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The global iron and steel industry: from a bilateral oligopoly to a thwarted monopsony

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The global iron and steel industry: from a bilateral oligopoly to a thwarted monopsony

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Abstract:

China's growing urbanization and the speed of its manufacturing industry development led to a shock in steel demand at the beginning of the 2000's and consequently to a shock across the iron and steel industry. In this paper, we carry out descriptive analysis of the evolution in the market structure and the related power market shifting. From a steady situation where few steelmakers negotiated with few mining firms in order to set up the annual price, the market evolved to a new price fixing process resulting from a supply-demand confrontation, like the move seen for most of the other materials a few decades ago. Moreover, the shock and the related events that occurred years after, led to a new composition of stakeholders in the iron and steel sectors, both on the demand and supply sides. In this new context, China has become an essential actor, modifying the industrial structure from a bilateral oligopoly to a thwarted monopsony.

Keywords: steelmaking industry, iron ore, industrial economics, oligopoly, monopsony

Classification JEL: L10, L61, L72

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Introduction

While the digital economy and the green economy lead to predicting growth perspectives for developed countries, the steel industry seems to only be the symbol of a glorious industrial past or the theater of labor-union revolts. Nevertheless, in addition to its necessity, the qualitative aspect of growth as it is meant by the two kind of economics mentioned above, has to be offset on a global scale. Indeed, regarding the place taken by the emerging countries, transport infrastructures, buildings and plenty of manufactured goods still have to be produced to fulfill the needs of the growing middle class and increasing urbanization. In this context, global growth also takes a quantitative form where the iron and steel industry hold an important place regarding its upstream supply position for sectors like building infrastructures, aeronautics, transport and energy. This direct confrontation of the steelmakers to the variations of the demand associated with the technical and economical limits of stocks, make the steel making industry relatively elastic to the short run economic fluctuations. However, regional disparities exist, in particular as a result of the greater or lesser involvement of public authorities. For instance, the 2008 crisis hit European steelmakers hard because of the demand collapse. While at the same time, thanks to the massive support of public authorities to maintain the demand of construction sectors or transport infrastructure, Chinese steelmakers were less impacted. China began this policy of massive public investments in the economy a few years earlier to stimulate growth. In the early 2000s, the demand-side policy led to a considerable expansion of the Chinese iron and steel industry. This need for steel for the entire Chinese economy created a real demand shock in the iron ore market. The impact not only affected mineral extractors but also all international steelmakers.

The objective of this article is to carry out a descriptive analysis of the impact of this demand shock on the market structure of the sector and its consequences in terms of market power distribution between miners and steelmakers. In the first part, our contribution factually describes the impacts of this shock on the sector. Secondly, the structure of the iron ore market is presented in order to deduce the way it evolved during the 2000s. A third and final section is devoted to the major weight represented by the Chinese authorities within the iron and steel industry to the point that they have drawn the outlines for an uncommon market structure in the economic literature: a thwarted monopsony.

1. The impacts of the Steel Demand Shock of the 2000's

Throughout the 20th century, steel production came from the major world economic nations, namely the United States, Japan, the USSR, France, Germany and the United Kingdom. Originally used primarily for military purposes, steel quickly turned to productive uses and to feed growth. Nevertheless, the cyclical episodes that have marked the world economy since the 1970s oil shocks have resulted in stability for the steel industry, both in the needs for production and in the relations between stakeholders. Hence, the emergence of China on the international market sounds like an upheaval for the entire iron and steel industry.

1.1. The external growth of steelmakers as a response to the shock

Historically, the world market discerns a period of strong growth in steel production during the Glorious Thirties (1950-1973: 5.8% growth per year), from a second period marked by a slowdown and a stable growth of steel production around 0.6% per year from 1974 to 2000 (World Steel Association, 2014). This stability from which the steelmakers benefited until the end of the 20th century, was suddenly shattered by the growth of China as a developing country and the explosion of its steel needs. Driven by growing urbanization and a dazzling rise in industrial production, the Chinese steel industry displayed an unprecedented economic boom. From 2000 to 2013, production is multiplied by four, with an average annual growth rate of 14.2% compared with 6% between 1980 and 2000. Although the global steel industry therefore moves on a twofold level, a single competitive worldwide market is still ongoing according to the types of steel products. While until the late 1980s, the market remained relatively fragmented and little globalized, in response to the shock, throughout the 2000s many mergers and acquisitions were carried out as illustrated by the following examples:

- The acquisition of Corus (born from a previous merger between Hoogovens (Netherlands) and British Steel (Great-Britain) in 1999) by Tata Steel (India) in 2006;
- The merger of Arcelor (born from a previous merger between Arbed (Luxembourg), Aceralia (Spain) and Usinor (France) in 2002) and Mittal Steel (Netherlands) in 2006 to form the world's largest steel group ArcelorMittal (Luxembourg);
- The merger of Sumitomo Metal and Nippon Steel (Japan) in 2012 to form Nippon Steel & Sumitomo Metal Corporation (NSSMC).

These horizontal integrations led to the formation of global scale steel groups. Due to the huge growth of Chinese steel production in parallel, this phenomenon did not have a real impact on the evolution of the distribution of market shares. In 2013 the world's ten largest steelmakers accounted for 27% of the market, like a decade ago. The difference is that only one Chinese steelmaker is present in the ranking in 2003, whereas they are six in 2013.

Regarding the market structure, it appears that steelmakers evolve in a competitive market, whose degree of competition grows with the added value of the steel product. Through a combination of a strong increase in Chinese demand throughout the 2000s, the appearance of new steelmakers and the low price of freight, this competition was exacerbated. To face it and since there is a change in profit margin towards mining activity, global steelmakers such as ArcelorMittal (Luxembourg), POSCO (Pohang Iron and Steel Company, South Korea) and Tata Steel (India) decided to follow external growth and bought mining assets in India, Canada or Africa. However, as this strategy requires heavy investments that are difficult to make profitable, it carries some risks especially when economic conditions deteriorate. Scheuplein (2010), calls into question traditional approaches to the vertical integration strategy. Based on the context of the iron and steel industry right after the 2008 economic crisis and with the theory of polarization highlighted by Perroux in 1964, he stresses the important role played by macroeconomic conditions. Hence in recent years, the tendency towards vertical integration has been achieved almost exclusively by Chinese steelmakers and a few others from emerging countries. Conversely, this strategy of vertical integration through indebtedness is almost no longer adopted by steel producers from OECD countries.

The trend now shared by almost all steelmakers is therefore a downstream orientation via internal growth. Indeed, the steel industry tries to integrate the control of the cold rolling process as much as possible in order to give more added value to the product. The end result of this process is the constitution not of a steel product but of a by-product, directly integratable by the aeronautical or automobile manufacturers. Besides, this strategy is reinforced by the gradual shift of Chinese demand towards more qualitative products, thus adding more value, exacerbating competition between steel producers.

1.2. The market power shift to the mining industry

In the iron ore market[2], the shock for demand has several direct consequences:

- Increase of investments in new mining production capacities;

[2] This article only refers to the export iron ore market (*i.e.* the seaborne market), which, with 1225 Mt, accounts for more than 70% of production in 2014.

- Expansion of the supply of minerals to the Chinese market, leading to an increase in the utilization of the under-exploited capacities of miners;
- Rise of iron ore and steel prices generated by the increased demand;
- Better profitability of miners thanks to the arrival of new outlets and the surge of the ore price.

Indirectly, this shock also generates a shift in the margin of steelmakers towards miners. Given the high weight of the investments, in particular the purchase of the mining concession from the public authority, and the time required between the launch of a project and the exploitation of the deposit, it strengthens the need for profitability. However on the one hand, demand from steelmakers remained stable until the end of the 1990s, and on the other hand, iron ore has no substitute use and 95% of the ore is consumed by steelmakers. These market conditions and this level of dependence give the miners very low market power against steelmakers, especially during the negotiations that take place annually to set the iron ore price. Once an agreement is reached by two contracting parties, all other negotiations stop and all prices are aligned with the new reference quotation for one year. Until the early 1970s, these agreements took place about every three years and the price could remain fixed for several years. This was called "Long Term Contracts". The confrontation between a small number of miners (Vale, Rio Tinto and BHP Billiton) and a small number of steelmakers[3] to fix the price of the ore, was already a first sign pointing to a global scale bilateral oligopoly (Sukagawa, 2010). This pricing process and the distribution of market power remained the norm until the demand shock. Throughout this period, the price reflects the main trade flows between the developed countries and therefore results in a negotiation price between the Australians and the Japanese, or between the Brazilians and the Europeans. Indeed, according to Warell (2008) and Germeshausen (2014), Australian miners tend to mainly focus on the Asian market and the European one to a lesser extent, whereas Brazilian miners only export to the European market. Moreover, it is forbidden for miners to offer a lower price than the negotiated tariff, as ironworkers are prohibited from contracting at a price higher than that negotiated (Li, 2010). This pricing method also allows stakeholders to limit market volatility in a context of stable demand.

