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## MANGANESE INDUSTRY ANALYSIS: IMPLICATIONS FOR PROJECT FINANCE

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Working Paper Series

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AFRICAN DEVELOPMENT BANK GROUP

# **MANGANESE INDUSTRY ANALYSIS: IMPLICATIONS FOR PROJECT FINANCE**

**Ousman Gajigo and Emelly Mutambatsere and Elvis Adjei**

Working Paper No. 132

June 2011

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**Office of the Chief Economist**

## **Abstract**

**This study analyzes the global manganese value chain, with the objective of understanding types and sources of project finance, and the role of development finance institutions (DFIs). We find that DFIs participation in transactions involving the iron group of metals, which encompasses manganese, was low for transactions completed between 2005 and 2010 as well as upcoming transactions between 2010 and 2015. Nonetheless, financing from local and multilateral development banks was countercyclical in nature; and in the very**

**few transactions where multilateral development partners were involved, their participation was in the form of A-B or syndicated loans, drawing-in additional financing from commercial banks. Applied to the manganese mining sector specifically, these findings suggest limited need for DFIs financing. However, some features of the manganese market are assessed to have a tempering effect on private finance, in particular, the substantial and largely unmitigated market risk which improves the case for longer term DFIs financing.**

**Keywords:** Manganese, development finance, project finance

**JEL classification** L70, O16, Q30, Q31

## **1. Introduction**

This working paper, analyzes the global manganese value chain, with the objective of understanding types and sources of project finance, and the role of development finance institutions (DFIs). This industry is of interest given growing global demand for manganese products, and the sector's high potential for the African continent which holds a lion's share of the world's manganese reserves. The globalized nature of commodity markets, and a dearth of transactions on the African continent, necessitates a global review of transactions.

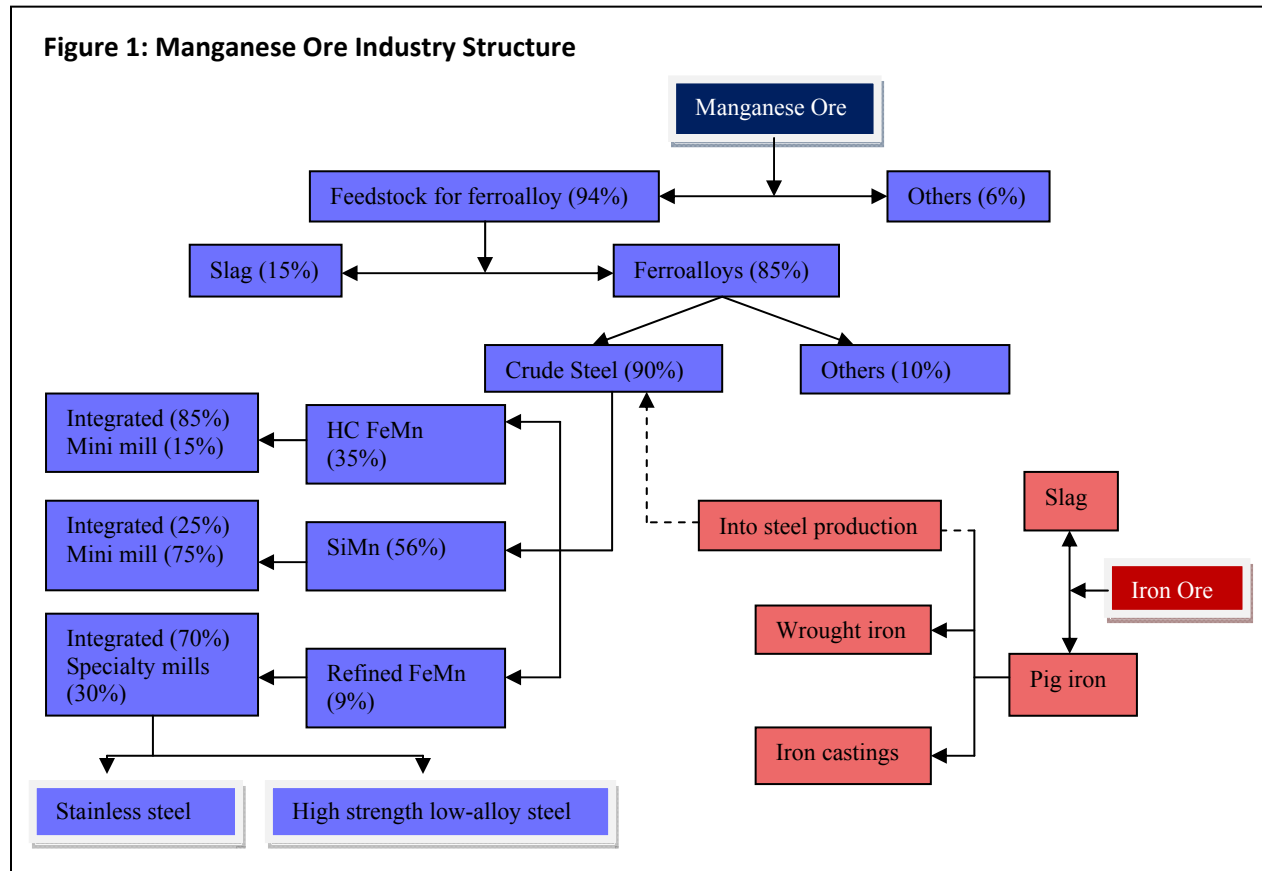
We find that DFIs participation in transactions involving the iron group of metals, which encompasses manganese, was low for transactions completed between 2005 and 2010 as well as upcoming transactions between 2010 and 2015. Nonetheless, financing from local and multilateral development banks was countercyclical in nature; and in the very few transactions where multilateral development partners were involved, their participation was in the form of A-B or syndicated loans, drawing-in additional financing from commercial banks. Applied to the manganese mining sector specifically, these findings suggest limited need for DFIs financing. However, some features of the manganese market are assessed to have a tempering effect on private finance, in particular, the substantial and largely unmitigated market risk which improves the case for longer term DFIs financing.

The paper is structured as follows. First we provide a comprehensive description of the manganese industry and its value chain. This is followed by a discussion of the industry outlook, which is justified by the fact that almost all the manganese produced is used in steel production. Section 4 covers financing options for transactions in the iron group of metals and the role of development finance institutions. A conclusion summarizes the main findings.

