The Belgian Iron and Steel Industry in the International Context

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by Frédéric Lagneaux and David Vivet

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Abstract

This paper provides a survey of the main developments in the iron and steel industry over the last few decades. The first chapter covers the changing conditions on international markets and identifies the main challenges facing the companies in this sector. These include the boom in China, the increasing prices of steel and raw materials, the wave of mergers and acquisitions as well as the implementation of environmental regulations, in particular the Kyoto Protocol. Against the backdrop of the worsening global economic crisis, market conditions for steel are also set to change markedly, at least in the medium term. The second chapter provides an assessment of the Belgian iron and steel sector's economic impact, in terms of direct value added, employment and investment. The chapter also includes an evaluation of the indirect effects of the sector, both upstream and downstream.

JEL classification: L61, L22, Q5, C67, J21.

Keywords: branch survey, iron and steel industry, market structure, indirect effects

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INTRODUCTION

The iron and steel industry has long been a major industrial sector for the Belgian economy. In fact, from the mid-19th century onwards, the largest factory in the world, in Seraing, owned by the company John Cockerill S.A., was located in Belgium, and this factory has continued to be a world leader in steel production for more than a century. The iron and steel industry in Belgium suffered a significant decline throughout the 1970s and 80s, due largely to stagnating global demand and growing competition. The sector never really picked up again, despite a recovery in global demand. More recently, the formation of the Duferco and Arcelor groups has, however, enabled the historic steel producers to begin to conquer world markets, whilst maintaining and modernising a certain number of facilities. In fact, the current situation demonstrates how central the iron and steel industry remains to our economy. The emerging economies, Asian countries and new EU Member States, first and foremost, are large consumers of steel and its many by-products. Some of them have also become major producers. Factories located in Belgium, the fate of which seemed sealed not so long ago, have become profitable once more as a result of an explosion in global demand and hence rising prices for raw materials and steel products, before faltering again due to falling global demand. The emerging economic and environmental challenges have led the Bank[1] to consider recent sector developments in terms of economic impact, and in relation to certain closely-linked global factors.

The methodology used in this report is similar to that applied in other sector studies published by the Microeconomic Analysis service.

1 REPORT OBJECTIVES AND DEFINITIONS

1.1 Objectives

This report focuses on recent developments in the iron and steel sector, ensuring that links are established with contextual factors such as trade, technological developments and economic data.

The report focuses on the following two aspects:
1) An international perspective, noting the current challenges, including in the field of environmental regulation.
2) The economic importance and structure of the iron and steel industry in Belgium, via an analysis of trends in direct and indirect value added and in direct and indirect employment, along with the social balance sheet and investment. Indirect effects are then analysed, supported by an examination of a number of coefficients relating to the inter-branch relations existing between the sector under review and the rest of the economy.

1.2 Definitions

The manufacture of basic metals consists of their production, the industry and technology (or group of industries and technologies) that enable metals to be obtained (Le Grand Robert 2007).

[1] National Bank of Belgium. NBB for short.

The iron and steel industry is a major sector of our economy. The manufacture of basic metals (NACE code 27) groups together two subclasses, ferrous metals, that is, the iron and steel industry, and non-ferrous metals. This report is particularly interested in the former. The manufacture of iron and steel, in other words, the iron and steel industry, is defined as follows: the manufacture of basic iron, including the technology of iron and steel as well as that of the industry itself, and covering steel, iron and cast iron. The iron and steel industry consists of the manufacture of basic iron, cast iron, steel and ferro-alloys.

In terms of classification of activities, the manufacture of iron and steel or the iron and steel industry, includes the branches of manufacture of basic iron and steel and of ferro-alloys, manufacture of cast iron tubes, manufacture of steel tubes, cold drawing, cold rolling of narrow strips, cold forming or folding, wire drawing, casting of iron and casting of steel.

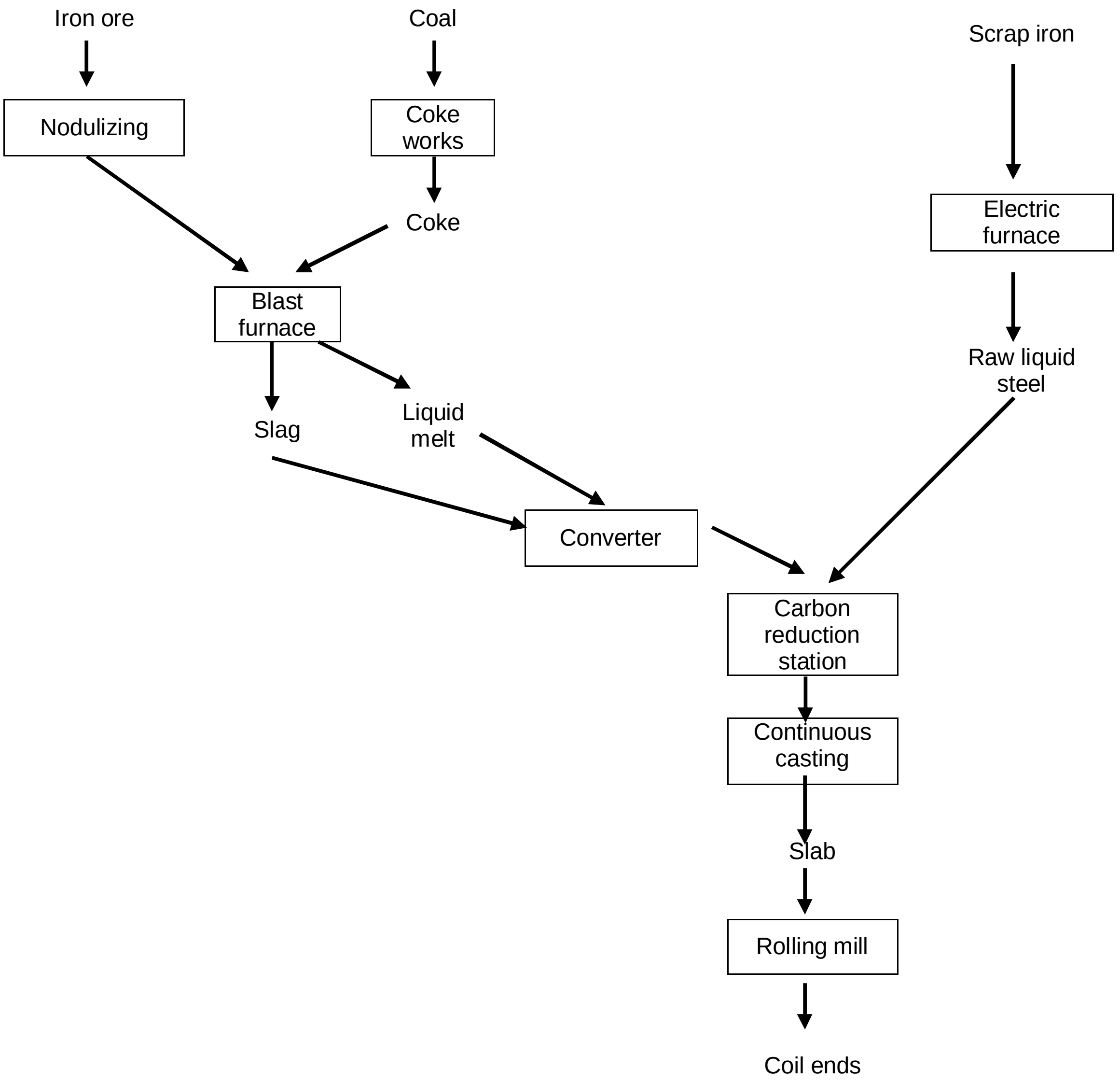
1.3 Process of steel manufacture

Different processes are used within the steel industry[2]:
- Integrated casting: the ore is loaded into a blast furnace with coke, the combustion of which melts the ore (1,250° C) to produce cast iron containing between 2.5 and 6 p.c. carbon; the liquid melt is then poured into a converter to which slag and lime are added; combustion takes the temperature to 1,600° C and burns off the unwanted elements (carbon, phosphorous, sulphur, etc.) to obtain steel with a carbon content of between 0.1 and 2 p.c.; the chemical composition of the steel is then adjusted by the addition of alloying elements.
- Electric processing: recycled scrap iron and recovered off-cuts of steel are melted down in a powerful electric arc furnace.
- Continuous casting: liquid steel from the integrated casting or electric methods is solidified by moulding in a continuous casting machine to obtain semi-finished products or rough specimens: slabs, blooms or billets ; 95 p.c. of semi-finished products are nowadays produced in this manner.
- Hot rolling then transforms the rough specimens into finished products (800 to 1,200° C).

2 Source: DiGITIP Ministry of Economy, Finance and Industry (France).

Chart 1 illustrates this process[3].

CHART 1 FROM IRON ORE TO STEEL



Source: UNCTAD (2008) and Usinor.

There are two broad families of finished products[4]:
- Flat products: slabs (more than 10 mm thick), hot rolled plates, cold rolled sheets or coils, later possibly coated, galvanised or lacquered.
- Long products: tracks, girders, sheet pile, wire rod, reinforcing bars, steel joists.

Different types of steel can be obtained by adjusting the carbon content (making the steel harder and more resistant but less malleable), by adding different elements (chrome and nickel for

[3] See also more detailed explanations in Annex 2.
[4] Source: DiGITIP Ministry of Economy, Finance and Industry (France)

stainless steels, silicon, molybdenum), by heat treatment or by applying protective coatings (zinc, tin, chrome). Improvements to the chemical composition of steel and the optimum use of mechanical and heat treatments are helping to comply with stricter consumer requirements and the desire for a more functional material in terms of safety, comfort, insulation and respect for the environment. Almost 3,000 kinds of steel, all slightly different, can now be produced.

The blast furnace process (integrated casting, cf. above) remains important in Belgium, given that this is the production process the country has long specialised in, namely flat carbon (the family of flat products). This top-of-the-range steel is produced according to the very specific quality requirements of clients such as the automotive sector, household electrical goods, etc. The electric arc furnace process, which uses recycled scrap iron in particular, is more suited to long products, for example in the construction industry. The electric arc furnace technology is used particularly for the manufacture of alloys, primarily in the Charleroi region, which specialises in the stainless steel and special alloys segment. Since 2006, when blast furnace technology - considered more investment intensive - seemed doomed to disappear from its European sites, including Liège, there has been a redeployment of activity towards cold rolling, and also towards electric arc furnaces.

The manufacture of non-ferrous metals concerns the production of metals that do not contain iron. The principal non-ferrous metals are aluminium, copper and zinc.

In the following report, and particularly in Chapter 3, consideration is therefore given to the fact that the manufacture of iron and steel includes activities of manufacture of basic iron and steel and of ferro-alloys, manufacture of cast iron tubes, manufacture of steel tubes, cold drawing, cold rolling of narrow strips, cold forming or folding, wire drawing, casting of iron and casting of steel. To facilitate our analysis of economic impact, the activity covering the manufacture of iron and steel will be included under the heading the iron and steel industry, especially in the commentary. Consequently, to distinguish branch 27.1 from other branches covered by the manufacture of iron and steel, this particular branch will be called manufacture of basic iron and steel and of ferro-alloys.

Further methodological explanation is given at the start of Chapter 3 and in Annex 1.

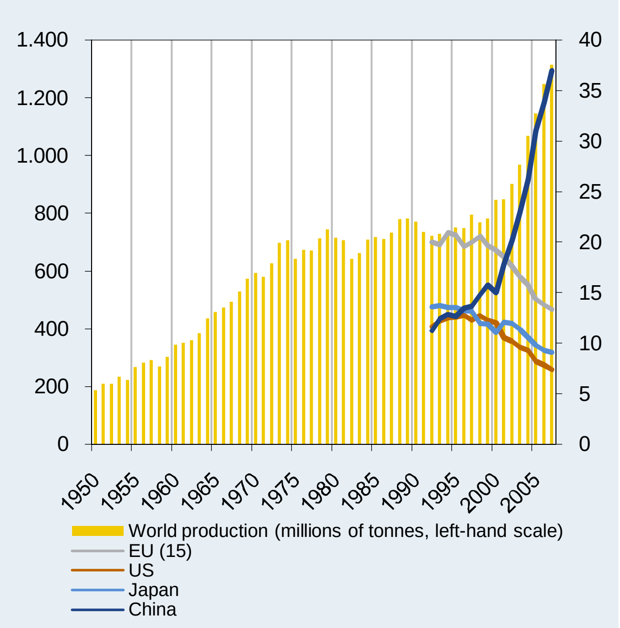
2 INTERNATIONAL PERSPECTIVE AND CURRENT CHALLENGES

2.1 Supply and demand

2.1.1 Supply

The iron and steel industry plays a key role in the economy as it provides the basic materials necessary for the production of many industrial goods. Some of the biggest consumers are the construction, automotive, machine tool manufacture and transport sectors. Steel, in this regard, represents an essential factor in economic development. Economists have, moreover, highlighted a linear relationship that exists between steel consumption and GDP growth, this relation being a function of the level of development achieved by an economy[5]. Therefore, in the immediate aftermath of the Second World War, production rose sharply, fuelled by the countries of Europe, the United States and Japan (Chart 2).

CHART 2 GLOBAL PRODUCTION OF CRUDE STEEL
(percentages of global production, right-hand scale unless otherwise stated)



Source: International Iron and Steel Institute.

After the first oil crisis put a brake on these economies' needs, the iron and steel industry entered a long period of stagnation: from 1973 to 1993, global production of crude steel grew at an average annual rate of only 0.2 p.c. as opposed to 5.6 p.c. over the previous twenty years. Coupled with significant productivity gains, this stagnation led to chronic overcapacity in the means of production.

[5] See for instance Paribas (1999).

Later fuelled by the break-up of the USSR, this overcapacity resulted in particular in the loss of hundreds of thousands of jobs in the industrialised countries. Between 1975 and 1995, sector employment thus fell by 665,000 units in the EU-15 (-67 p.c.), by 232,500 units in the United States (-49 p.c.) and by 169,000 units in Japan (-52 p.c.)[6]. In recent years, this trend has continued against a general background of deindustrialisation of the Western economies: from 1995 to 2006, iron and steel sector employment contracted by a further 10 p.c. in the euro area[7]. In addition to a growing shortage of infrastructure projects, there has also been a decline in the activities of steel-consuming industries in these countries, to which must also be added the fact that steel is now being substituted by such materials as plastic, aluminium or ceramic.

