Vertical Integration and Macroeconomic Growth: the Case of the Steel Industry

Scheuplein, Christoph

Westphalian Wilhelms-University Muenster

April 2010

VERTICAL INTEGRATION AND MACROECONOMIC GROWTH: THE CASE OF THE STEEL INDUSTRY

Christoph Scheuplein

Westphalian Wilhelms-University Muenster

christoph.scheuplein@uni-munster.de

October 2010

Summary

As a result of the rise in the raw materials market of 2007-08, steel-producing companies are re-thinking their purchasing of iron ore. Integration of upstream mining companies is one option for ensuring the supply of raw materials. This trend is being pursued mostly in the up-and-coming industrial companies of newly industrializing countries. In contrast, the steel companies of mature industrial countries are continuing to rely on the market. This variation in company strategies cannot be explained by current theories of vertical integration such as the Transaction Cost approach and the Global Value Chain approach. This only becomes possible by considering the diverse macroeconomic environment, which is characterized by high profit margins and high investment in the newly industrializing countries. Theoretically, this requires us to borrow arguments from FRANÇOIS PERROUX'S Polarization Theory and arguments from ANDREAS PREDÖHL'S theory of Economic Area Development. This paper contains an empirical investigation of vertical integration based on the steel and iron ore industries, and uses an Indian and a Chinese company as examples.

Keywords: Vertical Integration, Steel Industry, Iron Ore Mining Industry, Theory of Spatial Economic Development, Andreas Predöhl

1. Introduction

In February 2008, the Aluminium Corporation of China ("Chinalco") bought stock in the world's third largest mining company, Rio Tinto. Chinalco paid US $ 14 billion for their 9% share of Rio Tinto stocks, at that time the highest direct foreign investment by a Chinese company. One year later, Chinalco wanted to increase its share from 9% to 21%. Both companies announced a strategic partnership through the creation of joint ventures in aluminium, copper, and iron ore. However, this share was not realized, due to an agreement in June 2009 between Rio Tinto and BHP Billiton, the world's second largest mining company, which covered the entirety of both companies' Western Australian iron ore assets. What followed was a tough conflict between Chinalco and Rio Tinto, which has included diplomatic complications – and the arrest of four Rio Tinto employees in Shanghai – in July 2009. The first sign of a relaxation of the situation occurred in March of 2010, when Chinalco and Rio Tinto announced a joint running of operations in Guinea in western Africa. This shows how deeply economic interests are interwoven with strategic geographical interests and political means. Nevertheless, Chinalco is still the largest Rio Tinto shareholder, and this failed financial operation is only one incident in a series of otherwise successful takeovers in the mining industry by Chinese companies.

More interesting than the political turbulences are the changes in business strategies in the metal industry. CHINALCO (2009, 13) clearly states that it is following a strategy of vertical integration from upstream mining to processing and downstream fabricated products. There are many more metal firms that have adopted a similar strategy in the last few years, and nearly all of them have their roots in Asia. This raises the question of why the strategy of vertical integration is gaining ground in the metal industry and why this is happening mostly in Asia. Are such developments simply exceptions, or do they point towards a general trend for the 21st century? Some light is thrown onto these questions by the example of the steel industry, by far the most significant of the metal industries.

The following text is divided into seven parts. First, the discussion of economic geography in vertical integration is revisited (2.). Then, economic trends and features of the steel industry (3.) and the market for iron ore is discussed (4.). In the main part, business strategies of a European, a Chinese and an Indian steel company are described (5.). After this, reasons for the different strategy in Asia are discussed (6.). Finally, the

trend to vertical integration in the steel industry will be set within the more general framework of economic geography (7.). The analysis ends with some concluding thoughts (8.).

2. Vertical Integration

Every type of production can be seen as a material flow from raw materials to the final product. Hence, the different segments of a commodity chain may be handled by one actor or by many actors. The field of economic geography has, since ALFRED WEBER (1909) at the earliest, dealt with the physical value creation chain and its influence on locations. However, Weber only considered the economically efficient flow of material and did not show any interest in the structure of proprietary rights. This was more the area of economists such as ALFRED MARSHALL (1920), who highly valued the advantages of vertical integration within a company and predicted the triumphal procession of large companies. In particular, focus was placed on the development of the advantages of vertical integration, such as saving transport costs, faster and more secure access to primary products, utilizing resources to their full capacity and protection of quality, synergy effects across the various levels up the value chain as well as the protection of trade knowledge and secrets. It was only when the leading industrial conglomerates began to experience economic crises in the 1970s that vertical integration began to be treated as a problem of economic geography. In the past 30 years, other efficient solutions and changes to the value creation chain have shifted into focus. At the same time, the "California school of external economies" , which draws on RONALD COASE and OLIVER WILLIAMSON'S Transaction Cost Approach (SCOTT 1988; STORPER 1997), was particularly influential in the field of economic geography. According to this approach, specific forms and amounts of transaction costs, such as search costs, bargaining costs or enforcement costs arise. It stipulates that the transactions differ according to how safely, frequently and specifically they can be arranged. While some activities can be carried out cheaply in-house, others should be carried out by external specialists, resulting in an optimum ratio of internal and external costs in each sector (SCOTT 1988, 38). This leads to entrepreneurial strategies of vertical (dis)integration, which have been very widely expanded. This means that vertical integration in a big company can be accompanied by establishing various locations of operation. Conversely, vertical disintegration can also be linked to clustering, as for example MICHAEL STORPER and SUSAN CHRISTOPHERSON (1987) have shown in relation to the US film industry.

The "California school of external economies" adopts both the Transaction Cost Approach and the historic tendency to support smaller and more flexible companies working in regional production networks (SCOTT 1998, 100). This theory holds that various sectors and regions show a tendency towards vertical disintegration, providing a more efficient production model. It is at this point that this theory converges with the statements of the Theory of Flexible Specialization (PIORE and SABEL 1984) and of the Post-Fordist debate. A similar point of view was represented in industrial economics by the Core Competencies Approach (PRAHALAD and HAMEL 1990), which recommends a moderate outsourcing policy. These approaches have also strengthened convictions in the field of economic geography that the vertical disintegration tendency is unstoppable and that in the future, only virtual and boundary-less companies will be successful.

However, globalization of the markets in the 1990s was accompanied by the development of new, strongly opposing forces. Multinational companies in particular were able to make use of new opportunities. They sent their operational functions to those different locations that were best suited to handle the respective functions. This tendency to internal growth can, in part, be explained by the wish to avoid transaction problems that arise from global business relations and can be solved more easily in-house. In addition to this, the theory of the Global Value Chain (GVC) has focused on tracing the different distributions of power in a value chain. This requires an indirect inquiry into the issues of vertical integration, particularly into political and institutional influences and companies' business strategies (GEREFFI and KORZENIEWICZ 1994, GEREFFI et al. 2005).

