the schedules of several site managers and 18 staff based at headquarters), this primary visit occurred in December 2013. In the interim, however, I had the opportunity to meet with Mr Ameziane twice in Oxford: once for an informal hour-and-a-half-long discussion of OCP's strategy, and again for an hour-long meeting with my supervisor as well as Prof Michael Willis, the University's Mohammed VI Professor of Maghreb Studies. I had previously met with Prof Willis on two occasions, each for an hour-long informal discussion: first to seek advice and insight prior to travelling to Morocco, and again to brief him on my initial findings. I was also able to liaise with Prof El Mekkaoui for a two-hour informal discussion in Oxford in which we exchanged findings about OCP and the Moroccan economy more broadly.

My itinerary and logistics (including transport within Morocco and authorised access to OCP headquarters) for the December 2013 visit was arranged by two of Mr Ameziane's staff, Ms Selma Mansouri and Mr Hakim Hajoui. My schedule, while subject to minor last-minute changes, was finalised one week prior to my departure for Morocco. Ms Mansouri acted as my 'handler', accompanying me on each of my site visits and to each of my interviews, as well as managing all communication with site managers and interviewees, obtaining desk space, providing me with documentation, and occasionally acting as a translator.

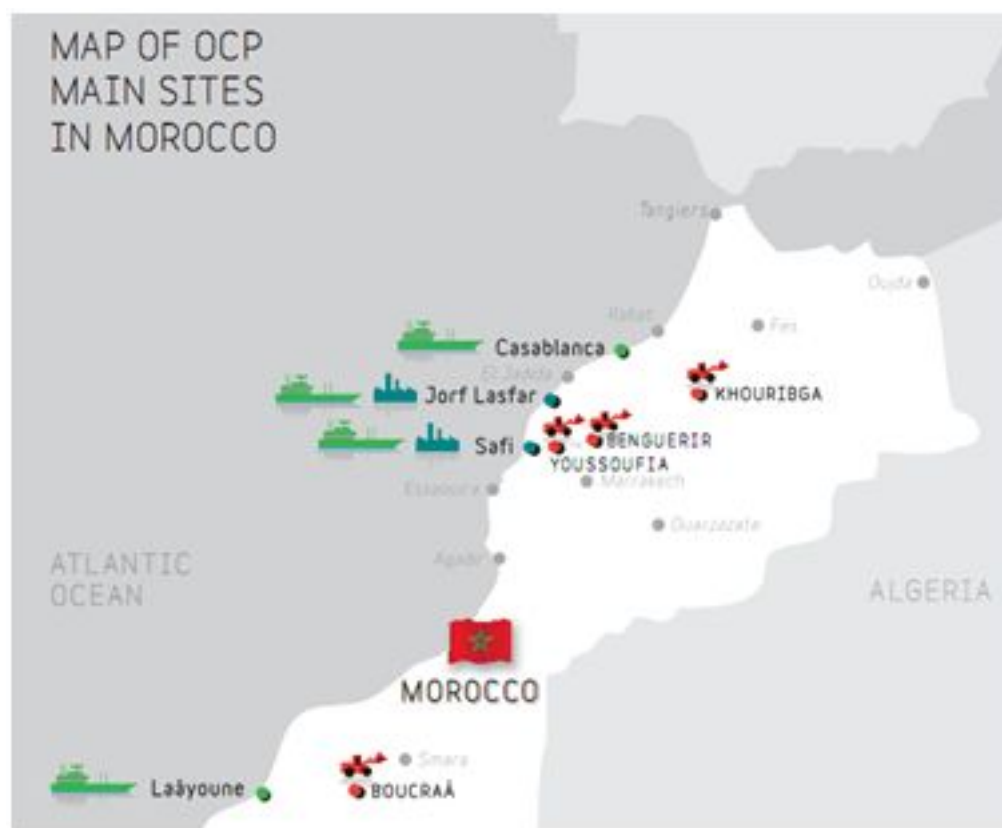
Ms Mansouri and Mr Hajoui met me at OCP headquarters on the morning of my first day, 9 December. After giving me a brief tour of the building and providing a few

initial introductions to their colleagues in the Cabinet team, they showed me to my desk and provided me with some official background documentation on OCP to review, including annual reports, presentations, and – perhaps most crucially – confidential market reports which would prove to be important primary source material for chapter 5 of my thesis.