But if steelmakers were in a strong position against miners for more than thirty years, new Chinese steelmakers expand the market and provide an alternative to the traditional European, Japanese and American iron ore demands. As a result, the market power shift from historical steelmakers to miners intensifies as iron ore demand in China increases. At the same time, the share of Chinese steelmakers in global steel production grows,

[3] Rohstoffhandel and Erzkontor (German intermediaries), Usinor (France), British Steel Corporation (United Kingdom), POSCO (South Korea) and Nippon Steel (Japan).

exacerbating international competition and thus questioning the existence of the bilateral oligopoly to annually set up the iron ore price.

1.3. The emergence of the iron ore spot market

Following the demand shock, the stability enjoyed by the steelmakers in the sector is challenged. In this context, the bilateral oligopoly is forced to integrate the new Chinese steelmakers into the annual price negotiations. Given the need to increase the production capacity of miners in order to respond to the demand growth and since the market power is now in their favor, the price increases. This is thus more representative of market conditions. Neither the established steelmakers nor the new Chinese entrants succeed in altering the price increase during the negotiations. Following the 2008 crisis, this method of price fixing is increasingly criticized by miners and steelmakers for its rigidity because it does not yet sufficiently reflect market conditions (Musacchio, 2010). Miners still need a high price in order to invest in new capacities, while steelmakers in OECD countries would like to see a price decrease, especially to deal with the crisis in the steel-seeking sectors.

For their part, Chinese steel producers are scattered and some do not hesitate to directly contract with miners in order to ensure production and satisfy domestic demand, even if this ore turns out to be more expensive. This parallel contracting process symbolizes the beginnings of the appearance of a spot market. Mineral sellers and buyers are therefore faced with an immediate transaction on quantities to be exchanged[4]. Hence, the price fluctuates according to the supply and demand for minerals at the time of the transaction. In the present case, this reference quotation includes the cost of production plus the freight price at the Chinese port of Tianjin for a 62% iron ore[5]. During a few months, the annual price negotiation process coexists with transactions based on the spot price, but this coexistence is only very brief (Warell, 2014). From the end of 2009 onwards, despite the hostility of Eurofer (European Iron and Steel Association), the spot market is rooted as a price reference in transactions. The price of iron ore is definitively set according to market forces. Such a price regime promotes greater transparency since it reflects market conditions no longer over a year but on a day-to-day basis[6].

Unlike steelmakers who fear the price surge and a greater volatility in the short term, miners are fully satisfied with this change in the market. This type of structural change already occurred in the 1970s and 1980s with aluminum and silver. Slade (1989) and Figuerola-Ferretti (2001) highlighted the consequences of a price-

[4] For the "price-producer" system giving rise to the annual negotiation, deliveries were deferred in time.
[5] This quote is for each transaction. A variable part is nevertheless taken into account depending on the location of the deposit and the quality of the ore
[6] However, a quarterly benchmark is put into place in 2010 but is based on the average spot price for the previous four months, rather than a negotiation between industrial stakeholders (Blas, 2010).

producer shift (*i.e* resulting from a negotiation between industry players) to market prices (*i.e.* following the introduction of metals to the London Metal Exchange) for several types of metals. If they agree to consider higher volatility when switching from a producer price to a market price, the authors nevertheless differ on its amplitude considering that the change in regime is not the only cause of greater volatility. Concerning more specifically iron ore, Warell (2014) shows through an econometric study, the highest price volatility after the inclusion of the spot market. However, she nuances this first observation by taking into account the volatility of the transport cost, which strongly influences the phenomenon initially observed. The causal link between volatility and the spot market is therefore not so obvious because its amplitude can be influenced by other parameters. In this study, Warell also identifies the Chinese GDP as the main determiner in changes in the price level. Hence, this result shades the hypothesis that the increase in the price of ore is solely responsible for the exercise of the miners' market power.