The GVC approach focuses on three decisive points: Complexity of transactions; codifiability of information; and capability of suppliers. These technical influences can be dealt with by various forms of organization, in which the organization can be controlled in-house or by external institutions. The GVC theory places emphasis not only on a complete handling of the value creation chain through markets and companies but also on solutions provided by networks. If, for example, suppliers prove to be particularly capable, then they will supply a complete solution to the original equipment manufacturers in their sector, and modular value chains will develop. On the other hand, if the end product manufacturers show a great deal of expertise, captive value chains form which, in turn, characterize the position of the suppliers. Finally, a "stalemate" between the position of suppliers and end product manufacturers make relational value chains possible as well.

The GVC approach also shows that the problem posed by vertical integration cannot only be formulated in terms of proprietary rights. If companies exercise power through their position in the value chain, then they have no formal proprietary interests in the other companies but, all the same they can generate extra profits through exercising this power. Despite all the differences in the finer details, the transaction cost approach and the GVC approach both have something in common: They both support the idea that the reason for the value chain configuration is to be found in technical and organizational factors. The GVC approach focuses even more closely on the element of organization and also advocates a broader interpretation of the concept of an institution. What can, however, be seen in both theories is that, in a given sector, a fixed set of techniques and organizational influences are put to use and, in each case, an economically efficient and spatially economic solution presents itself. The reasoning behind both theories is microeconomics-oriented. Although social institutions can play an important role, a macroeconomic level of operation does not seem necessary.

In the case of the steel industry considered here, however, there is evidence of different vertical integration strategies in companies in industrialised countries and companies in emerging economies. My central argument in the empirical part of this essay is that this can be attributed to the different macroeconomic growth rates in these countries. Consequently, a link is necessary between vertical integration and macroeconomic development. This is perhaps best provided by FRANÇOIS PERROUX'S Theory of Sectoral Polarisation and ANDREAS PREDÖHL'S Theory of Economic Development.

The theory of sectoral polarization draws attention especially to the strategic importance of economic interlacing (PERROUX 1964; BUTTLER et. al. 1977). Sectors with particularly marked forward and backward integration are seen as the key sectors of an economy as, by their development, they have a stimulative effect on the intertwined sectors. They may be regarded as motor units if they are of a quantitatively significant size and have a growth rate above the average of the economy. PERROUX'S sectoral polarization theory draws attention to the cumulative effects between intertwined sectors. When a cumulative upward trend begins, it seems rational to vertically integrate the upstream and downstream units on the basis of the motor units, because the positive growth effects can be internalized in this case. Since this does not exist in an economic environment that tends to be stagnant, this incentive to vertically integrate does not apply. PREDÖHL'S theory of economic development provides further information in addition to these statements concerning the polarization theory (PREDÖHL 1971). This

approach, which was developed in the German-speaking countries and became widespread in the 1960s (cf. HEIN 2003), has two additional clarification elements. First of all, the theory is not confined to nation states; instead it is based on a definition of the economic area. In other words, on an area that, in spatial terms, is made up of the relevant economic intertwining of companies. The factors determining intertwining levels are based on transport costs, the availability of suitable work skills and the demand for consumer goods and investment goods. An economic area is then constituted when the companies within the area are more closely interlinked with each other than with companies outside this area. In each case, an industrial core area develops that is structured by a centre and outlying core areas and surrounded by a periphery. The vertical integration strategies extend from the economic areas in the centre and taper off towards the periphery. In this context, the "integration argument" propounded by the polarization theory can be applied to economic integration across several countries. The cumulative development in a discrete economic area is of decisive importance for the companies located in that area. As a result, corporate strategies in the East Asia-Pacific economic area, with China as the industrial centre, peripheral cores such as India and peripheral countries such as Australia can differentiate themselves from other economic areas (HILPERT 1998). A second clarification element takes the historic development of the global economy into account. The development of each economic area is an event in a chain of historical events and changes the hierarchical structure of the global economy in each case. The Industrial Revolution led to the development of the north-western European economic area with Great Britain at its centre. During the 20th century, first the American and then the Japanese economic areas developed, which marked a transition to a tricentric global economy (PREDÖHL 1962). Accordingly, the formation of the new East Asia-Pacific economic area means that China is becoming the new hegemonic power – and a multicentric order is created. These historical shifts in the hegemonic structure of the global economy also mean that vertical integration strategies are not applied simultaneously in all economic areas. The emergence of new, core industrial areas that are taking over the leadership of the global economy is, of necessity, characterised by intensive forward and backward integration. On the other hand, old core industrial areas that are losing their importance may be tending towards sectoral disintegration.

PERROUX'S polarisation theory and PREDÖHL'S development theory provide a framework by which the differentiating corporate strategies in the same industry, but in

different economic areas, can be explained. Here vertical integration is both a cause and a consequence of high rates of economic growth. The power of this frame of reference is in the inclusion of these macroeconomic circumstances as a factor for vertical integration. This way, the transaction cost approach and the global value chain approach can be extended in a way that makes good sense. In the following, the value of such an extension will be shown on the basis of the steel industry and its various integration strategies in Europe and Asia.

3. Recent trends in the steel industry

Steel has been, and still is, a crucial commodity for industrialization and for industrialized countries. Despite the discoveries of alternative materials (e.g., lighter materials such as aluminium and plastic in the motor vehicle industry), which have been made over the last few decades, steel consumption has continued to grow worldwide. Consumption has increased from 773 million tons of crude steel in 1998 to 1,317 million tons of crude steel in 2007, the year before the economic crisis. The Asian region was the largest driver of growth, quantitatively at least, increasing its consumption from 303 to 707 million tons of crude steel in 2007. Increases in consumption were also seen in industrial regions such as the 15 old member states of the European Union, with increases from 155 to 181 million tons of crude steel in the same period. Globally considered, this increase is due to population growth and to continuous industrialization, reflected in an increasing consumption per capita. Worldwide consumption increased from 139 kilograms of crude steel equivalents per capita in 1998 to 214 kilograms of crude steel equivalents per capita in 2007. The only region in the world where the consumption of crude steel has clearly decreased is North America with a drop from 375 kilograms of crude steel equivalents to 315 kilograms of crude steel equivalents per capita in 2007. In contrast, the consumption of crude steel per capita in China has more than tripled from 98 kilograms to 321 kilograms. Whereas the consumption of steel in the old industrial countries is likely to decrease over the next two decades, the consumption in China is expected to continue increasing over this period and not fall again until after 20 years.