### **Site visits**

Site visits took place during the first week of the December 2013 phase of my fieldwork, from 10-13 December. They were intended to provide me with an overview of each of OCP's three mining and export 'axes' (see Figure 10): the Khouribga-Jorf Lasfar axis in the north, the Gantour/Benguérir-Safi axis in the centre of the country, and the Boucraâ-Laâyoune axis in Western Sahara (or 'the southern provinces', or simply 'the south', in official discourse). Apart from the port of Safi I had the opportunity to visit all of these sites. By the end of the week I had gained a far better sense of the physical scale of OCP's mining, fertilizer manufacturing, and transport operations, and of the scope of its non-core business activities – and thereby its overall competitive position and place in the Moroccan economy. More generally, seeing firsthand the physical operations of a mining company was very helpful in putting the materiality of the production process into perspective, an insight relevant to my thesis as a whole. I was also able to obtain key insights from formal and informal discussions with local and mid-level managers, which would not have been possible from Casablanca.

**Figure 10: Map of Morocco showing OCP's operations**



(Source: OCP)

For the first visit, to the Khouribga mining site on 10 December, I was accompanied by Ms Mansouri and her colleague Ms Aïda Bakkali. Two managers greeted us at the site's welcome centre and gave a PowerPoint presentation overview of the site.

Following this, we were driven to the mine itself, where we made a stop at each of the main stages of production: the removal of overburden by dragline (in this case, OCP's largest such piece of equipment), extraction, the screening plant, and the washing plant. In between we also stopped to view a depleted mine pit which will act as a reservoir as part of OCP's water sustainability programme, as well as a newly built OCP Skills training centre with a capacity of 1400 students. The day concluded with a brief visit to the Mine Verte ('Green Mine'), a rehabilitated mine site currently being developed by OCP's subsidiary company, SADV (*Société d'Aménagement et de Développement Vert*, or Green Management and Development Corporation) into an

ecologically sustainable urban district. Various points along the drive also afforded a view of the pipeline still under construction that will supplant the existing railway line to transport phosphate rock to Jorf Lasfar.

The following day, 11 December, Ms Mansouri and her colleague Mr Mehdi El Kadiri accompanied me to the Benguéir mining site, Mr El Kadiri having previously worked on a number of projects there. This visit followed a similar format to the previous day's: three managers greeted us at the local club, and after a brief introduction we were driven to the mine and shown the first few phases of phosphate rock extraction and production (since raw phosphate rock is shipped directly to the port of Safi, there is no washing plant at Benguéir). We were also shown a well at which initial exploration for phosphate deposits had taken place several decades previously, and the phosphate exploration process was briefly explained. The drive to and from the mine also afforded us the opportunity to view the conveyor belts on which raw phosphate rock is transferred from point to point within the site, as well as the trains on which it is shipped to the coast for export.

Next the director of one of OCP's flagship Skills training programmes, Rhamna Skills, gave us a tour of the centre he oversees. Then, following a lunch at the local club with the site managers as well as three employees from SADV, the afternoon was spent touring the Ville Verte ('Green City'), a LEED-certified urban development project at the heart of which sits the new Mohammed VI polytechnic university. While the Ville Verte itself is still in the relatively early phases of construction and so much of this part of the visit entailed discussion with the site

manager, the University buildings are nearly complete, and so its new president was able to give us a presentation and tour of its academic and living facilities.

It is worth noting that by this stage I was able to communicate relatively comfortably in French, and although most of the individuals I met were at least conversant in English, the removal of the language barrier was significant in increasing the free flow of information.