World production began to pick up during the second half of the 1990s, in line with the growing demand from China and the other emerging economies. This recovery rapidly gathered pace: from 2000 to 2007, the annual growth rate in global production reached an average of almost 7 p.c. This new demand for steel was largely satisfied by China itself. Over the last ten years under review, Chinese production rose by more than 300 p.c. to reach 487 million tonnes in 2007, or 37 p.c. of global production. Over the same period, the European, US and Japanese share of this market dropped sharply (despite continued growth in actual tonnage produced).

Globally, over the last fifteen years, the large steel producers have been relocating their production capacity to areas of high growth potential, particularly China, India, Brazil and the countries of the former USSR. This trend has been amplified by a number of factors, including the growing presence in these regions of iron and steel industry customers, new environmental regulations and lower production costs.

Regarding the latter, sea transport costs must also be taken into consideration. The *Baltic Dry Index* (BDI) can be used to track these costs, an index that gives an average for the prices charged over 26 international routes for the transport of bulk dry materials (ores, coal, metals, grain, etc.)[8]. Between 2003 and 2008, the BDI showed an unprecedented upwards trend: the average for the period 2003-2008 was more than three times higher than that for the period 1988-2002 (Chart 3). The reasons for this increase were, firstly, higher fuel costs and, secondly, repeated bottlenecks in fleet capacity and also in port infrastructure, particularly in Asia[9]. However these pressures, at the root of the recent volatility in the BDI, gave way to a collapse in the index from June 2008 onwards. It fell ten-fold in the space of four months, as a result of the slowdown in the world economy, probably intensified by the large number of orders for new vessels to be commissioned over the

6 International Labour Office (1997).

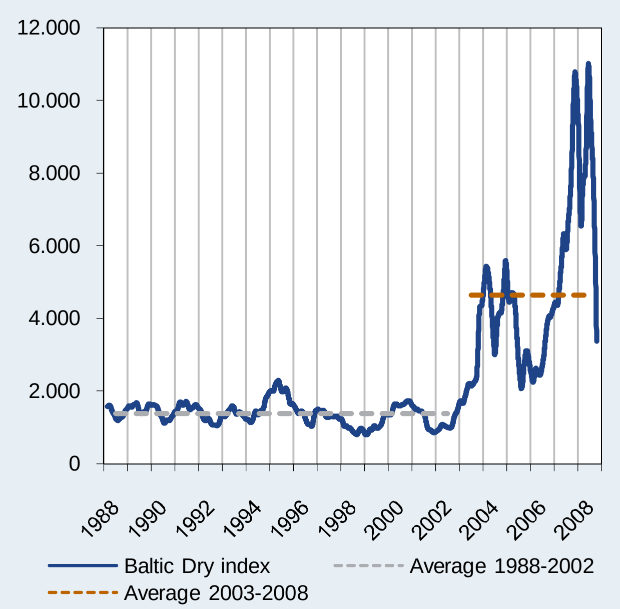
7 Eurostat data.

8 See www.balticexchange.com.

9 For more information on trends in international sea transport, see the United Nations Conference on Trade and Development (2007)

coming years[10]. The fear that higher transport costs could, in the medium term, act as a brake on the international steel trade, and, more widely, on globalisation itself, is thus now no longer justified. The same can be said of the claim made by J. Rubin and B. Tal (2008) in early 2008 when they said that, because of the increased costs of transport, Chinese steel exported to the United States would no longer be competitive compared to steel produced directly in the US[11].

CHART 3 COST OF MARITIME FREIGHT - BALTIC DRY INDEX
(moving average over 30 days)



Source: Datastream.

One has to note that the relative decline of Western production might as well be explained by the nature of production in these countries. In fact, part of the Western iron and steel industry specialises in high technology and value added steels, most often in response to highly precise specifications agreed in close association with their customers. One good example of this would be tailored blanks, precision sheets cut and pressed to order for the automotive industry. Coupled with the above-mentioned improvements in productivity, this strategy enabled the steel producers in question to protect themselves, at least in part, from international competition on these markets.

The main steel producers can be found in Table 1 below. Chart 4 gives their regional position (see below).

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10 In the container transport sector, for example, the equivalent of one-third of the current fleet will have been commissioned between now and 2013, according to statistics from the ship-broker Barry Rogliano Salles (Les Echos, 14 October 2008).

11 Information on production costs is clearly not made public for reasons of confidentiality.

TABLE 1 **MAIN STEEL PRODUCERS IN THE WORLD**
(millions of tonnes of crude steel)

Company	2007 Position	2007 Millions of tonnes	2006 Position	2006 Millions of tonnes
ArcelorMittal	1	116.4	1	117.2
Nippon Steel	2	35.7	2	34.7
JFE	3	34.0	3	32.0
POSCO	4	31.1	4	30.1
Baosteel	5	28.6	6	22.5
Tata Steel (1)	6	26.5	45	6.4
Anshan-Benxi	7	23.6	5	22.6
Jiangsu Shagang	8	22.9	17	14.6
Tangshan	9	22.8	9	19.1
US Steel	10	21.5	7	21.2
Wuhan	11	20.2	16	15.1
Nucor	12	20.0	8	20.3
Gerdau Group	13	18.6	15	15.6
Riva	14	17.9	11	18.2
Severstal	15	17.3	12	17.5
ThyssenKrupp (2)	16	17.0	13	16.8
Evraz	17	16.2	14	16.1
Maanshan	18	14.2	23	10.9
SAIL	19	13.9	19	13.5
Sumitomo	20	13.8	18	13.6

Source: International Iron and Steel Institute.

(1) 2007 data include Corus.
(2) Of which 50 p.c. from HKM.

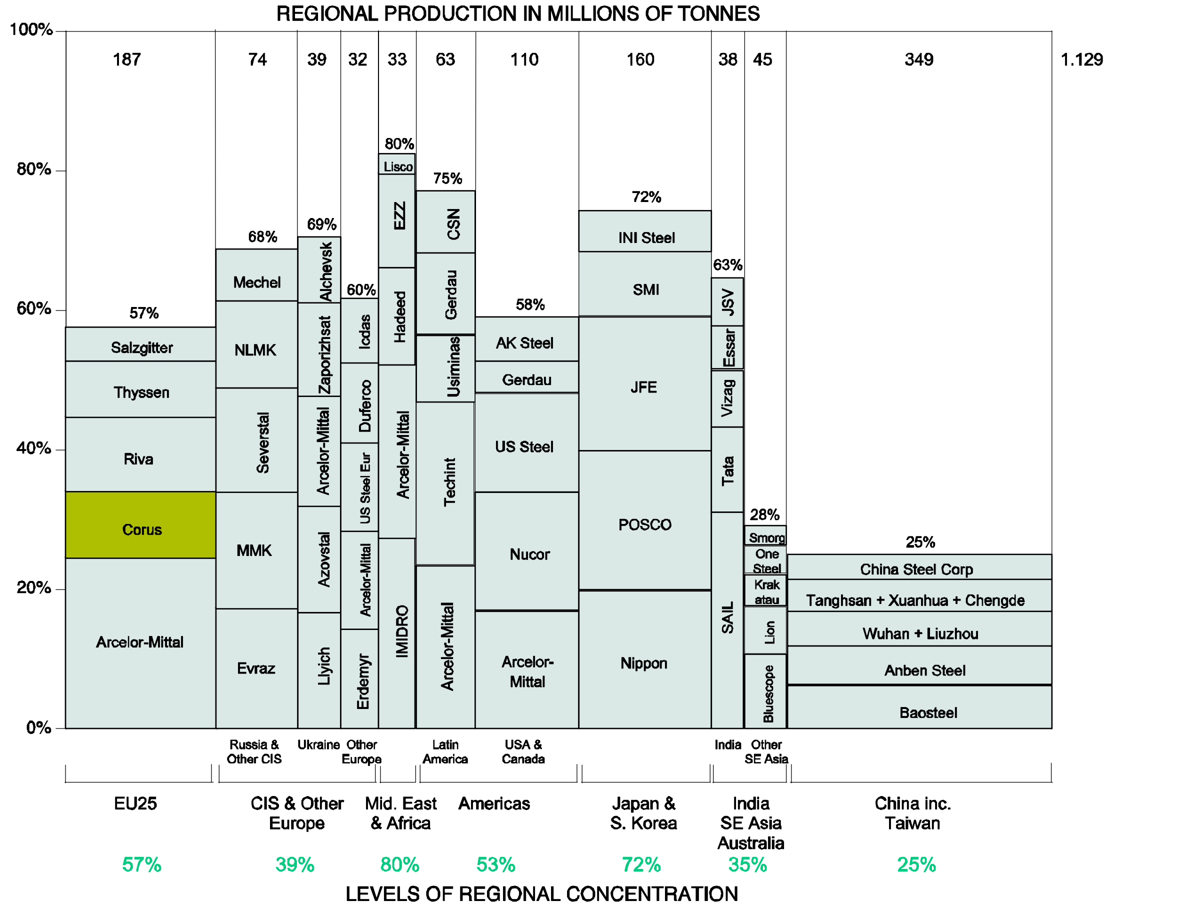
TABLE 2 **PRODUCTION OF CRUDE STEEL, BY PROCESS (2007)**
(percentages, unless otherwise stated)

	Production (millions of tonnes of crude steel)	Oxygen	Electric	Other (1)	Total
European Union - 27	209.5	59.6	40.2	0.3	100
Russia	72.4	56.9	26.6	16.4	100
United States	98.2	41.1	58.9	0	100
Latin America	49.3	61.3	38.7	0	100
East Asia	754.1	78.1	21.7	0.1	100

Source: International Iron and Steel Institute.

(1) This relates essentially to technologies now considered obsolete, such as the Martin process. This latter is a process for refining steel in an open hearth, invented by Pierre Martin and commonly known as the "Siemens-Martin" furnace. It consists of melting a mixture of cast and scrap iron or iron ore, then refining it through decarburization, desulphurization and dephosphorization.

CHART 4 REGIONAL DIAGRAM SHOWING WORLD STEEL PRODUCTION (2005)

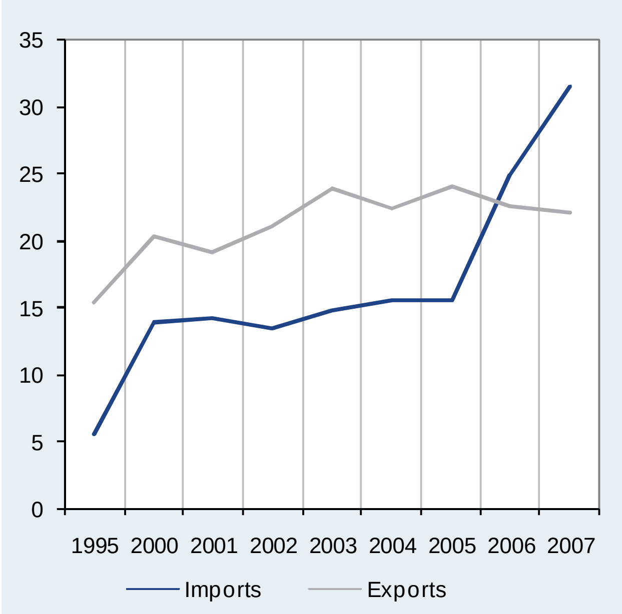


Source: Agoria.

Table 2 gives a breakdown of production by geographical region and by process, primarily oxygen furnace or electric arc furnace. The oxygen process is prevalent in all areas except the United States, where scrap iron recycling is particularly developed.

Until 2005, the European Union, for example, had always been a net exporter of steel (Chart 5). This came to an end in 2006, however, and particularly in 2007 following the significant increase in imports from China and also from Russia, Ukraine, Turkey and Brazil. The steel imported from China is primarily a basic steel used, for example, in the construction industry. However, this trend might be reversed due to the decline in export subsidies from the Chinese government and the fact that their supply is not guaranteed. Moreover, the emerging global economic crisis is likely to change the pattern of steel trade across the world.

CHART 5 EUROPEAN UNION: EXPORTS AND IMPORTS OF IRON AND STEEL PRODUCTS
(millions of tonnes of finished steel)



Source: GSV (Belgian Steel Federation).

2.1.2 Demand

Table 3 summarises the recent changes in the geographical structure of demand for steel. Between 1990 and 2006, Chinese demand increased by 550 p.c. China has thus gradually moved up the ranks to become the world's leading consumer of steel, currently accounting for more than 30 p.c. of the global market, as compared to almost 10 p.c. in 1990. Chinese demand has been fuelled by significant infrastructure needs, along with the considerable development of steel-intensive industrial sectors such as the automotive and ship-building industries. While China forms the main engine of global demand, much of South-East Asia and emerging countries are however following in its wake[12].

The potential for growth in the iron and steel market is theoretically far from exhausted, given the levels of per capita consumption in different parts of the world (Chart 6). Before the onset of the financial crisis, market players were anticipating growth of between 3 and 5 p.c. per annum for the next ten years. Although per capita consumption in China has caught up significantly with that of the West in the last decade, to just under 300 kg in 2006, this is not the case for other regions of the world, where consumption has scarcely changed. Africa and Latin America, for example, consume 10 and 4 times less steel than Europe or the United States respectively. The situation in Asia,

[12] For instance, one can cite India (from 22 million of tonnes in 1990 to 49 in 2006) or Brazil (from 10 to 21).

moreover, is very disparate, consumption in India for example being only 42 kg per person in 2006, on a par with Africa.