Worldwide crude steel production has almost doubled from 715 million tons in 1980 to 1,351 million tons in 2007. In the two subsequent years, production experienced a slight decrease. The global picture shows that a dynamic development was put in motion in the 1990s. Worldwide steel production increased modestly between 1980 and 1992. The

shares in production made by Europe, North America and the Soviet Union (or rather, its subsequent states) decreased in this period slightly from 71% to 61%. Between then and 2009, while the production of steel increased by a further 66%, the shares made up of the three regions mentioned above decreased to 37% in 2009. In contrast, Asia (and in particular, China) were able to increase their share enormously, with China increasing its production sevenfold to 568 million tons. A particularly notable point is the increasing production in China throughout the last two years, allowing China to increase its share to almost half of world production during, and in spite of, the period of economic crisis. As early as 1996, China overtook Japan and the USA, the then leading steel-producing nations, and since then this gap has continuously increased. Japan and the USA still rank second and third respectively. In that year, they were followed by Russia, India, and South Korea. Figure 1 summarizes the production of steel in the European Union (198 million tons), showing Germany on top as traditionally the biggest producer. Germany reached a production of 45 million tons in 2008. It is followed by Italy, France and Great Britain, inside the European Union. Over the last couple of years, the new players outside of Europe have been Brazil and Turkey.

Figure 1: Crude Steel Production in leading countries in million metric tons in 2008

Source: World Steel Association

The changing market and production structures have also given a new impetus to the structures of the sector at a corporate level. Because of sensitivity regarding freight costs, the steel industry is a regionally diversified industry. Furthermore, there is a strong regime of political regulation, which for many decades has ensured companies' national sales markets. The growth surge of the Asian markets has resulted in the appearance of some new faces on the global market stage. In 1998 the list of the 20 biggest companies included the names of two Chinese companies (Baoshan, Anshan) and one Indian company (SAIL), who managed to score in the last couple of places on the list. Ten years later, steel companies from the emerging nations dominate the list. China is represented by seven companies, India by two companies and there is even a Brazilian company on the list. The biggest European steel companies are the Italian Riva group (number 16) and the German ThyssenKrupp group (number 18).

Table 1: Top 20 steel producers 2008

No.	Company (Country)	Output *	No.	Company (Country)	Output *
1	Arcelor Mittal (Luxemburg/India)	103,3	11	Shandong Steel Group (China)	21,8
2	Nippon Steel (Japan)	36,9	12	Nucor (USA)	20,4
3	Baosteel (China)	35,4	13	Gerdau (Brazil)	20,4
4	POSCO (South Korea)	34,7	14	Severstal (Russia)	19,2
5	Hebei Steel Group (China)	33,3	15	Evraz (Russia)	17,7
6	JFE Steel (Japan)	33	16	Riva (Italy)	16,9
7	Wuhan Steel Group (China)	27,7	17	Angang Steel (China)	16
8	Tata Steel (India)	24,4	18	ThyssenKrupp (Germany)	16
9	Jiangsu Shagang Group (China)	23,3	19	Maanshan Steel (China)	15
10	US Steel (USA)	23,3	20	Sumitomo Metals (Japan)	13,8

*Million metric tons crude steel

Source: World Steel Association

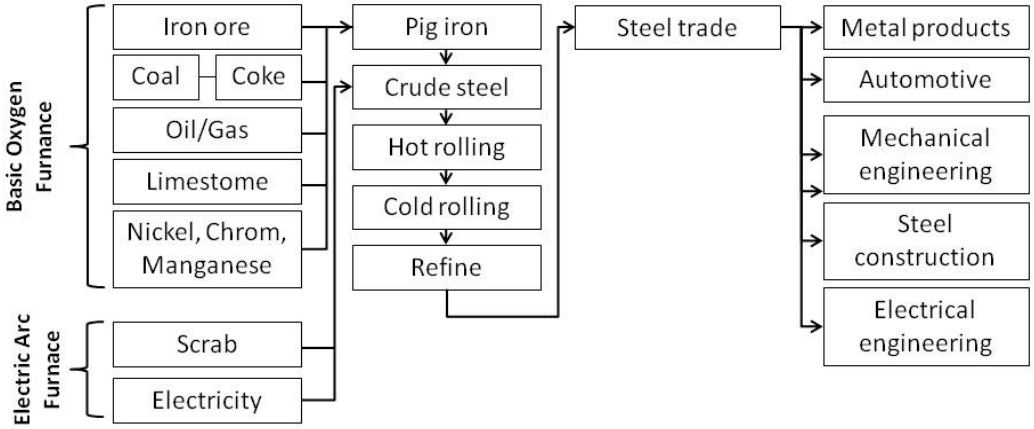
The most significant event to arise during the reshaping of the structure of the industry was undoubtedly the rise of Mittal Steel, a company which, in 1989 in a highly decentralized industry, began to buy up steel plants that were in deficit or situated in peripheral regions. This included steel plants in Trinidad and Tobago, Mexico, Indonesia and Kazakhstan, as well as Canada, the USA and Germany. A relentless policy of rationalization was implemented in all plants, the organization was simplified and the operation improved. The company's goal was to become the lowest-priced supplier in every steel market. As a result, Mittal agreed on global strategies of company

management, featuring regional limitations to specific markets. After becoming the largest steel company in 2005, Mittal merged with the Luxemburg company Arcelor in 2006. Ever since, ArcelorMittal has been by far the largest steel company worldwide. It reached its provisional peak in 2007 with a production of 116 million tons of steel. Despite this development, the steel industry is still not a highly concentrated industry. In 2008, the three biggest companies only made 13.2% of worldwide steel turnover, with a proportion of just 41.6% being produced by the top 20. Higher values can only be found in regional analysis: For example, the three biggest European companies were able to increase their share to 44% by 2006 (AMELING 2007a, 25). A continuation of this consolidation is to be expected over the coming years. China is the only country which shows a different trend, with the market share of the three largest companies only totalling 15%. In particular, the Chinese government is beginning to encourage publicly-owned companies to create synergies by developing larger business units.

4. Iron ore and the value chain

The steel value chain can be divided into four stages: First, the acquisition of primary resources; second, the production of steel, which can be further divided into the actual production of crude steel, reduction to steel, milling and refinement; third, trade and fourth, the processing of steel into steel products in the various branches of industry. In the first stage, the deployment of resources ratio is based on the process of steel production. The leading process is the basic oxygen furnace, which in the past has been the method used for two thirds of all crude steel production worldwide. A second

Figure 2: Value chain steel



Source: own illustration

method is the use of an electric arc furnace, which is particularly well suited to the recycling of scrap metal. Of course, the proportion of scrap metal recycling in established industrial countries is more significant than in emerging nations. This practice is responsible for 40% of production in the European Union and 59% in the USA. In contrast, in 2007, 91% of steel produced in China was produced using the basic oxygen furnace process. This shows that the steel industries in different regions depend on different sources of primary materials.