The third site visit took place at the phosphate production and export hub of Jorf Lasfar on 12 December. Following an overview of the site and a question-and-answer session with its top manager, Ms Mansouri and I were taken to a visitor centre and given a presentation by the manager of the site's chemical operations. Given time constraints, we were not able to take a first-hand detailed look at any aspect of the production process, but instead were given a step-by-step explanation by reference to a scale diorama of the site at the visitor centre. We were then driven around the 260-ha site, as well as to a vantage point overlooking the port itself.

Later that afternoon Ms Mansouri and I met her Paris-based colleague Mr Amine Maaouni, who had previously worked on projects for Phosboucraâ, at Casablanca's main airport for our flight to Laâyoune. Our tour of OCP's Western Sahara operations began the following morning. While we were driven to the mining site of Boucraâ, Mr Maaouni showed me a presentation he had helped to prepare the previous year which gave a detailed summary and rebuttal of the various 'myths' surrounding OCP's involvement in Western Saharan phosphate mining. At the site itself, following a presentation of the principal activities carried out by Phosboucraâ at the

site's main office building, two site managers drove us to the mine itself. Here we had the opportunity to go inside a dragline and were able both to watch its operator from inside the control room and to enter the engine room. For safety reasons we were not able to leave the car to view the following stages of the extraction process, though we were taken to view the site's screening plant. Finally, we were shown the site's amenities for its workers, including newly constructed accommodation and a club with a canteen, leisure and exercise facilities, an outdoor swimming pool, and a 'mini zoo' for employees' children.

That afternoon we were driven back to Laâyoune and had lunch with the managers of the town's phosphate export platform. The managers then drove us to the end of a wharf which stretches 3km out to the ocean and from which phosphate rock is loaded onto ships for export. From here we were also able to see OCP's new on-shore wind farm at a distance. The rest of the afternoon prior to our return flight to Casablanca was spent being shown an assortment of associated sites, including a small desalination plant, a fishing port (unconnected to OCP; fishing is Western Sahara's other main economic activity), and a primary school that was until recently run by OCP for employees' children but has been turned over to an external managing entity and has opened some places for the children of other locals. The week concluded with our return to Casablanca that evening.

### **Semi-structured interviews**

The second week of my visit was taken up with interviews with various executives and managers at OCP's Casablanca headquarters (see **Error! Reference source not**

**ound.**) These individuals provided me with vital information not available in written sources, whether official company documentation, the media, or academic literature. Because they were drawn from across the various representative divisions of OCP, the interviewees collectively gave me a holistic strategic perspective on the company. Elite interviews were also important to gain a supplementary perspective on my observations from site visits and a bird's-eye view of the company. They also afforded me the opportunity to ask questions about several aspects of OCP's operations which were not included in site visits, such as government relations and legal affairs (both essential for chapter 4 of my thesis) and sales and marketing (essential for chapter 5).

**Table 6: Schedule of December 2013 interviews**

<b>Tuesday 10 December</b>
1. 18:00-18:45: Mr Otmane Bennani-Smires, Senior Legal Counsel
<b>Monday 16 December</b>
2. 10:30-12:00: Mr Mohamed El Kadiri, Deputy Director-General and Secretary-General
3. 14:30-15:30: Mr Mustapha El Ouafi, Executive Commercial Director
4. 17:00-18:00: Mr Youssef Safouane, Director-General of SADV
5. 18:15-19:15: Ms Imane Belrhiti, Regional Marketing Manager Africa
<b>Tuesday 17 December</b>
6. 9:00-9:45: Mr Youssef El Bari, Director of Industrial Innovation
7. 10:00-11:00: M. Mohammed Soual, Chief Economist and Advisor to the CEO
8. 15:00-15:30: M. Aboufadel, Macroeconomist with the Office of the Chief Economist
9. 17:30-18:15: Mrs Ghislane Guedira Bennouna, Chief Financial Officer
10. 19:00-20:00: Mr Amine Louali, Vocational Training Director (in lieu of Mr Amar Drissi, Executive Vice President of Industrial Operations)
<b>Wednesday 18 December</b>
11. 9:30-10:30: Mr Kerry McNamara, Advisor to the Chairman and CEO
12. 15:10-16:20: Mr M. Faiçal Lamrini, Regional Marketing Manager Americas, & Ms Meryem Raquai, Regional Marketing Manager North America
13. 17:00-18:00: Ms Meryem Chami, Executive Vice President, Planning and Steering
<b>Thursday 19 December</b>
14. 14:30-15:30: Ms Nour Benomar, Deputy Director of Sustainability
15. 16:45-17:30: Mr Driss Lahlou Kitane, Marketing Strategy Manager
16. 17:30-18:30: Mr Khalil Jai Hokimi, Advisor to the CEO, Entrepreneurship
<b>Friday 20 December</b>

