The Day Oligopolistic Forces Lost Power

- A descriptive study on iron ore pricing

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Abstract

During the last decade, the price of iron ore has risen from $13 per tonne in 2001 to approximately $140 per tonne in 2010. Using commodity data and theoretical argumentation, this thesis analyses how market power amongst actors in the iron ore market have influenced and been affected by different pricing systems, as well as how the price of iron ore has been affected by the shifts in market power and various pricing systems. We find that the price trend of iron ore relative demand is unique when compared to other metals. Evidence suggest that the greatest single factor behind the recent price development is that the pricing mechanism shifted from oligopoly pricing to a state converging perfect pricing in late 2008, causing oligopolistic forces to lose market power. Further, prices will most likely always be higher under the new pricing system than they would have been in any given theoretical situation under the old pricing system. This thesis aims to contribute to academics and industry participants alike by providing an extensive and thorough analysis of the iron ore market, hence filling a gap in previous research.

Keywords: iron ore, oligopoly, pricing system, spot market, metals and mining

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1. Introduction

The introduction first presents the reader to the topic of iron ore, outlining some of the events and developments in the iron ore industry that have led up to the market structure of today. A section on previous research then follows that directs to the purpose of the thesis and the research questions. Lastly, there is also a brief outline of the study. The intention of section one is to illustrate on-going issues and to motivate the relevance of this study.

1.1 The Iron Ore Market – A Market In Transformation

Since the inception of international iron ore trading in the mid-1960's, the price level of the commodity has been set through an annual negotiation between the Big Three mining companies (Vale, BHP Billiton and Rio Tinto) and steelmakers, eventually resulting in a benchmark price – a fixed industry price for an entire year. Whilst the steel mills tried to push for as low a price as possible, the miners naturally wanted the opposite. To facilitate the process of reaching equilibrium, the first mining company to agree on a price with a steel mill became known as the first setter, and that price came to be the industry benchmark price for a year. The real incentive for the mining companies to be the first one to reach a deal, however, was that the first setter also ensured to get the most favourable tonnage treatment from the buyers (Sukagawa, 2010). The first setter advantage serves as a prime example of a measure that originally served its purpose well, but that later would come to play a significantly different role within the industry formation.

The annual benchmark pricing system within the iron ore industry was dependent on mutual understanding amongst the market participants; everyone knew they would be better off by sticking to the silent gentlemen's agreement (Rogers and Robertson, 1987). It may not come as shocking news, but the system led to a non-volatile, relatively flat price level over time. In the very beginning of the 21st century, something that would eventually play a part in the break up of the more than 40-year-old pricing system struck the industry with force, and it came from the east.

In the last ten years, China has increased its iron ore imports by some 570%. In 2010, the country's share of total world imports was 59%, up from 19% in 2001 (UNCTAD, 2011). Equally impressive, the nation now represents nearly half the global iron ore demand. Meanwhile, the price of iron ore has risen steadily from \$13 per tonne in 2001 to approximately \$140 per tonne in 2010 (IMF, 2011). The recent developments have also made way for numerous hedging alternatives, including centrally cleared swaps and futures markets.

What is really going on in the iron ore industry? Is the recent price increase merely reflecting the increased demand stemming from China, or is it more to the recent developments than seen at first glance? This thesis aims to thoroughly analyse different spectrums and aspects of the iron ore market in order to answer not only the questions outlined above, but also a number of related matters.

To start off, a review of previous research on iron ore and commodities follows.

1.2 Previous Research

Many finance and economics studies have been conducted within the field of commodity markets, some of them relating to iron ore (e.g., Chang, 1994, Fiuza and Tito, 2010, Hui and Jinqi, 2011, Jones, 1986, Rogers and Robertson, 1987, Sukagawa, 2010, Wårell and Lundmark, 2008). However, several studies on iron ore focus on mergers and acquisitions in the industry. Mullin and Mullin (1997) for instance use both qualitative and quantitative evidence to support the effects of U.S. Steel Corporation's acquisitions of iron ore properties. Another major academic focus is productivity within the industry, such as in Galdón-Sánchez and Schmitz's (2002) study on labour productivity in iron ore markets. Other papers such as Mancke (1972) examines the backwardation integration in iron ore production relating to the price.

Still, as the market for iron ore recently has been and currently is going through a lot of changes, there is an absence of academic research addressing the current topics. There are numerous industry reports from banks and mining organisations, such as Raw Materials Group (RMG), World Steel Association, and Iron Ore and Steel Derivatives Association, which all follow different aspects of the iron ore market. Yet, no academic research paper has been written as of today involving the relation between the price and the on-going structural changes in the market.

Various other papers have described other commodity markets in terms of imperfect competition and oligopolistic market structures. Research by Adams and Dirlam (1964) resulted in one of the first studies that looked into a potential oligopoly within a specific commodity market, namely the steel market. Giannakas and Fulton (2005) illustrate both the pros and cons of an oligopoly in the agricultural commodity market in a similar study. Karp and Perloff (1993) study the effects of the oligopoly in the coffee market, and Holloway (1991) observes how the food industry is affected by imperfect competition and how that influences the farm-retail spread. Easterbrook (1986) studies commodity futures markets and imperfect competition, and concludes that futures markets are difficult to manipulate or monopolise as a result of competition from spot markets.

Oil, with its distinct market structure, is another commodity that has been studied closely. Most academic papers analyse OPEC as a traditional cartel in the oil market. Hamilton (2008) demonstrates that the low price elasticity of short-run demand and supply, the vulnerability to disruptions in supply, and the peak in US oil production have all been contributing factors behind the large price movements since the 1970s. However, Alhajji and Huettner (2000) question the existence of imperfect competition as they find contradicting evidence supporting that neither OPEC nor the OPEC core countries can be considered dominant producers.

In the field of commodity derivatives and prices, most studies focus on comparing commodities as an investment to other asset classes, most commonly equities, and how commodities can be used to diversify portfolios and hedge other financial positions. There are a few academic papers that stand out, including Pindyck (2001), Routledge et al (2000), and Williams and Wright (1991), who all show the various characteristics of spot and futures prices for commodities and how they are determined by the interaction of demand and supply.

1.3 Purpose and Research Questions

The international iron ore market constitutes an excellent example of how the characteristics of a commodity made way for a long lasting, rigid pricing system, controlled by a few cooperating powerful forces on different sides of the trade. However, in just a short period of time, all that once was the industry norm came to change and the price started to rise sharply. Despite the area being a hot topic, there is an absence of academic research on the subject. Furthermore, there is no clear consensus in previous studies on commodity markets and market structures regarding the interaction between price level and structural market shifts. The purpose of this thesis is therefore to unravel the major forces and events behind the recent developments in the iron ore market. The thesis aims to fill a gap in previous research by providing a historical overview of the iron ore market, analysing the iron ore pricing mechanism, and establishing the interaction of price and market structure in the iron ore market. The thesis further aims to be beneficial to academics and industry participants alike.

The research questions in focus are:

- How have the shifts in market power in the iron ore market influenced and been affected by different pricing systems since the inception of international pricing in the mid-1960's?
- In what ways have the price of iron ore been affected by the shifts in market power and the various pricing systems?

To answer the first research question, the influence and relative power of different market participants will be of particular interest. Market power – not necessarily the same thing as market share – refers to who the controlling force in the market is; who can affect the price level, or by other means control the competiveness of the market. Pricing system refers to how prices are set, e.g., spot prices or forward contracts.

The second research question – naturally interlinked with the first research question – is directed at the steep iron ore price rise of the last few years and how the shifts in market power and the various pricing systems have affected the price level. The pricing mechanism of iron ore and the use of various financial markets within the scope of trade will be discussed.

1.4 Outline of Study

The thesis takes off in the theoretical framework surrounding commodities, discussing pricing systems and market structures. Economic matters, such as price elasticity and volatility, as well as how the industrial composition can affect the market structure are also reviewed, and a short example from the oil market is presented. Subsequently follows an overview of the data used throughout the thesis, including possible drawbacks. The scope is then narrowed and geared towards the iron ore market, starting with a historical review of what forces have shaped, influenced and affected the industry. Using financial and economic theoretical arguments as well as trade-related data, the historical development up until today of the iron ore industry is then analysed. The thesis ends with a presentation of the conclusions drawn, with a succeeding discussion around beliefs about tomorrow and suggestions for further research. The different sections aim to have a similar logical structure in order to facilitate for the reader.

2. Theoretical framework

The theoretical arguments in the section are applicable to the section on iron ore and follow the same logical structure. Focus lies on revealing strengths and weaknesses of different pricing systems and market structures and how they are interlinked. The section is ended with the case of the oil market – a commodity market with an imperfect structure.

2.1 General Concepts

The commodity market is in many ways unique. In contrast to assets in financial markets, commodities are real assets intended for consumption as they provide utility by use in industrial manufacturing. As such, commodities have an economic value unlike stocks and bonds that instead generate value through cash flows (Fabozzi et al., 2008). It is, however, important to understand that every commodity has its own unique features and market structure, as noted by Kat and Oomen (2006). Accordingly, neither commodities as a group nor specific commodities are homogenous as the properties and quality within any given commodity can vary greatly.

In the simplest form of a pricing system, buyers and sellers of commodities exchange goods when they can agree on a price based on local supply and demand, as first presented by Marshall (1890). A characteristic of local markets is that prices may differ vastly depending on the production and consumption in the local region – the price level does not necessarily reflect the global demand and supply. Large variations in terms of quality for the physically traded commodities are typical in such markets (Garner, 2010). Local commodity markets are usually in a premature phase, defined by high distribution costs or are simply of such nature that the products cannot be distributed to other markets. Negotiation is a natural element of the pricing process, hence market power is largely determined by each party's bargaining skills (Mansfield, 1997).

With the evolvement of the international pricing system for commodities, the value of the asset class is determined through global, rather than regional, supply and demand. An international pricing system opens up for global trade and more efficiency. Another benefit of an international market is that a standardised quality of the traded commodities can be distributed on a global basis. In international markets, more factors influence the market power of specific buyers and sellers than in local markets (Jehle and Reny, 2001).

Commodity supply is dependent on the offered quantity in the market; hence storability, availability and renewability are all crucial aspects for the supply of a commodity. Base metals have a high degree of storability, as they are non-perishable and the cost of storage remains low with respect to their total value. Non-renewability is another characteristic of base metals; the price depends strongly on current investor demand.

Availability varies greatly amongst base metals and other commodities. Thus, the finding of new reserves of raw materials is crucial for certain commodities (Fabozzi et al., 2008). Metals are not as dependent on seasonal supply factors as some other commodities as they can be extracted all year long. However, shortages in the metal market can be persistent and last over many years as the supply-side is slow to react. The lagging supply of the metal market can cause large price movements as a result of demand shifts (Garner, 2010).