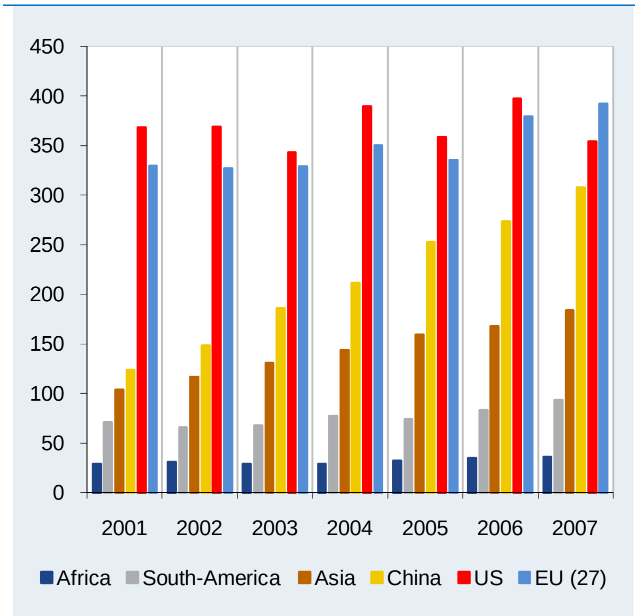
CHART 5 APPARENT CONSUMPTION (1) OF CRUDE STEEL PER REGION

	1990		2006	
	Millions of tonnes	**As p.c. of global consumption**	**Millions of tonnes**	**As p.c. of global consumption**
European Union - 15	134	18.8	178	14.4
Other European countries (2)	53	7.3	67	5.4
CIS	98	13.8	60	4.9
North America	123	17.2	176	14.2
Latin America	17	2.3	38	3.1
Africa	15	2.1	29	2.4
East Asia	256	35.8	641	51.8
of which China	*69*	9.6	*384*	*31.0*
Middle East	11	1.6	39	3.2
Others	8	1.1	9	0.7
Total	**715**	100.0	**1 239**	**100.0**

Source: International Iron and Steel Institute, own calculations.

(1) Apparent consumption is understood as being:
Production + imports - exports +/- changes in inventories
(2) Including the 10 new EU Member States and Turkey.

CHART 6 APPARENT PER CAPITA CONSUMPTION OF CRUDE STEEL, BY GLOBAL REGION
(kilograms)

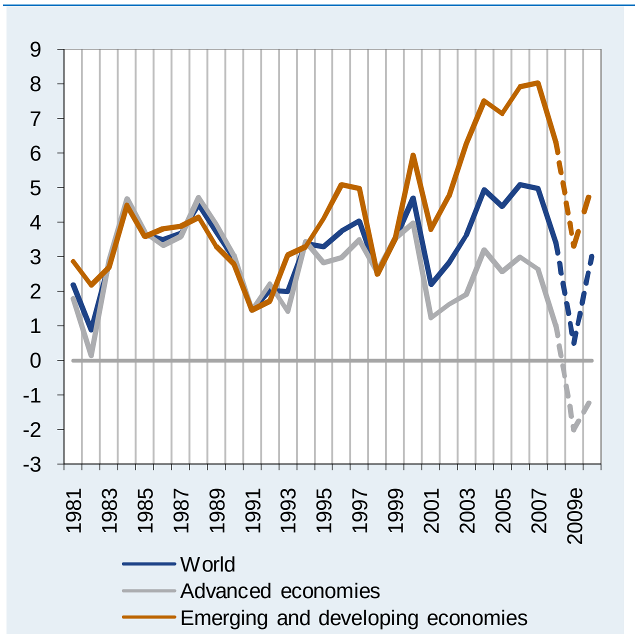


Source: International Iron and Steel Institute, own calculations.

2.1.3 Medium-term projections

The downturn in the world economy in 2008 is likely to have a significant effect on demand for steel. According to IMF projections dating from January[13], world growth is likely to reach 0.5 p.c. in 2009 and 3.0 p.c. in 2010, i.e. a very sharp slowdown in relation to previous years (Chart 7). In advanced economies, output is even expected to contract by 2 p.c. in 2009, what would be their first annual contraction during the post-war period. As far as the 2010 partial recovery is concerned, IMF notes that it is highly uncertain, depending on a lot of elements.

CHART 7 WORLD GDP
(constant prices, p.c. changes compared to the previous year)



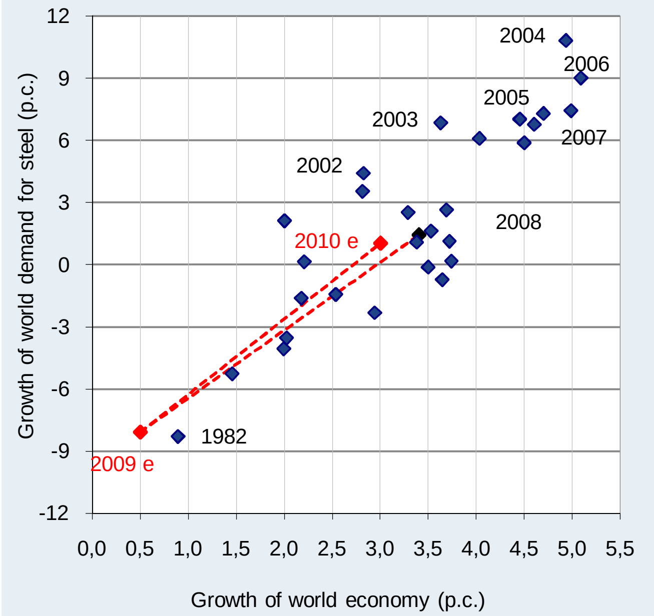
Source: IMF.

As Chart 8 shows, there is a clear relationship between world growth and demand for steel. An adjusted line of regression on the scatter diagram gives the following relationship: Δ(world demand for steel) = - 9.9 + 3.6 Δ(world GDP)[14]. In most cases, demand for steel thus only increases when growth in the world economy exceeds 2.7 p.c. For 2008 as a whole, on the basis of the most recent market data, growth in demand for steel is to be around +1.5 p.c., a particularly marked slowdown compared to previous years. In 2009, according to the above-mentioned line of regression and the most recent IMF forecasts for world growth (+0.5 p.c.), world demand for steel could fall by -8.1 p.c., i.e. an unprecedented situation since 1982. Due to uncertainty, 2010 figures are mentioned for information only.

13 International Monetary Fund (2009).

14 This regression uses the ordinary least squares (OLS) method and relates to the period 1980-2007, i.e. 28 observations. Intercept and coefficient are significant at the 99 p.c. level, and the adjusted R Square is equal to 0.75.

CHART 8 GROWTH IN THE WORLD ECONOMY AND DEMAND FOR STEEL (1)



Source: IMF, IISI and own estimates.
(1) Apparent consumption of crude steel.

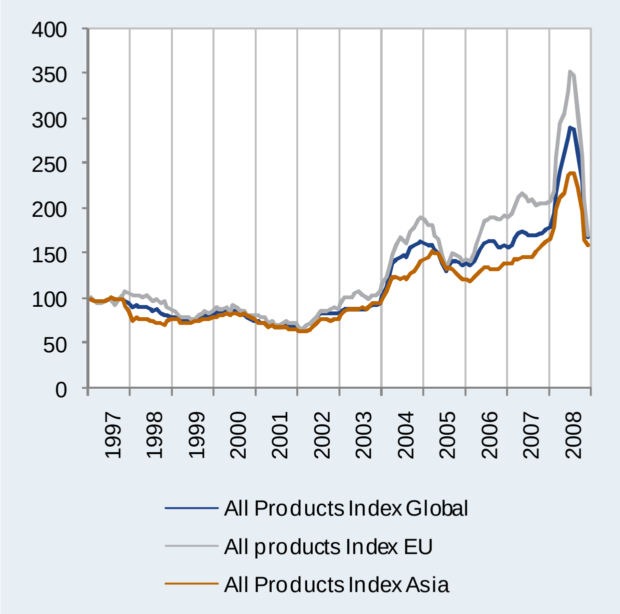
According to Eurostat, industrial production in the euro area as a whole decreased by an unprecedented 8.3 p.c. in the last quarter of 2008 compared to the previous year. One of the sectors most heavily hit by the economic downturn is the car industry, with registrations of new cars dropping by 9.1 p.c. in the third quarter of 2008 compared to the previous year. Apart from the industry, the construction sector also experienced a sharp downturn, indicated by the plunge in building permits, which in the third quarter of 2008 were 23.4 p.c. lower than in 2007.

Given the extent of the crisis, the iron and steel industry is likely to reduce production considerably. After announcing a 15 p.c. cut in global production in September, for example, ArcelorMittal then revised this figure putting it at 35 p.c. This contraction will affect Europe, where the group envisages a temporary shutdown of at least twelve blast furnaces along with a halving of stainless steel production in Belgium and France.

2.2 Trends in prices of steel and raw materials

The strength of global demand resulted in sustained increases in the price of steel for a number of years. It is not easy to retrace these trends insofar as there are a multitude of steel prices existing side by side, depending on the nature, quality and geographical origin of the product. In addition, the iron and steel industry offers ever-growing numbers of specific steels that are not traded on the market. However, whatever measure is used, a sharp increase in all prices can be seen. Chart 9, for example, shows a very significant rise in carbon steel prices across the world from 2002 to 2008, after a long period of virtual stagnation. The substantial effects of the global economic crisis on steel market are visible from September 2008 onwards.

CHART 9 GLOBAL TRENDS IN CARBON STEEL PRICES (1)
(index January 1997 = 100, data until December 2008)



Source: MEPS.

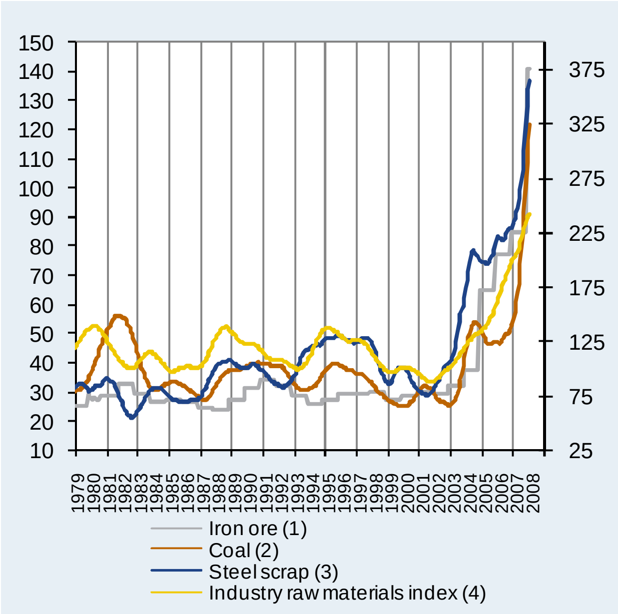
(1) MEPS carbon steel indexes are based on prices averages for the main carbon products (hot rolled coils, hot rolled plates, cold rolled coils, galvanized coils, electrozinc coils, wire rod, etc.).

Higher steel prices must be seen in the context of the rising prices of all raw materials. Since 2002, the latter have shown record increases, due to the strength of global growth. The raw materials used in steel have been no exception, the iron ore and scrap metal markets being exposed to significant pressures (Chart 10). Although the availability of scrap metal had long seemed secure, over the past few years it has been consumed faster than the recycled product has become available. This market imbalance has been fuelled by a growing use of processes requiring scrap metal, such as the electric arc furnace. As for iron ore, the experts are generally agreed that global reserves are sufficient to satisfy long-term requirements[15]; most of the recent pressures have been caused by under-investment in capacity and infrastructure during the 1990s. Combined with a vigorous recovery in demand, this situation has resulted in supply bottlenecks. The signal sent out by the recent price rises has resulted in numerous investment plans but, given the timescale

[15] See for example Loyer J.-L. (2007) and the United States Geological Survey (2008).

necessary to open extraction facilities (between five and ten years), the gloomier economic outlook may well call most of these plans into question.

CHART 10 TRENDS IN THE PRICE OF THE STEEL INDUSTRY'S RAW MATERIALS
(monthly data, centered moving averages over 12 months (except iron ore) until March 2008, left-hand scale, unless otherwise stated)



Source: Hamburgisches WeltWirtschafts Institute.

(1) Carajas fine ore, Brazil, contract price to Europe, fob, in US cents per tonne.
(2) Steam coal, Australia, average spot price, fob, in US dollars per tonne.
(3) Composite cast iron n°1, US, delivery price in US dollars per tonne.
(4) Excluding energy, Index 2000 = 100.

These price rises have a significant impact on the iron and steel industry given the proportion of steel production costs that they represent: according to references from Western Europe, raw materials account for 56 p.c. of a blast furnace's costs and 62 p.c. of those of an electric arc furnace (Table 4). Energy costs represent 9 and 10 p.c. respectively.

TABLE 4 **REFERENCE STRUCTURE FOR STEEL INDUSTRY COSTS IN WESTERN EUROPE**
(percentage of total cost)

	Oxygen furnace	Electric arc furnace
Raw materials	56	62
Labour	15	1
Depreciation	12	4
Fuel	5	2
Electricity	4	8
Maintenance	4	10
Others	3	13
Total	**100**	**100**

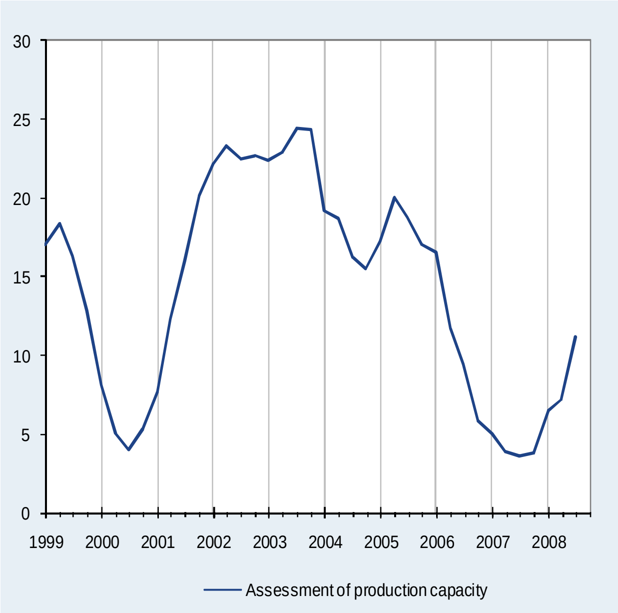
Source: Datastream and Reynaud J. (2005).

Concerns have, moreover, surfaced with regard to the market power being exercised by mining companies. The mining sector is particularly concentrated: 78 p.c. of the iron ore shipped by sea is produced by three companies: Vale, Rio Tinto and BHP-Billiton. Numerous large-scale merger-acquisitions have taken place over the last couple of years, as a result of substantial cash reserves in the mining sector. Moreover, because of the transport costs, the iron ore market is partly fragmented into different regional markets, which potentially encourages the exercise of market power. While it is clearly difficult to identify this kind of behaviour, the recent financial performance of mining companies sheds further light on this problem. Between 2002 and 2006, although total turnover of the sector's forty largest companies increased 2.6 times, net profit for the same companies rose 15-fold, to 67 billion dollars in 2006. Consequently, over the same period, their net profit margin increased from 5 p.c. to 27 p.c.[16] In comparison, the same margin for the five largest steel producers was between 8 and 13 p.c. in 2006.