By weight, the most significant primary materials for production of steel are iron ore, scrap metal and coal. Steel plant locations are usually determined by an analysis of the optimal transport costs of each of these three materials. With electric arc furnace plants, the sourcing area of the scrap metal is more relevant than with basic oxygen furnaces, which have locations that are usually closer to the coal sources. Despite the relevance of its transport costs, iron ore is also exported in considerable quantities. In 2008, for example, 1,722 million tons of iron ore were mined, of which more than half was exported.

Figure 3: Iron ore production in leading countries 2007 (in %)

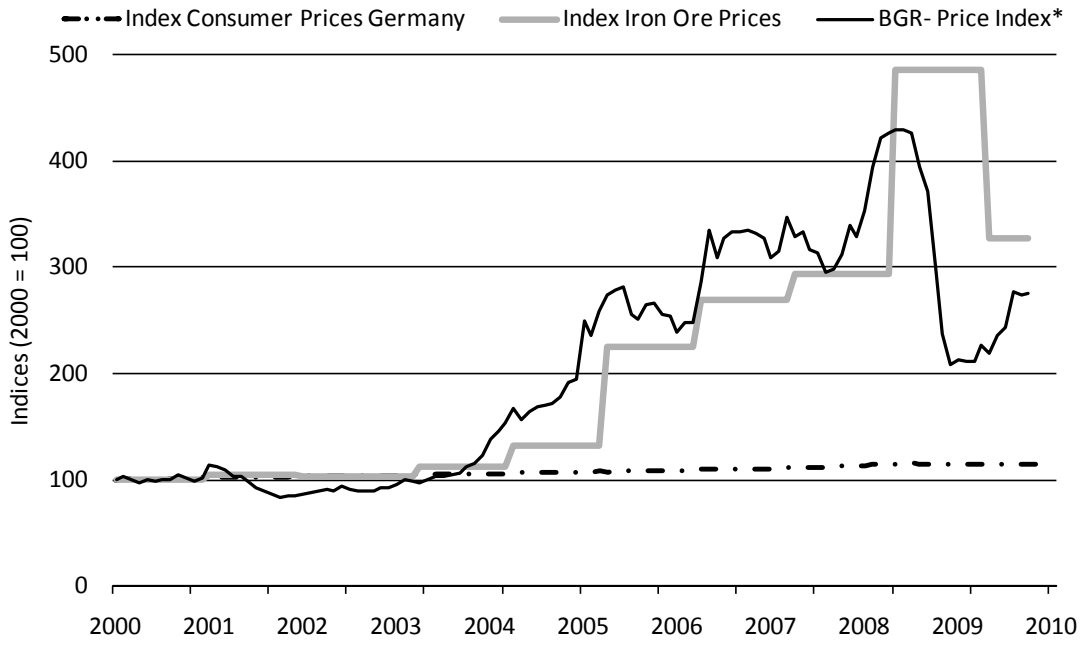
Source: U.S. Geological survey minerals yearbook 2007

The three leading iron ore producers are China, Brazil and Australia. Significant amounts are also mined in India, Russia and the Ukraine (figure 3). If the 2007 iron ore

shares of China (22%), Australia (17%) and India (11%) are added together, one can see that more than half of the worldwide iron ore production took place in these three countries. There is a strong correlation between these sources and the centre of a dynamic development in the world economy.

With these vast sources, China is able to secure a large proportion of its domestic steel needs using its own iron ore. Although the country was already mining 100 million tons of iron ore per year at the turn of the millennium, significant expansion has been made to its production (WORLD STEEL ASSOCIATION 2010, 109-114). In 2008, 366 million tons of iron ore were mined, yet for seven years imports of iron ore exceeded this volume. China's import vacuum is one of the main reasons for the leaps in iron ore prices over the last few years. There are few substitutes for iron ore, meaning that the demand does not fluctuate proportionately to price. Between 2005 and 2008, the iron ore price index rose more than 500 points compared with 2000 (figure 4). Until recently, iron ore was not traded in spot markets on any significant scale; the price was negotiated and set in year-long contracts. Ever since 2000, when Rio Tinto took over the Australian mining company North Ltd, and 2000 and 2001 when Vale (formerly

Figure 4: Price indices for mineral raw material, iron ore and consumer prices 2000 – 2010



* BGR-Price Index for mineral raw materials. Source: Federal Institute for Geosciences and Natural Resources. Source for consumer price index: Federal Statistical Office of Germany.

Companhia Vale do Rio Doce) bought up various mining companies in Brazil, the market has been oligopolistic. The three iron ore suppliers Vale, Rio Tinto and BHP Billiton represent more than 70% of the world market; and this situation could become more serious, given the cooperation agreement made between BHP Billiton and Rio Tinto with regard to iron ore. As a result of this process, increases in the price of iron ore were misaligned with those of other commodities in 2007/2008 (HUMPHREYS 2009). However, since then, the price has fallen again quite quickly. At the beginning of 2010, the price of iron ore was still about 300 index points higher than at the beginning of 2005. A comparison with consumer prices shows what a commodities boom this was. In the same period, consumer prices were rising at an average of a little over 1 point per year. Sharp increases in iron ore prices are expected again for this year, 2010 (BLAS 2010a). Meanwhile, the Japanese steel companies Nippon Steel, Sumitomo Metals and Kobe have agreed to price contracts for a quarter, which could herald the end of a system which has been intact for 40 years (MURPHY, A. et al. 2010; BLAS 2010b).

5. Backward integration in emerging economies

The development of the iron ore market indicates that a secure, long-term supply of inexpensive iron ore has become a key factor for every steel producer. In theory, there are two alternatives available to companies. They can continue to secure their supply in an oligopolistic market where more bargaining power and political initiatives aimed at a broader supply structure are necessary, or they can embark on a route of backward integration and attempt to secure their iron ore supply by buying or establishing their own iron ore mines. The second strategy can be observed in its operation in emerging countries, especially in China. The main location, which China has in its sights for fuelling its policy of expansion of iron ore supply security, is Western Australia. About 90% of Australia's exported iron ore makes its way to China by ship (WEDIG and KAISER 2009, 486). A dozen large acquisitions of mining companies or entries into joint ventures regarding mining projects were carried out by Chinese companies in 2008 and 2009 (Table 2). Eight such projects had to do with iron ore. The largest acquisition last year was the interest in the Fortescue Metals Group Ltd (to the tune of US $ 400 Million) made by Hunan Hualing Iron & Steel Group Co.