## **2. The Manganese Value Chain: Stylized Facts**

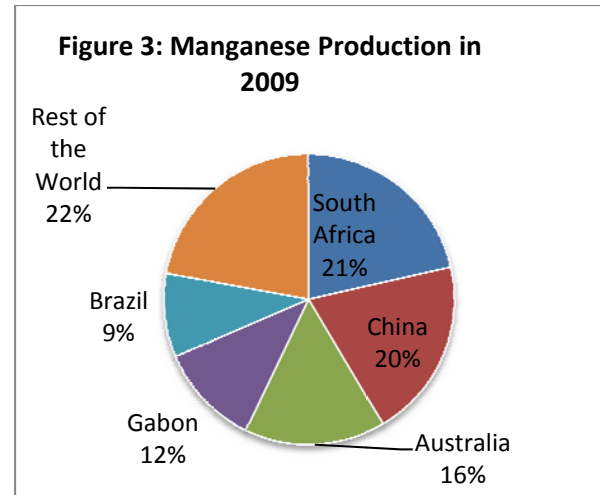
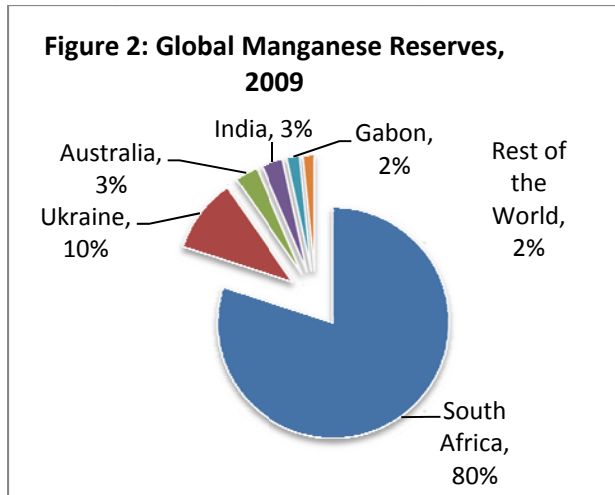
Manganese possesses chemical properties that make it an ideal input into the making of alloys. It is commonly obtained through manganese ore in the form of manganese oxide (also known as pyrolusite), or through iron ores. Manganese production is thus often subsumed under iron mining. Besides their ores being regularly obtained from the same mines, manganese and iron are further linked due to their complementarity in steel production. Before they become usable in steel production, both manganese and iron ores must undergo numerous processing. Manganese ore needs to be processed into alloys with high manganese content (which also includes iron). The most important of these alloys are high carbon ferromanganese (HC FeMn), refined ferromanganese (RF FeMn) and silica manganese (SiMn) alloys. Iron ore needs to go through

smelting, into a usable metallic iron form, which is then used to make various kinds of steel. These three industries – manganese, iron and steel – are therefore intricately linked (figure 1).



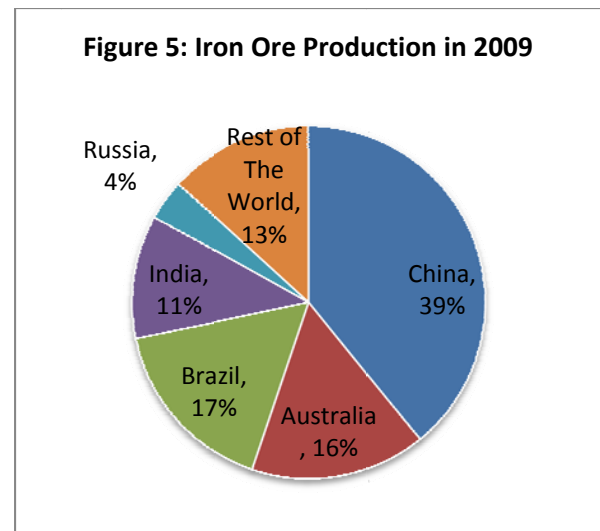
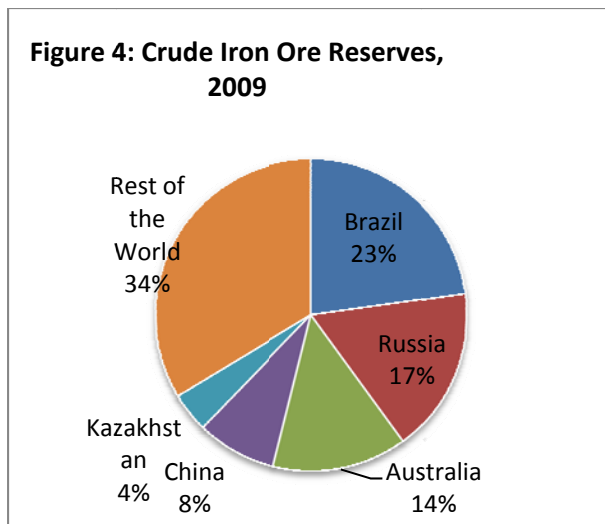
**(i) Supply**

About 80% of the world’s manganese reserve is found in South Africa. Other countries with substantial reserves are Australia, China, Gabon and Ukraine (figure 2). In terms of actual production, China and South Africa lead, followed by Australia, Brazil and Gabon (figure 3).



Source: US Geological Survey, 2009

Iron ore, unlike manganese, is found and mined on a much widespread of countries. However, the countries with the largest reserves are Brazil, Russia, Australia, China and Kazakhstan (figure 4). The largest producers are China, Australia, Brazil, India and Russia (figure 5). China is the world’s largest producer of steel and accounts for over 40% of global crude steel production (figure 6). Global production of steel stands at approximately 1.2 billion tons, and has grown at an average annual rate of approximately 6% in the past decade.



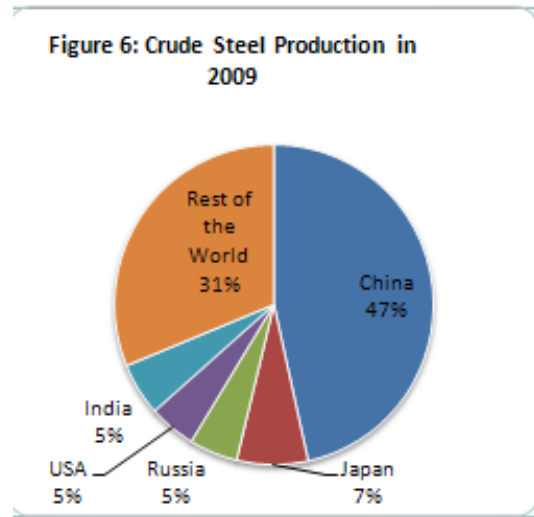
Source: US Geological Survey, 2009

**(ii) Demand**

Ideally, identifying manganese and iron users by countries and firms would provide us with the most direct estimation of the demand for these commodities. However, such data is hard to come by especially at the firm level. Nevertheless, we make use of the fact that the demand for both

manganese and iron is driven by steel production. Specifically, at least 90% to 94% of the manganese produced worldwide is used in steel production. Likewise, about 98% of iron ore produced is also used in steel production. Consequently, the demand for steel provides reliable information for understanding the market dynamics of both manganese and iron ore.

Currently, there are no suitable substitutes for manganese in steel production. So growth in the production of steel should have a positive effect on manganese demand. It is notable that the amount of manganese used per quantity of steel produced, has been declining over time. This is mainly due to technological improvements in steel production that has been recorded since the 1950s. However, the continuing rise in the worldwide demand for steel (and consequently, manganese) means that increasingly higher quantities of manganese demand are expected. Hence despite the above technological effect, the higher overall demand for steel has outweighed the efficiency effect so far, and is expected to continue to do so for the foreseeable future.

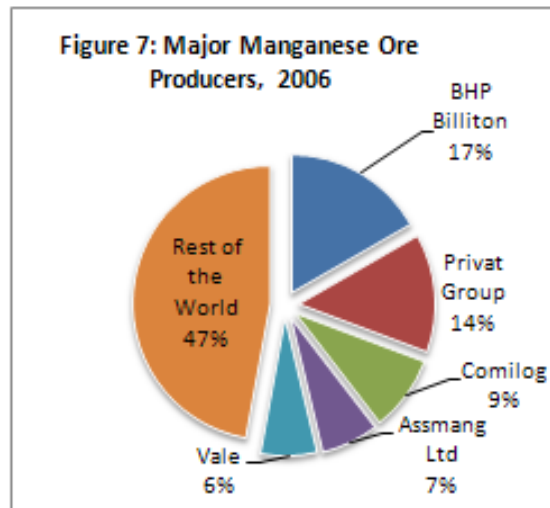


Source: World Steel Association 2009

### **(iii) Market Players/Competition**

The manganese value chain consists of three segments: ore producers, alloy producers and steel producers. The manganese ore industry is segmented by ore characteristics, and comprises of high grade ore (with more than 35% manganese contents) producers who account for two thirds of production, and low grade ore producer contributing a third of production. Alloy production is performed either by independent alloy smelters (70% of production) or by integrated alloy smelters (30% of production). The latter are vertically integrated firms involved in both ore mining and smelting. The end use customers are primarily steel producers (94% of demand) who can be classified into integrated mills, mini mill flat producers, mini mill long producers and specialty mills. Chemical and specialist metallurgical segments contribute the balance of the demand.