Power in markets with high demand and low supply will shift towards the sellers as commodities of good quality increase in value when there is excess demand. A market where sellers have power to reach their desired minimum selling price is a seller's market and conversely, a market with excess supply is a buyer's market. Commodity markets are commonly described in such terms, see for example the electricity market (Mansfield, 1997).

The price elasticities of supply and demand differ in the long- and short-term for commodities as the market responds differently to supply and demand shifts depending on the timeframe. In the long run, the supply and demand sides will adjust accordingly to any change in market conditions, whilst shortages or surpluses can cause large movements in the short run. Commodities all have different elasticities as some assets are more sensitive to shifts in supply and demand. The global demand elasticity of oil is for example -0.4, whilst steel is at a level of -0.2 to -0.3 (Case and Fair, 2008).

The price volatility is often of great interest to producers and consumers of physical commodities. Volatility measures the price variation for a commodity over a given time period and is used to derive the risk of the asset (Fabozzi et al., 2008). High volatility reflects rapid changes in market expectations, but in order for the price to fluctuate largely in the short-term, the price of a commodity cannot be locked in for a long period. Volatility can cause prices to rise and inventories to build-up in the short-run when there is an increase in demand. However, increases in price volatility can also result in a decrease in production as the value of alternative products and the associated opportunity cost might surge. Price volatility of commodities is closely dependent on the level of demand elasticity (Pindyck, 2004).

A commodity forward contract is an agreement to buy or sell a commodity at a specified future time for a certain price, and originally arose as a means to mitigate price risks between farmers and merchants (Hull, 2009). When the maturity of forward contracts exceed one year, they are referred to as long-term contracts (LTCs). Such contracts eliminate the risk of price fluctuation by locking in the price for both the buyer and the seller of the commodity. Thus, forwards can be used to hedge against certain risks, such as foreign currency risk. However, there is no protection against credit risk as forward contracts reduce price risk only if both parties to the agreement live up to their obligations, and in addition, market liquidity is often poor (Garner, 2010). Under a physically delivered commodity forward contract, the underlying commodity is delivered to the buyer at a predetermined price. Such contracts can also be cash-settled, opening up for speculation, so that the difference between the prearranged fixed price and the actual market value of the underlying commodity is paid in cash to one party by the other party at maturity of the contract (Chisholm, 2009).

Bessembinder and Lemmon (2002) assume that the forward market is perfect, the retailer's resale price is fixed, and the producer and the retailer have the same risk aversion. In such a competitive market, both the supplier and the manufacturer have significant market powers in the forward market and their individual bargaining skills will determine the price of the contract. Borenstein et al., (2000) find that significant deviations from competitive pricing in the energy market exist, mostly during periods of high demand. D'Ecclesia (2006) also analyses imperfect commodity markets and finds a pricing system with forward contracts to be favourable to dominant actors with a high degree of market power as they can take advantage of the risk hedging strategies more extensively. LTCs cause low volatility as the price level is locked in.

The spot market gives market participants the opportunity to buy or sell commodities for immediate delivery. Volatility and liquidity increase under spot markets compared to forward markets as the pricing system follows daily movements (Fabozzi et al., 2008). Most studies agree on that spot markets have been beneficial towards creating perfectly competitive markets; there is no Nash bargaining process where the powers of buyers and sellers play a critical role in determining the price. Smaller producers can thus more easily participate in the market and do not risk being subject to price discrimination, as the equilibrium price is set based on global supply and demand (Dong and Liu, 2007). However, Wu et al. (2002) argue that market participants often can find themselves incentivised to use the forward market for risk management issues. Following the same line of reasoning, Dong and Liu (2007) conclude that it is due to the hedging benefits offered by bilateral contracts that forward contracts are still widely used, even in the presence of liquid spot markets.

Swap contracts can either be of an over the counter (OTC) or cleared nature, and are agreements to exchange payments based on an underlying commodity in the future between two parties (Hull, 2009). The main strength of swaps is the option they provide to hedge certain risks including interest rate risk. Thus, producers often use commodity swaps in order to get price assurances for future earnings (Varangis & Larson, 1996). Yet, wide spreads and the monthly average settlement can discourage some market participants (Erb and Harvey, 2006). Swaps agreements are, just like spot markets, more common under perfect market structures, as liquidity and transparency are relatively high (Dong and Liu, 2007).

Futures markets for a commodity is an improvement to many other financial derivatives as they enhance public information, present reliable price volatility, transfer financial risks, provide lower transaction costs and improve liquidity in the market. Futures markets have numerous advantages compared to spot and forward markets. The exchange-traded contracts are standardised agreements without counter-party risk, and can easily be closed out or rolled over; delivery can be avoided so that shipping, storage, and insurance matters are not of concern. Compared to swap contracts, futures contracts for commodities have better pricing and trading efficiency as a result of tighter spreads. However, futures exchanges often require market participants to pledge collateral before given access to futures trading accounts (Erb and Harvey, 2006). Commodity markets with widespread futures exchanges are characterised by a high degree of liquidity and low transaction costs (Fabozzi et al., 2008). High volatility and liquidity generally advocate a perfect market as the pricing system brings transparency to all market participants. A result of the transparency is the difficulty for dominant producers to practice price discrimination (Streit, 1980). Given the reasoning of Streit (1980) and (Erb and Harvey, 2006), the prices of futures contracts, just like spot and swap prices, tend to follow the perfect market equilibrium more closely than forward contracts, hence futures exchanges tend to arise in perfect markets.

In many commodity markets, an oligopolistic structure with a few dominant actors is a common feature as there are many barriers to enter and exit, including high start-up and fixed costs, especially in infrastructure (Streit, 1980). Examples of cartels in the metal industry include aluminium, copper and steel (see for example Litvak and Maule, 1975, and Alhajji and Huettner, 2000). Futures, swap, and spot markets would all experience difficulties to improve information on supply conditions, attract speculators, and provide liquidity if the supply side is controlled by government agencies or cartels. A small number of dominant producers create insecurity in the market as speculators and hedgers fear getting stuck in positions due to liquidity issues (Streit, 1980).

An oligopolistic market is controlled by a few producers that are mutually well aware of each other's actions, often leading up to a Nash equilibrium, i.e. no seller can increase profits by individually shifting its own strategy. Two common characteristics of an oligopolistic market is price leadership and collusion, where the dominant producers set the price level and leave the rivals with no choice but to follow suit in order to compete (Alhajji and Huettner, 2000). Due to significant economies of scale within some industries, such as metals, it can be very difficult for small producers to compete on equal terms under such measures (Streit, 1980). Collusion is an agreement, formal or informal, between sellers to deliberately control the price level and supply. Collusion becomes known as a cartel when a formal agreement, stating how to control prices and supply, between the controlling market forces is reached. Although competition laws forbid cartels, they can still be found in many commodity markets (Alhajji and Huettner, 2000).

Historically, political pressure and down sloping business cycles have been the major reasons for why cartels and collusions break up. Fast growth in demand is another major factor behind lost power for oligopolistic forces, as other producers are able to gain market share. If demand becomes more elastic the incentives to create cartels and collusions decrease as profit opportunities are reduced (Pindyck, 1979). Market prices can be significantly affected by cartelisation as in the well-known example of OPEC, described in the coming subsection.

An oligopoly does not require an underlying shortage of a specific commodity. There are examples of cartels formed in attempts to prevent oversupply leading to a collapse in the market price (Jones, 1986). Historically, only about a third of all attempts to form cartels have succeeded in adjusting the price level (Eckbo, 1975). One explanation is the free rider problem, where one member of the cartel would benefit even more if they raised their market share. Successful cartels and oligopolies are characterised by a small number of producers in the market, a sense of common purpose amongst the producers, when the producers can operate as usual during temporary revenue shortfalls, when a high proportion of total output is controlled by the cartel, when the product has few substitutes, and when the supply outside the cartel cannot readily be increased (Jones, 1986).

Times of steep price increases will cause outside producers to increase production. In the metal industry, new mines will be developed and existing mines will be worked more intensively in such times. However, expanding and prospecting mines have long lead times. Cartels and oligopolistic producers react with increases in supply to meet the changing conditions. In the mining industry it is common among dominant producers to have excess capacity in the metal so if the market price were to rise significantly, a substantial overhang of capacity could be brought into production (Jones, 1986).

2.2 The Case of Oil

The oil market is a commodity market dominated by a few powerful actors. An illustration of the market for oil adds value to discussions about the market structure of other commodities.

Oil is the largest commodity market by value, followed by iron ore, and has a long history of changing market structures, with many political events that have caused dramatic oil price shocks. Going back in history, the US oil market was originally a monopoly with only one major producer: Standard Oil. The monopoly later broke up and three oil companies emerged out of what had been Standard Oil. Together with four other oil companies, the Seven Sisters were formed, resulting in an oligarchic monopoly market structure, controlling nearly 80% of the oil market during the 1960's. The number of firms in the industry did however increase, as more businesses wanted to enter the lucrative oil industry, causing the oil price to decrease. At this time crude oil was traded using LTCs (Barros et al., 2011).

During the 1970's, excessive price increases took place and a greater demand for oil made the newly formed organisation OPEC to rise in power. In the 1970's, OPEC gained full control over the production and price of oil. Eventually, their price became the global standard, but OPEC did not manage to maintain control of the oligopolistic market as oil prices were volatile, alternative fuels gained interest, and new actors emerged. Instead, OPEC formed a cartel to fix the price and control the trades. However, the new structure caused overproduction and a lower degree of power for OPEC, as its fixed price level was above that of market participants outside the cartel. However, OPEC was still the most influential entity affecting oil prices. To regain control, OPEC replaced its official (fixed) price with a weighted average that became used as the industry benchmark price (Almoguera and Herrera, 2007).

The last decades have been characterised by large fluctuations in oil prices. The spot market for oil was only used to complement the LTCs in the 1970's when oil producers had excessive quantities of oil to sell. The demand came from firms that needed extra quantities of oil. However, the oil crisis in the 1970's caused LTCs to reflect prices incorrectly, leading to a rapid growth in spot market trading. It was even profitable to default on the LTCs and sell the oil directly in the spot market, which more accurately reflected the fair value of oil as determined by supply and demand (Kaufmann, 2010).