One of the active companies is the Baosteel Group Corporation, China's largest steel company and the world's third largest steel producer, with an annual production of 35.4 million tons of crude steel. This Shanghai-based company was established in 1978 and

Table 2: Main acquisitions of Chinese Companies in Australia 2008 and 2009

Completion Month	Buyer	Share	Target	Resource
Sept. 2009	China Nonferrous Metal Mining (Group) Co., Ltd	51,6 %	Lynas Corp Ltd.	Rare Earths
Sept. 2009	Guangdong Nuclear Power Holding Co. Ltd.	70 %	Energy Metals Ltd.	Uranium
Sept. 2009	Railways Materials Corp	12,0 %	FerrAus	Iron Ore
Sept. 2009	Railways Materials Corp	11,4 %	United Mineral Corp.	Iron Ore
August 2009	Yanzhou Coal Mining Co.	100 %	Felix Resources Ltd.	Coal
August 2009	Baosteel	15%	Aquila Resources	Iron Ore, Coal, Manganese
May 2009	Anshan Iron and Steel Group	36,2 %	Gindalbie Metals	Iron Ore
March 2009	Hunan Hualing Iron & Steel Group Co Ltd	17,3 %	Fortescue Metals Group Ltd.	Iron Ore
Feb. 2009	Shenzhen Zhongjin Lingnan Nonfemet	50,1 %	Perilya	Zinc
Sept. 2008	Sinosteel Corp.	49,9 %	Murchison Metals Ltd.	Iron Ore
Sept. 2008	Sinosteel Corp.	100 %	Midwest Corp.	Iron Ore
Feb. 2008	Chinalco	9 %	Rio Tinto plc.	Iron Ore

Sources: www.reuters.com 8 September 2009: Chinese investments in Australian resources; PricewaterhouseCoopers: Metal Deals - Forging Ahead 2009 Annual Review.

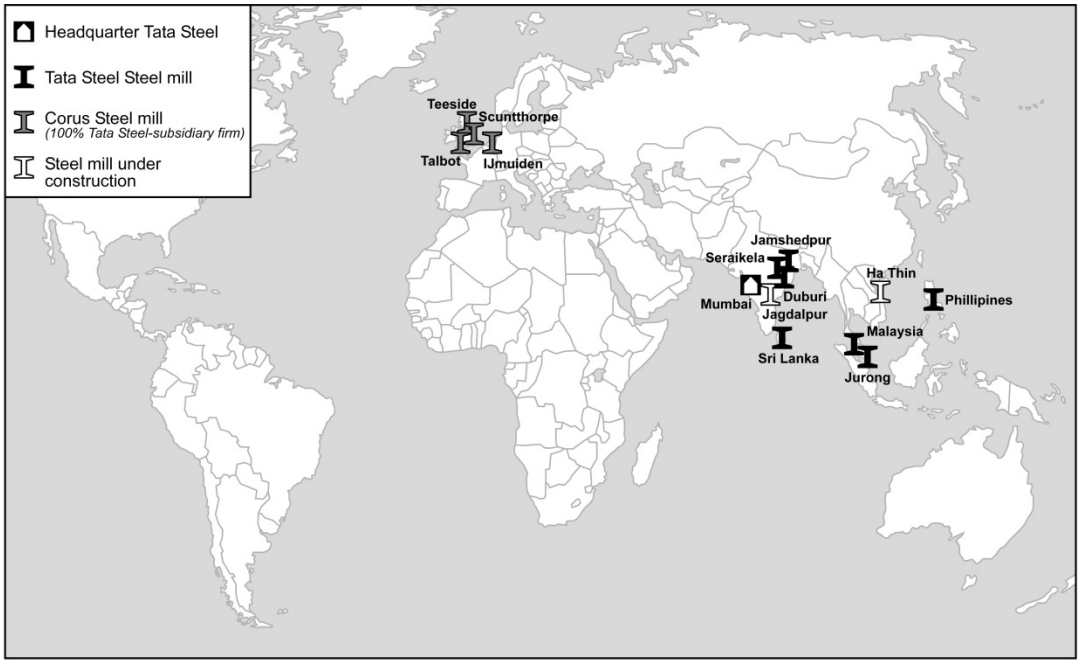
expanded into a new dimension in 1998 with the takeover of Shanghai's Metallurgical Holding Group Corporation and Meishan Group Co Ltd. The Chinese government has a 77% stake in Baosteel. The company is mainly active in the acquisition of primary resources through its subsidiary, Baosteel Resources Co Ltd and Rizhao Baoxin Mining & Resource Co Ltd, which mines limestone and dolomite. In addition to this, it owns Shanghai Baosteel Steel Resources Co Ltd and Shanghai Xinhua Steel Co Ltd, which provide scrap metal. In Australia, the company is represented by its subsidiary, Baosteel Australia Mining Company Pty Ltd. The subsidiary company, which was established in 2002, is based in Perth, Australia, and manages the company's interests in the Hamslay Iron Ore Mine, Australia and Fortescue Metals Group Ltd, as well as other mines.

In August 2009, Baosteel acquired a 15% stake in the Australian company, Aquila Resources for US $ 285 million. This acquisition included a strategic cooperation agreement concerning the supply of iron ore, coal and manganese. In addition to its Australian acquisitions, Baosteel also invests in Brazilian mines. The acquisition of the company Itaminas Comercio de Minerios for US$ 1.2 billion took place in March 2010. In this context, Lejiang Xu, Chairman of Baosteel, announced a further offensive with regard to the acquisition of iron ore mines: "China will more frequently look for new overseas mineral resources, invest in mining and participate in the international strategic layout of the industrial chain, such as the acquisition of mines and building of new steel mills. In the medium to long term, the shadow of resource monopoly that has shrouded the Chinese steel industry will be broken" (SEATRADE ASIA ONLINE 2010). Certainly,

this strategy will involve Baosteel and other large Chinese steel producers in acquiring smaller fledgling mining companies in Australia such as Atlas Iron or Mount Gibson Iron (WEDIG and KAISER 2009, 488).

Although China is the most active buyer of mining companies on the world market, other companies from emerging markets are also involved. Indian steel companies in particular are pursuing a strategy of backward integration in their own country, but have recently begun to expand into foreign markets. By way of example, the acquisition strategy of the Indian company Tata Steel will be explained below. Tata Steel is part of the Tata Group, which achieved a total turnover of US $ 70 billion in 2009 and was the second largest Indian company. Tata Steel was founded in 1907 and had a workforce of 80,000 in 2008. Several years ago, Tata Steel launched an internationalization strategy and bought the NatSteel Company in 2005, which had steelworks in Thailand, the Philippines and Singapore. In 2007, Tata Steel acquired the Anglo-Dutch steel company Corus for US € 12.7 billion and became the eighth-largest steel company in the world. By expanding into the European market, Tata Steel was imitating the acquisition strategy of Mittal and – after ArcelorMittal – is now the second-largest geographically diversified steel company in the world. The company is headquartered in Mumbai, and steel production continues to be focused in the region of origin, the Indian state of Jharkhand (Figure 5).