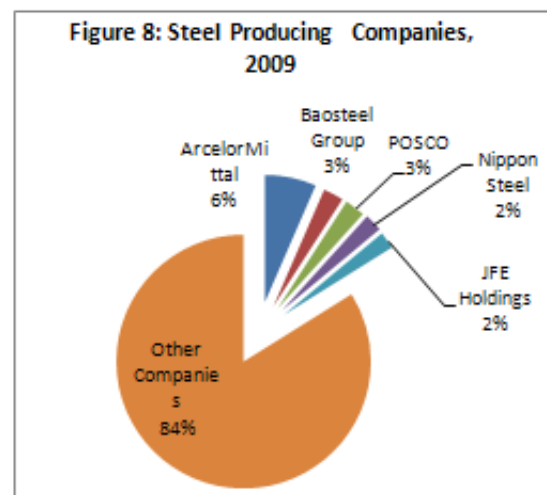
Manganese ore mining is dominated by a few firms (figure 7). One of the world's largest manganese ore producing companies is BHP Billiton, a global mining company with operations in Australia and South Africa. It is followed by the Privat Group (a Ukrainian company) with operations in Australia, Ghana and Ukraine. These two companies account for about a third of the worldwide manganese production, collectively contributing over 10 million tons of manganese of output per year.



Source: Eurasian National Resources Corporation, 2008

The remaining three companies among the top five manganese producers are Eramet Comilog (a French company producing over 3 million tons of manganese from mines in Gabon), Assmang Ltd (producing over 2 million tons of manganese from mines in South Africa) and Vale (producing over 2 million tons from mines in Brazil). These companies also dominate manganese alloy production. The top four producers of manganese alloy are Privat Group, Eramet, BHP Billington, Vale, Nippon Denko (Chinese Japanese firm).

Leading iron ore producing companies are BHP Billiton (Australia), Rio Tinto (Australia), and Vale (Brazil). These companies, with operating mines on all continents, currently account for about a third of the worldwide iron ore production. The aforementioned overlap of manganese and iron ore mining industries is displayed here by the prominence of the same players in these markets. The steel industry is far less concentrated (figure 8), with the largest steel company, ArcelorMittal, accounting for only 6% of global production. Although some steel companies are also involved in manganese ore mining and alloy production (see section 4.2), none of the major

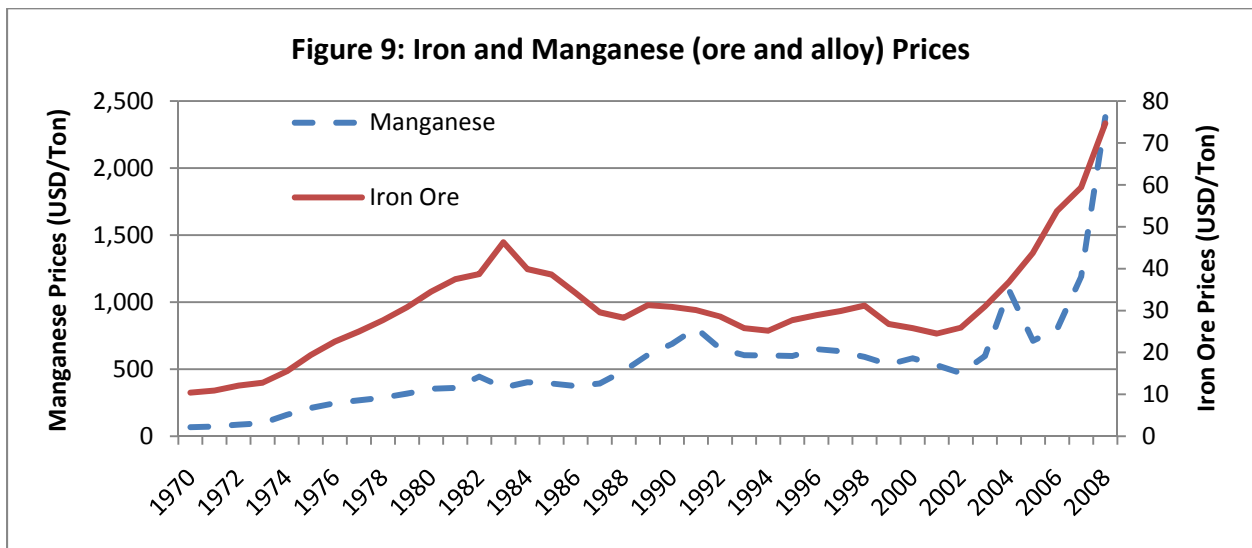


Source: World Steel Association 2009

players in the steel market figure prominently in the manganese market, indicating moderate vertical integration of the supply (manganese / iron ore and alloy) and demand (steel) segments of the market chain.

**(iv) Market Conduct / Pricing**

Manganese ore and alloy prices are determined on the spot market. This is because neither commodities are listed on commodity exchange or stock markets. However, links to iron ore and steel (both traded on futures markets) have implications for pricing and price trends for manganese ore and its products. Indeed the prices for manganese and iron ore have historically exhibited strong co-movement (figure 9). A notable weakening of this trend between 2004 and 2007 due to volatility in the manganese market<sup>1</sup>, however, highlights differences in primary market conduct for these two industries.