Finally, the pressures created by insufficient steel production capacity have probably also had an effect on rising prices. In the euro area, for example, responses to economic surveys highlighted a growing shortfall in production capacity between 2003 and 2007 (Chart 11). Since the end of 2007, the curve has headed upwards again, in other words, towards an under-utilisation of production capacity.

[16] On the financial situation of mining companies, see PriceWaterhouseCoopers (2007).

CHART 11 ASSESSMENT OF STEEL PRODUCTION CAPACITY IN THE EURO AREA
(Net balance of percentage of responses indicating "more than sufficient" or "insufficient" capacity)



Source: Eurostat.

2.3 Recent changes in industrial structure

In the above context, the steel producers' strategy has been first and foremost to ensure maximum security of supplies. ArcelorMittal has gained a firm foothold in the mining sector and now claims to be 45 p.c. self-sufficient, with the objective of reaching 75 p.c. Given that China imports 60 p.c. of its iron ore requirements, Chinese steel producers are also increasingly focusing on supply. At the start of 2008, Baosteel, China's largest steel company, signed a long-term contract with BHP Billiton. This concerns the supply of 10 million tonnes of ore each year for 10 years, the price being negotiated annually, however. The issue of supply was also behind the decision of the German steel producer ThyssenKrupp and the Brazilian mining company Vale, to establish a joint steelworks in Brazil.

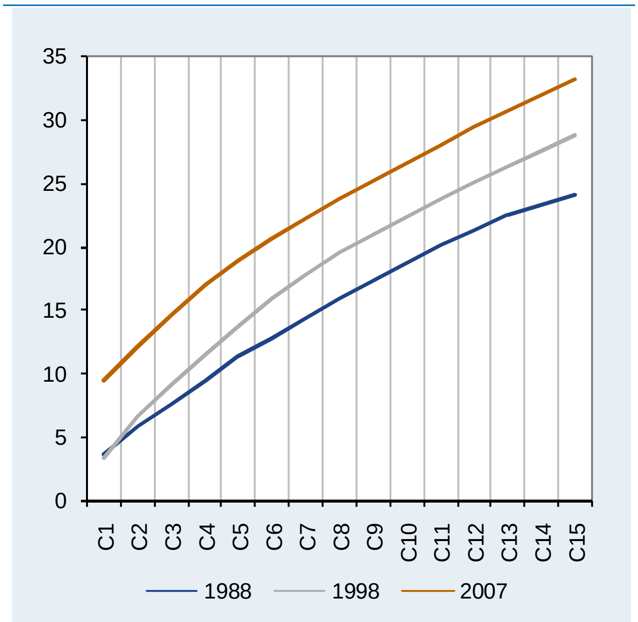
TABLE 5 MERGERS AND ACQUISITIONS IN THE IRON AND STEEL INDUSTRY

	2003	2004	2005	2006
Number of transactions	100	117	165	166
Value (billions of US dollars)	6.9	31.4	27.4	70.4

Source: PriceWaterhouseCoopers (2007).

Another of the steel producers' objectives has been to achieve a critical mass in order not only to strengthen their negotiating power but also, more generally, to benefit from economies of scale, particularly through the optimum management of production capacity. The trend towards external growth has increased sharply in the last few years, both in number and in value, culminating in Mittal's buyout of Arcelor in 2006, for 46 billion US dollars (Table 5). However, the pattern of the global steel sector continues to be fragmented and despite the numerous restructurings that have taken place over the last twenty years, sector concentration has changed little at global level. Chart 12 illustrates this situation. *Cn* gives the share in production of the *n* largest companies in world production, in terms of tonnes produced: the world leader, ArcelorMittal, represents 10 p.c. of production, while the ten largest steel producers account for a 27 p.c. share. Both upstream and downstream, most of the sectors with trading links to the steel industry are substantially more concentrated. Apart from the mining sector, already noted, the ten largest groups, including in the automotive and household electrical goods sectors, account for 95 p.c. and 80 p.c. of world production respectively.

CHART 12 DEGREE OF CONCENTRATION OF STEEL PRODUCERS GLOBALLY
(percentages)



Source: International Iron and Steel Institute, own calculations.

The degree of consolidation is not the same the world over, however (Table 6). China's steel industry structure is still particularly fragmented, which partly explains the low level of global integration. The tonnage produced by Baosteel, China's largest steel producer, accounted for little more than 5 p.c. of the country's total steel production in 2006. Since 2005, one of the main planks of Chinese industrial policy has, admittedly, been to consolidate the sector but, thus far, this central government objective has come up against resistance from local authorities fearing negative consequences in terms of jobs and tax revenue. Regulations limiting foreign investment in the iron and steel industry are also probably not conducive to speeding up concentration[17].

TABLE 6 **SHARE OF THE FIVE LARGEST STEEL PRODUCERS, BY REGION**
(percentages of total regional production in tonnes)

	1995	2000	2005	2006
China	34.6	35.7	19.7	24.5
Asia (exc. China)	46.1	47.3	54.7	54.7
North America	32.1	32.1	47.6	55.5
Europe	43.3	58.6	58.9	61.3
Latin America	53.7	57.7	80.1	80.1
World	12.9	14.6	17.9	20.0

Source: The Boston Consulting Group (2007).

Consolidation in the European iron and steel industry is far more advanced. This is a consequence of the significant restructuring and privatisation process it has gone through over the last thirty years. In Belgium, the progress of the Cockerill steel plants in Liège and their amalgamation into increasingly larger groups such as ArcelorMittal is an illustration of this[18]. The structural transformations have concerned not only capital ownership but also the nature of production. The search for value added, specialisation and long-term contracts with clients have become major objectives, in an attempt to stand out from the international competition and avoid the cyclical nature of the demand for steel.

The steel market is characterised by a significant cyclicality. Chart 13 shows, for Belgium, the confidence indicators and the degree of capacity utilisation in the iron and steel and other industries. These two indicators are subject to markedly wider fluctuations in the iron and steel industry. On the one hand, as indicated above, the iron and steel industry supplies intermediate (in particular, semi-finished) products to numerous other sectors. On the other hand, it is a highly capital-intensive industry. This pronounced cyclicality influences companies' strategic decisions, as they have to adapt in order to achieve their financial targets. In a letter to shareholders in 2007, Lakshmi Mittal thus presented the reduced volatility in profits as a major benefit of the merger between the Arcelor and Mittal groups, the newly created group guaranteeing diversification in both geographical terms and range of products offered[19].

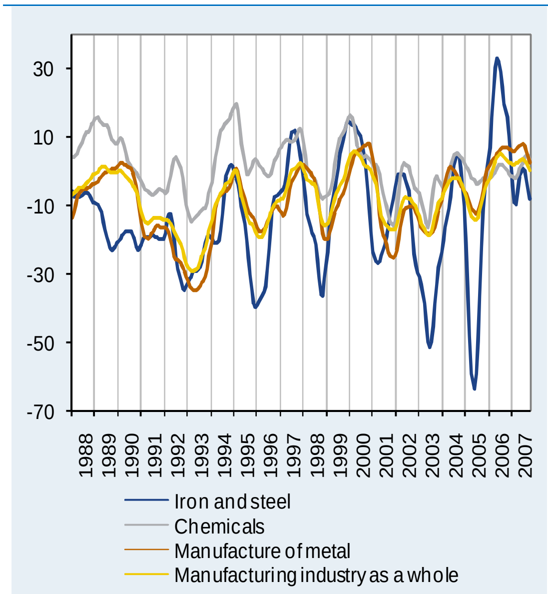
17 On the Chinese situation, see for example AFX News (8 August 2007), "China needs to consolidate its highly fragmented steel industry", and Asia Pacific Bulletin (11 October 2006), "Movers and shakers: signs of consolidation in Asia's booming steel giants".

18 See on this subject, among others, Fusulier B., J. Vandewattyne and C. Lomba (2003).

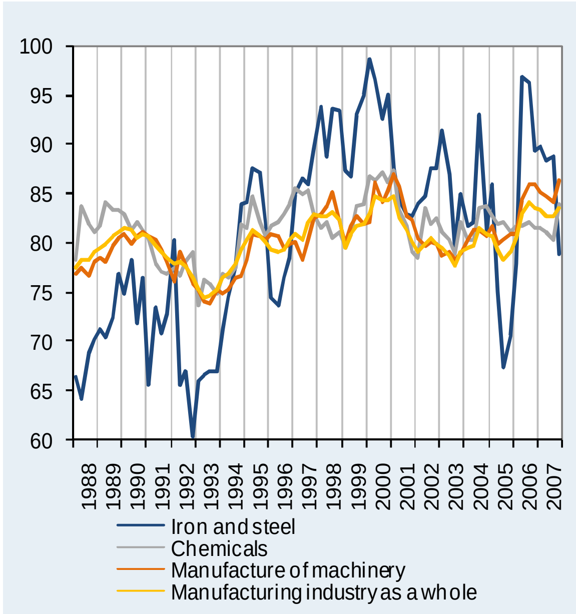
19 ArcelorMittal (2007).

CHART 13 CONFIDENCE INDICATOR AND DEGREE OF UTILISATION OF PRODUCTION CAPACITY IN BELGIUM – IRON AND STEEL AND OTHER INDUSTRIES

A. SMOOTHED CONFIDENCE INDICATOR



B. DEGREE OF CAPACITY UTILISATION



Source: NBB.

Moreover, recent trends in the global market have been particularly favourable to steel producers' profit margins. From 2005 to 2007, the total net profit recorded by the ten largest international steel producers came to more than 25 billion dollars. In general, this financial performance is the product of past rationalizations and the particularly favourable economic climate of the last few years. It should also be recalled that the profitability of most of these groups was hardly enviable at the start of the new millennium, some of them even facing losses.

Finally, the Tata conglomerate, now the fifth largest steel producer in the world following its takeover of Corus, has a significantly different strategy from that of the other players. Already active in sectors as varied as steel, IT, energy, raw materials, hotel and catering, manufacture of food products and telecommunications, the group recently also gained a foothold in the automotive industry, via the production of a low price car and the acquisition of existing brands. The group has thus far not mentioned possible synergies between its automotive and steel activities.

2.4 The Kyoto Protocol and the iron and steel industry

The Kyoto Protocol was adopted in 1997 by the Member States of the UN Framework Convention on Climate Change (UNFCCC). The main feature of this Protocol lies in the greenhouse gas emissions targets assigned to the countries that have ratified it. These targets differ from one country to another and have to be met over the period 2008-2012 (Table 7). Emerging/developing countries were not given a specific target, while the United States did not ratify the Protocol, meaning they are not obliged to meet the target assigned to them. Negotiations are currently under way to set targets for the post-2012 period[20].

TABLE 7 KYOTO PROTOCOL: GREENHOUSE GAS EMISSIONS TARGETS FOR THE 2008-2012 PERIOD
(percentage change in relation to 1990 levels)

	Target
European Union (25) (1), Liechtenstein, Monaco, Switzerland	- 8 p.c.
Canada, Hungary, Japan, Poland	-6 p.c.
Croatia	-5 p.c.
New Zealand, Russia, Ukraine	+ 0 p.c.
Norway	+1 p.c.
Australia	+8 p.c.
Iceland	+10 p.c.
p.m.: United States (2)	*-7 p.c.*

Source: www.unfccc.int.

(1) Excluding Hungary and Poland. The 15 States already members of the Union in 1990 came to an agreement to redistribute this overall target.
(2) The United States did not ratify the Protocol.

In order to facilitate its implementation, the Protocol provides for so-called flexibility mechanisms, including emission trading. This allows countries that have not achieved their reduction target to buy tradable emissions permits from more environmentally efficient countries. The European Union has put its own emission trading scheme in place on this basis (cf. box 1).

Box 1 The European Union Greenhouse Gas Emission Trading Scheme

The European Union Greenhouse Gas Emission Trading Scheme came into operation on 1 January 2005, in application of European Directive 2003/87/EC. It currently relates to 12,000 industrial facilities belonging to the main greenhouse gas emitting industries, such as energy production, iron and steel and the glass industry, cement, paper and ceramics. Overall, these facilities account for around 45 p.c. of the EU's total CO_2 emissions.

Each Member State had to draw up a national plan aimed at establishing how allowances will be allocated and distributed among the different industrial facilities. The principle of the system is that companies that exceed their emissions ceiling can buy unused allowances from more environmentally efficient companies. Although the European Directive establishing the system does not specify how these transactions should take place, various "carbon markets" have developed over the last few years, such as NordPool, BlueNext, the European Electricity Exchange and the European Climate Exchange. These platforms now seem to have become established as the best

[20] On the post-Kyoto challenges, see for example the International Energy Agency (2008).

way of guaranteeing market liquidity and transparency: in 2007, they accounted for more than 70 p.c. of transactions[21].

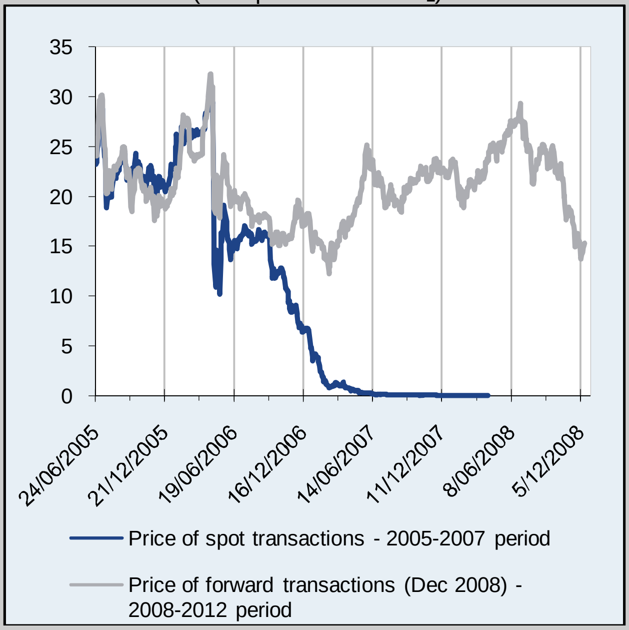
The system comprises two stages. The first (2005-2007) was primarily aimed at testing the mechanism. The second (2008-2012), which corresponds to the period of commitment of the Kyoto Protocol, strengthens the allocation conditions and increases the ceiling for allowances that can be auctioned. At the end of 2008, the European Council and Parliament adopted a plan for a revised system for the post-2012 period. This plan among other things significantly strengthens the reduction targets and substantially increases emissions auctioning. It also extends the scope of the system to new sectors such as aviation and petrochemicals.