Figure 5: Locations of Tata Steel



Source: Tata Steel

Tata Steel has always been a company that unified the value chain stages of iron ore extraction and steel production. The discovery of iron ore in the Indian state of Jharkhand in 1993 was the cue for the company to establish the first steelworks on Indian soil, with coal being extracted in the neighbouring state of Orissa. Since that time, Tata Steel has always owned iron ore mines. Today, these mines are located in Noamundi, Joda and Katamati in the states of Jharkhand and Orissa. Additionally, two coal mines in Jharkhand and a manganese mine in Orissa are currently also in operation. Through Hooghly Met Coke & Power Company Ltd., a joint venture with the West Bengal Industrial Development Corporation Ltd., Tata Steel obtains 1.2 million tons of coke per annum. Coal, the raw material used by this plant, is obtained from various mines in Australia, Canada and Indonesia. Tata Steel set up the joint venture S&T Mining Company Pvt. Ltd. together with the Indian state-owned enterprise, the Steel Authority of India Ltd. in order to acquire and develop new domestic coalfields.

In recent years, Tata Steel has also begun to set up overseas projects for the purpose of developing raw material fields. A project with the state-owned Ivory Coast mining company, Sodemi, is used to supply iron ore. In November 2009, Tata Steel had an 80 % participation in a port project of the New Millennium Capital Corp., which owns an iron ore field in the Canadian provinces of Newfoundland & Labrador and Quebec. The agreement also stipulates that Tata Steel will purchase the entire output of the ore mines.

Table 3: Joint ventures of Tata Steel for the purpose of procuring raw materials

Completion Month	Partner	Share	Project	Resource
November 2007	Joint Venture with Riversdale Mining Ltd. (Australia)	35 %	Mine Benga, Tete (Mozambique)	Coal
December 2007	Joint Venture with Sodemi (Ivory Coast)	Unknown	Mount Nimba, Ivory Coast	Iron Ore
January 2008	JV Al Rimal Mining LLC and Al Bahja Group (Sultanate of Oman	70 %	Uyun Limestone deposits at Salalah in the Sultanate of Oman	Limestone
May 2008	Vale (Brazil)	5 %	Carborough Downs (Queensland, Australia)	Coal
November 2009	New Millennium Capital Corp (Canda)	80 %	Direct Shipping Ore Project for Millennium Iron Range (Canada)	Iron Ore

Source: www.reuters.com, 8 September 2009: Chinese investments in Australian resources. PricewaterhouseCoopers: Metal Deals - Forging Ahead 2009 Annual Review.

The "Dhamra Port" infrastructure project is a slightly different and especially striking project set up by Tata Steel to ensure further supply of raw materials. It has been

operating since 1999 and is a joint venture between Tata Steel and the Indian engineering company Larsen & Toubro Limited (L&T), with each company holding a 50% stake. The core of the project is a deep-sea port at the mouth of the river Dhamra in the Indian state of Orissa. The port is designed to handle a capacity of 80 million tons per annum. The first ship was already able to dock there in February 2010. Backup facilities will also be created for handling coal, limestone and iron ore. 62 kilometres of railway tracks to the nearest rail connection at Bhardak are to be constructed.

The broadly ramified activities of Tata Steel in terms of raw materials' supply should be viewed in the context of the additional activities carried out by that group. Apart from steel production, the company is active in six other business areas for processing steel. These are the Agrico Division (Hand Tools), Tata Growth Shop (Mechanical Engineering), Tubes Division, Wire Division, Bearings Division as well as the Ferro Alloys and Minerals Division. Moreover, steel is processed on a large scale by other companies affiliated with the Tata Group. As a purchaser of steel, particular reference should be made to Tata Motors, India's biggest automobile company. Additionally a series of civil and structural engineering companies are part of the Tata Group. On the whole the Tata Group, including its subsidiaries, represents the entire steel value chain in an exemplary manner.

6. A bifurcation of business strategies

Of the above-mentioned two alternatives, vertical backward integration or supply via the market, only the emerging markets vehemently pursue the first strategy. However, if one goes back a few decades, this strategy was also pursued by companies in the established industrial countries. Today, within the triad, Japanese steel companies primarily continue to be heavily involved in mining with corporate investments often the result of strong growth during the 1970s and 1980s. Thus, the iron deposits of the Robe River in Western Australia, which have been exploited since 1972, are operated by Pilbara Iron, a joint venture between Rio Tinto (53 %), Mitsui, a Japanese trading company, and two Japanese steel companies, Sumitomo Metal Industries and Nippon Steel Corporation. As mining activities have steadily increased, Robe River is the largest supplier of lower-grade iron ore in the world today. Along with another Japanese trading house, Mitsui is also involved in Western Australian mining projects operated by BHP Billiton; in the Mt. Newman project since 1967, in the Yandi project since 1990 and in the Goldworthy project since 2002. In recent years, these projects in Western

Australia have been continued partly by the Japanese steel companies and partly by their trading companies with Rio Tinto and BHP Billiton.

The corporate investments of US steel companies are even older and primarily aimed at mining regions on the American continent. U. S. Steel, the largest steel company in the United States, operates two iron ore mines in Minnesota and has a 14.7 percent ownership interest in Hibbing Taconite Company, which also produces iron ore in Minnesota.

On the other hand, European steel companies have taken the former approach over the past two decades. Today, they are virtually distancing themselves from an integration strategy. During the 1990s, the British, French and German steel companies at the time discontinued their existing participations in mining companies. The last German iron ore mining company, Ferteco, then the third-largest iron ore producer in Brazil, was sold by ThyssenKrupp to Vale in 2001 (DALHEIMER 2001, 6). This was communicated as being a useful restriction within the framework of the shareholder value strategy which was to create resources for expansion in the core business area. In retrospect, DIETER AMELING, then president of the steel trade association, portrayed this as a conscious decision by steel producers in Germany to prevent backward integration. From his viewpoint, funds were released by the divestment process with which the quality of steel could be improved and could be invested in the downstream stages of the value chain (AMELING 2007b, 11). Since that time, no purchases of iron ore mines have been transacted by German or large European steel companies. In fact, the reverse approach of forward integration of the mining industry into the steel industry is more readily identifiable. Thus, in 2006, the Brazilian iron ore producer Vale became involved in the reconstruction of the Sepetiba steelworks (state of Rio de Janeiro) in Brazil with a projected annual capacity of 5 million tons of crude steel. In 2009, its share increased to about 27% and production started in the first half of 2010. ThyssenKrupp is the operator of the steelworks which supplies the slabs produced at this site for further processing at its plants in Germany and the USA. As a strategy, at the beginning of the raw materials crisis in 2007, the German steel industry recommended that the efficiency of production processes be improved and steel scrap be returned to the production cycle to a greater degree (AMELING 2007b, 12). At the same time, competition law initiatives to combat any further concentration process in the mining industry were intensified. However, the issue is not high on the political agenda as EU institutions themselves state: "(…) there has been no integrated policy response at EU level up to

now to ensure that it has sufficient access to raw materials at fair and undistorted prices" (COMMISSION OF THE EUROPEAN COMMUNITIES 2008, 5). Just how little can be achieved with this strategy is reflected in the recent round of negotiations regarding steel prices. The current president of the Steel Trade Association, HANS JÜRGEN KERKHOFF, can only issue a warning about imminent new price hikes for iron ore (WIRTSCHAFTSVEREINIGUNG STAHL 2010).

