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Mining investment trends and implications for minerals availability

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3 Mining investment trends and implications for minerals availability

David Humphreys

3.1 Investment trends

A discussion on trends in mineral investment necessarily starts with the commodity price boom of 2004-2008 (Figure 1). This was longest and strongest such boom in the last fifty years. It was a boom, moreover, which, having apparently burned out in 2008, then acquired a second wind, beginning in the second half of 2009. This sustained price buoyancy has stimulated an intense interest in commodities from investors and governments and triggered an unprecedented wave of investment in new capacity from miners.

The boom, coming at the end of a prolonged period of weak and declining real terms prices, took the industry by surprise. Companies had had little incentive to invest in large-scale new capacity for many years. In the late 1990s and early 2000s the preoccupation of the industry was cost-cutting and capital efficiency, not volume growth. The share prices of mining companies were universally depressed. Companies had few projects in the pipeline and were lightly staffed in project development.

The surge in prices from 2004 through 2006 rapidly refilled the coffers of the mining industry. Flush with cash, and lacking shovel-ready projects, the larger and better-financed companies sought to capture the benefits of strong market conditions by buying other companies (Figure 2).

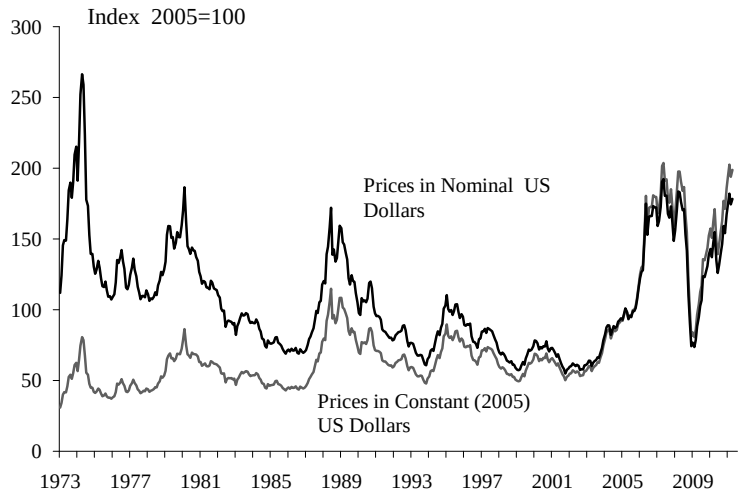

Figure 1: Nonferrous metal prices. (*Sources: The Economist, US Dept of Commerce (for US GDP deflator)*)

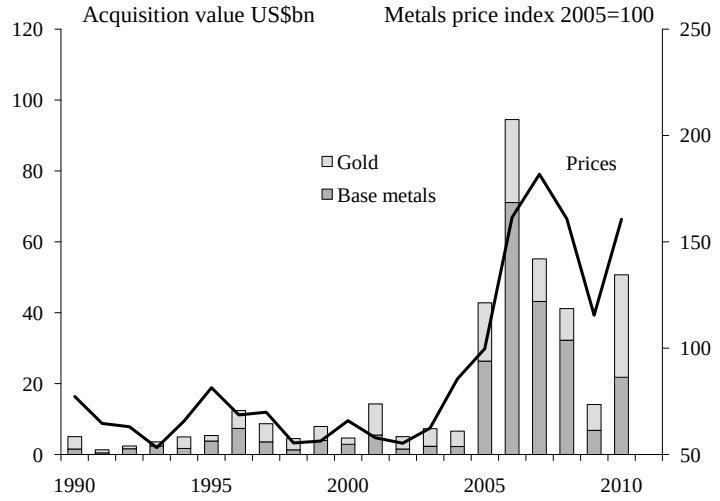

Figure 2: M&A in mining and metals. (*Sources: Metals Economics Group, The Economist)*

During these years, BHP Billiton acquired WMC Resources (2005), Xstrata acquired Falconbridge (2005-06), CVRD (now Vale) acquired Inco (2006) and Freeport-McMoRan acquired Phelps Dodge (2006). These purchases had the effect of serving to bulk up the production volumes of the acquiring company whilst giving them instant access to the acquired company's cash flows.

Meanwhile, mining companies were also beginning to invest heavily in expanding their existing mines and to evaluate the development of new ones. By the nature of the business, this is a long slow process. Suitable targets for investment have to be identified, feasibility studies conducted, permits acquired, environmental impacts assessed, community agreements struck, and all this before a project can be financed and committed. The whole process can easily take ten years to complete. Adding to the challenge, the personal and corporate resources needed to undertake large projects had been depleted after so many slow-growth years. For similar reasons, there were also severe constraints on the availability of equipment supplies and engineering contractors.

Figure 3 shows a compilation of data on investment in nonferrous mining and metals by quoted mining companies. This shows how the unprecedented high level of prices in recent years has resulted in an unprecedented level of industry investment. If investment in other mined products such as coal, iron ore, diamonds and uranium is added in, the total investment in 2011 would double from $90 billion to around $180 billion. This is completely off the scale of historical experience.

A second point to note from Figure 3 is that there is a clear delay between price peaks and investment peaks (indicated on the graph by the arrows). This follows naturally from the fact that it takes time for companies to respond to higher prices and to commit to new capital expenditure. Not only do companies have to be convinced that higher prices are likely to persist, but it takes time to bring projects to a point where they can be financed and money spent on them.