The main question arising from the system relates to carbon allowance prices, insofar as these are supposed to send a signal to market players. After publication, in the spring of 2006, of data revealing surplus distribution, the price of the 2005-2007 allowances collapsed to 0.02 euro at the end of 2007 (Chart 14). Although initially following the same trend, the 2008-2012 allowances took a different path from October 2006 onwards, following the announcement of a reduction in the allowances granted for 2008-2012. Following the decision by the European Council to step up long-term environmental efforts, prices recovered substantially. After reaching almost 30 euro at the start of summer 2008, the price per tonne of CO_2 fell sharply, the financial crisis influencing forecast demand for allowances. According to the price of forward transactions beyond 2008, the market anticipates a recovery. Future trends will, however, largely be determined by the regulatory environment.

The trading scheme is an expression of the modern economic theory which advocates that, in general, environmental problems should be resolved by having recourse to the market. For such a mechanism to work at its best, a certain number of conditions must, however, be fulfilled. The main difficulty no doubt relates to the initial distribution of ownership rights, in this case emission allowances. The 2005-2007 collapse in prices reveals the extent to which the system can become inoperable if ownership rights are inappropriately distributed.

[21] On the development and structure of these markets, see for example Convery F., D. Ellerman and De Perthuis C. (2008)

CHART 14 PRICE OF EUROPEAN CO_2 EMISSION ALLOWANCES
(euro per tonne of CO_2)



Source: BlueNext and European Climate Exchange.

This problem arises not only within the European Union but also between the EU and the rest of the world. The distribution of Kyoto targets was the source of protracted negotiations and the origin of a reluctance, even refusal, on the part of some countries, particularly the United States, which, it should be recalled, is responsible for almost one-quarter of global emissions. Complaints related particularly to the exemptions granted to emerging countries, whose share of global emissions is increasing rapidly year-on-year.

These difficulties reflect the very nature of the fight against global warming, which is a global public good in the same way, for example, as the fight against epidemics or the existence of a stable international monetary system. Apart form the traditional features of a public good (non-rivalry and non-exclusion), a global public good requires coordination among States if it is to be produced as an optimum quantity. And yet such coordination is particularly complex given the great diversity of national preferences which result, among other things, from unequal levels of development and cultural differences. The success of an international agreement is all the more difficult given that many global public goods are characterised by a strong intertemporal dimension. This puts not only flows (i.e. greenhouse gas emissions) at stake but also stocks accumulating over a long period (i.e. the concentration of these gases in the atmosphere), in some cases irreversibly[22].

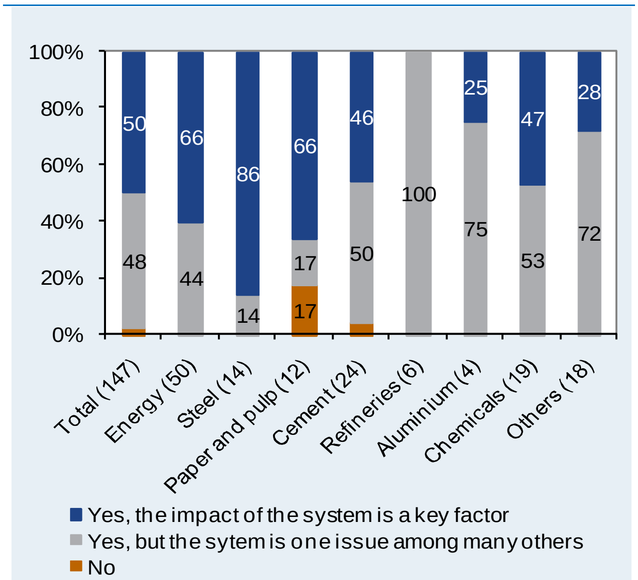
Given the complexity of the issue, it is not easy to measure the impact of this system on the structure of industrial costs in Europe. According to studies thus far conducted, the global impact is

[22] On the theoretical foundations of the notion of global public good, see for example Kindleberger C. (1986). For a summary and environmental application, see Lepeltier C. (2004).

limited, at least with regard to existing facilities[23]. However these studies are based on a range of hypotheses relating, among other things, to the structure of production costs, industrial and trade relations, the competitive environment, fluctuations in electricity prices, and the prices and rates of free distribution of carbon allowances. In the light of these reservations, the conclusions of these studies should be considered as an indication of scale.

With regard to the iron and steel industry, a distinction must be made between oxygen furnaces and electric arc furnaces. Among other things, the latter emit significantly less CO_2 per tonne of steel produced; moreover, the impact of the scheme on their costs is primarily indirect and related to the price of electricity. On the basis of allowances at a cost of 20 euro and a 95 p.c. free allocation, McKinsey and Ecofys (2006) estimate the net increase in the cost of existing production to be 1.7 p.c. for oxygen furnaces and 0.6 p.c. for electric arc furnaces. The impact on the marginal cost, that is the cost of any additional production is, however, significantly higher: for oxygen furnaces, the increase in the marginal cost is estimated at 17.3 p.c. (+2.9 p.c. for electric arc furnaces). This increase in marginal cost is not only due to hypothetical new facilities but also existing facilities due to debottlenecking, that is, a gradual surpassing of theoretical production capacity. Finally, given the tightening of the allocation conditions announced by the European Commission (cf. box 1), these estimates are likely to be revised upwards in the future.

CHART 15 STATED IMPACT OF THE EMISSION TRADING SCHEME ON COMPANIES' LONG-TERM DECISION-MAKING
(percentages, responses to the question "Is your long-term decision-making process (for example, investment decisions) affected by the emission trading scheme?"

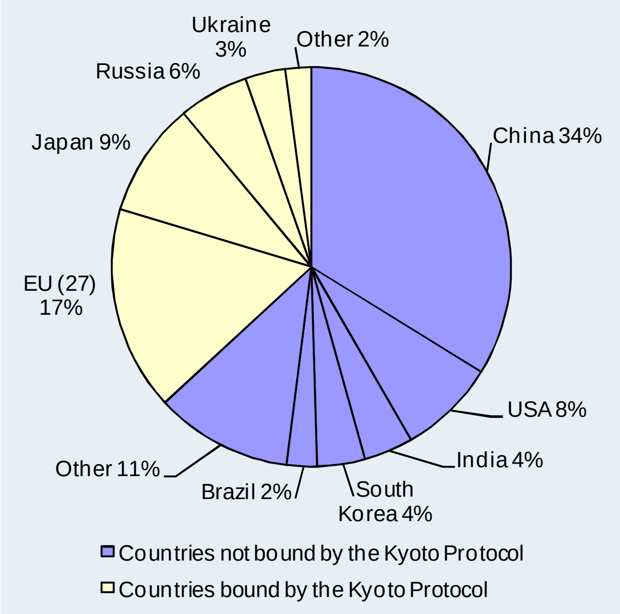


Source: McKinsey and Ecofys (2005).

[23] See, in particular, McKinsey and Ecofys (2006) and Reinaud J. (2005).

To these tentative estimates should be added the opinion of the companies in question themselves. In this regard, if we are to believe the answers given by European companies, investments in the iron and steel industry could be particularly affected by the European emission trading scheme: 86 p.c. of sector companies consider this scheme to be a key factor in their long-term decision-making. This percentage falls to only 50 p.c. for industry as a whole (Chart 15). This is fairly logical insofar as the iron and steel sector still accounts for one-fifth of industrial CO_2 emissions in Europe[24], making it one of the sectors most affected by environmental legislation. Moreover, 63 p.c. of global steel production currently comes from countries exempt from targets or which did not ratify the Kyoto Protocol (Chart 16). For these countries, weak (or even absent) environmental constraints are in addition to the comparative advantages, such as labour costs and the availability of raw materials.

CHART 16 DISTRIBUTION OF WORLD STEEL PRODUCTION BY COUNTRY'S KYOTO PROTOCOL STATUS
(2006, percentages)



Source: International Iron and Steel Institute and own calculations.

Implementation of the Kyoto Protocol is thus likely to affect the competitiveness of European industries and, consequently, to encourage relocations outside of the EU. In the context of combating global warming, this carbon leakage is all the more paradoxical given that the European industry is comparatively less energy intensive than the rest of the world. For example, the production of one tonne of primary steel requires significantly less energy in Europe, Japan or the United States than in China or India (Table 8). These regional differences can be explained by a

[24] Source: Odyssee (www.odyssee-indicators.org).

number of factors, including the technology used, the quality and availability of raw materials and the structure of the industry. Moreover, energy efficiency has been improving in the European iron and steel industry for several decades, in line with industry and the economy as a whole. Over the past 20 years, the energy efficiency of the iron and steel sector has improved by 35 p.c., CO_2 emissions consequently falling by 37 p.c. (Chart 17). These trends must be interpreted with care, as they depend on many different parameters, including the production process used. Part of the gain recorded can thus be attributed to the growth in the use of electric arc furnaces, which consume far less energy than oxygen furnaces[25].

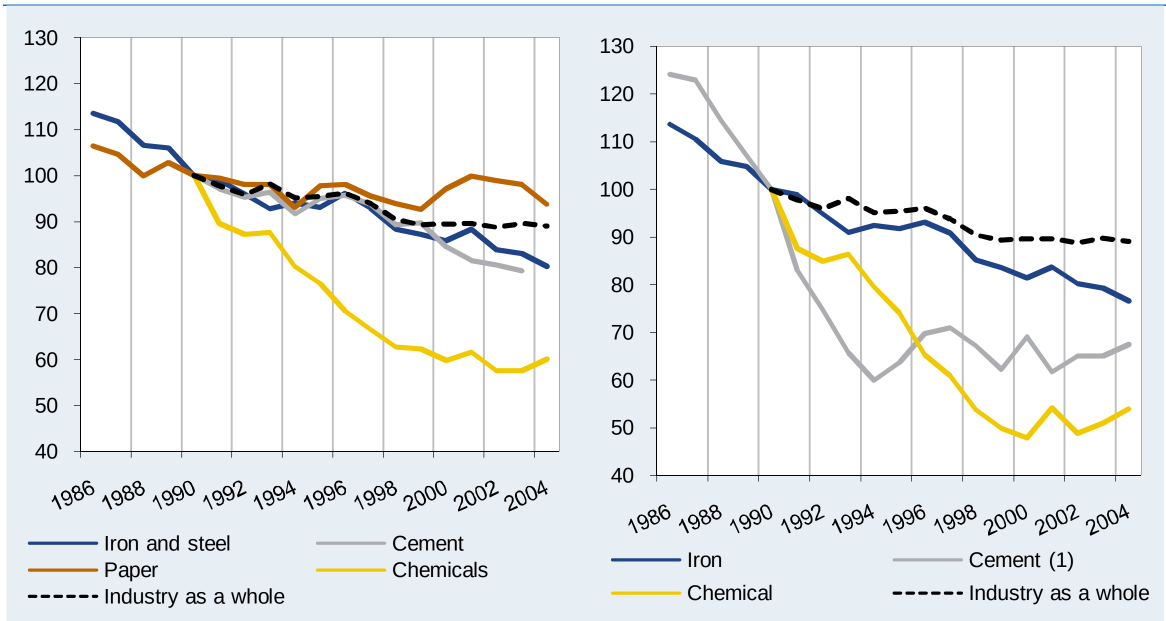
TABLE 8 **ENERGY INTENSITY OF PRIMARY STEEL PRODUCTION IN THE WORLD (2004)**
(Index 100 = the most efficient country)

	Index
Japan	100
Europe	110
United States	120
China	150
India	150
Russia	150

Source: Ministry of Energy, Technology and Industry (2004) and International Energy Agency (2006).

CHART 17 **ENERGY AND CO_2 INTENSITY OF EUROPEAN INDUSTRY**
(Index 1990 = 100, tonnes of energy used or CO_2 emitted per unit of production)

A. ENERGY INTENSITY **B. CO_2 INTENSITY**



Source: Odyssée.
(1) France only.

[25] See ADEME (2007) on this subject.

3 ECONOMIC IMPORTANCE OF THE BELGIAN IRON AND STEEL INDUSTRY

This chapter considers the economic importance of the Belgian iron and steel industry, focusing on the variables of value added, employment and investment. The employment issue is completed by a consideration of the social situation of the sector's companies, in terms of the composition, turnover and training of the salaried staff under review.

3.1 Introduction

3.1.1 *Definition of the sector under review*

The sector under review groups together all iron and steel branches of activity, namely:

TABLE 9 IRON AND STEEL BRANCHES OF ACTIVITY

NACE Code	Definition
27100	Manufacture of basic iron and steel and of ferro-alloys (ECSC[26])
27210	Manufacture of cast iron tubes
27220	Manufacture of steel tubes
27310	Cold drawing
27320	Cold rolling of narrow strips
27330	Cold forming or folding
27340	Wire drawing
27510	Casting of iron
27520	Casting of steel

Source: NBB.

Bearing in mind the respective importance of these different sub-branches, some of them have been grouped together to enable ease of understanding of some tables and charts (cf. breakdown in Table 9):

1. Branch 27100, fundamental to the sector in question, is presented separately under the name manufacture of basic iron and steel and of ferro-alloys;
2. Branches 27510 and 27520 are grouped together in a second category, entitled casting of metals;
3. All the other branches, involving the first processing of steel, are grouped into a third category, entitled other iron and steel branches of activity.

Bearing in mind the clear links - confirmed in Annex 3 - that exist between the activity of the iron and steel industry and the manufacture of non-ferrous metals, on the one hand, and the

[26] European Coal and Steel Community.

manufacture of fabricated metal products, on the other, developments in direct value added, direct employment and investment of these related branches are also given to illustrate the recent period (1995 - 2006). Methodological clarifications can be found in Annex 1.