The majority of oil is now traded under forward contracts instead of the spot market. As there are many costs involved in the refining process of oil, producers find it preferable to know the quantity and price level in advance. In the late 1970's the first oil futures exchange was introduced in the US, tied to a specific benchmark for a certain quality. As a result of its popularity, many other futures exchanges soon opened up, often tied to different benchmarks. The improved market transparency that came from the new pricing services with more detailed reports of transactions led to more volatile prices as a reflection of the increased trade activity. The development of futures markets was highly dependent on the increased transparency. The other major reason behind the development of futures markets was that many oil companies, especially in the Western world, lost their power to OPEC. The establishment of futures markets was thus a way for western oil companies to retake control of the pricing system. It did not take long before other oil derivatives, such as options and more advanced financial instruments, came to market (Xiaoming, 1999).

3. Data

The section about data covers and motivates the approach and methodology used in the thesis. A detailed description of the data as well as a discussion about its validity is presented.

Since this study is descriptive in its nature, previous descriptive studies have been used as a benchmark to find an suitable approach (e.g., Rockness and Williams, 1988, Beattie et al., 2000, and Dreéze et al, 2004). The purpose is to analyse the iron ore pricing mechanism, and more specifically, to see how the shifts in market power relate to different pricing systems as well as how the price of iron ore has been affected by the changes. Data of prices, demand, producers and production is used to answer the research questions. Moreover, theoretical arguments cited in other research papers and relevant findings from the part about iron ore are used to draw conclusions. Thus, a combination of data and theoretical argumentation, i.e. both quantitative and qualitative methods, is used as a basis for the analysis.

Data for iron ore production, import, export, and demand come from a database provided by RMG, an independent organisation consisting of mineral economists, strategists and analysts, founded in 1990. RMG is considered to be the leading independent industry research entity, and much of the research conducted within the area of iron ore use RMG's compiled database, Raw Materials Data. The body also prepares an annual iron ore analysis published by United Nations Conference on Trade and Development (UNCTAD) Trust Fund Project on Iron Ore Information financed by income from the sale of its publications and by contributions from the Governments of Brazil, Canada, Sweden, and the United States of America. The database includes more than 25,000 entities (projects, mines, smelters, refineries, companies, industry associations and government agencies) and a wealth of mine details (status, open pit, underground, metal, grades, capacity, ore production, reserves, resources, present and past metal production, etc.).

Figures for iron ore production and trade are presented in gross weight and not as the metal content of the natural ore or concentrates produced. Comparability of data concerning different mines or countries may be a problem as the natural iron content of ore varies dramatically, with mines in China at one extreme producing ore with an average iron content of less than 30%, whilst many other countries produce ore with an iron content of above 60%. To solve this problem, RMG has adjusted the data to be equal to that on average in the rest of the world.

The term "iron ore" may refer to natural ore, concentrates or pellets that all have different iron content. In this study we focus only on natural ore. Also, iron ore can either be wet or dry that similarly differs in concentrate. Wet ore is used in the database as it is the most commonly used measure, and figures are recalculated from sources that refer to dry ore.

Still, it must be noted that potential inaccuracies in the data may arise due to the comparability problem of different kinds of iron ore. The figures on iron ore production include only iron ore that is intended for steel production. Another problem is the difficulty of identifying production from captive producers as there are commercial forces prompting to reduce the availability of data (UNCTAD, 2011).

Price data for iron ore and other metals have been gathered from the International

Monetary Fund (IMF) Commodity Price Data prepared by the Commodities Team of the Research Department. The iron prices are based on the China import Iron Ore Fines 62% FE spot (Cost and Freight Tianjin port), with the unit US dollars per tonne, which is what RMG has defined as standard for the industry price as well. The time series have taken into account the change in pricing system as the annual iron ore contract price series are replaced by the iron ore spot price series starting in December 2008. The prices are denominated in nominal US dollars. The monthly prices are reported as averages, but no seasonal adjustment has been made. However, neither the averages nor the lack of seasonal adjustments bias the price data; prices for all commodities are calculated in the same way, and the trend over time is the main point of interest. Price data is used from IMF instead of RMG as the data stretches further back in time and allows for easier comparison with other metals including copper, tin, nickel, zinc and aluminium. Copper is defined as grade A cathode with London Metal Exchange (LME) spot price, and cost, insure and freight (CIF) to European ports. The standard grade and the LME spot price are used for tin. For nickel, the melting grade with LME spot price and CIF European ports is used. The high grade 98% pure is used for zinc and 99.5% minimum purity for aluminium with LME spot price and CIF UK ports (IMF, 2011).

Data for commodity price indices are collected from the World Bank using their Commodity Price Indices, published by the Development Prospects Group. The body provides information and analysis on global trends in the world economy. The World Bank Commodity Indices are one the most commonly used series of indices in the world (World Bank, 2011).

The data used in this study are non-stationary and have means, variances and covariances that change over time. Such data is unreliable to use for statistical inferences as no valid conclusions can be drawn from any autoregressive model since at least one non-stationary regressor is included in such models. Unpredictable data may indicate relationship between certain variables that do not exist. Non-stationary time series have variable variances and means that are distant from a long-run mean over time (Wallace and Silver, 1986). The observations are also somewhat limited, as the price data in the data sample for iron ore has been annually fixed until December 2008. Afterwards the prices are set on a monthly basis. The data for production, trade and demand is annual, also resulting in few observations. To avoid false statistical inferences from a non-stationary dataset, the data is instead graphed and rigorously analysed to make logical inferences in combination with results from previous studies. The above arguments also justify the descriptive approach of this thesis. All graphs in this thesis are created by the authors and based on the data presented in this section.

4. Iron Ore

Although the iron ore market is the world's second largest commodity market by value, an iron ore spot market has not existed until recently. To understand why, it is essential to first take a look at the characteristics of iron ore and the history of iron ore pricing.

4.1 The History of the Iron Ore Market

Iron is one of the first metals to ever be used by mankind, and the art of iron metallurgy is believed to date back to the third millennium BC. The iron content in the earth's crust is approximately 6%, although the ratio increases significantly further towards the interior of the earth. It is, however, more difficult and costly to mine iron ore the deeper into the ground the ore bodies are hidden. In reality it is therefore almost exclusively iron ore with iron (Fe) contents of up to 70% that are being traded; 62% has been adopted as the industry standard for spot price indices, e.g., Platts Iron Ore 62% Fe Index. The global steel industry accounts for some 98% of the worldwide demand for iron ore, and as a result, the performance of the two industries have been highly correlated throughout history (Geological Survey of Sweden, 2002).

International iron ore pricing first started in the mid-1960s with the development of the mines in the Pilbara region in Western Australia. Until then, only regional markets had existed, and different prices were set depending on local demand and supply in each region of the world. The Pilbara deposits led the Australian government to change their stance on iron ore exports; from previously having been considered a strategically important and rare resource, it suddenly became clear that the country had an abundant supply of the commodity (Sukagawa, 2010). During the same time, Japan experienced significant economic growth and the domestic steel makers wanted to secure their long-term supply of iron ore whilst diversifying their sources. When shipping costs also decreased sharply, the Pilbara deposits looked like the natural way to tackle the threat of a Japanese shortage of iron ore.

There was, however, one problem with the Pilbara mines. For the projects to receiving funding, the lenders required certain collateral to guarantee a revenue stream from their investments. The costs involved in setting up a new mine are high, much due to the fact that substantial economies of scale must be established in order to run profitable iron ore production (Rogers and Robertson, 1987). An example of the cost structure of the industry comes from when CVRD (as of today Vale) opened its operations in Carajás, Brazil, in 1978. In addition to the mining and port facilities and the general infrastructure of the sites, 890 km of railway also had to be built in order to get the iron ore to the port at Punta de Madeira. The total cost of the project added up to $3 billion, of which the railway represented 56%. The rest of the sum was divided between the mining facilities (20%), the port facilities (14%), and the general infrastructure (10%) (Geological Survey of Sweden, 2002).

The solution to the collateral problem came to be the LTC on iron ore, a contract that proved "bankable", i.e. passing as acceptable collateral to the creditors. Originally the LTCs were of very long-term nature (15-20 years), with a fixed price for the first 5-7 years and annual price reviews to reflect changes in the rate of inflation and the economic sentiments. In the mid-1970s when inflationary pressure hit the global economy at a time when it also became apparent that the miners' operating costs often were subject to unexpected production stops and other unforeseen events, the annual price reviews got replaced by annual renegotiations resulting in an annual industry benchmark price (Sukagawa, 2010). Since iron ore is not a standardised product, the bilateral contracts agreed upon based on the benchmark price could then either be made at premium or discounted levels to reflect the quality and iron content of the ore (Ericsson, 2011).

The annual renegotiations became known as the Champion Negotiations, referring to the fact that both the miners and the steel mills consisted of a small number of orderly groups or large corporations, the so-called champions. The major players, or champions, that since the dawn of the LTC-system have acted as the negotiators of the sell side in the pricing process consist of Brazilian Vale, British-Australian Rio Tinto, and Australian BHP Billiton, together known as the Big Three. On the buy side, the negotiating steel companies and conglomerates have been the German duo ThyssenKrupp and Salzgitter, French Usinor (as of today a part of ArcelorMittal), British BSC (now defunct), and Japanese Nippon Steel.

Whilst the steel mills tried to push for as low a price as possible, the miners ideally – and naturally – wanted the opposite. To facilitate the process of reaching equilibrium, the parties on both sides were given incentive to compete with each other: the first setter advantage. The first mining company to agree on a price with a steel mill became known as the first setter, and that price came to be the industry benchmark price for a year. The real incentive for the mining companies, however, was that the first setter also ensured to get the most favourable tonnage treatment from the buyers, something that was particularly important for the miners when iron ore was in an oversupply situation. Hence, the first setter mechanism effectively meant not only that the negotiations would run smoother, but also that both parties increased their incentive to reach a deal (Sukagawa, 2010).

Apart from being bankable, LTCs were also implemented to improve market stability and reduce price volatility. In steelmaking, the proportion of iron ore to be used can vary, but there is no substitute for the commodity. In addition, the cost of the iron ore input is relatively small compared to that of the finished steel product. As a result, these two factors support low price elasticity of the long-term demand for iron ore. Iron ore supply is also fairly inelastic to short-run price changes. The existing capacity of a mine together with the lengthy timespan of setting up new producing mines (usually 3-7 years), limit any short-term production increase to the upside, no matter how high the price of iron ore shoots. Similarly, high fixed costs work as a factor that limits any production decrease in times of low iron ore prices.

However, the short-term demand for iron ore is first and foremost determined by the demand for steel, which in turn is very sensitive to abrupt changes in income. Considering the short-term price inelasticity of supply, short-term market instability could be expected, and with that follows an unwanted threat to iron ore miners, steelmakers, and steel consumers alike. The implementation of LTCs meant that market participants reduced the uncertainties related to trade (Rogers and Robertson, 1987). The theoretical short- and long-term supply and demand situations in the absence of LTCs are depicted in Figure 1 and 2. Previous studies have shown that the short- and long-term price elasticities of demand for iron ore equal -0.15 and -0.51, respectively (see Chang, 1994, for example). Rogers and Robertson (1987) showed that countries using a higher degree of long-dated contracts have had better price and market stability than those that rely more extensively on annual benchmark prices.