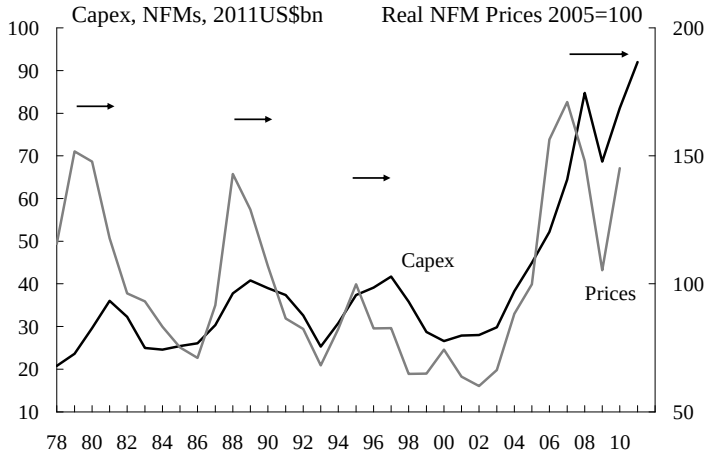

Figure 3: Investment in nonferrous mining and metals (NFMs). (*Sources: CRU, Citi 14 Dec 2010, The Economist)*

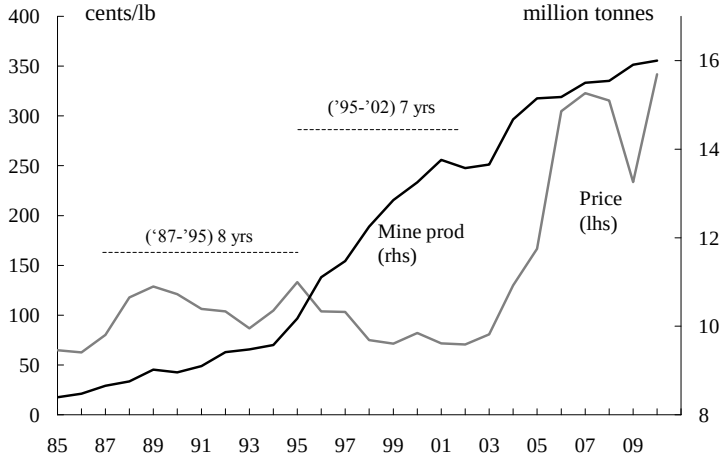

Figure 4: Copper prices and mine production. (*Sources: LME, WBMS)*

There are then even longer lags before these investments start contributing to supply. Using copper as an example, Figure 4 suggests that in previous cycles, there has been a gap of seven or eight years between a change in the price trend and a change in the production trend. The uptick in copper prices in 1987 did not result in an acceleration in global mine production until 1995, while the decline in prices following the price peak of 1995 did not result in a visible reduction in global mine supply until 2002. It can be observed from Figure 4 that the high copper prices of recent years have failed to produce acceleration in copper mine production. On the basis of history, it might reasonably be supposed that the pickup in copper prices in 2004 will impact copper mine supply around 2012.

These long lags in the supply response of mining and metals are one of the defining characteristics of the industry. It is also, arguably, a characteristic which is not always well understood by policy makers, whose time horizons are typically quite short term. The lags are, however, unavoidable. Mining is a capital intensive industry, with new mine developments typically requiring extensive ground preparation, the construction of plant, the acquisition of specialised equipment and the creation of facilities for the disposal of mine waste. Not uncommonly they will also require the building of railways, ports and power stations. It is this capital intensity which make mineral supply so inelastic and which gives rise to the highly cyclical nature of mineral prices. At the same time, it is important to emphasise, the market does work and while there may be delays in the supply response, given time, the supply necessary to balance the market is always forthcoming.

3.1.1 Investment destination

If high level information on trends in mining investment is difficult to compile, detailed information on the destination of mining investment is even harder to come by. However, information on mineral exploration – the activity which necessarily precedes production and which provides some indication of where future production might be headed – is more readily available.

The most widely-quoted data on mineral exploration are those complied by Metals Economics Group (MEG). Figure 5, which is based on data from this source, shows that well over half of exploration for metals in recent years has been directed towards developing countries. Major beneficiaries of this growth have been Latin America (especially, Chile, Peru, Argentina and Brazil) and, more recently, Africa.

This situation contrasts with the position twenty years ago where most exploration spending went to developed countries. Raw Materials Group of Stockholm have pointed out that because MEG's data compilations rest heavily on information provided by publicly quoted companies, their (MEG's) data almost certainly understates the amount of exploration spending in China. If this is so, and it seems plausible, then the proportion of exploration accounted for by developing countries is probably even higher than that shown in Figure 5.

The fact that more than half of global exploration in minerals is going to developing countries should not, perhaps, be considered so surprising in the light of the fact that these countries occupy some three-quarters of the world's land surface and, according to the USGS, a similar proportion of its known mineral reserves (Figure 6). Nor, for the same reason, should it be considered surprising that developing countries have accounted for almost all increases in global mineral production in recent years.