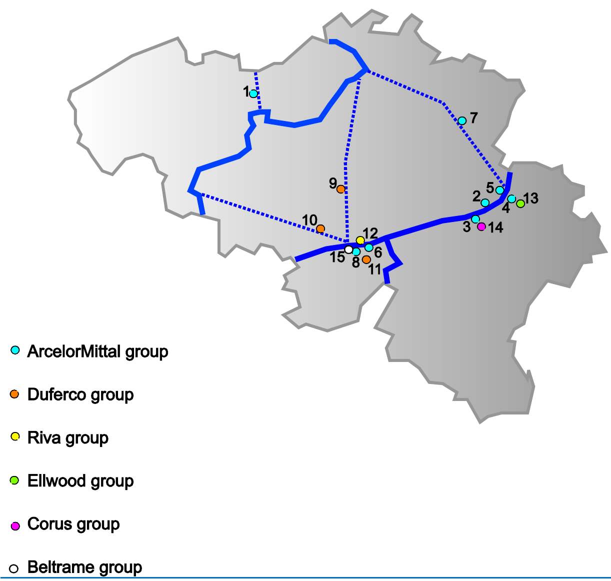
3.1.2 Industrial context

As will be seen from the figures below, the Belgian iron and steel industry is dominated by the ArcelorMittal group, followed by Duferco. Arcelor merged with the Indian steel producer Mittal in 2006. The Arcelor Group itself was formed in February 2002 following the desire of three European steel producers, Spain's Aceralia, Luxembourg's Arbed and France's Usinor, to create a world leader in the steel industry. The ArcelorMittal Group is involved in activities in four main sectors: flat carbon steels, long carbon steels, stainless steels and customized steel upmarket solutions at Arcelor Steel Solutions & Services. Based in the Grand-Duchy of Luxembourg, where it is the largest private employer[27], the group is a top-level operator in five major markets: automotive, construction, household electrical goods, packaging and general industry. ArcelorMittal owns sites at Ghent, Geel, Genk, Liège and Charleroi. Duferco is the second largest steel producer in the country, with a presence since 1997 following the acquisition and reindustrialisation of the Clabecq, La Louvière and Carsid sites, which specialise in hot-rolled strip, coils and wires, and slabs respectively.

As in other industrialised countries, the Belgian iron and steel sector has undergone considerable transformation over the last few decades. In terms of production processes, the share of electric arc furnaces has increased substantially, from 5 p.c. of production in 1980 to 25 p.c. today, due above all to the closure of a large number of oxygen blast furnaces. In terms of products, there has been a move towards flat products (including coated), in other words, high value-added products. Finally, Belgian production is destined primarily for outlets in France (28 p.c.), Germany (19 p.c.) and Belgium (14 p.c.). Only 10 p.c. of production is exported outside the European Union.

[27] The ArcelorMittal Group employs approx. 6,500 people in Luxembourg. Although in structural decline, the iron and steel sector remains the number one manufacturing industry in that country, alone representing almost 3 p.c. of Luxembourg's GDP. Source: STATEC.

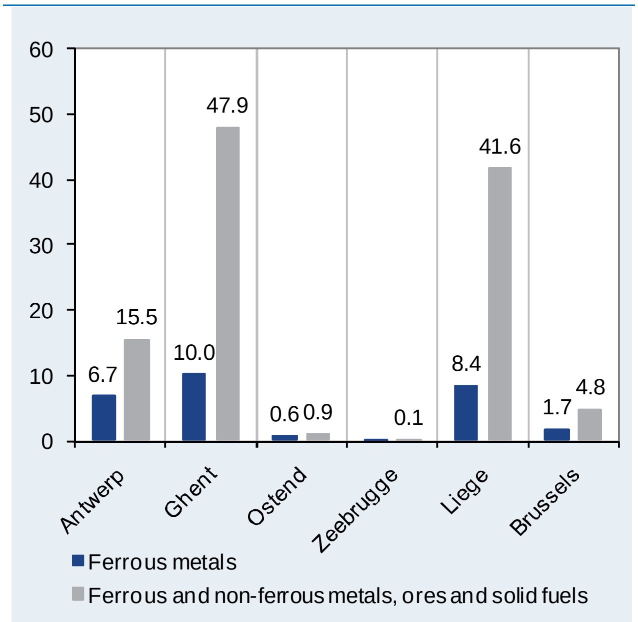
CHART 18	MAP OF STEEL PRODUCTION SITES IN BELGIUM



Source: Steelbel.

The Belgian ports play a major role in transporting the raw materials necessary for steel production and conveying the semi-finished and finished products in transit. The iron and steel sector, along with its associated activities, accounts for a significant proportion of the cargo passing through the ports of Antwerp, Ghent and Liège, as Chart 19 shows.

CHART 19 A. SHARE OF IRON AND STEEL AND OF METALS IN TOTAL PORT TONNAGE
(2007, percentages)



Source: Port companies and Vlaamse Havencommissie.

B. ABSOLUTE FIGURES
(thousands of tonnes)

	Ferrous metals	Ferrous and non-ferrous metals, ores and solid fuels	Total port tonnage
Antwerp	12,244	28,395	182,897
Ghent	2,521	12,023	25,103
Ostend	46	71	7,983
Zeebrugge	6	50	42,078
Liège	1,326	6,568	15,789
Brussels	73	206	4,317

Source: Port companies and Vlaamse Havencommissie.

Antwerp, Belgium's busiest port with 182.9 million tonnes of cargo passing through in 2007, is also considered to be the European port of choice for the steel sector. Apart from the easy access it offers in terms of the import and export of materials necessary for steel manufacture as well as of the sector's finished and semi-finished products, it also represents an important logistical centre in this regard. ArcelorMittal Logistics Belgium thus controls almost 3.5 million tonnes, or 30 p.c. of the steel passing through this Scheldt port. These activities do not currently seem to be threatened in any significant way by the growing strength of the Asian economies, given that the company has geared its production to the very top end, enabling the position of the port, and of the country, to be strengthened in the high value-added steels segment. Steel-related traffic is currently experiencing growth at Antwerp. The same can be said for Ghent (25.1 million tonnes of maritime freight in 2007), which is a very important port for the steel industry (10 p.c. of total tonnage in the same year). A large part of the port's activity is geared to the import of ores and solid fuels (the iron and steel sector and non-ferrous metals, along with raw materials, account for almost 50 p.c. of the tonnages recorded at the port in 2007), a significant amount of which is used by ArcelorMittal Belgium. Major investments in terms of developing sea access are also being considered, such as the forthcoming construction of a new tide gate at the mouth of the sea canal at Terneuzen, in the Netherlands. The Liège port complex (15.8 million tonnes on the public waterways in 2007) is, for its part, closely linked to the birth and history of the iron and steel sector in Belgium. It was at Seraing that the world's largest steel factory was built in the mid-19th century, owned by John Cockerill S.A.. This company, later taken over by the ArcelorMittal Group, was one of the world's leading steel producers for more than a century, before going into decline in the 1970s. Despite the storms buffeting the different Liège-based sites of this steel producer, the Seraing blast furnace (BF)got back on track in early 2008, following the site shutdown in 2005[28]. Despite this temporary suspension of activity, the steel produced in the Liège region in 2007 accounted for no less than 8.4

[28] This reopening was linked to the explosion in world demand that was occurring up until the start of 2008. This has declined somewhat since September, leading the ArcelorMittal management team to forecast a fall of 15 p.c. in its European production and to decide, on 23 October 2008, to close BF No. 6 temporarily. This should reopen at the end of February 2009. These downward revisions of Cockerill's production do not, however, call into question the modernisation plans for the Chertal facilities.

p.c. of the total tonnage passing through the port, and if all of the iron and steel and metals production and the raw materials necessary for steel production are added, this proportion, which is also up, came to almost 42 p.c. In other words, the three ports mentioned above depend on the health of the iron and steel sector. The ports of Brussels, Ostend and Zeebrugge focus more on other segments of sea and inland water transport, and tonnages relating to the iron and steel sector and related industries are therefore limited.

The following analysis focuses on the results published by Belgian steel producers for the period 2000 - 2006.

3.2 Direct value added

3.2.1 Trends

TABLE 10 **DIRECT VALUE ADDED IN THE IRON AND STEEL INDUSTRY**
(millions of euro – current prices, unless otherwise stated)

	Year							
Sector	1995	2000	2003	2005	2006	Relative importance in 2006 (in p.c.)	Change 2005 to 2006 (in p.c.)	Average annual change from 1995 to 2006 (in p.c.)
Manufacture of basic iron and steel and of ferro-alloys	1,818.3	1,763.2	1,569.7	2,153.4	2,437.3	79.6	+13.2	+2.7
Casting of metals	131.2	138.2	141.4	141.9	143.7	4.7	+1.2	+0.8
Other iron and steel branches of activity	585.2	453.7	402.6	455.6	480.4	15.7	+5.5	-1.8
Iron and steel sector	***2,534.6***	***2,355.1***	***2,113.8***	***2,750.9***	***3,061.5***	***100.0***	***+11.3***	***+1.7***
p.m., p.c. of total economy	*1.2*	*0.9*	*0.8*	*0.9*	*1.0*			
For information:								
Non ferrous	*674.4*	*926.2*	*779.8*	*731.9*	*763.6*		*+4.3*	*+1.1*
Manufacture of fabricated metal products	*2,550.5*	*2,993.3*	*3,156.6*	*3,359.1*	*3,447.1*		*+2.6*	*+2.8*
Total iron, steel and metals	**5,759.5**	**6,274.5**	**6,050.1**	**6,841.9**	**7,272.2**		**+6.3**	**+2.1**

Source: NBB (calculations based on annual accounts filed at the Central balance sheet office.

Among the different iron and steel branches of activity can be distinguished branch 27.1 (manufacture of basic iron and steel and of ferro-alloys), casting of metals (iron and steel) and other iron and steel branches of activity (see list Table 8). On average, the value added (VA) of the Belgian iron and steel industry has increased by 11.3 p.c. at current prices in 2006, or 19.3 p.c. at constant prices (see explanation in Box 2).

Box 2 Measurement of value added in volume (*)

In general, most readers would expect that the increase of the VA at current prices would be higher than the increase at constant prices. We see however the opposite. The explanation can be found in the nature of the concept of VA itself which relates to the difference between production and the intermediate consumption of goods and services. In terms of intermediate consumption, raw materials continued to rise, quite spectacularly. In terms of turnover, the relative decline of casting (blast furnaces) should be noted, although still predominant in Belgium, and the subsequent increase in low-price steel imports from Asian countries, which has resulted in some downward pressure on the prices of finished products, tempering the upward effects noted in previous years. The increase in the sale price of steel, significant as it was, remained below the trend observed in the price of raw materials in 2006. This combination of effects automatically resulted in a relative deflation of value added.

(*) In terms of the national accounts system, value added in volume is obtained by deflating (i.e. excluding price effects) the nominal value added.

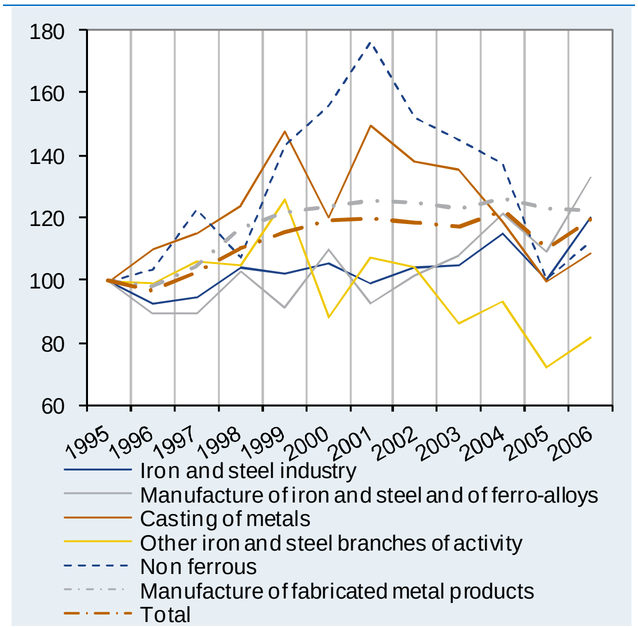
Over the period 1995 – 2006 as a whole, average annual growth was 1.7 p.c. at current prices (Table 10), in line with that noted in constant prices.

In branch 27.1 (+13.2 p.c.), and more specifically within the ArcelorMittal Group, ArcelorMittal Belgium saw its VA increase by 31.9 p.c. in 2006 while Cockerill Sambre’s fell by 73.5 p.c. This ‘communicating vessels’ effect can be explained by the book transfer of activities between the two structures, the first having absorbed, in 2006, most of the hot activities previously accounted for by the legal entity of Cockerill Sambre. The latter also experienced operating losses in 2006, particularly due to the closure of blast furnace no. 6 at Seraing in April 2005, and the loss of resulting activity. In the end, flat carbon activities at Liège and Ghent experienced a slight decline in VA (-3.3 p.c. at current prices). The VA of ArcelorMittal-Stainless Belgium (ex-Ugine & ALZ Belgium), also belonging to the ArcelorMittal Group, more than doubled, due particularly to the merger of U&A Belgium (Genk) and U&A Carinox (Charleroi) in 2006 and to a significant increase in turnover, which resulted in a net increase in VA of 18.6 p.c. This growth can also be attributed to the start-up, in September 2005, of the new steel plant at the Carinox site. These new facilities offer a production capacity of one million tonnes of stainless steel for this integrated site which represents, along with the Genk steel plant, the company’s upstream focus. The VA of Industeel Belgium, another member of the same group, also grew. The main companies in the Duferco Group had differing fortunes: an increase for Duferco Clabecq, whose profits are up, and Carsid, supported by higher staff numbers, but a decline for Duferco La Louvière. An increase was also recorded for Thy Marcinelle (Riva Group).

In the casting of steel (+1.2 p.c.), a significant increase was noted for Magotteaux Liège, whose operating profit is rising, the overall balance sheet looking very positive for all the Liège sites. The VA of Bekaert (wire drawing) remained unchanged.

By way of comparison, VA in non-ferrous metals increased by 4.3 p.c. at current prices: the declines observed at Umicore - a shift of its employment towards new divisions Zinc Alloys and Cumerio Belgium, both outside the reviewed branches, partly offset by increased profits - and Hayes Lemmerz België, contrasted with increases at Metallo Chimique and Sapa RC. VA in the manufacture of fabricated metal products grew by only 2.6 p.c., the increases observed at Dalkia, Cockerill Maintenance et Ingénierie, Betafence NV and Fabricom GTI Industrie Sud, being insufficient to offset the 13 p.c. fall noted at Fabricom GTI, due largely to a decline in staff numbers and an operating loss. In 2006, the iron and steel sector's value added accounted for 1 p.c. of the country's economic activity (GDP), an increase on the previous year (0.9 p.c.). This was still lower than in 1995, however, when it amounted to 1.2 p.c.