In just a few short years, the shift to the spot market coupled with the exacerbation of competition, strongly weakens the steel industry, in particular the traditional steelmakers who have also been hardly hit by the economic crisis. Moreover during this period, the oligopolistic structure is maintained because as a result of the demand shock, only the Australian and Brazilian miners are able to adjust their short-term supply unlike other marginal miners such as the Canadians, the Indians or the Swedish (Hellmer, 2012).

2. The strategic behavior of the mining oligopoly

Despite their level of dependence on the downstream sector, the miners hold the market power during the 2000s thanks to a sudden sharp rise in demand. This power is this strong given the existence of a mining oligopoly and the presence of strong barriers to entry.

2.1. Do Barriers to entry restrict the concentration of the mining sector?

In the same way as for a monopoly and whether they are voluntary or not, barriers to the entry of the market may exist for an oligopoly. They may not only be the source of a non-competitive market structure but they also contribute to the maintaining of the monopoly or oligopoly. Concerning the iron ore mining market, and more broadly all commodity extraction markets requiring very high fixed costs (Ridsdale, 2011), there are a number of barriers, the most important of which are:

- Efficient minimum size: the purchase of mining concessions from public authorities requires an efficient minimum size. Any new company wishing to enter the mineral extraction market must have sufficient financial strength to face with extremely high fixed costs (purchase of the mine, transport infrastructures);
- Low average cost: the production of existing companies is high enough to cover investments and achieve a relatively low average cost, especially for the oligopoly;
- Institutional barrier: the purchase of mining concessions results either from a negotiation with a public authority or from the purchase of a competitor's asset (or an upstream company for steelmakers). Concerning the first case, an institutional barrier may be present in the market if the public authorities do not consent to sell their asset(s) to any company but condition the sale to a potentially discriminatory criterion (*e.g.* nationality of the firm). Moreover, the Australian and Brazilian deposits are among the richest in iron in the world, giving a considerable advantage to companies already set up against potential entrants;
- Effects of experience: the time delay of the presence of minors on the market constitutes a barrier to entry. In addition to the reduction in average costs gained from experience, relations with steelmakers are already established, thus lowering transaction costs.

Considering the time necessary and the difficulty of opening a mine and making it profitable, in the short term, the supply of ore is relatively inelastic at price (Medeiros, 2006; Zhu, 2012). Like the entire mining sector, it is therefore difficult for a non-mining company to enter this activity, even with the presence of a high price ore. In addition, financial actors might be skeptical to be involved in a project of this type. In the literature, Germeshausen (2014) shows that the accumulated experience and the location of the assets are the main factors determining the amplitude of the market power of the miners (*i.e.* the potential power of the oligopoly) against steelmakers and potential new entrants. However, the protection of the market from which the oligopoly and all the established miners seem to enjoy is called into question with the demand shock. Little exploited to date, Chinese iron deposits appear on the market as new assets that local miners can take advantage of to compete with historical miners. Nevertheless, although the Chinese ground is highly endowed with iron ore in volume, it contains very poor quality of iron ore. This geological configuration limits the potential competition from the Chinese mining industry, and therefore, limits the erosion of the concentration of the sector that would have occurred massively with the arrival of these new miners. Conversely, this concentration could have been much stronger in view of the wave of mergers and acquisitions that took place in the mining sector. In 2006, USD 140

billion was spent on the mining sector's external growth strategy[7]. The previous record was in 2001 with a total amount of mergers and acquisitions estimated at nearly USD 40 billion (Ericsson, 2007). Behind these transactions, there may be a desire to improve the efficiency of the firm (*i.e.* exploiting synergies, reaching a critical size and obtaining economies of scale in a highly capitalist industry), or to increase its market power (Warell, 2007). In her article about horizontal integrations in the iron ore sector, Warell shows that efficiency was the main reason for the merger between Rio Tinto and North Ltd in 2000, while the purpose of improving market power was certainly present but not dominant. Like the impact of this merger on the market structure, the iron ore industry has historically known a continuous consolidation trend since the 1970s (Ericsson, 2001), and large-scale transactions took place such as between Rio Tinto and North Ltd in 2000 or between Vale and Caemi in 2001.