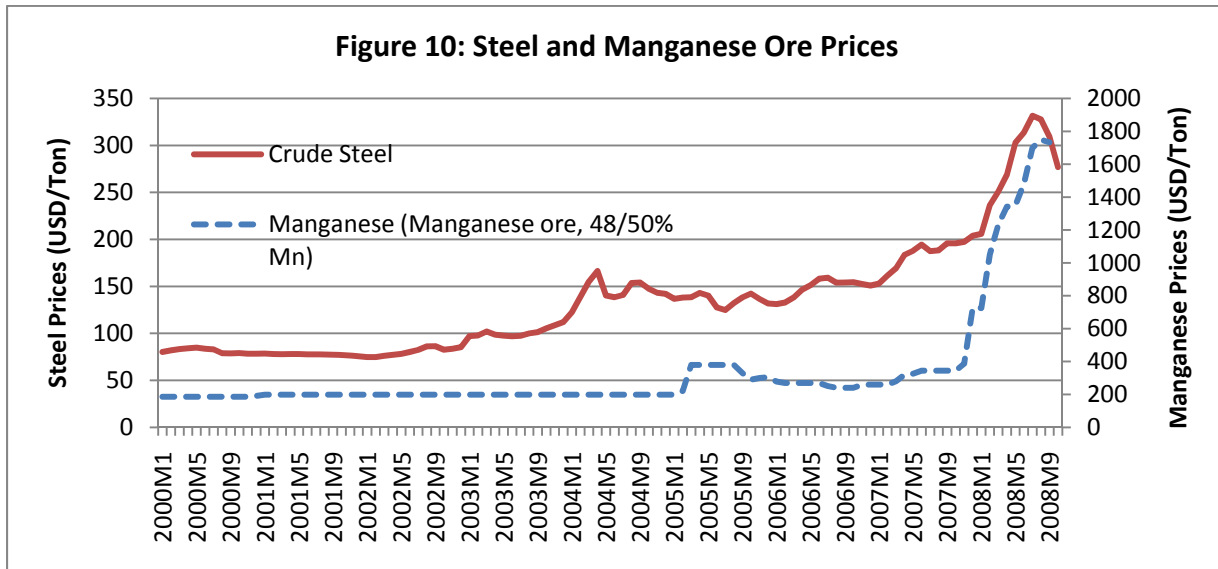


Source: US Geological Survey, 2009

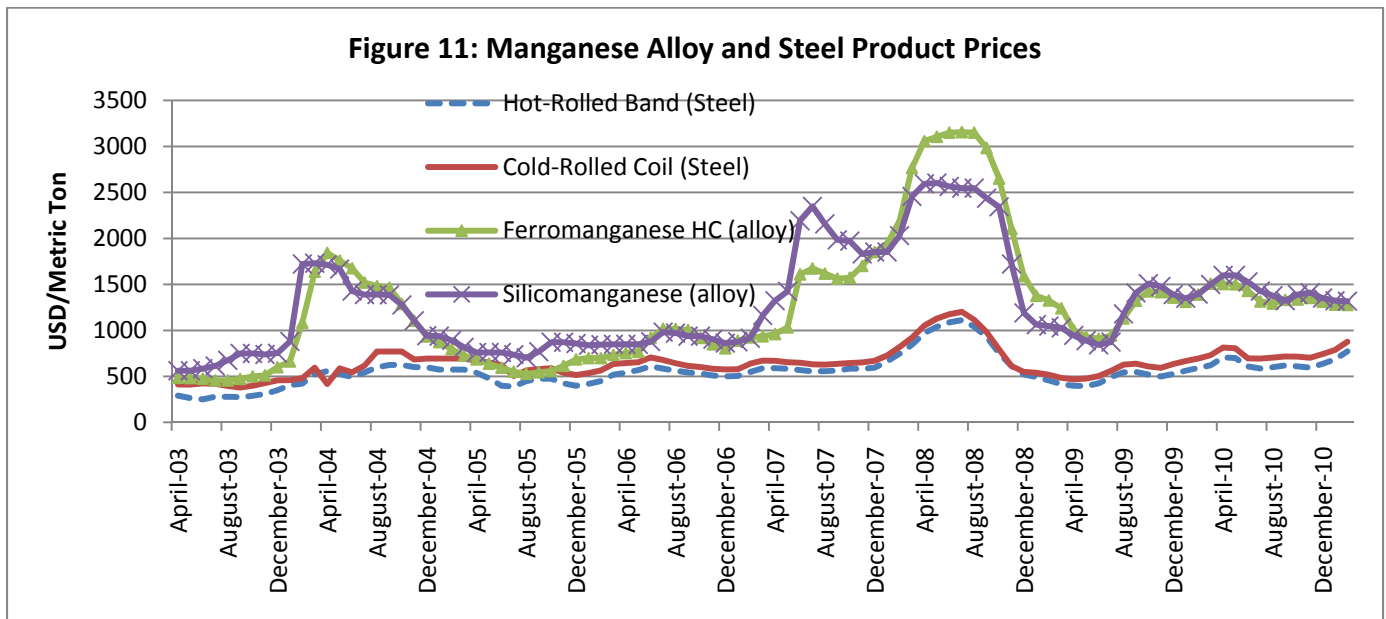
Figure 10 shows that correlation between manganese ore prices and the prices of steel products has been equally strong historically. Until the mid-2004, prices for both commodities had been stable. However, a spike in prices was observed in 2004 for steel, which triggered a similar increase in manganese prices in 2005. These sudden movements were caused mainly by China’s preparation for the Olympics when it underwent massive infrastructural investments. Figure 11

<sup>1</sup> The price hikes were attributed mainly to major and unusual snowstorms in key mining areas in China in early 2008 which affected production of key metals such as manganese and aluminum, coupled with a concurrent rise in the production of stainless steel.

shows that the strong long term correlation between manganese alloy prices and steel, is not as strong over shorter time horizon especially in the post-2004 period. Whereas both iron ore and steel prices exhibit an upward trend, manganese prices have greater downside risk, and exhibit greater volatility.



Source: UNCTAD Commodity Price Bulletin & IMF Commodity Price Bulletin.

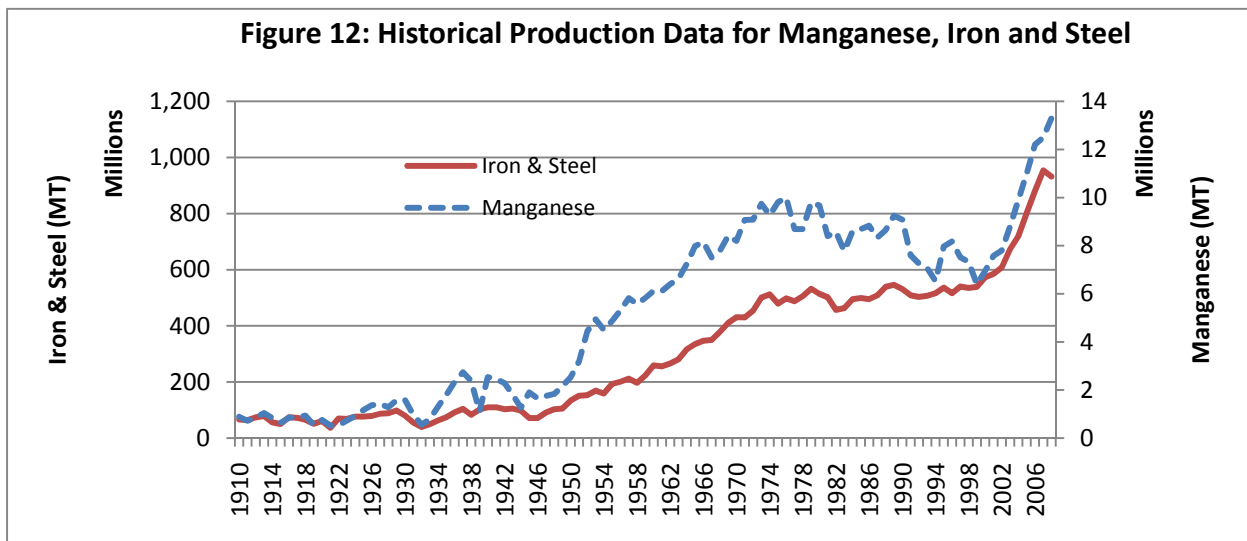


Source: Metal Prices & News, 2011.

### 3. Industry Outlook

The outlook of the steel industry is critical for manganese for three reasons. First, at least 90% of manganese produced is used in steel production. Second, there is no suitable substitute for manganese in steel production. Third, the presence of vertical integration in the manganese value chain means that the leading steel firms are directly involved in manganese production. Consequently, world demand for manganese and ferroalloy products depends directly on the outlook of the steel industry.

As discussed above, and in figure 12 below, growth in the production of steel should have a positive effect on demand (hence prices) of manganese. Global demand for steel is driven in turn by housing construction, the automobile industry and general infrastructural constructions. Due to the positive average annual economic growth and increasing industrialization globally, all these three categories are expected to continue to expand in the decades to come.