CHART 20 COMPARATIVE CHANGE IN VALUE ADDED, FROM 1995 TO 2006
(constant prices)

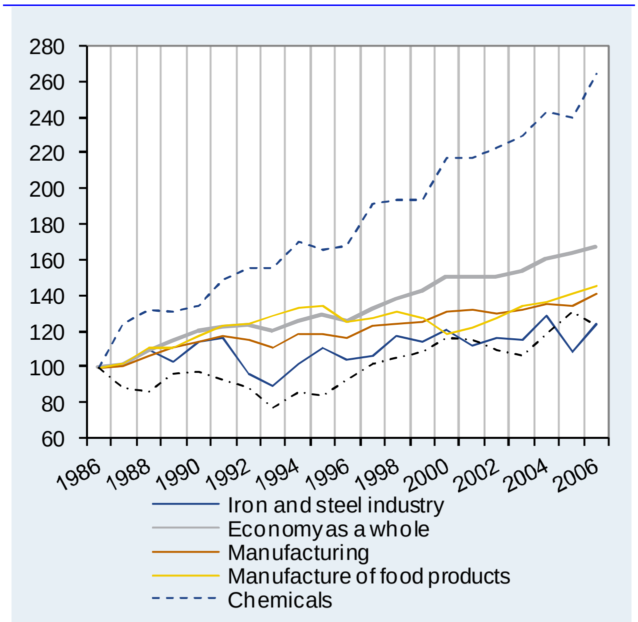


Source: NBB and own calculations.

Excluding the effects of inflation, the iron and steel sector's value added has increased slowly and rather erratically since 1995, as can be seen from Chart 20. This is nothing new, since significant changes were also noted over the course of the previous decade, as shown in Chart 20. The variability seems, however, to have intensified in recent years, with strong growth in 2004 in iron and steel, the manufacture of steel tubes and wire drawing in particular, the latter two seeing their VA decline considerably the following year. The total then increased once more in 2006 (cf. above). The sector did not experience an increase similar to that of non-ferrous metals over the 1999 to 2001 period, however, and this can be explained primarily by the good results, significant investments since 1997 and considerable increase in the production in the branches covering the first processing of aluminium, and lead, zinc and tin production. As for the manufacture of fabricated metal products branch, its VA increased moderately, particularly between 1996 and 2001.

Within the iron and steel industry, it seems to be the casting of metals branches which recorded the sharpest increases, bolstered particularly by companies focusing on the casting of steel. The same can be said for the cold drawing and manufacture of steel tubes branches. Trends in the VA of the casting of iron and wire drawing branches are also similar.

CHART 21 CHANGE IN VALUE ADDED IN COMPARISON WITH OTHER MANUFACTURING SECTORS, FROM 1986 TO 2006
(constant prices)



Source: NBB and own calculations.

Following the decline that began in the late 1970s and early 1980s, the trend in the iron and steel sector's value added as given in Chart 21 shows, since 1986, a number of peak periods for the industry. A slight recovery in activity can be observed at the end of the 1980s, following by the recession of 1992 and 1993, before a recovery at the end of the 1990s – a return to 1986 levels was not seen until 1995 - and the start of the 2000s. At the end of the period movements were more erratic. Movements recorded in terms of the average for the manufacturing branches were more moderate. Manufacture of food products, chemicals and automotive are the three other main Belgian industries, the first of these experiencing almost continual growth, the second a strong increase - albeit erratic - between 1996 and 2000 and the third a period of decline followed by a return to positive values. These four industries are key sectors of our economy and, at least as far as the chemicals and automotive industries are concerned, these are capital and energy-intensive as well as largely export-oriented industries. The economic impact up to 1990 was around 2 p.c. of GDP, before falling again at the start of the 1990s (cf. above).

3.2.2 Concentrations

TABLE 11 TOP 20 FOR VALUE ADDED IN THE IRON AND STEEL INDUSTRY IN 2006
(millions of euro)

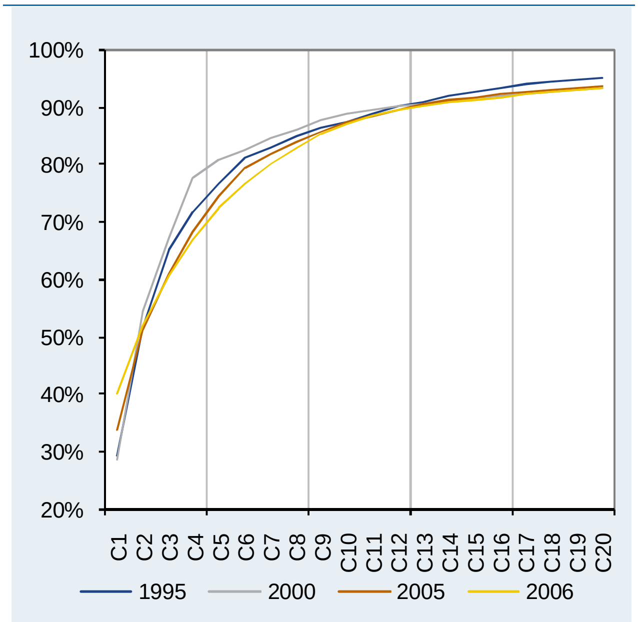
Position	Company name	Sector	Group	Value added
1	ArcelorMittal Belgium	Manufacture of basic iron and steel and of ferro-alloys	ArcelorMittal	1,224.2
2	ArcelorMittal-Stainless Belgium	Manufacture of basic iron and steel and of ferro-alloys	ArcelorMittal	359.4
3	NV Bekaert SA	Wire drawing	Bekaert	266.6
4	Duferco Clabecq	Manufacture of basic iron and steel and of ferro-alloys	Duferco	189.7
5	Industeel Belgium	Manufacture of basic iron and steel and of ferro-alloys	ArcelorMittal	172.0
6	Cockerill Sambre	Manufacture of basic iron and steel and of ferro-alloys	ArcelorMittal	128.2
7	Duferco La Louvière	Manufacture of basic iron and steel and of ferro-alloys	Duferco	106.5
8	Carsid	Manufacture of basic iron and steel and of ferro-alloys	Duferco	84.9
9	Thy Marcinelle	Manufacture of basic iron and steel and of ferro-alloys	Riva	77.1
10	Sadef	Cold forming or folding	Voestalpine	50.3
11	Sadaci	Manufacture of basic iron and steel and of ferro-alloys	Molymet	44.8
12	Magotteaux Liège	Casting of steel	Magotteaux	31.6
13	Bekaert Hemiksem	Wire drawing	Bekaert	23.6
14	Europese Staal Prefabricatie	Cold rolling of narrow strips	ArcelorMittal	18.3
15	Intersig	Wire drawing		15.9
16	Proferro	Casting of iron	Picanol	13.5
17	Arcelor Tailored Blank Liège	Casting of steel	ArcelorMittal	13.0
18	Arcelor Packaging Belgique	Manufacture of steel tubes	ArcelorMittal	13.0
19	Longtain	Manufacture of steel tubes	Condesa	11.6
20	Laminoirs du Ruau	Manufacture of basic iron and steel and of ferro-alloys	Beltrane	11.3
	TOTAL for top 20			**2,855.4**

Source: NBB and own calculations

The iron and steel sector in Belgium is dominated by the ArcelorMittal and Duferco groups (Table 11 and explanations above), the two of them accounting for almost three-quarters of the sector's value added. Following Arcelor's merger with the Indian giant Mittal in 2006, Arcelor Steel Belgium was recently renamed ArcelorMittal Belgium now includes, under the same name, plate carbon activities in Gent (former Sidmar), Liège, Genk, La Praye and Geel.[29] This also explains the widening gap between this group and the rest of the top 20. ArcelorMittal-Stainless Belgium, which also forms part of the ArcelorMittal Group, has benefited from the rapid increase in prices of ferro-alloys (stainless steel and nickel), an area in which it is one of Belgium's leaders, to obtain an excellent result (a more than four-fold increase in the year's profits), this increase in value added also being attributable to the merger of the Genk and Charleroi entities[30] (cf. above). Next comes Bekaert, a leader in wire drawing, followed by Duferco Clabecq, Industeel and Cockerill Sambre, all three classified within the manufacture of basic iron and steel and of ferro-alloys branch of activity.

The iron and steel industry, like any capital-intensive industry, is highly concentrated in terms of activity. In fact, if one considers the top ten companies in this table, their combined value added accounts for 86.8 p.c. of the sector's direct value added (cf. Table 9). The top 20 (with 2.9 billion euro) represent 93.3 p.c. of direct VA. The following chart illustrates the trends in concentration of value added in the iron and steel sector between 1995 and 2006.

CHART 22 CONCENTRATION OF VALUE ADDED IN THE IRON AND STEEL SECTOR, HISTORICAL COMPARISON
(millions of euro – current prices)



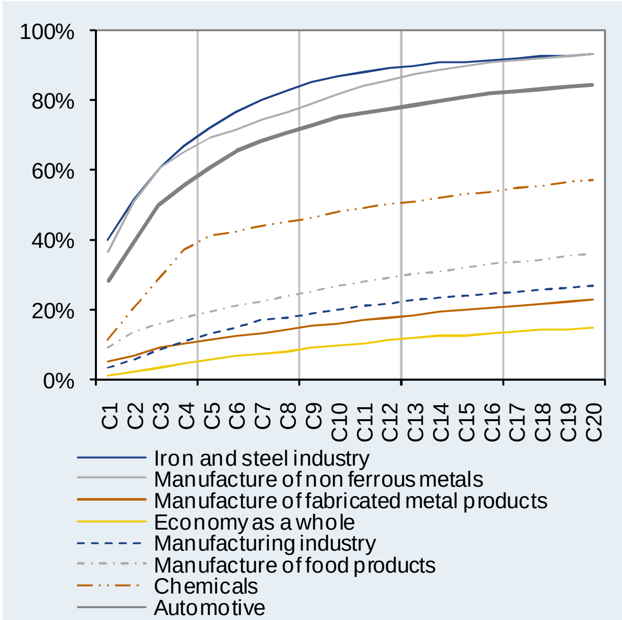
Source: NBB.

[29] More information can be found at www.arcelor.com.

[30] But not only, since the cumulative VA of the two companies prior to merger (2005) was 221.5 million euro and it increased, after merger in 2006, to 359.4 million euro.

The concentration of activity within the iron and steel industry is, from the point of view of direct value added, quite high, since, in 2006, the leading company, after its restructuring to ArcelorMittal Belgium, more than ever dominated and generated 40 p.c. of total value added. In 2000, this percentage was under 30 p.c., although the four largest companies were responsible for nearly 80 p.c. of the wealth produced by the sector, as opposed to less than 70 p.c. in 2006 (Chart 22). In terms of the relative impact of the twenty companies producing the most value added, this has varied little: 93.3 p.c. in 2006 (cf. above), it amounted to between 93 and 94 p.c. in 2000 and 2005, and only recorded a higher total in 1995 (95 p.c.).

CHART 23 CONCENTRATION OF VALUE ADDED IN THE IRON AND STEEL SECTOR IN 2006, IN COMPARISION WITH OTHER MANUFACTURING BRANCHES OF ACTIVITY
(millions of euro – current prices)



Source: NBB.

Chart 23 shows, for 2006, the concentration of iron and steel industry activity, in comparison with that of other metals branches, the economy as a whole, the manufacturing industry in general and also some specific industrial branches of activity, such as the manufacture of food products, chemicals and automotive industries, as these are the most significant in the country[31]. It clearly emerges that the activity under review is particularly highly concentrated, broadly comparable to the manufacture of non-ferrous metals branch of activity. The automotive industry is itself quite concentrated but less pronounced, while activity appears more dispersed within the chemicals

[31] The economy as a whole is logically less concentrated than its separate sectors. This remarks also applies to other concentration charts.

industry and even more so in the manufacture of food products industry and in the manufacture of fabricated metal products branch.

3.3 Direct employment and social balance sheet

3.3.1 Direct employment

3.3.1.1 Trends

TABLE 12 **DIRECT EMPLOYMENT IN THE IRON AND STEEL INDUSTRY**
(FTE, unless otherwise stated)

	Year							
Sector	1995	2000	2003	2005	2006	Relative importance in 2006 (in p.c.)	Change 2005 to 2006 (in p.c.)	Average annual change from1995 to 2006 (in p.c.)
Manufacture of basic iron and steel and of ferro-alloys	22,672	20,571	18,468	17,498	17,962	70.9	+2.7	-2.1
Casting of metals	3,011	2,602	2,535	2,454	2,135	8.4	-13.0	-3.1
Other iron and steel branches of activity	8,904	6,114	5,353	5,100	5,238	20.7	+2.7	-4.7
Iron and steel industry	***34,587***	***29,287***	***26,356***	***25,052***	***25,335***	***100.0***	***+1.1***	***-2.8***
p.m., p.c. of total salaried workforce	*1.1*	*0.9*	*0.8*	*0.7*	*0.6*			
For information:								
Non ferrous	*10,537*	*9,931*	*9,707*	*9,056*	*8,845*		*-2.3*	*-1.6*
Manufacture of fabricated metal products	*54,589*	*55,609*	*55,521*	*56,057*	*54,105*		*-3.5*	*-0.1*
Total	**99,713**	**94,826**	**91,584**	**90,166**	**88,285**		**-2.1**	**-1.1**

Source: NBB.

Between 1995 and 2006, employment in the iron and steel industry recorded an average annual decline of 2.8 p.c. From 2005 to 2006, however, staff levels in the companies under review increased by 1.1 p.c. (Table 12).