Figure 1 - Short-term Equilibrium

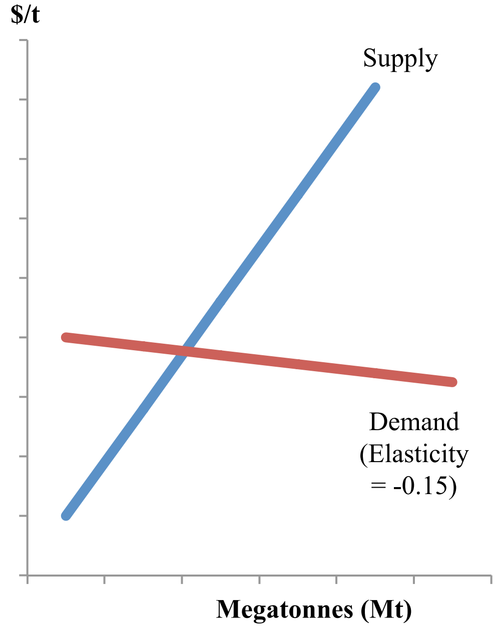
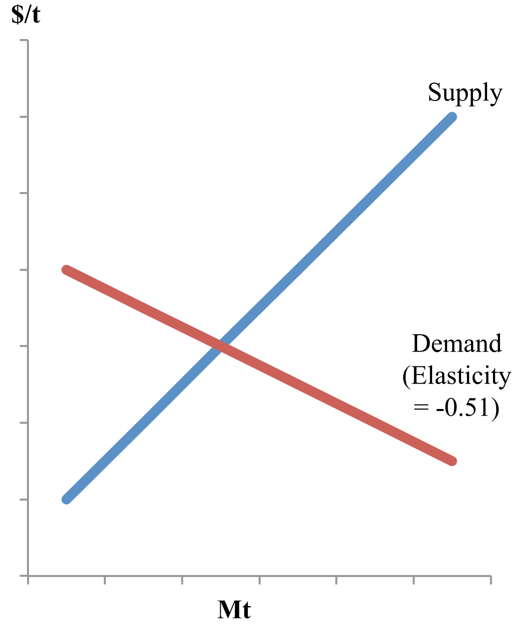


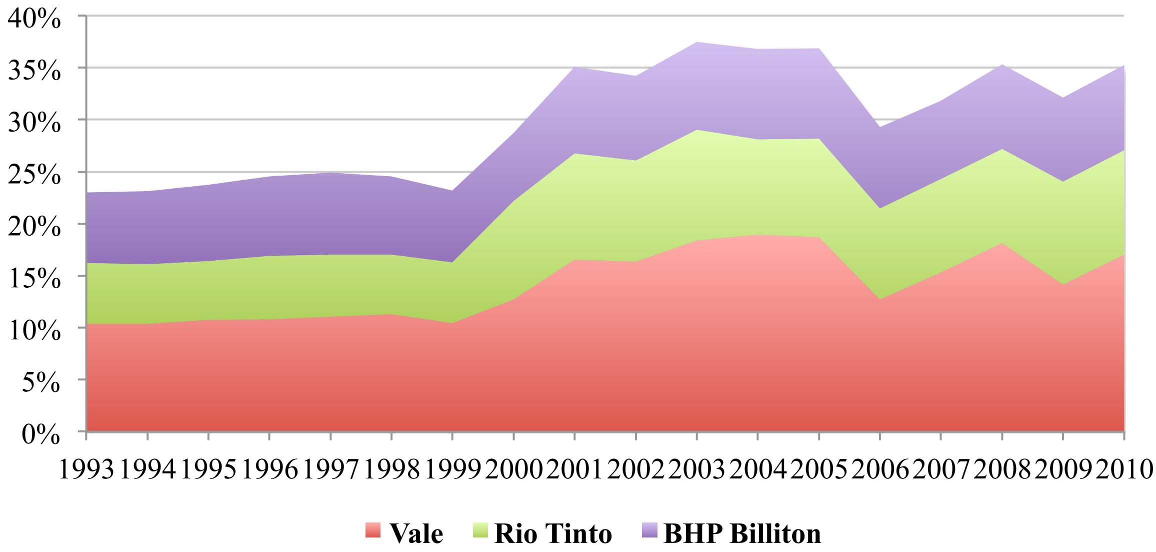
Figure 2 - Long-term Equilibrium



The system of Champion Negotiations was largely dependent on, if not cooperation, then at least mutual understanding amongst the market participants. Without an agreement of some sort, it could be difficult to understand why the system worked. However, because the number of players in the industry was limited, the need for systemic coordination was little and the system with Champion Negotiations and benchmark pricing was an unwritten rule to be followed; everyone knew they would be better off by sticking to the silent gentlemen's agreement. An executive at Nippon Steel described the situation rather well when he expressed that the market participants were all part of the same crew on the same boat, and emphasised the utter importance of not rocking the boat (Rogers and Robertson, 1987).

Not only the barriers to entry associated with the cost structure of the industry and the high degree of acceptance towards the pricing system with Champion Negotiations have led to an oligopolistic market structure; in fact, the iron ore market has all the features that support the creation of a successful oligopoly, just like Jones (1986) argues. However, Jones (1986) also mentions that the potential resistance from iron consumers and the fact that no single producer is sufficiently powerful to dominate the market are strong counterarguments, and concludes that any attempt to establish an iron ore cartel would be met by limited success. Conversely, UNCTAD (2011) upholds that by keeping prices high enough to pay for capital expenditures, but low enough to keep new entrants from becoming realistic alternatives in the competition, the Big Three have been able to maintain control throughout most of the era of international iron ore pricing. In 2010, Vale, Rio Tinto, and BHP Billiton had shares of 17%, 10% and 8% of global production, respectively (UNCTAD, 2011), as shown in Figure 3.

Figure 3 - Share of Global Iron Ore Production 1993 - 2010



Although the system of benchmark pricing and Champion Negotiations worked well, as time passed, voices of concerns from within the industry were raised. For one, a single global price was perceived to reflect domestic conditions in all steel-making countries poorly. It was also argued that the first setter rule could cause a small producer to agree to an unreasonable price level in order to secure a contract, thereby creating an imbalance in the market. Furthermore, an annual pricing system was thought of as too rigid to reflect the more volatile global economy, especially since the forecast models used by the steelmakers have proven highly inaccurate (Rogers and Robertson, 1987). Finally, it could be said to exist an element of principal-agent problem in the Champion Negotiations, e.g., when one party leaks information about its negotiating strategy to the counterparty before the actual price discussions (Hui and Jinqi, 2011).

Despite of the many problems, the annual benchmark pricing system and the Champion Negotiations prevailed until recently, when a dragon suddenly emerged out of the shadows.

4.2 China – The Rise of the Dragon

Starting in the 1970s, China began adopting a new stance towards private ownership and foreign investment; a policy change that became known as the Chinese economic reform. Following the policy measures, China started to climb up the ranking for the largest economies of the world, with an impressive GDP growth, particularly during the last decade. With a growing economy followed, amongst other thing, a rapidly increasing steel production, which resulted in a subsequent demand boom for iron ore. Although the Chinese government tried to cool off the economy in a number of ways to assure a soft landing, the domestic steel industry has so far been relatively unaffected.

China was self-sufficient in iron ore during the beginning of the nation's expansion phase, and if they had had the means to stay that way, then the impact of the country's growth on the global iron ore industry might have been negligible. However, early in the new millennium, China was drifting away from self-sufficiency. The government urged the iron ore producers to increase their output and the miners rushed towards expansion, but a limited labour force and a limited supply of building materials aggravated their efforts. In addition, many Chinese iron ore mines were old, and a significant number had to be shut down due to high operational costs. The situation resulted in a surge in China's imports of iron ore (Sukagawa, 2010).

In 2003, China surpassed Japan and became the largest iron ore importer in the world. In 2010, the country's share of total world imports was 59%, up from 19% in 2001. During the same time period, China's imports increased by some 570%, from 92 megatonnes (Mt) to 619 Mt, whilst the nation's domestic production noted an upswing from 102 Mt to 315 Mt (UNCTAD, 2011). Sukagawa (2010) argues that China's increasing domestic production despite the many obstacles previously mentioned is remarkable.

Considering China's dramatic increase in imports of iron ore over the last decade, it might not come as a surprise that the nation has caused quite a stir in the international iron ore industry. One perhaps unexpected effect came from the sea. The seaborne iron ore trade has been increasing every year during the last decade, and the volume of shipped iron ore has more than doubled since 2001 to 989 Mt in 2010 (UNCTAD, 2011). The increased volumes of shipments proved to be a serious shock to many of the ports and railways in China. Initially, when China first started to increase their imports, the ports were filled with iron ore, and carrier vessels unloading often caused bottleneck situations where many other ships got held up. As a result, the ocean freights rate hiked, leaving a footprint on the seaborne trade in other bulk materials. The situation was eventually taken care of when the Chinese government stepped in and expanded the capacity at the major ports (Sukagawa, 2010).

Coincidentally with China's economic expansion, the price of iron ore has risen steadily from $13 per tonne in 2001 to approximately $140 per tonne in 2010 (IMF, 2011). Whilst the price boom benefited the financial statements of the mining companies, Chinese steel mills, on the other hand, were not very pleased with the situation as they saw profit margins shrink, and what is more, they felt left out of the price negotiations. Although China had already surpassed Japan as the world's greatest importing nation in 2003, Japan was still a part of the price talks in 2008, whereas China and Chinese steelworks were not (UNCTAD, 2011). As a reaction to not being able to influence the price formation in the industry, the Chinese steelworks formed a united front in 2009 by letting the China Iron & Steel Association (CISA) formally implement an import agent system, inspired by Japan's experience. The thought was that CISA would represent the Chinese steel mills in the annual iron ore price negotiations, whilst letting large, independent traffickers be in charge of imports.

When many steel companies try to secure iron ore volumes, the result can be that they bid up against each other and end up with a higher price than they would have reached if they had spoken as a united front. Although the number of enterprises with the right to import iron ore in China dropped from above 500 in 2005 to around 100 in 2007, and although CISA represented the industry in 2009, its efforts to push prices down were not very effective. China currently has some 5000 steelmakers, and CISA only takes the largest into consideration when negotiating prices. The result has been that the firms with the right to import iron ore have sold it on to the small and medium-sized enterprises (SMEs) at a significantly higher price, something that did not happen in Japan. The answer to why that is lies within the industry compositions of the countries; in China the ten largest steelworks account for some 43% of the total output, whereas in Japan roughly the same proportion is accounted for by the two largest firms, Nippon Steel and JFE. Hui and Jinqi (2011) argue that CISA's attempts to monitor the domestic importers were futile.