Source: US Geological Survey, 2009

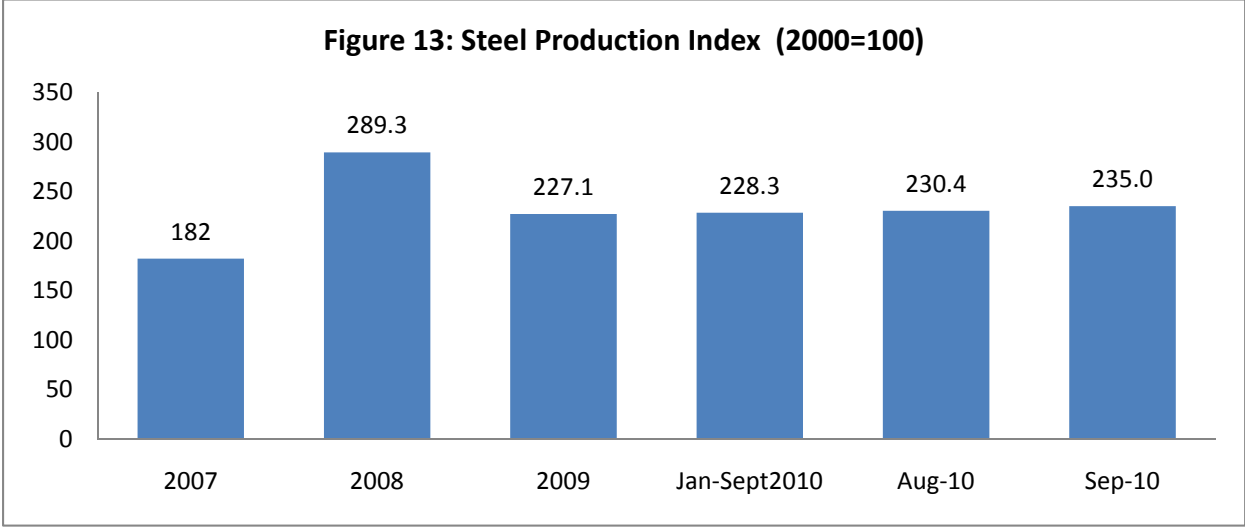
Demand will be concentrated in two countries namely China and India. For example, India's national steel policy projects production of 110 million metric tons (MT) of steel by 2020 from a current production level of approximately 60 million MT. Several key economic factors suggest that these countries will continue leading the demand for steel in the medium term. First, both countries are expected to continue their high economic growth rates for the foreseeable future (for example, both countries are expected to grow on average in excess of 7% per annum for the next two decades at least). A concomitant increase in the demand for cars would follow as a result of income effect. Secondly, both countries are rapidly urbanizing and this would likely result in further steel-intensive construction in housing and infrastructure. UN population projections show the urbanization rate for China growing from 47% in 2010 to 59% in 2030, while India would experience an urbanization increase from 30% to 37% over the same time period. Since India lags behind China both in income levels and urbanization rate, the former is projected to overtake China two decades down the road as the most important country in steel consumption, and possibly production.

As with most commodities, the standard mechanisms of supply and demand determine the price. However, for the steel market, most of the supply and demand shocks have largely been unpredictable. A few cases are worth highlighting. The dissolution of the former USSR in the early 1990s led some of its former republic to supply too much steel and depress prices, especially in Asia. The rebuilding that followed the Kobe earthquake in Japan in 1995 led to a rise in demand for steel in Japan and a corresponding rise in prices. Also more generalized phenomena such as recessions or financial crises also affect steel prices. Both the Asian financial crisis (late 1990s) and the recent financial crisis (2008/09) have led to a fall in steel prices because of natural cutbacks on industrial production during economic downturns. The impact of the recent financial crisis has been especially pronounced. Steel production fell by about 18% worldwide but with large variations across regions: 47% in North America, 41% in the European Union and 4% in Asia. The relatively small fall in production in Asia was due to the fact that China's production actually increased by about 5% in this period.<sup>2</sup>

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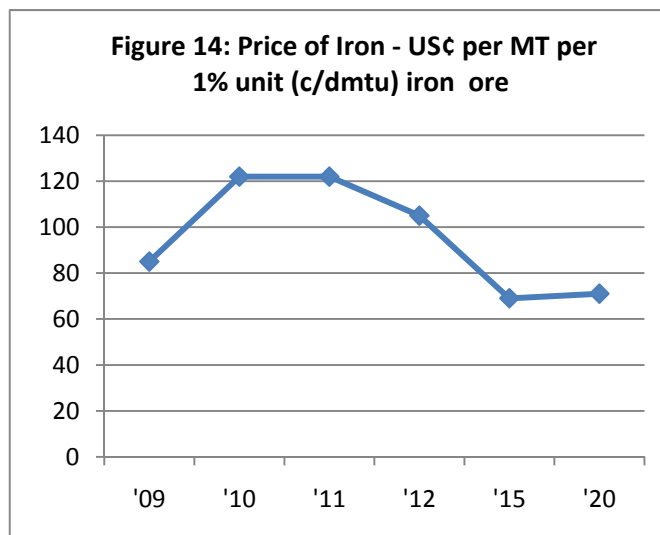
<sup>2</sup> The exact changes vary by source but relatively rankings are consistent.

Given the uncertainty surrounding such events, it is not surprising that there is some significant unpredictability in steel prices. The degree of the price risk can be mitigated, however, since steel is a traded commodity on at least one commodity exchange (e.g. Hot Rolled Coil steel on New York Mercantile Exchange). Moreover, the severity of the recent financial crisis and the resulting precipitous drops in both steel prices and production make the forecast growth in steel prices more plausible. The fall in production in 2009 has since stabilized and has begun to pick up (figure 13) in response to the global recovery from the crisis. So growth in production and prices are likely to continue to increase for the next several years. Some industry forecasts exist to this effect. For example, Laplace Conseil - a metal and mining consulting firm - in 2007 forecast (“with a 65% probability”) that global steel demand would increase at an annual rate of 5% - 6% up to at least 2020. Similarly, in the 2010 World Steel Outlook published by the World Steel Association, steel demand is expected to increase by 5.3% in 2011, after recovery in 2010. By induction, demand for manganese is expected to be strong and positive.



Source: World Bank 2010

Although the outlook of the steel market is a key determinant of demand and prices for manganese, other non-trivial factors also come into play, for example developments in the iron ore (a major complement to manganese in steel production) sector, and specific features of (and events affecting) the manganese market directly rather than through either the steel or iron ore markets. The forecast for the iron ore sector supports the conclusions already drawn. Iron ore prices are expected to fall over time (figure



Source: World Bank 2010

14), due partly to supply side factors including over-production, and demand side factors such as the expected pressure from Chinese steel companies on major iron ore producers to lower prices. The lower prices should support the production growth projected for steel.

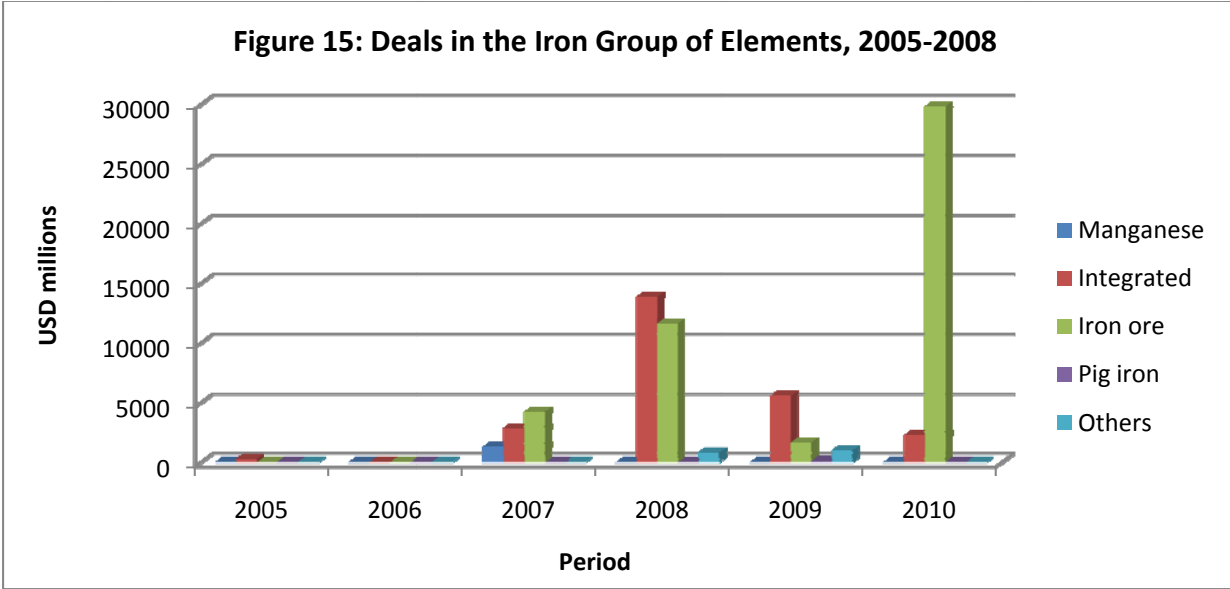
#### 4. Financing of Manganese Operations and the role of DFIs