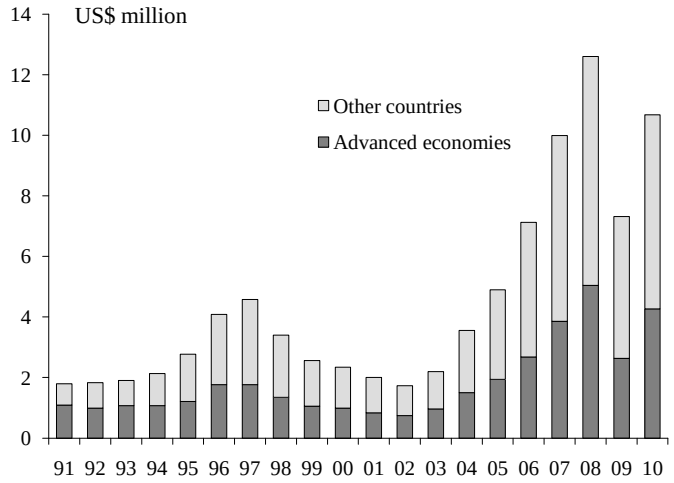

Figure 5: Mineral exploration expenditure by destination. (*Source: Metals Economics Group)*

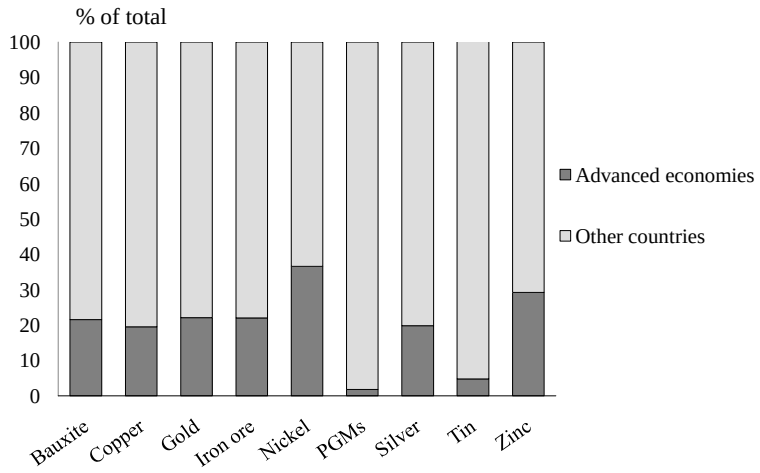

Figure 6: Global distribution of mineral reserves. (*Source: USGS, Jan 2011.)*

With both mineral production and mineral demand moving toward developing countries, minerals trade is shifting gradually towards a south-south nexus, and away from the north-south pattern that it has displayed in the past. In this process, the developed countries of the world, traditionally the dominant consumers of minerals, as well as major producers, are finding themselves being progressively marginalised. This gradual loss of control over developments in the minerals sector perhaps helps explain some of the current concern in these countries over minerals availability.

For the large western mining companies, which remain a major feature of global mineral supply, it is not really an option to confine their activities exclusively to developed countries.

Mining companies have to go to where the minerals are and many of the best unexploited opportunities are to be found in developing countries.

As regards the breakdown of exploration by commodity, it can be seen in Figure 7 that exploration spending is dominated by base metals (such as copper, nickel and zinc) and gold, the balance between the two being largely a function of relative prices. Exploration for other metals, and for diamonds, is relatively small by comparison. The importance of the role played by gold in exploration may be considered by some to be surprising. It arises from the fact that junior exploration companies play a major part in global exploration and the small scale of many gold deposits combined with the easy saleability of gold makes it the target of choice for many such companies.

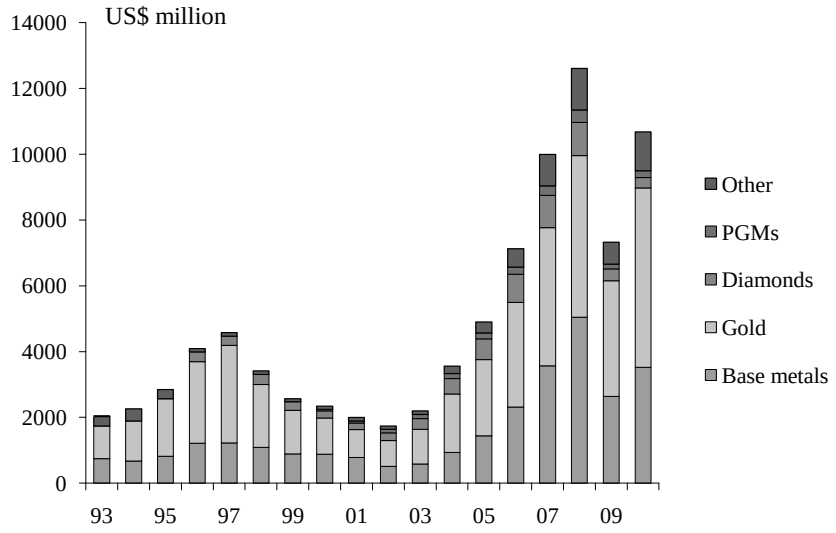

Figure 7: Mineral exploration expenditure by commodity (*Source: Metals Economics Group*)

The key point to emerge from this examination of trends is that the mining industry is investing very heavily and that the investment is spreading more and more widely across the globe. Subsequent to the global financial crisis and the recovery in commodity prices during 2009-2010, asset values in the mining sector have remained at elevated levels making corporate growth through M&A (mergers and acquisitions) less attractive than previously. Indeed, several of the most recent attempts at large-scale M&A, including BHP Billiton's attempted take-over of Rio Tinto in 2008 and of Potash Company of Saskatchewan in 2010, failed. However, cash flows into the sector have remained strong and companies have been spending a lot on organic growth. There is a general sense in the industry that, notwithstanding some short term concerns over the state of the global economy, the long term outlook for mining remains extremely positive with growth continuing to be driven for many years to come by demand from emerging markets.