The agents with the right to import iron ore could either choose to increase the import volume to sufficiently meet the domestic demand, or they could import volumes below the domestic demand in order to create a situation of undersupply and obtain monopoly returns when selling the iron ore onwards to the domestic producers who lack import rights. In China, the latter option has been the norm. As a result, SMEs have had to compete in a domestic bidding war to secure supply. The SMEs, in turn, had the choices of competing in the bidding war and buy iron ore on LTCs, or they could break the annual benchmark system by purchasing iron ore to market prices on the spot market. A spot market had been established in China since 2004, albeit to a beginning only insignificant volumes were traded, and almost exclusively domestically (Hui and Jinqi, 2011).

What followed was a situation where buyers of iron ore had incentive to use the spot price when the benchmark price was relatively high, and use the benchmark price when the spot price was relatively high. Sellers, naturally, acted in the opposite way. During 2010, it was impossible to retain a system of annually fixed prices as buyers, particularly from China, to an increasing extent chose the spot market (UNCTAD, 2011).

The end of the annual benchmark system was confirmed. The gentlemen's agreement was broken. The iron ore industry was undergoing the most radical change it had seen in some 50 years.

4.3 The Market of Today

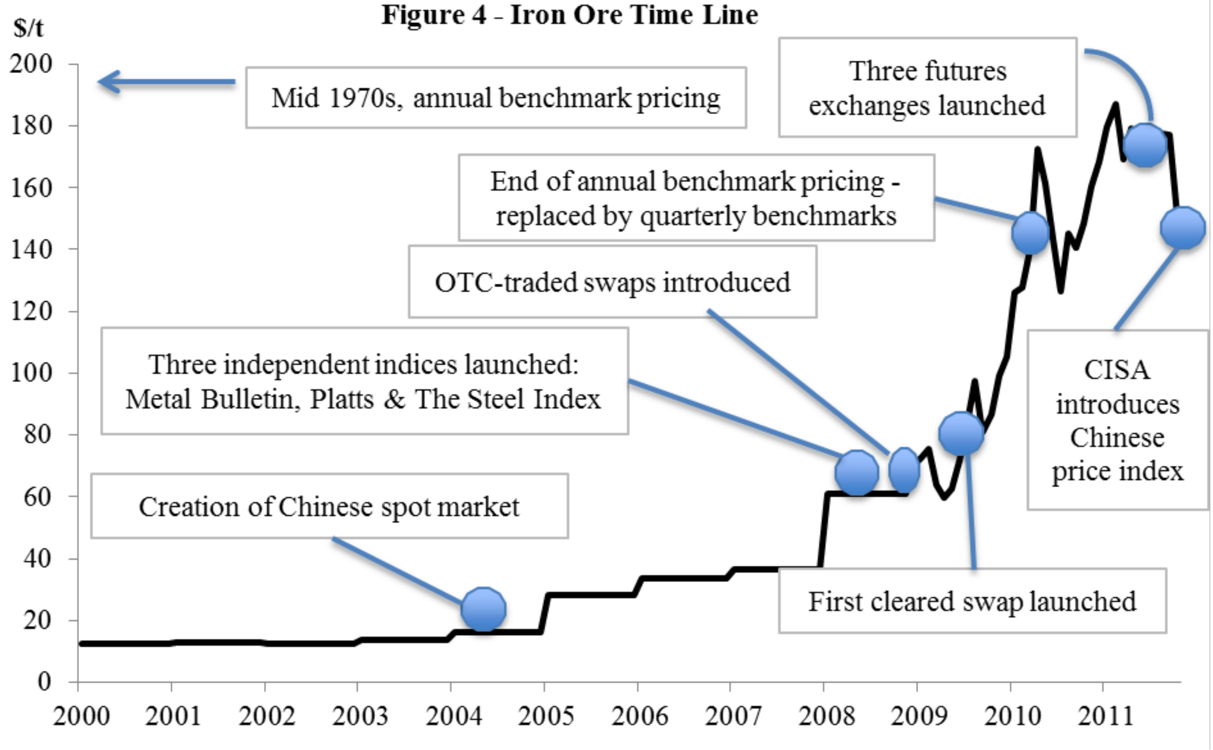
To replace the annual benchmark system, a new and more flexible quarterly iron ore pricing system was adopted, much to the discontent of the steelmakers. According to Ericsson (2011), the steel producers dissatisfaction mainly stemmed from unfamiliarity with the shorter pricing mechanism; the steelmakers neither have experience of short-term pricing nor want to spend the additional man-hours it requires to negotiate prices quarterly instead of annually. As of today, the spot market and the quarterly system exist concurrent, however, a small number of miners in narrow markets still use annual pricing methods, amongst them Swedish LKAB.

The day-to-day price development of iron ore has become considerably easier to follow with the launch of three iron ore price indices during 2008 (Metal Bulletin, Platts, and The Steel Index), which all utilise data from slightly different spectrums of the market. In late 2011, The China Iron Ore Price Index (compiled by CISA) was launched.

The price indices have also made way for new hedging opportunities in iron ore. OTC traded iron ore swaps came to market in 2008, and cleared swaps were launched the following year. Three iron ore futures exchanges have also been launched in 2011: two in India (ICEX and MCX) and one in Singapore (SMX) (a time line over important milestones for the iron ore market can be seen in Figure 4). Despite the increased hedging (or speculating) opportunities, iron ore miners and steelworks have so far showed weak interest.

During 2010, iron ore swap volumes accounted for 5% of the spot market turnover. According to the United Nations Conference on Trade and Development (UNCTAD) (2011) it might be that the market participants react slowly, and that modern risk management practise will support the use of the different hedging facilities henceforth.

Figure 4 - Iron Ore Time Line



Chinese miners currently face an uphill struggle. The country's geological status, with few small and high-grade deposits, has led to a situation where SMEs stand for most of the production. Most large mines are either owned by international mining companies or by the Chinese state – very few are independent. Most of the SMEs operate with very low margins, much due to depletion of mines, declining ore grades, increasing domestic inflation, RMB appreciation, and lower freight rates, resulting in cheaper imports for the steel companies. The domestic miners are hence believed to find it difficult to increase their iron ore production. The occurrence of a Chinese industry consolidation, where SMEs either default or get acquired by larger entities, is known as the Great Chinese Shakeout, and is believed to continue at a higher pace when, or if, iron ore prices settle at a lower level.

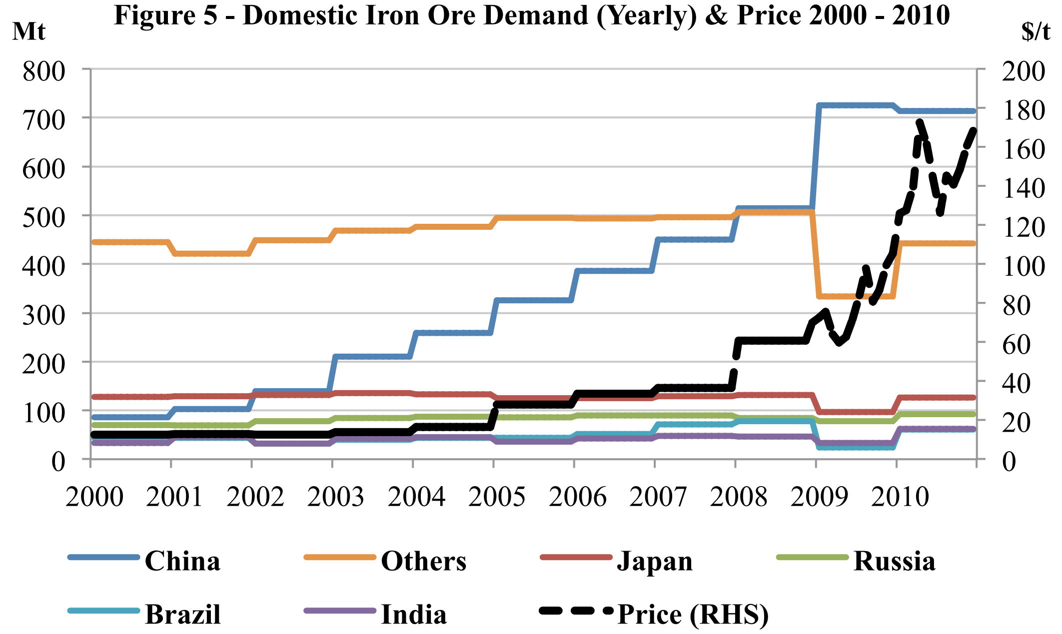
Chinese steel companies also face hardships. Using longer term contracts is a trade-off for the steel mills between securing a steady supply of consistently high-quality iron ore and running the risk of not being able to sell the finished steel product with a profit, as when many steel companies were locked in LTCs during the 2008 financial crisis. If a steel company chooses to buy iron ore on the spot market, however, the consistency in the quality of the ore is likely to be lower, and hence will result in reduced productivity in the steel production (UNCTAD, 2011).

5. Analysis

The analysis section consists of a discussion around cause and effect in the evolution of the iron ore industry and pricing, which the conclusions drawn hereinafter will be based upon.