In large scale production of both manganese and iron ores, sponsors often source external capital to finance part of the capital costs. Understanding how previous transactions were financed is important for understanding the potential role of Development Finance Institutions (DFIs) as financiers in such transactions.

Information on the financing of exclusive manganese projects is difficult to find. Our search of the Thompson One, Loan Radar and International Finance Corporation (IFC) databases for transactions concluded in the years leading to, and during, the global economic downturn produced only two manganese-exclusive transactions. This dearth of information on manganese ore-only transactions is partly a function of how manganese exists in nature. As previously mentioned, in addition to manganese mines, manganese is also commonly found in iron ores. Consequently, a significant amount of manganese ore production is a component of integrated mining of which iron is the predominant metal. An overlap between major manganese ore and iron ore producers also exists. Therefore in the absence of information on a large enough pool of

historic evidence on sources of financing for manganese transactions, information on the characteristics of iron ore transactions provides the best proxy.

The subsequent analysis is based on a review of project finance transactions in the iron ore sector that reached financial close in the period 2005 to 2010, from a sample of seven countries (Gabon, Indonesia, Mongolia, Russia, India, Brazil and Australia). As shown previously, Gabon and South Africa are the two African countries among the list of countries with large manganese reserves. However, South Africa is the only African country in the top 10 global iron ore producers. These facts account for the low number of African countries in this list. Funding for the various metals of the iron group of elements has been dominated by iron ore with the exception of the period 2008 and 2009 in which integrated products were mostly financed (figure 15). Manganese, as a single element, only received funding of USD 37.6 million and USD 1.3 billion in 2005 and 2007, respectively. The other components which include slab casting, hot strip mill, silver, and heavy plate mill constitute the least funded projects among the iron group of elements in the period under study.

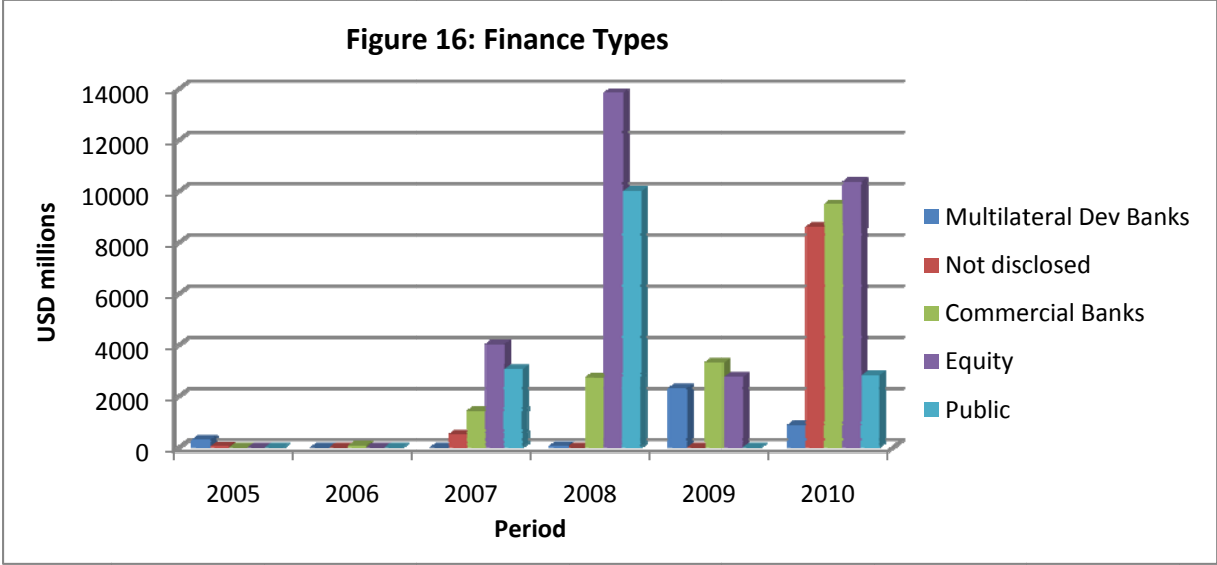


Source: Thomson Reuters, IFC.  
 Note: The period 2010 is from January to September.

**4.1 Financing of Iron Ore Operations**

Figure 16 shows that a majority of iron ore mining projects are financed through equity and by private commercial investors and in some instances by governments or state-owned enterprises.

Out of the total funding of USD 76.1 billion for transactions during the period 2007 to 2010 (January to September) in the countries reviewed, equity financing in the sector represents about 40%, commercial banks and ‘governments and state-owned enterprises’ account for about 22% each, whereas DFIs’ participation was low, at 4% of total project costs.



Source: Thomson Reuters; IFC.

Table 1 summarizes the characteristics of these transactions by country. Of the transactions reviewed, one project on the African continent benefited fully from Chinese public funds. This USD 5 billion transaction based in Gabon reached financial close in 2008 with financing from the Bank of China (about USD 1 billion line of credit extended in 2002), and the rest fully financed by China Eximbank (fully owned by the Chinese Government) in 2008. Commercial banks were dominant in the Mongolian, Indonesian and Brazilian transactions, contributing 100%, 48% and 40% of project costs respectively. Much of the financing for Australian, Russian and Indian transactions was equity financing, with a significant government presence in Australia, and some DFI participation in Russia and India. DFI financing was mostly present in Brazil, both in terms of volume and proportion of project financing.

**Table 1:** Summary of Manganese and Iron Ore Financing across Selected Countries for the period 2005-2010 (million USD, unless otherwise stated)

Country	Number of Transactions	Total Project Finance Mobilized	Min.	Max.	Equity	Commercial Banks	Public	DFIs
Gabon	1	5,000	-	-	-	-	100%	-
Indonesia	3	2,300	500	1,100	30.4%	47.8%	-	-
Mongolia	1	200	-	-	-	100%	-	-
Russia	5	1,900	65	1,000	52.4%	38.7%	-	8.9%
India	5	20,900	16.5	12,000	57.3%	0.2%	-	1.4%
Brazil <sup>(a)</sup>	16	19,800	100	3,600	38.2%	39.7%	0.8%	21.3%
Australia <sup>(a)</sup>	21	31,800	19.6	5,000	37.1%	29%	28%	-

Source: Thomson Reuters; IFC.

<sup>(a)</sup>Note: includes one manganese transaction.

The two manganese mining projects in the sample reviewed include the Cupixi manganese project, a USD 1.3 billion transaction sponsored by International Gold Resources Inc (IGR) in 2007 in Brazil. The datasets reviewed unfortunately do not reveal the sources of the bulk of the financing, other than the USD 1.3 million sourced through a private placement. The second manganese mining transaction, Bootu Creek project in Australia (2005), was a USD 37.6 million whose financiers were also not disclosed.