Besides, the limit of concentration that occurred with the arrival of new Chinese miners is weakened since they suffer from low competitiveness faced with established miners. This economic fact results only from the poor quality of the Chinese iron ore, the high labor costs, the technological weakness of the production tool and the long distance between deposits and steel factories. According to Hurst (2015), between 2003 and 2012, the Hirschmann-Herfindhal[8] index remained between 1200 and 1600, while the value above which a market is considered highly concentrated by US anti-competitive authorities is 2500. Taking this criterion into account, the market for iron ore mining seems to be relatively concentrated. The existence of three firms, also called the "Big 3", representing today nearly 70% of the seaborne market nevertheless requires us to look at the strategic behavior of these firms to the variations in demand.

2.2. An oligopoly of miners with collusion?

In response to the demand shock, some Chinese executives and commentators claimed the practices of the Big 3 were aimed either directly at manipulating prices or indirectly at limiting the supply of ore (Du, 2012; Zhang, 2010). Li (2010) and Liu (2011) also pointed out the anti-competitive nature of the existence of the oligopoly and the profits generated by the exercise of their market power. In light of these accusations, it is therefore important to analyze the strategic behavior of the oligopoly following the explosion of demand and its slowdown in effect since 2010-2011. To respond to the insatiable Chinese demand in the years that followed the shock, the strategy of the Big 3, and to a lesser extent marginal miners, logically consisted in increasing their production

[7] This is five to six times the average amount spent each year between 1995 and 2006.

[8] The Hirschmann-Herfindhal Index or "HHI" measures the concentration of a market. It is established by adding up the square of the market shares (generally multiplied by 100) of all the companies in the sector concerned. The higher the HHI of a sector, the more concentrated is the production.

capacities. Whilst in theory, in a context of high demand, an oligopolistic strategy would aim at slowing down the supply of minerals to raise prices, it seems that with a rate of utilization of production capacity close to 100% and massive investments in new capacities, the Big 3 probably did not adopt such a strategy by quantities. Similarly, regarding a potential direct price manipulation strategy, as discussed earlier, Warell shows that China's GDP is the main factor behind the price evolution of minerals. Even though the oligopoly's power over price is undeniable and its profit margin sharply increased following the shock, this result invalidates the hypothesis according to which the miners, thanks to the change of market power in their favor, would have voluntarily raised the price for the sole purpose of accumulating profit. However, the slowdown in Chinese demand from the end of 2010, and even more so since 2014, coupled with the introduction of new capacity launched a few years earlier, has led to a drop in the price of ore. While in a competitive market, the miners would be incited to reduce the opening up of production capacity, especially since this trend of a slowdown in demand is confirmed in the long term, it turns out that the Big 3 intend on opening up new production capacities. For instance, Vale and BHP plan to increase their respective capacities by 23% in 2017 compared to January 2014. Rio Tinto intends to rise by 34% in 2017. Beyond a possible bet on a continuous increase for demand in ore, the Big 3 take full advantage of this context. The greater is the gap between the anticipated demand and the potential supply (*i.e.* existing supply and entry of new production capacity), the higher the decline in the utilization rate of production capacity, the lower the price of ore.

The main consequence of this is the elimination of competition and therefore the maintaining of rent for the oligopoly. It turns out that a form of collusion seems to be in place between the mining firms. After having massively reduced their production costs to 30-40 USD/ton, the Big 3 can now face a very low market price environment while gaining profit. As a consequence, competition can hardly exist with production costs varying between USD 60/ton for medium-sized firms such as the Australian Atlas Iron, and USD 90-100/ton for smaller firms or Chinese minors (UNCTAD, 2013). The strategy of an abundant supply affects the price and therefore the strategy of marginal minors. Hence, the latter are either subject to purchase by a larger firm or forced to reduce the average cost of production.

Few mining firms seem to have benefited from the growth of Chinese demand in iron ore. Since new market conditions emerged a few years ago with the demand slowdown, collusion between these firms is now perceptible. Nevertheless, in view of the importance of China in the demand side of the iron ore market, it seems that a new market structure has emerged and as far as we know, it is very marginally present in the economic literature: a thwarted monopsony.