This wave of investment should lead in time to the alleviation of shortages and result in better balanced markets. Where they are permitted to do so, mineral markets generally work well and supply adjusts to meet demand, albeit with time lags. High commodity prices provide a signal to miners that new investment is required whilst at the same time providing funding for that investment. Few, if any, minerals are so scarce in nature that reserve availability imposes

a material constraint on mine development and global supply. Most minerals have static reserve lives measured in decades, and some (such as aluminium and lithium) are measured in hundreds of years. There are, nonetheless, a variety of other obstacles to the industry's supply response, some natural, some economic and some institutional. These are examined in the next section.

3.2 Obstacles to investment

3.2.1 Natural obstacles

Amongst the natural constraints on resource development is the fact that, while reserves may be plentiful, they are sometimes highly concentrated in nature. Most of the world's platinum group metals (PGMs) are located in South Africa (Figure 8) and fall under the control of a small number of large companies. An additional problem is that at the moment all South African producers are constrained in their development activities by power shortages.

Gaining access to reserves of PGMs for development is thus problematic for outsiders.

Against this background, it cannot be entirely coincidental that platinum has over the past decade been one of the most supply-constrained markets, showing very low growth in mine supply (Figure 9), and very high prices. Cobalt and niobium are other examples where this concentration of reserves occurs, the concentration in these cases being in DR Congo and Brazil respectively.

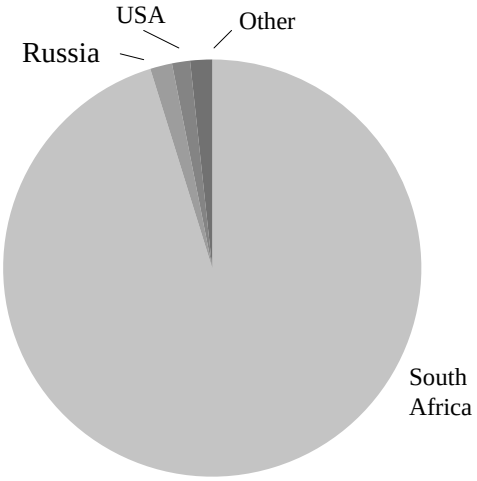

Figure 8: World reserves of platinum group metals (Source: USGS, Jan 2011)

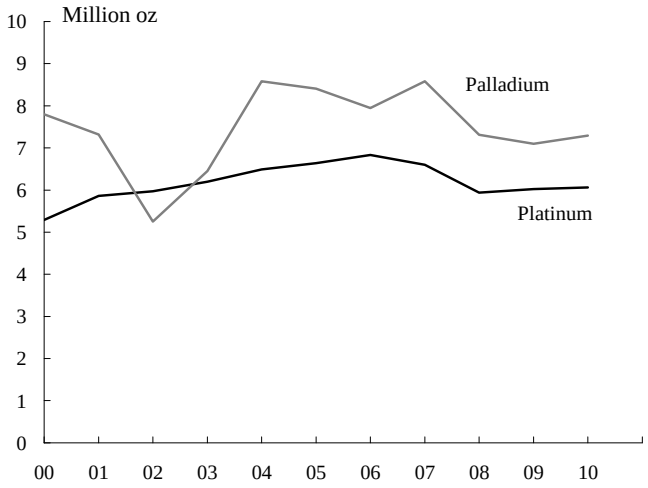

Figure 9: Mine production of platinum group metals (Source: Johnson Matthey)

A second natural constraint on supply of minerals arises from the fact that some metals are produced predominantly as the by-product of another, economically more important, metal. This is not to say that they cannot be recovered in their own right, only that the cost of doing so will be much higher, perhaps prohibitively so.

Thus cobalt is produced largely as a by-product of copper and nickel. Cadmium, indium and germanium are produced as by-products of zinc production. Gallium is produced as a by-product of bauxite. This gives rise to supply which is generally unresponsive to changes in demand with the result that prices can fluctuate wildly. The price of molybdenum, which is produced mostly as a by-product of copper, shows a fairly classic by-product profile, which is to say, long periods of low and stable prices (when markets are well supplied) interspersed with spectacular price peaks. It might be noted that quite a few of the metals on lists of 'strategic minerals' tend to be by-products and are subject to this price pattern.