Notably, traditional DFIs are mostly absent in this sector. In Table 2, we highlight the current position. In Brazil, for example, of the USD 19.8 billion aggregate project cost 21% was financed by multilateral development banks. The Brazilian Development Bank (BNDES) accounted for 82% of the MDB financing, the Fundo Nacional de Desenvolvimento da Educação (FNDE) of Brazil 16.4%, and the Inter-American Development Bank (IDB) only 1.6%. The IDB's contribution was limited to the USD 200 million Ouro Branco Steel Mill project in 2008. In this particular transaction, an 'A' loan of USD 50 million was provided by IDB and a syndicated 'B' loan of USD 150 million by seven commercial investors that were not disclosed. The Russian case involves a 2010 USD 760 million transaction to which the European Bank for Reconstruction and Development (EBRD) extended a five-year 'A' loan of EUR 100 million, and brought in UniCredit on a three-year 'B' loan of EUR 25 million. The only transaction involving a DFI in India was a 2005 transaction in which the IFC provided a corporate loan of

USD 300 million to Tata Iron and Steel Company Limited that included a syndicated loan of USD 200 million.

An important characteristic of the transactions involving DFI is that these transactions are not limited to small or large companies. As shown in Table 2, the size of the sponsor (the private company) can range from a top 10 steel company to those too small to feature in a global ranking. This suggests that the need for DFI financing may be independent of the size of the sponsor.

**Table 2:** DFIs Participation in Manganese and Iron Ore transactions for the period 2005-2010

Country	DFIs	Size of Transaction (million , USD)	Sponsors	World Ranking (2008/2009) of Sponsor Companies
Brazil	IDB	200	Gerdau	13
Brazil	BNDES	3,600; 514	MMX Mineracao e Metalicos	n/a
Brazil	BNDES, FNDE	3,142.8	Companhia Siderurgica Nacional (CSN)	40
India	IFC	300	Tata Entities	7
Russia	EBRD	760	Novolipetsk (NLMK)	21

Source: Thomson Reuters; IFC; Creamer Media's Research Channel, 2010

One interesting aspect to assess is whether DFI financing was counter-cyclical in nature. As depicted in Figure 16, the total value of project financing dropped from USD 26.6 billion in 2008 to USD 8.4 billion in 2009, consistent with a fall in actual iron ore production in virtually all countries, except Australia and South Africa. Different types of financing also seem to have been affected differently by the financial crisis, with equity and public financing experiencing the sharpest decline. Lending by commercial banks appears to not have been substantially affected, although the large increase in 2010 may suggest caution in the 2008 and 2009 figures. Financing from multilateral development banks was highest in 2009, driven primarily by financing from Brazilian banks.

We have also examined upcoming manganese and iron ore transactions expected to take place in Africa between 2010 and 2015, which are summarized in Table 3. Despite the size of the iron ore transactions, none so far have sought DFI participation. In the only manganese transaction in the table, at least one DFI (Industrial Development Corporation of South Africa) has been identified

so far. As with the earlier concluded transactions between 2005 and 2010, table 3 reinforces the findings that manganese-only transactions are relatively rare and iron ore projects are mostly financed through equity and private investors.

**Table 3:** Expected Iron and Manganese Ore transactions in Africa: 2010-2015

Country	Major Company	Project Name	Mineral	Value	Start Date
Burkina Faso	Not decided – competing bids	Tambao	Manganese ore	\$220 million	n/a
Cameroon	Sundance	Mbalam	iron-ore	\$3 billion	2012
Gabon	Hwazhou Group	M'Bembele	Manganese Ore	\$85 million	2010
Guinea	Rio Tinto	Simandou	iron-ore	\$2.9 billion	2015
Ivory Coast	Tata Steel	Mount Nimba	iron-ore	n/a	n/a
Liberia	BHP Billiton	n/a	iron-ore	\$3 billion	2010
Liberia	ArcelorMittal	Mount Nimba	iron-ore	\$1.5 billion	2011
Mali	Sahara	Tienfala	iron-ore	\$41 million	2010
Mauritania	Societe Nationale Industrielle et Minière	Guleb II	iron-ore	\$700 million	2010
Senegal	ArcelorMittal	Faleme	iron-ore	\$2.2 billion	2010
Sierra Leone	African Minerals	Tonkolili	iron-ore	n/a	2011
Sierra Leone	London Mining	Marampa	iron-ore	\$300 million	2013
South Africa	ArcelorMittal & Kalahari Resources	Kalagadi Manganese	Manganese ore	\$600 million	2010
South Africa	Anglo American	Kumba	iron-ore	\$1.02 billion	2012
South Africa	Ntsimbintle Mining	Tshipi	Manganese Ore	\$200 million	2012
		Manganese			

**Sources:** Creamer Media's Research Channel, 2010; Steel Orbis; Businessweek;

To sum up, DFI participation in transactions in the iron group of metals has been limited. However, where present, participation has been in the form of A-B or syndicated loans, catalyzing additional commercial financing. DFI financing has also been counter-cyclical, increasing in proportion against other major forms of financing during the financial crisis.

#### 4.2 Implications for Manganese Project Finance

DFIs participate in lending and as a substitute for commercial lending when the latter has dried up, especially during credit crunches. For the manganese-only transactions (in other words, where the mines are predominantly or exclusively manganese ore), the generalization is less obvious due to the paucity of manganese-only transactions in our sample.

Beyond the paucity of manganese-only transactions, there are at least two further factors to consider. First are the different degrees to which companies and financiers can hedge their price risk for iron relative to manganese. Second is the current structure of the metals industry, which reinforces the inability of private financing companies to hedge against this risk.

Whereas iron ore is a traded<sup>3</sup> metal for which a futures market and hedging instruments exist, manganese is neither publicly traded nor does it have a similar range of hedging instruments. To the extent that companies can hedge their risk in manganese transactions, this is mostly limited to foreign currency hedging for transnational transactions. The need for hedging against price risk is substantial given the high price volatility of manganese products (see figures 9 and 10). Prices of different types of manganese ore are observed to be cyclical, with a fairly large coefficient of variation (figure 11). Specifically, the coefficient of variation (the ratio of standard deviation over mean) of manganese prices between 1998 and 2008 was 100%. For these reasons, market risk for manganese mining projects is considered high.

With limited hedging instruments for manganese, one may naturally look to the steel industry to provide insurance cover to investors in the manganese industry. This assumption is assessed in light of the fact that the metals industry exhibits a significant degree of vertical integration. For example, steel companies have partial or complete ownership stakes in companies that produce inputs into steel production such as iron, manganese and other metals. In fact, it is within the steel industry that vertical integration has first been documented in modern times (i.e. the famous case of Carnegie Steel). Trends towards this consolidation are necessitated by firms' desires to mitigate risk by establishing stable supply chains. It is also necessitated by the fact that different types of steel need different degrees of manganese and iron contents, consequently different metallic alloys. Controlling production in upstream firms allows steel producing companies to meet both requirements.

We have already noted that four out of the top five alloy producing companies are also the world's largest producers of manganese ore. These companies account for about half of the

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<sup>3</sup> By tradability of iron and non-tradability of manganese, we respectively mean that the two metals are either listed or not listed on a commodity exchange.

World's output of manganese alloys. This phenomenon persists, albeit less strongly, as we go downstream. Nippon Steel, one of the world's largest steel producing companies, was created through a merger of an iron ore company and a steel company. The world's current largest steel producer, Arcelormittal has acquired iron ore companies such as Baffinland Iron of Canada in 2010 and has acquired a 50% stake in Kalagadi Manganese of South Africa. Tata Steel, another major steel company, owns several mines in India that produce both iron and manganese ores.