17. 12:00-13:30: Mr Marouane Ameziane, Head of Cabinet

18. 15:00-16:30: Mr Kerry McNamara (2)

During the first week of my visit I had finalised a general questionnaire (see Appendix B) which Ms Mansouri had then circulated to all interviewees. Ms Mansouri having already given a brief e-mail introduction to my background and research topic, this questionnaire was intended to give interviewees an idea of the questions I planned to ask, though not all were necessarily applicable to each interview. The questions served not as a ‘checklist’ but as a guide to discussions, and for my own purposes was constantly updated with modifications and expansions as the second week progressed – indeed, it had been updated over the previous weekend in light of information gleaned from the sites. More detailed questions were posed during the course of each interview based on initial responses.

As **Error! Reference source not found.** shows, each interview lasted between 45 to 90 minutes. Interviewees’ ease of answering questions varied somewhat, and some were more forthcoming on information perceived as sensitive than others. On the whole, however, my interviewees displayed an impressive depth of knowledge of their respective areas of responsibility, and often of other aspects of OCP’s history, strategy, and corporate culture as well. They were all highly professional in demeanour and enthusiastic about their roles within the company; most seemed proud of what they perceived as OCP’s contribution to Morocco’s national development and to global food security. Some were surprisingly candid about subjects such as government relations, internal divisions within OCP, international market dynamics, and certain developments that have not yet been publicised. All concluded their interviews with an offer of whatever assistance I might require in future.

As well as pre-arranged interviews, I had a few opportunities for informal discussions with staff, particularly during meals. For example, Ms Mansouri had organised a welcome dinner for me which her colleagues from the Cabinet team attended, and during which I was able to have a particularly candid conversation about Morocco's competitive position in global phosphate export markets. Ms Mansouri and Mr Hajoui had also reserved a lunch table in the canteen at headquarters for the same group for each day I was based there, affording further such opportunities. Lunches at the various sites yielded insights into local socio-economic conditions as well as 'tacit knowledge' about OCP, particularly its transformation process.

### **Summary of benefits of fieldwork**

- Key informant interviews, particularly elite interviews, were essential in providing factual information related to various aspects of the company's governance (e.g. formal and informal ties to the state, regulatory framework, financial flows and oversight thereof, its critical 'transition' period which began in 2008), as well as its position in global markets, which is not available in written sources. Information gleaned in interviews thus forms the backbone of my empirical findings.
- Key informant interviews collectively also helped me to form a more intangible understanding of OCP as an institution, for example through my impressions of its corporate culture.
- Visits to production sites gave a sense of the scale and scope of OCP's operations, both in terms of the materiality of the production processes and their socio-economic impact on local communities.