3. From the questioning of the oligopoly's market power to the appearance of a thwarted monopsony

The trend over the past few years in the iron ore market faces an increasing supply to a lower demand resulting from the slowing down of Chinese growth. With the introduction of the spot market, the effect on the price is instantaneous and there is therefore a collapse in the price of iron ore where each stakeholder tries to take advantage of this new context. On the supply side, the mining oligopoly leans its strategy towards the overabundance of minerals in order to contain and oust potential competitors, attracted by the demand of emerging countries and especially China. On the demand side, although China experiences a slowdown, it still accounts for more than 50% of steel production and 65% of ore imports (in volume). Its dependence on the oligopoly is strong. Due to the heterogeneity of its steelmaking industry, it has never really managed to weigh in on the pricing negotiations, and has never been able to take full advantage of its status as a major buyer of iron ore (Liu, 2011).

3.1. The role of the Chinese authorities as a stakeholder in the iron and steel industry

The rules of the market are not the only ones to organize the Chinese iron and steel industry. The central government plays its full part not only by acquiring a majority shareholding in a large majority of steel groups but also by setting up economic and regulatory mechanisms for external relations. Before China joins the WTO in 2001, the authorities do not intervene very much in the market and let the steelmakers contract with the miners for their supplies. The Chinese minerals then take its entire share in the supply of the steel sites of the country though the stakes are high. With a strong demand for steel and as iron ore deposits are of poor quality, dependence on imports of ore iss expected to be relatively high in the early 2000s. From 2003, the Chinese government changes its policy and names BaoSteel as representative of national steelmakers. For several years, BaoSteel sits at the negotiations with the objective of containing the rising price of iron ore. This strategy is a failure. The decentralization of the sector and the heterogeneity of domestic steelmakers give the miners considerable market power. Some steelmakers under the control of local authorities do not hesitate to contract directly with suppliers without worrying about the needs of other Chinese steel producers (Liu, 2011).

China pays high prices for its steel needs in the construction and manufacturing sectors. In 2009, the Chinese Iron and Steel Association (CISA) replaces BaoSteel in the negotiations but this change of representative in the Chinese delegation does not achieve the expected results. The dispersion of steelmakers is too important and the

CISA represents only the biggest steelmakers who can benefit from the advantages of long-term tariff contracts. Small and medium-sized enterprises, representing the majority of steelmakers, have very little experience in international trade and have significant difficulties in planning their production and thus their ore requirements. Therefore, a majority move towards the spot market, which gradually expands and where the price reaches USD 120/ton in 2013. Then, the solution to emerge from this dependence seems unsolvable for the Chinese authorities. The old mines are too expensive to exploit, politically and socially difficult to officially close. The Australian and Brazilian mining deposits are of very good quality. With such low freight costs, the supply from these miners is inevitable for the Chinese authorities, which in parallel, intend to improve the competitiveness of their iron and steel factories and to develop new markets with higher added value. The high price of iron ore is a real problem for the authorities. From 2010 to the end of 2013, the ore never falls to less than USD 120/ton and rises to around USD 180/ton in 2011. Throughout 2013, ore stocks accumulate in Chinese ports. This buildup of inventories confirms the slowdown in Chinese demand that began a few months earlier and turned out to be a sign suggesting the market downturn. After ten years of insatiable appetite for iron ore, Chinese growth slows down due to a decrease in demand from steel-intensive sectors. A trend that continues in 2014 but does not fully explain the extent of the downturn where two strategies accumulate. On the supply side, miners continue in their strategy throughout 2013 and 2014 by continuing to invest heavily in new production capacities, while China seems less and less able to absorb imports. On the the demand side, in addition to the slowdown in the steel-consuming sectors mentioned above, steelmakers anticipate easy access to raw materials and begin therefore to leave stocks at Chinese ports to produce on a just-in-time basis. Under these conditions, the role played by the Chinese government is central. It is not only a matter of heading the main steelmakers of the country and thus mastering this policy of stock accumulation but the authorities also intend on limiting the overheating of the Chinese economy via a deeper reorientation of the economy. One wish is manifested in particular by the increase in the diversification of outlets. Like their international competitors, they develop a strategy towards higher-value-added segments for consumption rather than primarily for investment. This trend also confirms the decline in steel consumption intensity and thus the concavity of the consumption curve. A medium-term reorientation that nevertheless has important repercussions in the short term. From USD 136/ton in November 2013, the price falls below USD 93/ton six months later. This fall continues throughout 2014 and 2015 until reaching less than 40 USD/ton at the end of 2016. According to forecasts, miners and market analysts were indeed expecting lower prices, but it is the magnitude that surprises them. The abundance of minerals and the Chinese government's strategy thus broke a price cycle that only miners took advantage of.