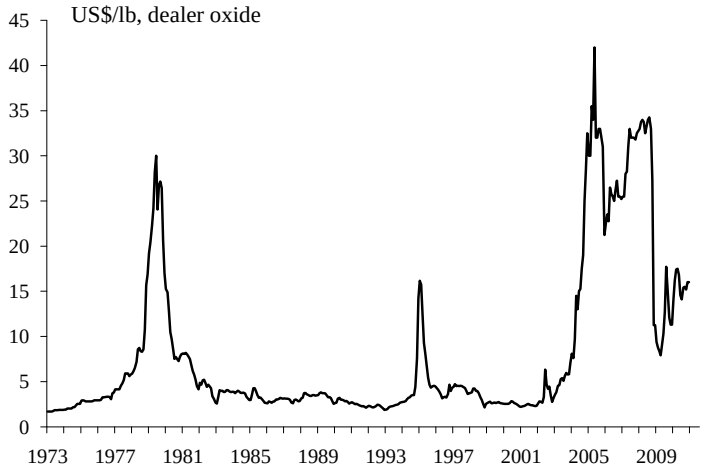

Figure 10: Molybdenum prices

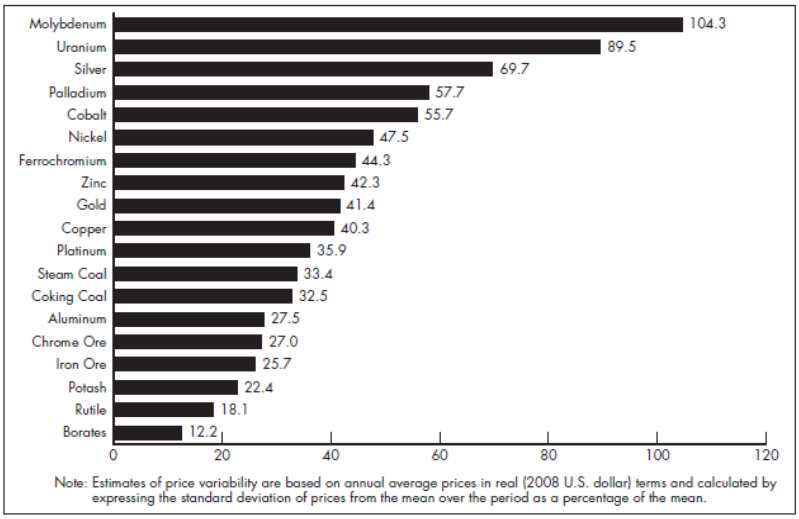

Figure 11: Mineral price variability 1970-2007. (Source: SME, Mining Engineering Handbook, 2011)

A more systematic comparison of mineral price variability is shown in Figure 11. Commodities having the greatest price volatility are at the top of the chart; those with the least at the bottom. It is evident that the top of the table features several by-product metals, including molybdenum, cobalt and palladium. By contrast, the bottom of the table is dominated by bulk commodities and by industrial minerals. In the case of these latter commodities, market imbalances tend to be addressed as much through volume adjustments (with producers reducing output to what the market will bear) as through price adjustments.

3.2.2 Economic obstacles

The second set of constraints on mineral development - referred to here as economic constraints - are a product of the fact that mineral resources deplete over time. That is to say, ores become lower in grade or more difficult to treat, whilst ore deposits are found at greater depth or in more remote locations. As an illustration of this, Figure 12 shows the recent declining trend in copper ore grades and in recoveries from those ores. Other data suggest that copper reserve found per unit of exploration spending is also in decline (Figure 13).

To some degree, the upward pressure on industry costs which results from these trends can be offset by improvements in technology, and typically this has been the experience of the past 30 years. However, there is no law which says that this has to be the case and, for a number of mineral commodities, it would appear that the declining quality of reserves, combined with other factors like higher energy prices, are pushing up net production costs, notwithstanding continuing technological progress.

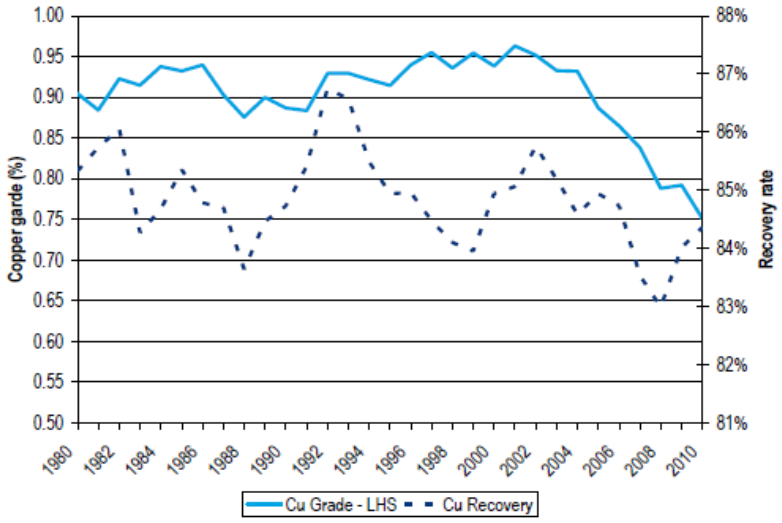

Figure 12: Copper grades and recoveries.(Source: Citi 19 May 2011)