- Visits to social investment sites provided a sense of the scale and scope of OCP's efforts to share mining benefit with local communities and other stakeholders. This was also true of production sites, which as mentioned above often included infrastructure and amenities for employees and their families (e.g. subsidised housing, schools, health and leisure facilities).
- My presence on-site at headquarters also facilitated access to confidential documents, particularly market reports which will be critical primary sources for chapter 5 of the thesis.
- My presence at all of OCP's sites also allowed for several spontaneous informal discussions that yielded information and perspectives that would not otherwise have been disclosed in a prearranged interview setting.
- Finally, underpinning all of these benefits was the very fact that I demonstrated strong enough curiosity about so many aspects of the company that, with the support of my department and the University, I was willing to invest the resources to undertake a comprehensive field visit. Coupled with my efforts to obtain information in as open-minded and non-threatening a manner as possible – in contrast to much of the company's previous experience with foreign outsiders – as well as my willingness to communicate in French, this allowed me to begin building a relationship of trust and collegiality at the individual and institutional levels which greatly facilitated a freer flow of information. This was true not only of face-to-face discussions but also of the sharing of confidential documentation. It also paved the way for future communication.

## APPENDIX B | Interview Questionnaire, fieldwork December 2013

### General/management/strategy

- What do you see as the mission of OCP?
- What do you consider to be OCP's greatest accomplishment?
- What are your greatest challenges of the next 5, 10, 20 years? Are these challenges greater internally or externally?
- What will OCP need most to develop its full potential? (e.g. technology, investment capital, managerial capacity, marketing capacity, price stability...)
- Has there been resistance to OCP's new corporate culture, either from within the company or externally?
- Is there a generation gap between younger and older employees?
- What do you see as a 'Southern' style of management, the term used in Pascal Croset's book on OCP? How does this differ from the concept of 'shared value'?
- What changes are being made with the new mining code of 2013? Why were these changes necessary?
- What is the difference between OCP '1.0' (2006-11) and '2.0' (2011-15)?
- What is meant by the term 'tutelage' (*tutelle*)?

### Transition to S.A. status

- How/why was the decision to transition from a government office to a *société anonyme* taken? Why was this particular corporate form chosen?
- Why was the externalisation of the pension fund from the balance sheet important to this change?

- How has OCP's status as a S.A. affected its relationship with the government over time?
- The concept of 'shared value' is clearly a core principle at OCP – do you think that the company's status as a S.A. is more conducive than other corporate forms to promoting shared value?

### **Taxation/fiscal**

- Can you tell me more about OCP's change in commercial policy from one based on volume (and thereby royalties) to one based on shareholder value creation?
- Are any of the taxes and dividends collected by the government from OCP set aside for any specific purposes, or are they integrated into the state budget?
- What is the function of the Cour des Comptes? Do any other third parties audit OCP's accounts?
- How important has external financing been to OCP's operations?
- Do you see the 'resource curse' or Dutch disease as a potential threat to the Moroccan economy in the future?

### **Sustainability/operations**

- What do you think of the concept of 'peak phosphorus'?
- What percentage of total global phosphate reserves does OCP own, according to its own calculations?
- What is OCP's depletion policy and how is it set?
- What per cent of rock phosphate is lost in fertilizer production?
- How does OCP deal with the cadmium content of phosphate rock?

- How does environmental regulation work at OCP? Is there oversight by the Ministry of Energy, Mines, and Environment or does the company ‘self-regulate’?
- What has been your experience of technical or other types of collaboration with foreign companies?
- What has been your experience of JVs abroad? Was this an explicit policy decision to have more JVs abroad to gain expertise?

### **Social investment**

- During the course of my visit I have learned a great deal about OCP’s many social investment programmes (e.g. OCP Skills, Mine Verte, Ville Verte). The social and economic value of all of these projects for their respective local populations is very clear, and in some cases the direct economic value to OCP (e.g. OCP Skills’s technical training modules) is also clear. In some cases, however, the value to OCP is less direct (e.g. leisure facilities for general population of Benguerir). Do you believe it is necessary for all of OCP’s social investment programmes to have a clear ‘business case’ for the company?
- Has it been common for other companies in Morocco to carry out extensive social investment programmes, or is OCP unique in this regard?
- Do you believe OCP has unique competencies to make these social investments?
- Is there any process of external ‘validation’ of the progress of OCP’s social investment programmes?