3.2. The appearance of a thwarted monopsony

The rupture of the cycle has several advantages for the Chinese authorities. The collapse of the price of iron ore first of all allows steel producers, whether Chinese or foreign, to be more profitable to the detriment of miners. In fact, market power is better balanced, especially as oligopolistic firms continue to invest in new capacities that they will necessarily have to make profitable. The other advantage for the Chinese government is in the domestic market. The low price of ore, under the guise of excessive external supply, causes some old and sometimes illegal mining sites to close down as their survival in such a context is impossible. Finally, new market conditions create significant fragility among marginal miners in Africa, Australia or India, enabling the Chinese authorities to invest in quality assets outside their borders, thereby reducing their dependence on imports. These events mark a new milestone for the global steel industry. Nowadays, because of its strategic behavior, it is the Chinese government that controls demand and indirectly the price of ore. This thwarted monopsony configuration of the iron and steel industry allows China to limit the power of influence of the small number of miners. At the same time, international steelmakers are too economically and geographically heterogeneous to be able to exert any influence and change the structure of demand, at least in the short term. It seems that the very high level of ore prices was only a cyclical episode related to the heterogeneity of Chinese demand, but that in the longer term, the price of ore remains at a lower level, as suggested by the existence of a thwarted monopsony.

Conclusion

Prior to the arrival of China in the international steel market, the sector was relatively steady and characterized by a bilateral oligopoly at negotiation to fix the iron ore annual quotation. This stability, both in the relations between the stakeholders and the volumes extracted and produced, gives the steelmakers considerable market power over the mining sector. Following the demand shock in the early 2000s, a similar phenomenon occurred for steelmakers and miners. While the wave of mergers and acquisitions should have strengthened the concentration of both markets and potentially damaged the end customer, the effects were offset by the magnitude of the demand shock. In the iron ore market, despite the mergers and acquisitions, the arrival of Chinese miners tended to mitigate the effect of these operations on the level of market concentration, as evidenced by the Hirschmann-Herfindhal index (Hurst, 2015). In the steel market, Chinese steelmakers took an increasingly important place in the domestic and then international markets and the direct consequence was the break-up of the bilateral oligopoly. The illustration of this new structure was highlighted in the changes in the system of fixing the price of ore with the arrival of the spot market.

This context in which the oligopoly of miners faced competition between steel producers and enjoyed significant market power has been called into question in recent years with the slowing of Chinese demand and the introduction of new capacities for miners. The direct effect was the decreasing iron ore price, and thus the decrease in the profitability of the latter. In this unfavorable context, the Big 3 still continued to abound the market in minerals and kept on opening new capacities. This strategy of excessive supply, despite a slowdown in demand, reinforced the fall in prices and allowed the oligopoly to eliminate marginal competitors by positioning themselves in a long-term market where prices were likely to be lower, hence, involving lower margins. The collusion between the firms constituting the oligopoly seemed effective, but met the interventionist Chinese public policy at the end of 2013. While for years, the steelmakers from the biggest Asian country were very heterogeneous facing the supply of miners, it seems that the market downturn started in 2011 and particularly strengthened at the end of 2013, consolidating the Chinese demand around a single actor, the central Chinese authority. Representing more than 65% of mineral imports (by volume), China stands out as the "sole actor" in causing changes in market conditions, including the price of iron ore. In this new context, our analysis highlights the change in the market structure of the steel industry with the transition from an oligopoly to a thwarted monopsony.

In the long term, in addition to the dominance of the structure identified above, the slowdown in Chinese growth should be coupled with a greater availability of scrap metal (Hurst, 2015). This transition remains hypothetical

but would reinforce the weak demand for ore. While at the global level, the share of scrap in the steelmaking production remains marginal, it is likely to evolve in the following years on a regional scale.

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