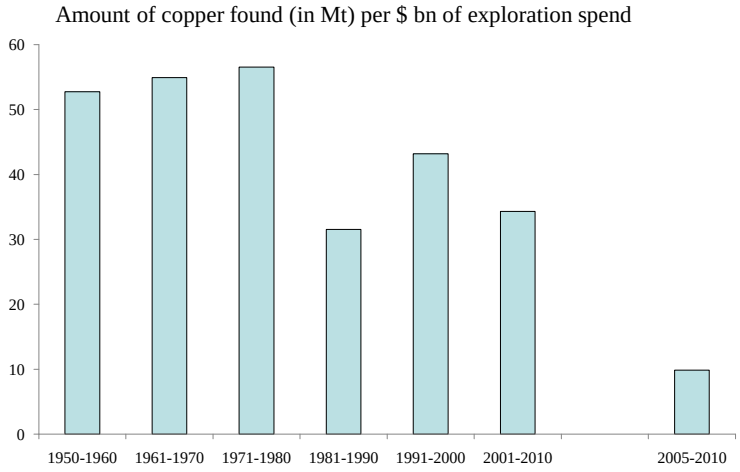

Figure 13: Copper exploration strike rates. (Source: MinEx Consulting, Sept 2009)

Sticking with copper, Figure 14 shows a recent analysis by CRU, the consultants, of what their database is telling them has happened to the operating costs of the marginal producer of copper over the past few years. Considering that these costs had been falling for the previous twenty-five years, the increase is extraordinary. Partly, of course, the effects are cyclical, but it seems likely that underlying these developments a structural shift is taking place. Moreover, this experience is not exclusive to copper. Similar evidence of deteriorating quality of ore resources and rising production costs can be adduced for nickel, PGMs and gold. At the same time, it should be noted, evidence of declining ore quality is less evident in other cases, for example, in iron ore, coal and bauxite.

What applies to operating costs applies also to capital costs. As mines become deeper and more remote from infrastructure, and as the environmental and political challenges of mining mount, so the cost of building mines has escalated too. Figure 15 shows estimates of the capital costs of some large green field copper mines currently in development or undergoing evaluation. The capital costs of these mines seems typically to fall in the range US $10,000-20,000 per tonne of annual mine capacity. Capital costs historically have generally been below US $7,500 per tonne of capacity, with US $5,000 per tonne for a long time being used by the industry as a rough rule of thumb.

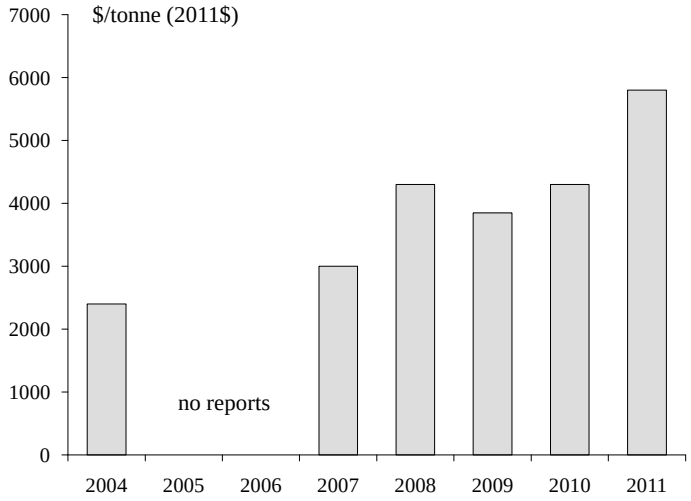

Figure 15: Marginal cost of copper production.(Source: CRU Apr 2011)

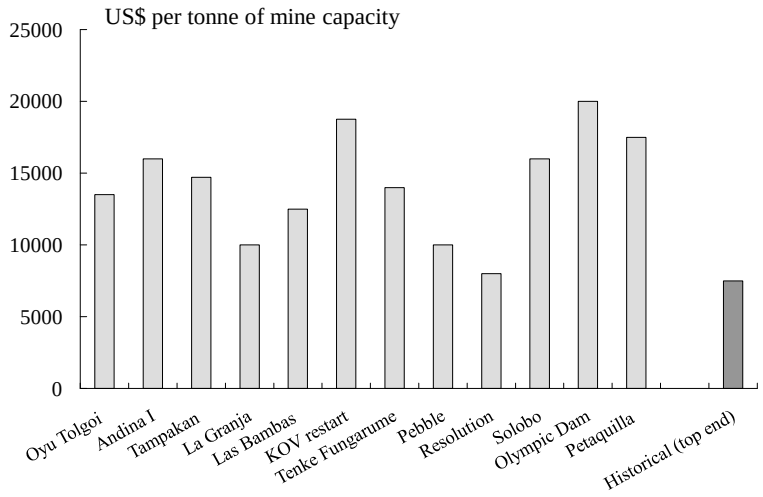

Figure 15: Capital cost of green field copper mines. (Sources: Citi Jan 2010, CRU Apr 2011)

In principle, higher costs of production should be reflected in higher prices which should in turn contribute towards bringing forward the necessary investment to balance the market. However, there are lags in the system. The long run prices used by companies in the evaluation of their projects have been rising, but companies, and the banks financing them, have to be absolutely convinced that prices are going to stay substantially higher on a sustainable basis before risking a commitment to these large projects. It might also be noted that the more multi-polar economy that the world is moving into, with its associated decline in US dollar hegemony, is likely to bring with it increased currency instability, adding a further layer of complexity and risk to mine project evaluation. In short, while companies may be investing heavily in new capacity, they are having to overcome higher and higher economic barriers, and assume greater exposure to risk, to do so.