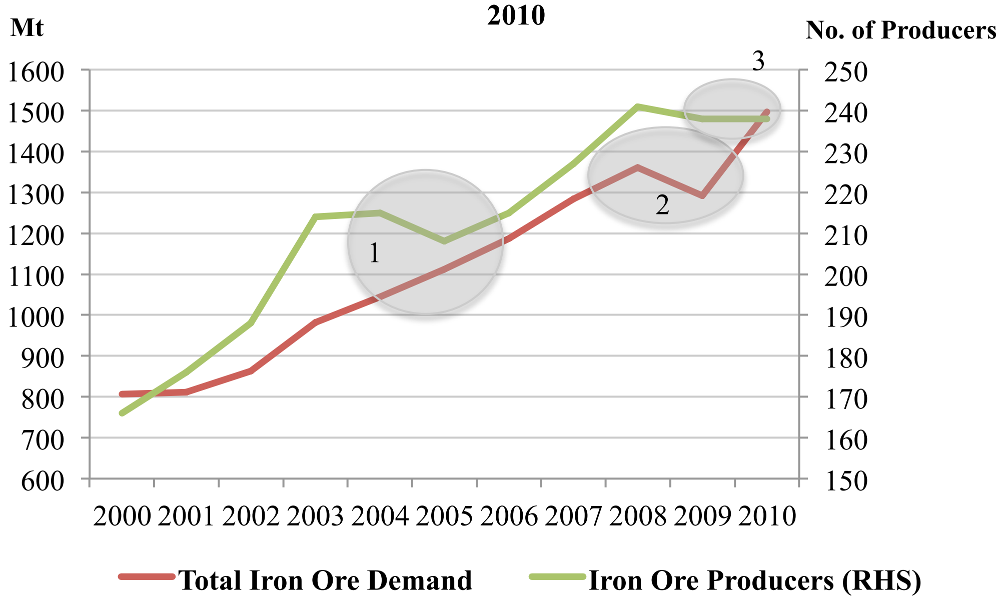
As can be noted in Figure 5, China has consistently been increasing its share of the global iron ore demand, defined as domestic production plus imports minus exports, throughout the last decade. In 2010, the country's share equalled close to 48%. The trend in the price level of iron ore has also been upward sloping, with a correlation of 0.88 for China's demand compared to 0.84 for the total demand. Two things depicted in Figure 5 deserve special attention. Firstly, the price level did not really take off until 2005, despite an increasing global demand from the start of the decade. Secondly, when the annual benchmark pricing system got replaced by a quarterly ditto and market participants showed an increasing interest in spot market trading in late 2008, not only did price volatility intensify, but the rise in price level also became significantly steeper, resembling an exponential-like function. The price took off despite being the time of the financial crisis – a time when many asset classes dramatically decreased in value. According to Pindyck (1979), down sloping business cycles have a negative effect on dominant producers' market power.

Figure 5 - Domestic Iron Ore Demand (Yearly) & Price 2000 - 2010



To address the first consideration – the flatness of the price level until 2005 – it is important to remember what Rogers and Robertson (1987) conclude, namely that any short-term supply increase is limited by the capacity of existing mines. Furthermore, they also mention that it takes 3-7 years to set up new producing mines. Garner (2010) implies the lagging supply could lead to short-term shortages in the metal markets, which in turn would cause large price movements when demand increases unexpectedly. However, Jones (1986) stresses that oligopolistic producers can respond to the threat of a price increase by bringing any excess capacity into production. Now, if the increase in demand, largely stemming from China, throughout the last decade had not been anticipated and the market would have been perfect, then a price increase would be expected as soon as the demand took off. However, the iron ore miners seem to have anticipated the forthcoming increase in demand.

Figure 6 - Total Iron Ore Demand & Number of Iron Ore Producers 2000 - 2010

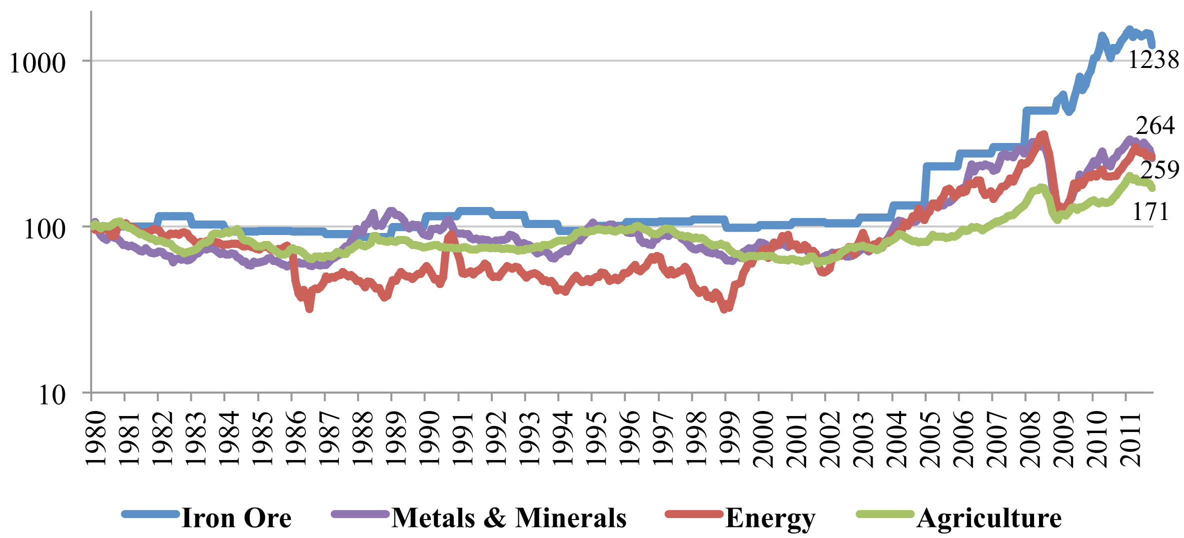


Judging by Figure 6, the number of iron ore producers (in production) increased steadily up until 2003. Following Rogers and Robertson's (1987) reasoning, the miners that entered the production stage during the early years of the 21st century must have started their exploration activities considerably earlier, most likely in the mid 1990s. The relative flatness of the price level up until 2005 is thus likely the result of a combination of excess capacity being brought into production by existing miners, and an increase in the numbers of producing miners, anticipating increased demand. Another point to take away from Figure 6 is that the 2005 price increase is coincidental with the drop in iron ore producers (point 1). Meanwhile, the demand kept on rising, hence explaining the upturn in the price of iron ore in

2005.

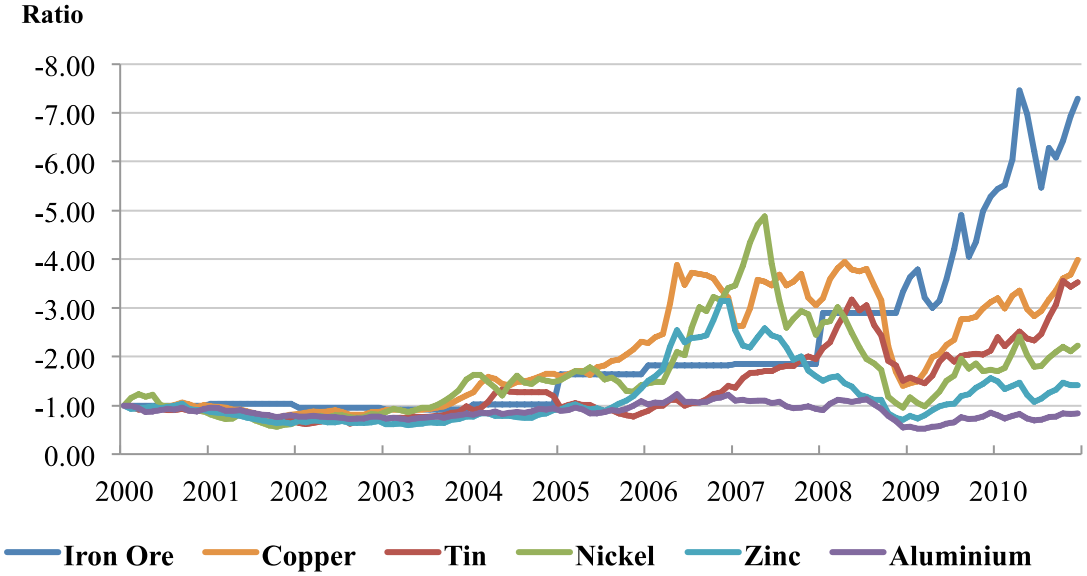
Before considering why the price level increased more sharply from late 2008 onwards, let us stop for a minute and consider whether the price development of iron ore stands out when compared to other metals and commodities. As shown in Figure 7, the surge in the price level of iron ore does indeed seem quite unique when compared to the World Bank Commodity Price Indices, especially after 2008.

Figure 7 - Iron Ore Price & World Bank Commodity Price Indices 1980 - 2011 (Logarithmic)



Of course, if the relative price increases of iron ore are explained solely by a relatively greater total demand, then the price surge in itself could be argued to be expected and not remarkable at all. However, when comparing the price level of copper, tin, nickel, zinc, and aluminium with iron ore, and the development of their respective levels of total demand, it is apparent that the increase in demand is not a satisfactory explanation for why the price of iron ore has skyrocketed in the last few years. The time series for each commodity in Figure 8 is calculated as the negative of the commodity's indexed price level (base year 2000) for a specific time period, divided by an annual indexed level (base year 2000) of total demand for the same commodity in the corresponding time period (i.e. a negative indexed price/demand-ratio). A high negative value hence implies that prices have increased more than demand in proportional terms.

Figure 8 - Explanatory Power of Demand on Commodity Price Levels 2000 - 2010



As can be seen in Figure 8, when the other metals' price/demand-ratios plunged during the early stages of the financial crisis in late 2008, the ratio of iron ore showed a reversed tendency (note point 2 in Figure 6: the demand for iron ore actually decreased in 2009 – both in absolute terms and relative the number of producing entities. At the same time the price kept on increasing). From previously having been positioned close to midpoint amongst the metals, the iron ore ratio swiftly shifted to a substantially wider position than the industry average. This implies that the price increase in iron ore truly is unique when compared to other metals, and is not solely explained by the increased demand. The fact that the price/demand-ratio shot up during the recent financial crisis further strengthens the conclusion.

So, what other factors than demand, which alone apparently is not a satisfactory explanation, can justify the exponential-like price hike from late 2008 onwards? Looking back at the course of events taking place prior to the price hike, it can be noted that the spot market gained in popularity as a result of limited import rights amongst Chinese steelmakers and an inadequate import agent system, which led to a domestic market situation of undersupply, with monopoly pricing and returns. Chinese market participants felt left out of the price negotiations, and therefore had little respect for the industry wide gentlemen's agreement.

But why did the break-up of the annual pricing system and the increasingly wide acceptance of spot trading lead to such a price hike? Although the Big Three has not and does not constitute a cartel by definition since no formal agreement amongst the market participants exists, the first setter advantage in the price negotiations, predicated by the silent gentlemen's agreement, could still be considered price leadership, just like Streit (1980) notes is common practise amongst metal producers. Further, the fact that prices increased so significantly when the spot market gained in popularity could be considered evidence that collusion has existed in the iron ore market for quite some time; powerful forces in the market had kept prices artificially low. This goes in line with what UNCTAD (2011) argues regarding the Big Three's incentive to try to exercise price control: "Their objectives are obvious – maximizing profits – and their method of achieving the objective equally so: keep the price high enough to pay for new investment and low enough so that new entrants do not become realistic alternative sources of the product." Hence, we argue that the greatest single factor behind the recent price development is that the market structure shifted from oligopoly pricing to a state converging perfect pricing in late 2008.

The first setter advantage was introduced during a time when international iron ore trade was limited to a small number of companies. Originally it served its purpose well; it facilitated the process or reaching equilibrium between sellers wanting a high price and buyers wanting a low price, as Sukagawa (2010) argues. D'Ecclesia's (2006) conclusion – that forward contracts are favourable to dominant actors in imperfect markets due to risk management advantages – also goes in line with why LTCs were originally introduced. However, evidence suggest that what once worked well in a market with a limited number of participants quickly turned into a means of price leadership and market control for those being a part of the price negotiations as new actors entered and tried to move up the market.