## Marketing/commercial

- Do you feel that OCP influences the market or is dependent on it? Is there an equivalent of a 'swing producer' in phosphate markets as there is in oil markets?
- Where does OCP sit on the industry cost curve?
- Can you explain the connection between the management of the production system and the maximisation of OCP's opportunities for margin?
- Who are your main competitors? (Who is best positioned to weather low prices?) What are their main competitive advantages? What are yours vis-à-vis theirs?
- Whom do you view as your main partners?
- What do you see as your greatest risk areas over the next 5, 10, 20 years?
- On which entities does OCP rely for energy imports? How will the company meet its energy challenges in future?
- On which entities does OCP rely for imports of ammonium and sulphur?
- Has OCP considered acquiring energy, ammonium, sulphur, or other assets abroad?
- What is the pricing methodology for phosphate rock, phosphoric acid, DAP/MAP? Are these decisions taken inside or outside OCP?
- How does OCP manage price volatility? Has volatility become a problem in phosphate markets post-2008?
- How would OCP manage a significant (e.g. 10-20 per cent) drop in phosphate prices?
- What role does IFA play in your industry? What is your own relationship to them?

- Can you describe the elements of the contracts setting phosphate (rock and/or derivative products) prices? Is the drafting of these contracts for exports a routine commercial decision, or does it require special consideration?
- Do you see any prospects for the development of a spot market for phosphate rock? Of a futures market for derivative products?
- Do you believe that the majority of market participants are satisfied with current pricing arrangements, or is there dissatisfaction/a search for alternative pricing methods?
- Would OCP consider joining a marketing organisation? If so, with whom?
- How would cuts to fertilizer subsidies in any of your major trading partners affect markets?
- Has OCP considered diversifying into other mining/processing other types of minerals domestically?
- What is your view on ‘declining’ phosphate producers such as the US?
- Does OCP have any commercial relationships with Chinese companies?

**APPENDIX C | Non-Disclosure Agreement between the University of Oxford (on behalf of the researcher) and the Office Chérifien des Phosphates (OCP) Group**

DATED 28/2/ ~~2018~~



(1) THE UNIVERSITY OF OXFORD

(2) OCP S.A.

APPROVAL OF  
LEGAL TERMS  
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DIVISION

**THIS AGREEMENT** dated 2013 is made **BETWEEN:**

- (1) **THE CHANCELLOR MASTERS AND SCHOLARS OF THE UNIVERSITY OF OXFORD** whose administrative offices are at University Offices, Wellington Square, Oxford OX1 2JD, England, represented by Eve Henshaw, duly empowered (the "**University**");
- (2) **OCP S.A.**, a limited liability company incorporated under the laws of Morocco whose registered office is located 2-4 rue Al Abtal, Hay Erraha, 20200 Casablanca, Morocco, represented by Mr. Mostafa Terrab, duly empowered (the "**Company**").

**WHEREAS:**

- (A) The Student (as defined below), as part of her DPhil studies at the University, is undertaking a Research Project into the political economy of mineral resource scarcity (the "**Research Project**"); and
- (B) The Company has certain information and data relevant to the Research Project and is willing to provide a copy of such information to the University for the purpose of enabling the Student to complete the Research Project as part of her DPhil studies and submit a related thesis (the "**Purpose**"), subject to the following terms and conditions.

**NOW IT IS AGREED** as follows:

**1. Definitions**

Unless defined elsewhere in this Agreement the following terms have the following meanings:

- 1.1 "**Effective Date**" means 1 October 2013;
- 1.2 "**Information**" means all information and data which is disclosed (whether orally, in writing, electronically or in any other format or media) from the Effective Date by the Company to the University and/or the Student in connection with the Purpose;
- 1.3 "**Student**" means Sarah McGill.

**2. The Information**

- 2.1 The Information shall remain at all times the property of the Company. Except as permitted expressly by the terms of this Agreement, the University and/or the Student shall not disclose the Information to any third party.
- 2.2 The University and/or the Student shall not acquire any rights to the Information disclosed to it under this Agreement, and shall not use it for any purpose other than for Research Project without the prior written consent of the Company.
- 2.3 The University and/or the Student shall not in any way reproduce or exploit the information for its own benefit, or for the benefit of another, without the prior written consent of the Company.