7. Growth and spatial economic integration

If one considers the current trend towards integration of upstream production phases in the steel industry, the above-mentioned theories provide important information about the explanation of the value chain. By adopting the transaction cost approach, it is possible to show that iron ore supply by steel companies was a frequent and, over the last three decades of the 20th century, also a safe transaction. Additionally, the specificity of the transaction was not too high. (It should be borne in mind, however, that the production process in steelworks is designed for particular types of iron ore and can only be converted at a high cost). Given this situation, advantages accrued from procurement through the market. On the other hand, the sharp increase in demand for iron ore since 2005 and the subsequent price hikes have increased the insecurity of the transaction enormously and have given rise to vertical integration. The changes can also be demonstrated by using the global value chain theory, according to which this is a producer-driven value chain. Producer-driven value chains are usually dominated by large producers with a high intensity of capital and technology (GEREFFI and KORZENIEWICZ 1994). If one looks at the factors that have an impact on governance, then a lot can be said for organization through the markets: In the steel industry, the complexity of transactions is mostly low, the ability to codify transactions is mostly high and the capability of the suppliers used to be low. However, the relative scarcity of iron ore has shifted the distribution of power in the value chain in favour of the iron ore producers. It can also be used to explain why the mining companies may opt for forward integration if the steel producers believe they are incapable of backward integration, such as in the participation of Vale in the ThyssenKrupp's steelworks in Brazil. However, both theoretical approaches focus on a set of techniques and organizational influences that create an economically efficient solution. While the trend towards hikes in demand and prices affects all companies, the significant differences between strategies in the industrialized nations and the emerging markets in relation to these approaches cannot be understood via these approaches. An initial attempt at

clarification can draw attention to the cultural differences between the corporate strategies. In his study of the iron ore market over a long period, SUKAGAWA (2010, 58) observed a tendency on the part of the Japanese towards safe supply, stable prices and long-term business relationships. By contrast, European companies always tended to adopt solutions through anonymous markets. Chinese companies, too, require a high degree of stability, cooperation and trust. Furthermore, these are usually companies that are heavily controlled by the state. However, this cultural approach falls short, particularly in relation to the dramatic appearance of Chinese companies on the world market for iron ore after 2005. The combined factors of an enormous rise in crude steel production and consumption in China is certainly the decisive economic variable that has resulted in corporate strategies being modified. This industry growth should be viewed in the light of macroeconomic growth both in China and the emerging markets. In China, average increase in gross domestic product was 9.6 % from 2000 to 2009 and 6.9 % in India, while the developed economies of the USA, Japan and the Euro zone grew at a rate of 1.7 (IMF 2009). Even in the previous crisis year of 2009, the Chinese economy grew at a rate of 6.5% and the Indian economy at a rate of 4.5%. As a result of this strong economic dynamism, companies in the emerging markets are, firstly, able to realize higher profits that are available for investments. Secondly, future economic prospects are much better, which has a positive impact on a willingness to invest and to issue loans. Thirdly, the different economic sectors mutually impact on each other, thereby resulting in a cumulative upward trend.

This economic momentum is the reason why the current challenges can be successfully met through a strategy of vertical integration in China and India. A theoretical link between economic performance and vertical integration is first provided by the polarisation theory. In China, to use PERROUX'S terminology, the heavy industries along with numerous export-oriented consumer goods industries have become the drivers for growth. The steel industry, as an industry that is both a supplier of raw materials and an independent exporter, is also involved in this growth process. This trend has also radiated out to affect the iron ore mining industry. As an upstream sector, with its current shortages and price levels, it presents special risks for the steel industry.

For goods that are liable to transport costs, such integration can be achieved with even greater ease if there is only a short distance between the sectors to be integrated. Secondly, PREDÖHL'S theory of economic development provides for this spatial economic aspect. In fact, in the case of the steel industry, there are large stocks of iron

ore in the production countries of China and India. This simplifies the economic, legal and cultural conditions for integration. The industrial core of the Chinese steel industry integrates the industrial periphery of mining locations in this way. In the case of India, as the most significant peripheral core of the new economic area, steel works can often be built directly in the vicinity of the iron ore mines. The third country that has found large deposits of iron ore is Australia, which can supply East Asia with economical transport costs. Here also, conditions exist that promote vertical integration, or the integration of Australia in the newly-emerging Asia-Pacific economic area.

The current rise of new globally acting companies and their strategies of vertical integration are an expression of this new block formation. Thus, the theory of economic integration demonstrates that vertical integration should also be understood as a concomitant occurrence of a historically new phase in the global economy which is certainly set to last for decades.

Two conditions are missing in Europe for a similar vertical integration strategy to develop: On the one hand, there is no similar growth process in the steel market and, on the other hand, the current production facilities are located a long way away from the European economic area. Consequently, under these macroeconomic and spatial economic conditions, the European steel industry is at a considerable disadvantage when it comes to ensuring supplies of raw materials in the form of iron ore.

8. Conclusion

In the wake of a global rise in the cost of raw materials in 2007/08, a new trend in corporate organization is appearing within the steel industry. Leading companies in this sector are hugely involved in upstream stages of iron ore production as well as other raw materials such as coal, limestone and steel stabilizer. This process is primarily discernible among companies in China, but also in other emerging markets. By contrast, this strategy is scarcely discernible in the steel companies of the established industrial countries of the USA, Japan and European nations. In Germany, companies and associations currently denounce any integration of upstream value chain stages in no uncertain terms.