On the contrary to what Jones (1986) concludes – that the prospects for an iron ore cartel even in times of high demand are poor due to potentially stiff consumer resistance, amongst other things – we find that cartel-like features have existed in the iron ore market. According to us, Jones (1986), just like many other authors on oligopoly returns and cartels often do, overlooks the possibility for powerful market participants to push prices down to artificially low levels in order to shut competition out. We find that an oligopoly does not have to imply a price level above the perfect price – the characteristics of an industry can sometimes lead to the opposite: a price level well below what would have been in a perfect market. The underlying cost structure of the iron ore industry, with significant economies of scale and high barriers to entry, is a prime example of when keeping prices low makes sense for the biggest players in the market. That way they can stay on top of the industry, unthreatened by competitors, as a result of their economies of scale. In line with the statement of Jones (1986), cartelisation tends to significantly impact market prices, such as in the case of oil, yet in the iron ore industry the price level have been swayed in the opposite direction.

An additional minor factor that could have contributed to the great upswing in the price level can be noted in Figure 6 (point 3). When demand picked up pace in 2009 and increased at a record rate, the number of producing entities fell back. Nonetheless, fast growth in demand tends to decrease oligopolistic market power, as argued by Pindyck (1979).

Figure 9 - Full Year 2010 Short-term Equilibrium

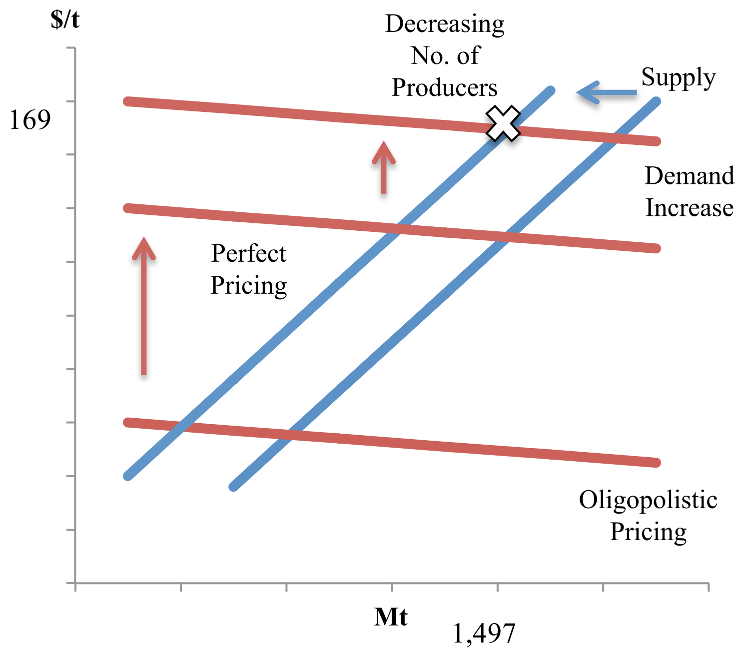


Figure 9 depicts the short-term equilibrium for the full year 2010, using the same academically confirmed demand elasticity as in Figure 1 (-0.15). However, we suspect that the demand has become more elastic since Chang (1994) determined the elasticity for iron ore, as in accordance with what Pindyck (1979) emphasised, incentives for collusions decrease with an increase in demand elasticity. With the emergence of the broad spot market, the oligopoly lost one of its most important tools for controlling the market: the annual benchmark negotiations. As the artificially low price upheld by the oligopoly got lifted, the market approached a state of perfect pricing (i.e. what would have been the price level, had oligopolistic collusion not existed). Whilst the total demand for iron ore increased rapidly during the same time, the number of producing iron ore entities decreased. This caused the demand curve to shift wider and the supply curve tighter, leading the price level to reach an (thitherto) all time high. It appears that Dong and Liu (2007) have a valid point, as iron ore spot trading seems to have put an end to the price discriminating Nash equilibrium for the oligopolistic producers that otherwise would have existed. The dominating producers are now forced to adjust to a price level reflecting perfect competition more closely.

It is still to early to draw any conclusions regarding the effects of the recently established iron ore futures markets on the on-going industry power shift. However, judging from the oil industry, futures markets seem to further increase market transparency, which in turn could increase volatility, thus possibly leading to a (further) reduction in oligopolistic power. What can be said with more certainty though is that futures contracts tend to arise in perfect markets in accordance with Streit's (1980) and Erb and Harvey's (2006) conclusions. Hence, the emergence of three futures exchanges in 2011 could be seen as a final piece of evidence, indicating that the iron ore market has become more perfect and that oligopolistic forces have lost control of the pricing formation.

Several similarities between the iron ore and oil markets can be observed. Both markets have had an oligopolistic structure, starting with the respective commodity being traded under LTCs, later entering the spot market, to eventually be traded in other derivatives markets such as futures. However, a major difference is the influence political power has had on the oil market, unlike in the case of iron ore. Furthermore, the price discriminating organisation OPEC is a famous example of a cartel, whereas the Big Three act more in a collusion-like manner, without a formal agreement to bind the producers. In the 1970's when oil prices increased sharply, OPEC gained more influence over the price and supply. In the case of iron ore, the steep price increase that started in 2008 appears to, on the contrary, decrease the power of the dominant actors in the market. Still, as pointed out by Kat and Oomen (2006), each commodity has its own unique features and market structure, hence it is difficult to draw any general conclusion regarding market power and price level. However, there is still a tendency towards that spot markets, once having been sufficiently established and widely used, have the potential to break imperfect markets and make perfect markets.

Once a short-term equilibrium is reached in a perfect market, basic economic theory suggests that for prices to decrease either the supplied quantity must increase or the demanded quantity must decrease. It is, however, important to remember that although the annual benchmark negotiations have ceased to exist, the underlying cost structure of the industry remains intact, implying that the biggest companies will be the most profitable – both in absolute and relative terms. Hence, the Big Three still have other ways to exercise their powers, e.g., through acquisitions of smaller competitors (however, such efforts would be subject to approval by competition authorities). Theoretically the Big Three could also try to exercise price control by increasing their production, causing the price to fall. In reality capacity constraints hinders such measures. Furthermore, given the massive current demand, it would require an enormous production increase to push prices down to any greater extent.

UNCTAD (2011) argues that the Great Chinese Shakeout is likely to generate more power for the Big Three, but that the new pricing methods could to at least some extent offset the oligopoly powers. “The full effects of the new pricing mechanisms are still not clear but we consider it unlikely that the new model would have any major effect on price level. It is however clear that price volatility will increase”. UNCTAD’s conclusion about price volatility goes in line with Rogers and Robertson’s conclusion dating back to as early as 1987: the shorter the contract; the greater the instability. Given the historically stable price level of iron ore, we see no evidence disputing UNCTAD’s conclusion regarding volatility. When it comes to the power of the Big Three, nothing points towards that the Big Three will lose in market share in the short-term, but that does not necessarily mean that they will not lose in power. We argue that the Big Three has already lost a significant amount of control over the industry formation, something that very well could be a long-term threat to the oligopoly.

In contrast to UNCTAD’s beliefs about the price level, we argue that the new pricing system has caused a permanent shift on the price of iron ore, as shown in Figure 9. Although it is difficult to quantify the magnitude of the effect, we find a price level well above what was under the old pricing system to be the new normal, given the current supply and demand situation. Of course, supply and demand can change, but prices will most likely always be higher under the new system than they would have been in any given theoretical situation under the old system.

The irony of the story, as we see it, is that China effectively has managed to push the industry towards a shift, with the creation of a widely accepted spot market, triggering price indices, swaps, and futures markets, by having an insufficient domestic import agent system. It is also a bit ironic that the Big Three have managed to uphold what could be considered a buyer’s market throughout most of the era of international iron ore pricing – the recent price increase is possibly the first time ever iron ore has shifted towards a seller’s market.

We argue that the clear winners of the new pricing system and market structure are the mining companies; particularly small and midsized miners that would not have found it profitable to enter the exploration phase at lower price levels. Although the Big Three will likely face more and tougher competition under the new system, they will still benefit from higher prices from a strictly financial perspective. Steelmakers stand out as the obvious losers on the new system, as higher prices on iron ore imply lower margins. However, it could to at least some extent be possible for the steel companies to pass on the higher costs to the steel consuming companies, which in turn could pass them onto the end consumers. Whilst it might be hard to say who will get struck the hardest, it stands clear that anyone on the direct or indirect buy side of iron ore risk having to pay the price of a more perfect iron ore market.

The day when the old pricing system ceased to exist was the day oligopolistic forces lost power.

6. Conclusions

Based on the preceding analysis, this section presents short and concise answers to the research questions in focus throughout this thesis.

The main objective of this thesis was to unravel the major forces and events behind the recent developments in the iron ore market. Firstly, we wanted to know how the shifts in market power in the iron ore market have influenced and been affected by different pricing systems since the inception of international pricing in the mid-1960s.

To address the first research question, when international iron ore pricing first started in the 1960's, it stands clear that it was the market power of the producers that were affected by the pricing system, and not the other way around. LTCs were originally introduced as a solution to the collateral problem induced by the cost structure of the industry, as argued by (Sukagawa, 2010). The fact that the system of Champion Negotiations also led to significant market powers for those involved was not obvious until new companies tried to enter the market.

During the second – and on-going – shift in market power, we argue that it is a case of two-way causality; China became powerful as the nation increased its share of global demand, which in turn led to the emergence of a domestic spot market. As the spot pricing system became more established, the shift in market power got enhanced, away from the oligopolistic powers of the Big Three, towards smaller producers, being able to take advantage of what possibly is the first case of a seller's market ever seen for iron ore.

Secondly, we were interested in finding out in what ways the price of iron ore have been affected by the shifts in market power and different pricing systems. Evidence from the analysis section, such as the massive increase in the price of iron ore relative demand, point towards that powerful forces in the market have kept the price level artificially low under the system of LTCs and annual Champion Negotiations. Theoretical arguments, as those by Pindyck (1979), stating that growth in demand tends to decrease oligopolistic market power, as well as that down sloping business cycles have a negative effect on dominant producers' market power, also suggest that the recent price increase is a result of oligopolistic forces losing power. Dong and Liu (2007) also give this reasoning support when arguing that spot markets have been beneficial towards creating perfectly competitive markets. We hence argue that the recent surge in the iron ore price partly is the effect of a system of more perfect pricing, but the effect likely also got magnified by the contemporary hike in demand, hence causing a feel of overshooting. To conclude, we find that prices likely always will be higher under the new pricing system than they would have been in any given theoretical situation under the old pricing system.