APPROVAL OF LEGAL TERMS LEGAL DIVISION
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- 2.4 The University shall use the same degree of care as it uses to protect its own confidential information, but no less than reasonable care, to prevent the unauthorised use, dissemination or publication of the Information.
- 2.5 The University and/or the Student shall disclose or otherwise make available the Information only to those employees of the University, external examiners, external lecturers who need access to the Information for the performance of their work with respect to the Purpose, and who have been notified that the Information is confidential.
- 2.6 The Information disclosed under this Agreement will be delivered "AS IS"; and the Company makes no warranty of any kind, express or implied, with respect to the accuracy or completeness of the Information which it discloses, or with respect to the suitability of such Information for the Purpose or for any other particular use and the Company will have no liability to the University or the Student resulting from the use of such Information.
- 2.7 The Company reserves the right, in its sole and absolute discretion, to reject any request for Information if deemed inappropriate or to decline to furnish further Information at any time without liability. The exercise of these rights shall not affect the enforceability of any obligation arising under this Agreement.

**3. The University's Rights**

- 3.1 Nothing contained in this shall in any way restrict or impair the University's right to use, disclose or otherwise deal with any portion of the Information which:
  - 3.1.1 was known to the University before receipt from the Company, and was not received by the University under an obligation of confidentiality owed by the University to the Company;
  - 3.1.2 is or becomes publicly known without the fault of the University and/or the Student;
  - 3.1.3 is obtained by the University from a third party in circumstances where the University has no reason to believe that there has been a breach by the provider of the information of an obligation of confidentiality owed to the Company;
  - 3.1.4 the University can establish by reasonable proof was substantially and independently developed by officers, employees or students of the University who had no knowledge of the Company's Information;
  - 3.1.5 is approved for release in writing by an authorised representative of the Company; or
  - 3.1.6 the University is specifically required to disclose by law or pursuant to the order of any court of competent jurisdiction provided that, in the case of a disclosure under the Freedom of Information Act, none of the exemptions in that Act applies to the Information.

**4. Freedom of Information Act 2000**

If the University receives a request under the Freedom of Information Act to disclose the Information, it will notify and consult with the Company. The Company will respond within five business days after receiving notice if the notice requests assistance in determining whether or not an exemption in the Act applies.



**5. Individuals**

- 5.1 The Company undertakes to make no claim in connection with this Agreement or its subject matter against any employee, the Student, agent or appointee of the other (except for claims in relation to fraud or wilful misconduct). This undertaking is intended to give protection to individuals: it does not prejudice any right which a party might have to claim against the other. The benefit conferred by this clause is intended to be enforceable by the persons referred to in it.
- 5.2 Nothing in this Agreement shall prevent or hinder the Student from submitting for a degree of the University a thesis completed by her with the aid of the Information, the examination of such a thesis by any examiners appointed by the University or the deposit of such thesis in accordance with the relevant procedures of the University.

**6. Liabilities**

- 6.1 The Company warrants that it has the right to disclose the Information to the University and the Student and that to the best of the Company's knowledge the Information disclosed does not infringe any third party intellectual property rights.
- 6.2 The liability of either party to the other for any breach of this Agreement, for any negligence or arising in any other way out of the subject matter of this Agreement will not extend to any indirect damages, or losses, or to any loss of profits, loss of revenue, loss of business, loss of Information, loss of contracts or opportunity, whether direct or indirect.

**7. Publications**

- 7.1 The University shall acknowledge the provision of the Information by the Company in all publications relating to the Research Project.
- 7.2 Where the University wishes to submit for publication results of the Research Project in which the Company has an interest pursuant to this Agreement or containing any Information, the University shall submit such contemplated publication to the Company in writing not less than thirty (30) days in advance of submission for publication. The Company shall promptly notify the University if in the Company's opinion, the work contains any Information and, if necessary, the parties shall work together in good faith to either disguise or remove such Information.