A final observation on economic obstacles to mine development is that some of the minerals of interest in the context of the 'strategic minerals' debate are relatively small in terms of their market size. Based on 'back of the envelope' calculations, the market for gold and aluminium were worth around US $100 billion in 2010, while copper was worth almost US $150 billion. At the same time, the market for cobalt was worth less than $4 billion, the market for rare earth elements around US $2 billion, while the markets for gallium, germanium, indium and tantalum combined probably amounted to less than US $1 billion.

As such, these latter commodities tend to lack the critical mass to make them of commercial interest to the large companies in the sector. Not unnaturally, these companies like to focus their financial resources and management time on the commodities which can make a material contribution to their businesses. As a result of this, the development of projects producing many of the minerals deemed 'strategic' is often left to smaller companies which, while they may be enterprising, lack the experience, political clout and financial muscle of the big companies, making the route from discovery to production lengthier and more uncertain. This said, there are a very large number of projects currently in construction or undergoing evaluation for a number of strategic minerals, including rare earth elements and lithium.

3.2.3 Institutional obstacles

Institutional obstacles to miners' supply responses are very much at the heart of the Polinares project. However, the subject is a large one and it is not possible in this report to address this subject in any detail.

Some of these institutional obstacles to increased mine supply come in the form of the normal delays in mine development that arise from the need for miners everywhere to conduct environmental and social impact studies prior to applying for mine permitting and then to go through a lengthy process of approvals before obtaining the permits necessary to commence production. These regulatory hurdles are getting higher with time and taking longer to surmount (as well as costing more) as the standards expected of the industry rise and public scrutiny of the industry increases.

Beyond these normal regulatory obstacles to mine development are some more overtly political obstacles relating to the distribution of benefits from mining and occasionally the ownership of mining assets. These obstacles have become a lot more prominent in recent years as commodity prices have increased and governments have sought to acquire a greater share of the industry's increased revenues for their own use and for their citizens.

Right across the industry, governments have raised taxes and royalties on the mining industry. How far this has affected company investment decisions it is hard to know. For companies already in production, there is not much that they can do about these increased imposts and, whilst prices remain high, they can generally absorb them. However, taxation is a factor mining companies have to take into account when assessing the likely returns to shareholders from an investment and, at the margin, it can be an important factor influencing the decision whether or not to proceed with an investment. A particular problem is posed by royalties based on production volumes (as opposed to profits) which are a real operating cost for a mining business and the effects of which flow straight directly through to the bottom line.

Then, of course, there are the more direct forms of intervention which governments engage in from time to time as expressions of resource nationalism. Such interventionism was a common feature of mining during the 1970s but generally fell out of favour in the following two decades. (Although, it should be pointed out, it continued to gather strength in the oil sector.) As commodity prices have revived in recent years so too has the incidence of direct government intervention in the affairs of the mining industry. Bolivia, for example, embarked on a programme of nationalisation for the mining industry in 2005. Zimbabwe passed an Act in 2008 to promote the 'indigenisation' of mining companies operating within its borders. Guinea stripped Rio Tinto of some of its permits to mine iron ore in 2008 on the grounds that they were not advancing the projects quickly enough, while the government of DR Congo in 2010 expropriated two mines belonging to First Quantum Minerals.

Nor should it be supposed that such interventionism is confined to developing countries. The Australian government blocked the purchase of the Prominent Hill mine by China Minmetals in 2009, while the Canadian government blocked BHP Billiton's proposed take-over of the Potash Corporation of Saskatchewan in 2010.

Such interventionism inevitably adds another layer of uncertainty to investment decision-making by mining companies. Political risk assessment is difficult and unreliable and there are only so many things that companies can do to mitigate risk. Many available strategies for risk mitigation, such as bringing in partners or buying political risk cover, result in reduced control over projects and/or increased costs. Despite this, on the basis that mining companies have to go where the minerals are found (and presumably also because mineral prices remain high), companies are committing to invest in what might be regarded as 'difficult' countries such as DR Congo, Guinea and Mongolia in the hope and expectation that they can manage the geopolitical risks and not become victims several years down the road of the 'obsolescing bargain'. Time will tell whether this confidence is justified. The experience of the oil sector, which is now wholly dominated by state firms, provides a somewhat discouraging example.

Figure 16 shows the results of the most recent issue of an investor perceptions survey which is carried out annually by the Fraser Institute of Canada. The survey seeks to gain the mining industry's perception of the relative attractiveness of various mineral-rich country. While such analyses have their limitations, it is evident that the relative attractiveness of many mineral-rich countries in the developing world is considered quite low.