7. Beliefs About Tomorrow & Suggestions for Further Research

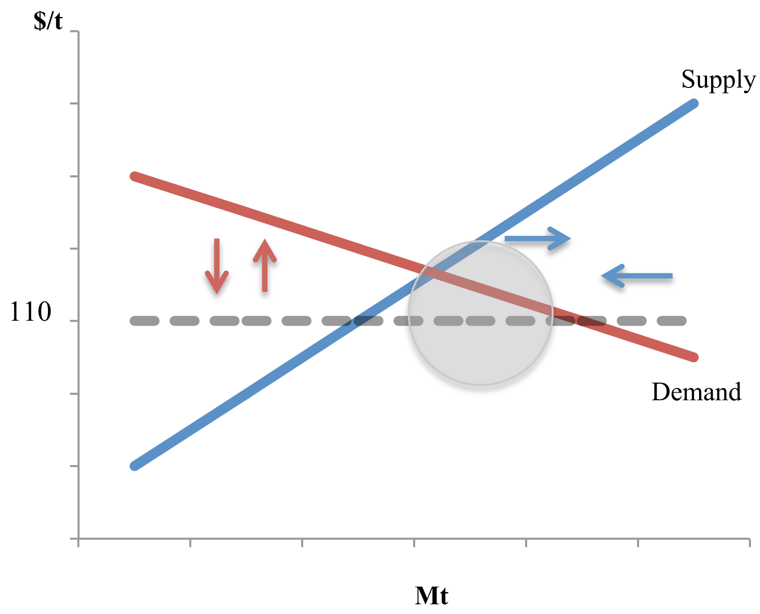
The following section works as an extension, where matters outside the scope of the thesis, but that still could be considered relevant for the reader, will be discussed. Recommendations for further research will then bring an end to the thesis.

Given the shock to the iron ore market imposed by the abandonment of the annual benchmark price in late 2008, and considering the time span of 3-7 years for the supply side to adapt to an increased demand as suggested by Rogers and Robertson (1987), it makes sense to deem the current equilibrium as in transformation towards its natural long-term state. Two things are central when forecasting the long-term market equilibrium. First, it is a matter of determining whether the demand shift is permanent or temporary. If the demand shift is temporary, the market would likely go into an oversupply situation caused by miners that entered the market during times of undersupply, leading to a significant price decrease. However, as many academics, amongst them Sukagawa (2010), point toward continued Chinese expansion, we find it unlikely that the entire demand shift is temporary (as Figure 9 points out, most of the shift is a result of more perfect pricing). Still it is essential to emphasise that China makes up for close to half of the global iron ore demand, hence any slowdown in the country's steel production would cause the demand curve to shift downwards. When China's growth rate deteriorates, which it eventually will, whether the global demand will stay on its current level depends on to what extent other (emerging) markets will compensate for it. We consider the long-term demand effect to be ambiguous, but with some pressure to the downside.

Second, the recent price increase is likely to lead to an increased supply in the longer term. Both new mining companies entering the market, incentivised by the high price level, and the Big Three, in attempts to push down the price, will conduce to a rightward shift of the supply curve. Sukagawa (2010) argues that India and other South Asian nations are ready to join the competition for exports. However, a factor restraining the price level from becoming significantly lower is that the Chinese miners already operate at low margins, as pointed out by UNCTAD (2011). If prices were to fall below a level of $110-$120 per tonne, as much as 200 Mt in annual capacity would be knocked out of the market, hence causing the supply curve to shift to the left. UNCTAD (2011) believes that the market will reach its long-term equilibrium in 2013 at earliest, and that the $110/t-level will act as a floor.

The reasoning above is depicted in Figure 10, using the same academically established long-term demand elasticity as in Figure 2 (-0.51). The shaded area represents the likely long-term equilibrium, as we see it. In conclusion, we find that the current short-term price level is overshooting the likely long-term equilibrium.

Figure 10 - Future (Long-term) Equilibrium



In late November 2011, Steel Business Breifing, an independent steel industry research agency, reported that China's National Development & Reform Commision currently looks into the prospects for establishing an iron ore futures market in China. If established, it would be the fourth of its kind in Asia and globally. A suggestion for further studies is to examine whether more futures markets are likely to arise, and what the prospects are for establishing iron ore futures market in the Western world – how come the existence of the markets so far is limited to Asia? Could it be the case that all three futures exchanges have opened up in Asia because small producers in the region are currently gaining more market power?

The futures markets that currently exist have only been around for less than a year, hence historical price data is limited. Nevertheless, in case the iron ore futures markets become more established and attract more market participants in some years, we find it a splendid idea for further research to investigate if, and how, the recent futures markets have affected the price level of iron ore. Similary, it could also be of interest to observe quantatively how price volatily have changed since the the inception of the futures markets, i.e. do the iron ore futures markets affect iron ore price volatility? Another area that we have come across whilst writing this thesis is how hedging strategies differ amongst the iron ore producers, often depedning on the size of the company. How and why do hedging strategies differ between small and large producers of iron ore? What is the optimum hedging policy in the iron ore industry?

Moreover, when taking into account the recent changes in the iron ore market, we find it likely that the classic estimates of demand elasticities for iron ore are outdated. The elasticity of demand could have an impact on how incentivised oligopoly forces are towards using a particular pricing system. Further research within this area could as a suggestion take off in the work done by Chang (1994).

Finally, whilst we have analysed the development of the iron ore industry quite throughly, we have not analysed the effect on the steel industry to the same extent. Hence, a similar study with the steelmakers in focus would contribute by taking the research one step further down the value chain; from the extraction of ore bodies to finished steel products.

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Appendix

Share of World Production (%)

Year	Vale	Rio Tinto	BHP Billiton
1993	10.38	5.86	6.79
1994	10.35	5.75	7.03
1995	10.74	5.65	7.36
1996	10.78	6.15	7.64
1997	11.05	5.96	7.88
1998	11.28	5.77	7.49
1999	10.41	5.88	6.88
2000	12.72	9.46	6.57
2001	16.51	10.22	8.32
2002	16.35	9.73	8.16
2003	18.39	10.63	8.45
2004	18.93	9.21	8.67
2005	18.7	9.48	8.7
2006	12.71	8.76	7.81
2007	15.29	8.98	7.54
2008	18.14	9.04	8.16
2009	14.14	9.88	8.08
2010	17.01	10.03	8.19

Table 1

Global Demand For Metals (Mt)

Year	Iron Ore	Aluminium	Copper	Nickel	Tin	Zinc
2000	806,250	52,700	15,400	1,115	250	8,800
2001	811,050	53,200	15,250	1,155	245	8,930
2002	862,160	56,000	15,300	1,195	255	8,800
2003	981,480	59,500	15,300	1,240	260	9,500
2004	1,044,590	62,000	15,850	1,250	300	9,750
2005	1,111,690	65,000	16,600	1,280	340	10,100
2006	1,187,000	73,000	17,350	1,355	335	10,400
2007	1,283,330	80,000	18,100	1,425	350	11,100
2008	1,360,750	85,000	18,450	1,380	317	11,700
2009	1,291,300	80,000	18,650	1,330	309	11,400
2010	1,497,450	88,000	19,200	1,450	312	12,100

Table 2

China's Demand For Metals (Mt)

Year	Iron Ore	Aluminium	Copper	Nickel	Tin	Zinc
2000	85,948	4,290	1,392	51	97	1,780
2001	103,016	4,730	1,427	50	93	1,572
2002	140,063	5,444	1,584	54	82	1,471
2003	210,429	6,133	1,772	65	102	2,029
2004	258,174	6,558	2,061	75	97	2,264
2005	325,809	8,510	2,480	98	120	2,547
2006	385,433	13,696	2,925	137	126	2,844
2007	449,627	19,453	3,497	199	147	3,048
2008	514,614	22,800	3,780	200	121	3,186
2009	725,106	23,800	4,110	254	128	3,190
2010	712,856	29,000	4,575	333	134	3,700

Table 3

Prices ($ per tonne)

Year	Iron Ore	Aluminium	Copper	Nickel	Tin	Zinc
2000	12.45	1,551	1,815	8,631	5,436	1,128
2001	12.99	1,447	1,580	5,970	4,489	887
2002	12.68	1,351	1,560	6,783	4,061	779
2003	13.82	1,433	1,779	9,630	4,890	828
2004	16.39	1,719	2,863	13,821	8,481	1,048
2005	28.11	1,901	3,676	14,778	7,385	1,381
2006	33.45	2,573	6,731	24,126	8,755	3,266
2007	36.63	2,640	7,132	37,136	14,495	3,250
2008	60.80	2,578	6,963	21,141	18,467	1,885
2009	79.99	1,669	5,165	14,672	13,603	1,658
2010	146.72	2,173	7,538	21,810	20,367	2,160

Table 4

Iron Ore Demand (Mt)

Country	China	Japan	Russia	India
2000	85,948	127,604	70,308	33,808
2001	103,016	129,112	69,339	44,746
2002	140,063	131,155	78,417	31,563
2003	210,429	135,369	84,695	43,139
2004	258,174	132,605	87,077	45,702
2005	325,809	125,210	85,628	36,448
2006	385,433	125,484	89,578	42,202
2007	449,627	128,760	90,110	48,181
2008	514,614	131,219	84,279	45,876
2009	725,106	96,728	78,227	33,522
2010	712,856	126,510	92,934	62,130
Country	**Brazil**	**South Korea**	**Ukraine**	**USA**
2000	43,874	39,626	38,557	73,892
2001	43,739	42,132	41,592	51,730
2002	31,745	44,319	40,746	56,984
2003	39,417	42,177	47,929	55,007
2004	44,175	44,089	49,463	58,093
2005	43,382	43,054	50,428	56,400
2006	51,096	42,262	52,727	55,768
2007	71,100	43,321	56,581	52,774
2008	78,344	49,577	51,346	50,845
2009	24,188	40,853	42,364	22,835
2010	61,426	53,331	49,870	46,969
Country	**Germany**	**Australia**	**Others**	**Total**
2000	39,363	-7,015	260,285	806,250
2001	36,623	7,447	241,574	811,050
2002	38,270	13,973	254,925	862,160
2003	38,602	17,559	267,157	981,480
2004	42,135	13,991	269,086	1,044,590
2005	42,086	25,137	278,108	1,111,690
2006	42,267	28,025	272,158	1,187,000
2007	44,192	33,818	264,866	1,283,330
2008	41,084	41,504	272,062	1,360,750
2009	19,610	30,470	177,397	1,291,300
2010	42,053	28,382	220,989	1,497,450

Table 5