Although these corporate consolidations help mitigate risk for producers, they also have the added effect of reducing transparency and competition in the pricing of inputs into steel production. The result is that while consolidation may have reduced the production risk for steel companies, it has made financing riskier for commercial lenders. Commercial lenders need sufficient information to help forecast prices and reduce uncertainty through hedging instruments to provide them with comfort to take part in financing transactions. And this perceived risk by commercial lenders is unlikely to be mitigated by the correlation between steel and manganese prices. For one reason, the extent of the correlation tends to be weaker over short time horizons. Furthermore, the price correlation is not some manifestation of an immutable economic law, and divergences from the long term trend have been observed (section 2iv) introducing uncertainty with regards to when a weakening of the correlation might arise. The implications for manganese project finance may be, quite plausibly, lower levels of interest from risk-averse commercial lenders relative to the high private finance appetite observed for the iron ore sector.

Vertical integration may involve a subsidiary only partially owned by the conglomerate (as opposed to the conglomerate itself). The capitalization of such subsidiaries is often a small fraction of the parent company's. In those cases, the extent to which vertical integration might mitigate risk depends not only on the conglomerate's stake in the subsidiary but also on the latter's size.

## **5. What Explains DFI Participation in Manganese Mining? The Case of South Africa**

We noted earlier that South Africa holds 80 percent of global reserves in manganese, and currently produces 21 percent of the global manganese output. Thus some lessons could be learnt from South Africa's experience with project finance for manganese mining. We document these

experiences for two reasons. First, there is an exponential growth in the number of mining projects in the iron group of metals expected to reach financial close between 2010 and 2015 on the African markets. Significant room for further extraction of this metal in South Africa also exists, given the volume of reserves. Second, South Africa is considered a pace-maker with respect to mining sector regulation, and promotion of local entrepreneurs' participation in the industry, through its broad-based black economic empowerment (BBBEE) strategy. Integrating local beneficiation into mining operations is being promoted, but yet to materialize for most operations. If a case for DFI participation could be made for the industry, what shape would this involvement take?

Five manganese producers operate in the South African market: Samancor Manganese (BHP Billiton), Assmang Limited, Kalagadi Manganese, Tshipi Manganese and United Manganese of Kalahari (UMK). Samancor Manganese and Assmang Limited are the major players. As indicated in section 2(iii), BHP Billiton<sup>4</sup> is the world's largest manganese producer while Assmang Limited is fourth. Until recently, these two companies accounted for 100% of South Africa manganese production. Samancor's production feed mostly its parents company's alloy production in Australia while the largest markets for Assmang Limited are steel and alloy producers in the US, Europe and Asia. Both have traditionally used on-balance sheet financing to cover production and capital expansion costs.

The other three companies are poised to enter the market, and have either recently closed, or are in the process of closing, their financing plans. All three companies are majority-owned by historically disadvantaged South Africans, and qualify as BBBEE firms. The owners with major stakes in Kalagadi Manganese, Tshipi Manganese and UMK are Kalahari Resources, Ntsimbintle Mining Limited and Chancellor House respectively. As of early 2011, both Kalagadi Manganese and Tshipi Manganese were at advanced stages of mine development, but yet to start to manganese production. Understanding the characteristics of these firms and their interaction with the financial market would provide some insight into the need for DFI funding.

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<sup>4</sup> While the BHP engages in both manganese ore and alloy production globally, the South African subsidiary specializes in manganese ore production.

Table 4 provides the relevant details on these relatively new manganese firms in South Africa. Among the three, only Kalagadi Manganese has received DFI debt financing. The operations of the other two (Tshipi and UMK), are financed 100% through equity.

**Table 4:** Characteristics of Recent Manganese Operations in South Africa.

	<b>Kalagadi Manganese</b>	<b>Tshipi Manganese</b>	<b>United Manganese of Kalahari</b>
<b>Operation Size</b>	USD 1,500 million	USD 200 million	USD 200 million
<b>Type</b>	Greenfield	Greenfield	Brownfield
<b>Method of Ore Extraction</b>	Underground Mining	Opencast Mining	Opencast Mining
<b>Range of Operations</b>	Manganese ore, sinter and alloy production	Manganese ore production only	Manganese ore and sinter production
<b>BBBEE Ownership</b>	Yes	Yes	Yes
<b>Debt-Equity Ratio</b>	60:40	0:1	0: 1
<b>% Debt Financed by DFIs</b>	38%	-	-

The main factors that seem to account for DFI participation in Kalagadi are the greater range of operations (ore extraction plus beneficiation) and the size and complexity of operations. Specifically, the total cost of Kalagadi is roughly seven times that of the other two firms. Part of the difference in size of operation reflects the difference in cost depending on method of mining employed: it is a lot more costly to extract manganese ore from underground than it is to use opencast mining<sup>5</sup>. Furthermore, Kalagadi's operations also include a smelter that produces alloys, a level of activity absent in the other two firms. Part of reason for the higher operation cost is that the ore and sinter need to be transported from the manganese producing region in Northern Cape to the coast where the smelters are located. This means further cost not only in making arrangements for reliable rail transportation but also in power, water and warehousing, among others. DFIs' participation contributed to circumventing these challenges, through (i) early expression of interest which sent a positive signal to the market (ii) provision of financing for some of infrastructure projects which helped alleviate the infrastructure risk (iii) potentially filling a financing gap.

<sup>5</sup> The method of extraction is determined by geology and the depth of the ore. Opencast become feasible when the ore is close to the surface and the mining company owns a large land size. Underground mining is employed when ore is located far underground and/or adjacent lands are owned by others.

DFIs participation in mining transactions is often motivated more by expected improvements in development outcomes that are attributable to the development financier's presence, rather than by financial returns per se. For example, a DFI would seek to ensure that the project is designed in a way that minimizes negative externalities (e.g., environmental degradation, relocation of people or businesses, staff safety). DFIs may also seek to ensure that governments get a fair deal in terms of royalties and other applicable fees; and at times, to improve the local content of procurement in mining projects.

In the case of Kalagadi, the location of the operation in an investment grade country with well established mining regulation means that these effects were small. Likewise, the presence of well developed support industries for mining weakens the case for DFI intervention from a local procurement perspective. Although the Kalagadi Manganese project benefits from a small and medium sized enterprises (SME) linkage program, this program was a committed undertaking included in the project's Social Development Plan that accompanied the mining license application. DFIs are expected only to assist the sponsor in developing the program. In a nutshell, DFI participation in this case is almost purely financial. However, in less developed markets, potential for far-reaching engagement exists.

## **6. Conclusion**

In conclusion, the manganese market can best be understood in the context of its broader value chain, which included elements from the iron group of metals and steel. The assessment shows strong long term correlations in production and price trends for these industries, as well as substantial vertical integration of the value chain, especially in the upstream ores and alloys industries. DFIs are generally absent in the financing of transactions under the iron group of metals, although when present their participation appears to be counter-cyclical and catalytic. Specific differences between the iron ore or steel markets relative to the manganese market are worth noting. First, whereas both iron ore and steel are publicly traded metals for which hedging instruments exist, manganese is not. Second, price volatility is higher for high-value manganese products than for either iron ore or steel. For these reasons, market risk for manganese mining projects is considered higher, which strengthens the case for DFI financing in exclusive manganese-ore projects, relative to integrated or iron ore mining projects. However, where such

projects are sponsored by vertically integrated conglomerates and located well in developed markets, the case for DFI financing is less obvious.

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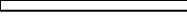
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