**8. General**

- 8.1 This Agreement is not transferable, and neither party may purport to assign it (in whole or in part) without the prior written consent of the other.
- 8.2 No one except a party to this Agreement has any right to prevent the amendment of this Agreement or its termination, and no one except a party may enforce any benefit conferred by this Agreement, unless this Agreement expressly provides otherwise.
- 8.3 Either party may at any time terminate the Purpose or this Agreement, by written notice to the other. Upon request of the Company to terminate the Purpose or this Agreement, the University and the Student shall immediately cease all use of the Information; and within eight (8) days thereafter shall destroy or return to the Company all such Information in its possession, sending written confirmation of despatch or destruction to the Company. The University may however retain for record purposes one copy of the Information in secure conditions in a law office or other non-technical files.

- 8.4 This Agreement shall be effective as of the "Effective Date" and shall terminate on the earlier of (a) eight (8) days after a party notifies that it wishes to terminate the Purpose or the Agreement or (c) September 30, 2014. The University's and Student's duty to protect the Information shall survive the termination of the Purpose and the Agreement and continue in full force and effect for the period of three (3) years thereafter.
- 8.5 If the whole or any part of the Information becomes the subject of any further agreement between the parties, then the terms of this Agreement shall be superseded by that further agreement; but only in respect of such part of the Information as is the subject of such further agreement.
- 8.6 This Agreement may only be amended by way of a written agreement duly signed by authorised representative of the parties. This Agreement comprises the full agreement of the parties with respect to the subject matter of this Agreement and supersedes all prior communications, understandings, and agreements between the Parties in respect of the subject matter of this Agreement, whether written or oral, express or implied.
- 8.6 This Agreement shall be governed by English Law, and the parties submit to the exclusive jurisdiction of the English Courts for the resolution of any dispute which may arise out of this Agreement, should no amicable settlement be reached despite the parties' reasonable efforts.
- 8.7 If any provision of this Agreement is declared illegal, invalid or unenforceable by a court of competent jurisdiction, that provision shall be modified by the parties to the extent necessary to render it enforceable or validly consistent with its original purpose, if possible, and if impossible, shall be severed from this Agreement, with the remaining provisions continuing in full force and effect.
- 8.8 All written notices authorized or required by any of the provisions of this Agreement shall be in English, addressed to the following individuals:  
For the University:

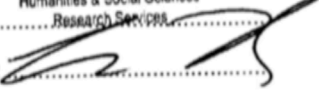
The Director, Research Services, Wellington Square, Oxford OX1 2JD, England

For the Company:

OCP SA – To the attention of Mr Marouane Ameziane  
2-4 rue Al Abtal, Hay Erraha, 20200 Casablanca, Morocco

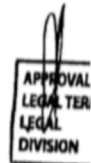
**AS WITNESS** the hands of authorised signatories for the parties on the date first mentioned above.

**SIGNED for and on behalf of THE  
CHANCELLOR MASTERS AND  
SCHOLARS OF THE UNIVERSITY  
OF OXFORD:**

Name: ..... Eve Henshaw .....  
 Position: ..... Senior Research Contracts Manager .....  
 Position: ..... Humanities & Social Sciences .....  
 Position: ..... Research Services .....  
 Signature:  .....  
 Date: 7/11/2013 .....

**SIGNED for and on behalf of OCP:**

Name: ..... Directeur Général Adjoint .....  
 Position: ..... Secrétaire Général .....  
 Signature: Mohamed ELKADIRI .....  
 Date: 28 FEB. 2014 .....



**Acknowledged by the Student**

Name: SARAH M. GILL.....

Signature: *S. M. Gill*.....

Date: 05/11/2013.....

**Acknowledged by the Student's Supervisor**

Name: .....

Signature: *[Handwritten Signature]*.....

Date: .....

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