Normally, contemporary economic geography treats the problem of vertical integration by adopting two theoretical approaches. The transaction cost approach explains the

degree of vertical integration through security, frequency and specificity of transactions. Due to increasing insecurity regarding the supply of raw materials, the integration of iron ore producers can therefore be considered as a more cost-effective strategy. Similarly, the global value chain theory – which explains the distribution of power in the value chain in terms of the complexity of transactions, codifiability of information and capability of suppliers – may be applied to substantiate increasing vertical backward integration. From this viewpoint, the power of the raw production phase increases and results in a new configuration of the value chain. However, these approaches can scarcely explain the development of different corporate strategies in the established industrial countries, particularly in Europe, compared with the strategies adopted in the emerging markets. Using the example of the leading Chinese steel producer, Baosteel, and the second-largest Indian producer, Tata Steel, their expansion was traced to the raw materials sector, consisting of the purchase of mining companies, joint ventures for developing iron ore mines, and investments in transport infrastructure. The bifurcation of corporate strategies can only be understood if the different macroeconomic conditions in the respective economic areas are taken into account. This paper has dealt with this aspect by referring to FRANÇOIS PERROUX'S polarization theory, which focuses on the stimulative effects of economic sectors on upstream and downstream value added stages. With higher growth rates, stronger stimulative effects are to be expected, which result in greater incentives to integrate if the supply of raw materials is not secure. Further statements may be made by referring to the related theory of spatial economic development as propounded by ANDREAS PREDÖHL. In this context, attention is drawn to the spatial economic dimension of intertwining effects. From this viewpoint, a new East Asian-Pacific economic area is merging with China at its centre, outlying core areas such as India, and peripheral countries such as Australia. With ownership integration occurring in this region, current events reflect what happens when other economic areas begin to emerge. The conglomerates of steel producers and mining companies that are currently emerging in China, India and Australia are concomitants of a new global economic configuration. The theory of spatial economic development can be applied to take the different trade activities of companies, in East Asia and in Europe for example, into account. While business-related theories such as the transaction cost approach and the global value chain approach only take the technical organizational criteria into account, these different macroeconomic frameworks may also be used to explain diverging attitudes towards vertical integration. This theoretical perspective also implies a new view of the trading strategies being discussed in Europe. Above all, a discussion at

political level is being mooted in this context, based on the assumption of blocking global free trade. On the other hand, for spatial economic reasons, it has to be assumed that there is a much greater degree of economic rationalisation. In the East Asian-Pacific economic area, a corporate strategy determined by spatial economic considerations is now being adopted, similar to that pursued at the time of the emergence of the North-western European economic area and other economic zones. Economic geography now faces the tasks of proving itself, primarily by showing the extent of its spatial economic integration and by providing an analysis of this – one that is free of any illusions.

References

AMELING, D. (2007a): Chinas Rohstoffhunger fegt die Märkte leer. Die Stahlindustrie im Spannungsfeld der Globalisierung. Vortrag am 15. November 2007 in Essen, VAF/VDF-Bezirksgruppe Essen. http://www.stahl-online.de/medien_lounge/Vortraege/start.asp (13 March 2010)

– (2007b): Energiemangel – Rohstoffknappheit: Welche mittelfristigen Perspektiven hat die deutsche Wirtschaft? In: ifo Schnelldienst 60 (6), 10–13.

BLAS, J. (2010a): Vale turns up heat on iron ore prices. In: Financial Times (12 March 2010).

– (2010b): Zeitenwende auf dem Eisenerz-Markt. In: Financial Times Deutschland (22 March 2010).

BUTTLER, F.; GERLACH, K. and LIEPMANN, P. (1977): Grundlagen der Regionalökonomie. Reinbek.

CHINALCO (2009): Aluminium Corporation of China: An Overview. http://www.chinalco.com/chinalco/media/factbook/factbookfeb09/factbookfeb09.pdf (15 March 2010)

COMMISSION OF THE EUROPEAN COMMUNITIES (2008): The raw materials initiative – meeting our critical needs for growth and jobs in Europe. Brussels.

DALHEIMER, M. (2001): Eisen. Die Konsolidierung des Welteisenerzmarktes hält an. In: Commodity Top News 14.

GERREFI, G. and KORZENIEWICZ, M. (eds.) (1994): Commodity chains and global capitalism. Westport, CT.

GEREFFI, G.; HUMPHREY, J. and STURGEON, T. (2005): The governance of global value chains. In: Review of International Political Economy, 12 (1), 78–104. DOI: 10.1080/09692290500049805

HEIN, W. (2003): Andreas Predöhl: Wirtschaftsraum, Staatsraum und Entwicklung. In: Entwicklung und Zusammenarbeit 4, 158–160.

HILPERT, H. G. (1998): Wirtschaftliche Integration in Ostasien in raumwirtschaftlicher Analyse. Berlin, Munich.

HUMPHREYS, D. (2009): The great metals boom: a retrospective. In: Resources Policy 35, 1–3. DOI: 10.1016/j.resourpol.2009.07.002

IMF (2009): International Monetary Fund: World Economic Outlook October 2009: Sustaining the Recovery. Washington, DC.
MARSHALL, A. (1919): Industry and trade: a study of industrial technique and business organization; and of their influences on the condition of various classes and nations. London.
MURPHY, M.; PALM, R. and SLODCZYK, K. (2010): Rohstofflieferanten entfesseln den Stahlpreis. In: Handelsblatt (26 February 2010).
PERROUX, F. (1964): L'économie du XXème siècle. Paris.
PIORE, M. J. and SABEL C. F. (1984): Second industrial divide: possibilities for prosperity. New York.
PRAHALAD, C. K. and HAMEL, G. (1990): The core competence of the corporation. In: Harvard Business Review 68, 79–91.
PREDÖHL, A. (1962): Das Ende der Weltwirtschaftskrise: Eine Einführung in die Probleme der Weltwirtschaft. Reinbek.
– (1971): Außenwirtschaft. Grundriß der Sozialwissenschaft 17. Göttingen.
SEATRADE ASIA ONLINE (2010): Brazilian iron ore miner bought by Chinese for $1.2bn. (26 March 2010).
SCOTT, A. J. (1988): Metropolis. From the division of labour to urban form. Berkeley.
– (1998): Regions and the world economy. Oxford.
STORPER, M. (1997): The regional world: territorial development in a global economy. New York, London.
STORPER, M. and CHRISTOPHERSON, S. (1987): Flexible specialization and regional industrial agglomerations: the case of the US motion picture industry. In: Annals of the Association of American Geographers 77, 104–117. DOI: 10.1111/j.1467-8306.1987.tb00148.x
SUKAGAWA, P. (2010): Is iron ore priced as a commodity? Past and current practice. In: Resources Policy 35, 54–63. DOI: 10.1016/j.resourpol.2009.09.001
WEBER, A. (1909): Über den Standort der Industrien. Erster Teil, Reine Theorie des Standorts. Tübingen.
WEDIG, M. J. and KAISER, H.-P. (2009): Eisenerz in Westaustralien – ein aktueller Rohstoff in der Krise. In: Zeitschrift für Bergbau, Rohstoffgewinnung, Energie, Umwelt 60, 484-490.
WIRTSCHAFTSVEREINIGUNG STAHL (2010): Milliardenkosten durch Rohstoffe sind Risiko für Erholung der Stahlmärkte. In: Mediainformation (16 March 2010).
WORLD STEEL ASSOCIATION (2010): Steel Statistical Yearbook 2009. Brussels.