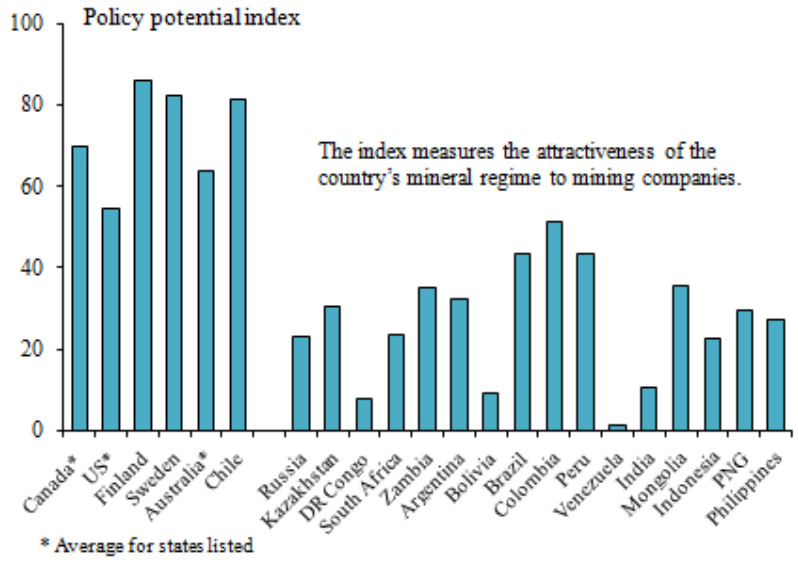

Figure 16: Investor appeal of selected mining countries. (Source: Fraser Institute, Survey of Mining Companies 2010-2011, Apr 2011)

3.3 Minerals availability

Concern over mineral availability in public policy circles is closely correlated with mineral prices, and recent high prices have predictably triggered a revival of concern about mineral supplies in consuming regions.

Generally speaking, where markets are left to operate, mineral shortages will be overcome. Higher commodity prices result in increased investment and, eventually, higher mineral production. Constraints arising from reserve limitations are rarely, if ever, a problem. However, there are, as has been discussed, inevitable lags in the system, and supply adjustments take time. Doubtless, policy-makers find this frustrating.

History should provide some reassurance for policy-makers concerned about minerals availability. Intense concern over resource availability in the late 1970s and early 1980s - a concern bolstered by allegations that the Soviet Union and its client states were engaged in a 'resource war' - were effectively resolved in the middle of the 1980s by a combination of slowing global growth and rising mineral production. Shortages quickly disappeared and the problem for the next twenty years ironically became not too little supply but too much.

As to when exactly the current shortages will be alleviated, this will similarly reflect a combination of how the global economy develops and more specific sector influences. However, if LME stock levels are anything to go by, then it would appear that some metal markets have already eased significantly (Figure 17).

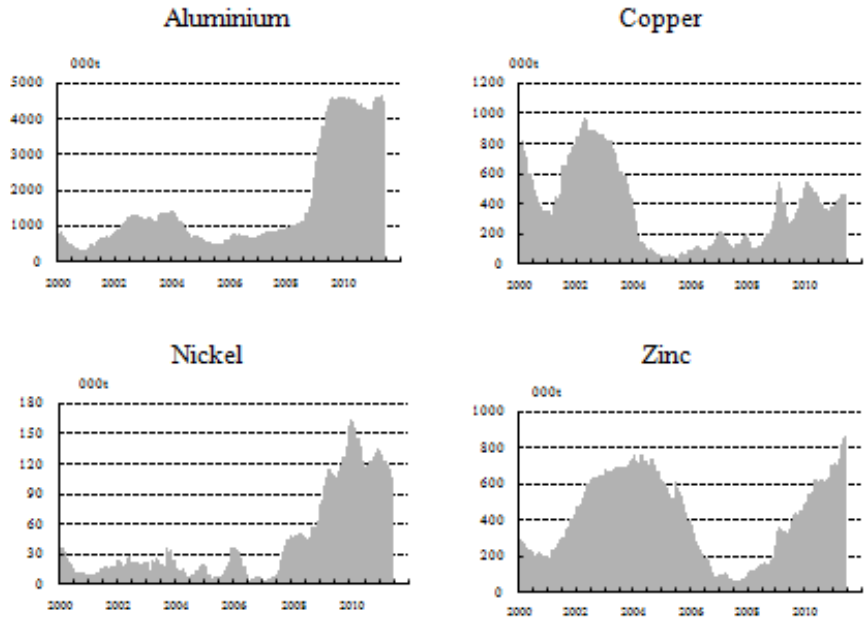

Figure 17: LME metal stocks.

The weight of projects in other, more evidently shortage minerals, such as iron ore and rare earth elements, should result in a similar easing of markets. At the same time, a demand shock resulting, for example, from a slowdown of China's economy could bring about a much more rapid easing of markets.

Perhaps the biggest unresolved issue for future mineral availability - and perhaps the one that should be the primary focus of attention for policy-makers in consuming countries - is how far governments of mineral producing countries will take their campaign of resource nationalism and how far this will inhibit the market's supply response. Unquestionably, the perception that the world is facing a multi-decade minerals 'supercycle' (a perception which the industry itself has done much to encourage) has reinforced the case for many producing countries to increase their take from, and involvement in, the minerals sector. If anything, this tendency is continuing to strengthen. Up to now, the profitability of the mining industry has been such that it has been able to absorb the additional financial and political pressures that this policy has brought with it. However, as markets become better balanced and price expectations moderate then government demands will become a more important factor in mining companies' assessment of their investments and a bigger factor in the supply equation.