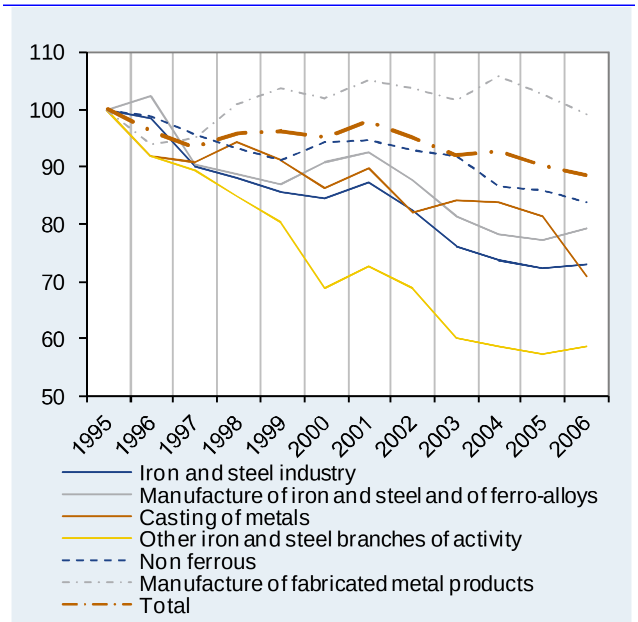
This increase in labour can firstly and primarily be explained by the incorporation into ArcelorMittal Belgium of plate carbon activities in Gent, Liège, Genk, La Praye and Geel. This means that ArcelorMittal Belgium’s staff levels soared (+45.1 p.c.), while those of Cockerill Sambre fell by half from an accounting point of view. Additionally, the staff levels for flat carbon as a whole increased by 1.9 p.c. The 186 p.c. increase observed at ArcelorMittal-Stainless Belgium was simply a consequence of the merger of Genk & Charleroi, the net change between pre- and post-merger being negative, however (from 2,206 to 2,159 FTE). An increase in staff levels was, however, noted in Industeel. Within the Duferco group, staff levels rose, particularly within Duferco La Louvière and Carsid, while they remained at their 2005 level in Duferco Clabecq.

Employment fell slightly in the casting of metals branches, for example at Magotteaux Liège, while it increased in other iron and steel branches of activity such as at Bekaert (wire drawing).

By comparison, employment fell in the non-ferrous metals branches of activity, both at Umicore - see comments at section 3.2.1 -, Hayes Lemmerz België (parts manufacturer for the car industry, which closed its Belgian factory in 2008, to relocate activities in Germany) and at SAPA RC Profiles, despite an increase in Cumerio Belgium. In the production of fabricated metal products branches, staff levels fell, among others, at Fabricom GTI, while they increased particularly at Cockerill Maintenance et Ingénierie.

In 2006, iron and steel industry employment accounted for 0.6 p.c. of the country's total salaried workforce, compared to 1.1 in 1995.

CHART 24 COMPARATIVE TRENDS IN EMPLOYMENT, FROM 1995 TO 2006
(FTE)

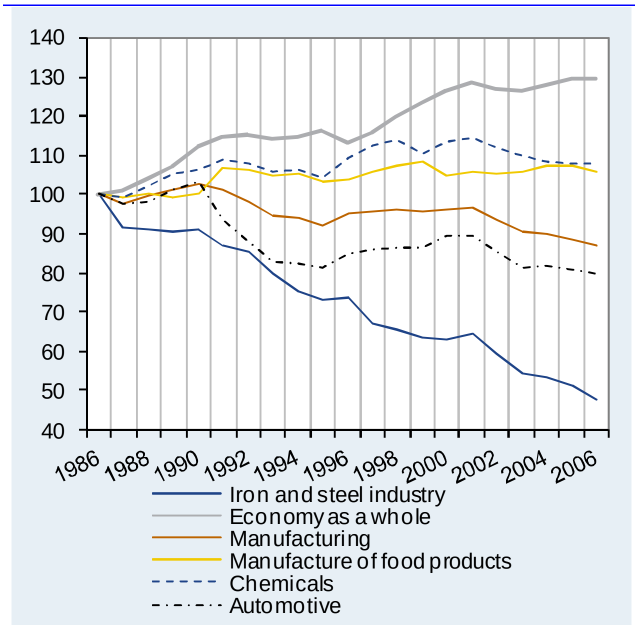


Source: NBB and own calculations.

The decline in employment seems to have been greater in the iron and steel industry than in the non-ferrous metals and fabricated metal products branches of activity, the latter branch even maintaining employment at 1995 levels (Chart 24). Within the iron and steel branches of activity, it was those grouped together as 'other iron and steel branches' that suffered the heaviest job losses.

Such was the case particularly of the cold drawing and cold rolling branches. As far as the casting of metals branch is concerned, the casting of steel held up well while the casting of iron suffered steady losses. The pattern observed in terms of value added trends also applies to employment between the wire drawing and casting of iron branches of activity.

CHART 25 COMPARATIVE TRENDS IN EMPLOYMENT IN RELATION TO OTHER BRANCHES OF MANUFACTURING, FROM 1986 TO 2006
(FTE)



Source: NBB and own calculations.

This observation is even clearer for the 1986 - 2006 period (Chart 25), where the collapse in employment in the iron and steel industry was substantially worse than the average recorded for manufacturing industry and, for example, the manufacture of food products, chemicals and even automotive industries in particular. In 1986, the sector still represented 1.6 p.c. of national employment; by 1990 this had dropped to 1.4 p.c., before falling below the 1 p.c. mark in the 1990s (cf. above). This chart seems to confirm the deindustrialisation that our country has been experiencing for more than twenty years, national employment (in the economy as a whole) having increased, in contrast to employment in the manufacturing sectors.

3.3.1.2 Concentrations

The ArcelorMittal and Duferco groups also dominate the iron and steel industry in terms of employment (Table 13) since, between them, they employ approximately 70 p.c. of the sector's labour force. Following the movements that took place within the ArcelorMittal Group, to the advantage of the ArcelorMittal Belgium structure, the latter accounted for no less than 8,146 FTE in 2006. The other companies in this table are, with few exceptions, the same as those in the top 20 for VA. Among the front runners are Bekaert SA, Cockerill Sambre, ArcelorMittal-Stainless Belgium, Duferco La Louvière and Industeel Belgium.

TABLE 13 **TOP 20 EMPLOYERS IN THE IRON AND STEEL INDUSTRY IN 2006**
(FTE)

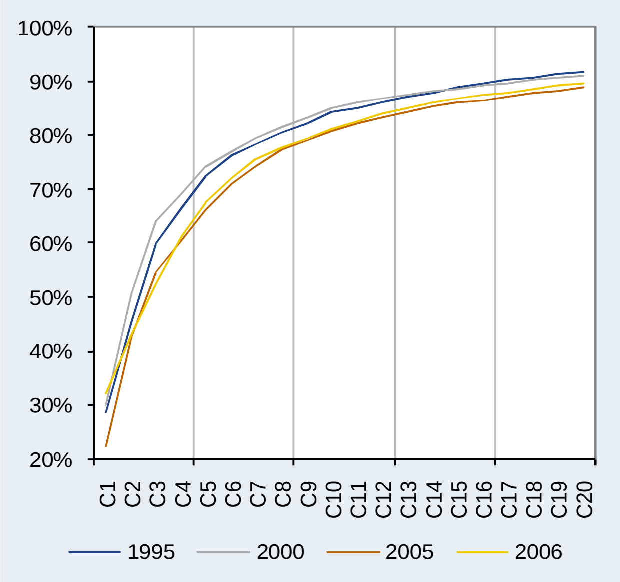
Position	Company name	Sector	Group	Staff
1	ArcelorMittal Belgium	Manufacture of basic iron and steel and of ferro-alloys	ArcelorMittal	8,146
2	NV Bekaert SA	Wire drawing	Bekaert	2,741
3	Cockerill Sambre	Manufacture of basic iron and steel and of ferro-alloys	ArcelorMittal	2,386
4	ArcelorMittal-Stainless Belgium	Manufacture of basic iron and steel and of ferro-alloys	ArcelorMittal	2,206
5	Duferco La Louvière	Manufacture of basic iron and steel and of ferro-alloys	Duferco	1,589
6	Carsid	Manufacture of basic iron and steel and of ferro-alloys	Duferco	1,177
7	Industeel Belgium	Manufacture of basic iron and steel and of ferro-alloys	ArcelorMittal	881
8	Duferco Clabecq	Manufacture of basic iron and steel and of ferro-alloys	Duferco	500
9	Sadef	Cold forming or folding	Voestalpine	476
10	Magotteaux Liège	Casting of steel	Magotteaux	407
11	Arcelor Packaging Belgique	Manufacture of steel tubes	ArcelorMittal	400
12	Bekaert Hemiksem	Wire drawing	Bekaert	308
13	Thy Marcinelle	Manufacture of basic iron and steel and of ferro-alloys	Riva	285
14	Proferro	Casting of iron	Picanol	263
15	Europese Staal Prefabricatie	Cold rolling of narrow strips	ArcelorMittal	163
16	ESCO Turbine Technologies-Belgium	Casting of steel		159
17	Precimetal Fonderie De Précision	Casting of steel	Manoir Industries	154
18	Sadaci	Manufacture of basic iron and steel and of ferro-alloys	Molymet	143
19	Laminoirs du Ruau	Manufacture of basic iron and steel and of ferro-alloys	Beltrame	139
20	Magolux	Casting of steel	Magotteaux	130
	Total for top 20			**22,655**

Source: NBB and own calculations.

Less concentrated than value added, most employment in the steel industry is however generated by the sector's largest players, as shown in this table. The ten largest companies thus account for no less than 81 p.c. of the steel sector's direct employment, the 22,655 FTE employed by this top 20 accounting for 89.4 p.c. of total sector employment.

Chart 26 illustrates the trend in concentration of employment in the steel industry between 1995 and 2006.

CHART 26 CONCENTRATION OF EMPLOYMENT IN THE IRON AND STEEL INDUSTRY, HISTORICAL COMPARISON
(FTE)

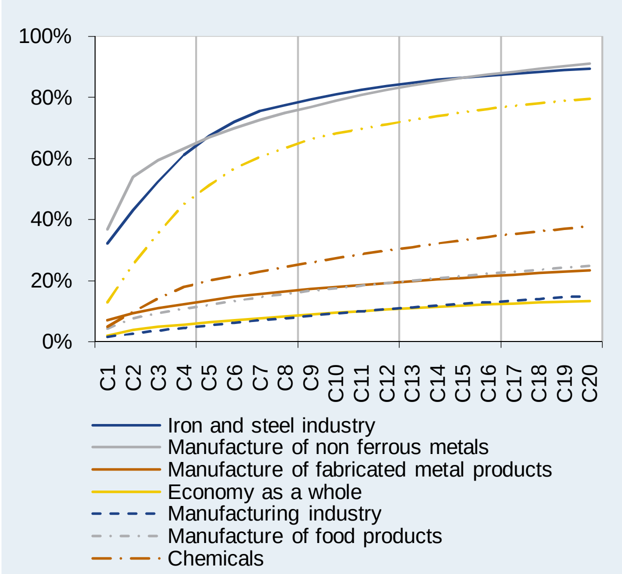


Source: NBB.

As with value added, while the largest steel company accounted for more activity, and thus more staff, in 2006 than in previous years, the opposite was the case for all the largest sector companies put together, since the 1995 and 2000 curves are (on the basis of the total of the top three companies in any case) always above those of 2005 and 2006 (Chart 26).

Chart 27 highlights the level of concentration of salaried workers in the iron and steel industry in 2006, in comparison to the levels observed in the other metals branches, in the economy as a whole, in the manufacturing industry in general and also in some specific industrial branches of activity, such as the manufacture of food products, chemicals and automotive industries, these being the most significant in the country. It is clear from this that employment is particularly highly concentrated in the activity under review, with a level very similar to that noted in the manufacture of non-ferrous metals branches. Again, as found with value added, most employment in the automotive industry is accounted for by the top five sector companies, while jobs are more dispersed in the chemicals industry and even more so in the manufacture of food products industry and that covering the manufacture of fabricated metal products.

CHART 27 CONCENTRATION OF EMPLOYMENT IN THE IRON AND STEEL INDUSTRY IN 2006, IN COMPARISON WITH OTHER MANUFACTURING BRANCHES
(FTE)



Source: NBB.

3.3.2 Social balance sheet

The social balance sheet covers various aspects of employment in the company: the appointment and composition of the staff, the contractual status and educational level of the salaried employees, staff costs, training policy and reasons for termination of contract. The results set out below, which relate to direct employment in the iron and steel branches of activity, are not exhaustive. They relate to a constant sample[32] defined for the whole of the period 2004 - 2006.

Three dimensions of employment are analysed here: the type of contract and the composition of companies' salaried staff, the staff movements during the financial year, and the training policy. Table 14 summarises the main developments recorded between 2004 and 2006.

[32] The constant sample was defined based on businesses which, over the 2004 – 2006 period as a whole, filed their accounts according to the full presentation and filled in the headings of the "social balance sheet" annex of the annual accounts necessary for this report. This constant sample involves 32.5 p.c. of the population of the businesses under review in 2006, and 95.3 p.c. of the direct employment under consideration in this report in the same year.

TABLE 14 SOCIAL BALANCE SHEET IN THE IRON AND STEEL INDUSTRY
(percentages)

-	2005	2006
Own human resources: changes relative to the previous year		
Full time hours worked	-3.1	+7.2
Corresponding costs	+1.2	+8.5
Part time hours worked	+4.0	+7.1
Corresponding costs	+31.6	+4.9
Total hours worked	-2.8	+7.2
Corresponding costs	+1.9	+8.4
Hourly paid staff costs (in euro per hour)**:**		
Hourly paid staff costs	41.7	42.2
*National average costs of hourly paid staff **	*32.1*	*33.1*
External human resources: changes relative to the previous year		
Hours worked by hired temporary staff	-17.3	+23.9
Hours worked by hired temporary staff and staff placed at the company's disposal	-15.9	+39.4
Corresponding costs	-20.4	+59.8
External human resources: compared to total hours worked by own staff		
Hours worked by hired temporary staff	3.8	4.4
Hours worked by staff placed at the company's disposal	0.1	0.7
Staff movements: changes relative to the previous year		
New contracts	-23.1	+246.1
Terminations of contracts	-20.6	+181.2
Reasons given for terminations of contracts:		
Retirement	4.1	1.8
Early retirement	25.7	16.5
Dismissal	8.8	2.6
Other reasons	61.3	79.2
Training		
Percentage of employees taking part in training courses during the year (total)	59.8	59.8
*National average percentage of employees taking part in a training course during the year **	*40.4*	*40.9*
Percentage of hours worked set aside for training programmes (total)	2.2	1.8
Average number of hours devoted per employee involved in training	54.5	45.1
Average percentage of staff costs allocated to training programmes (total)	2.1	2.1
Training: changes relative to the previous year		
Average number of hours of training among the men involved	+3.9	-18.2
Corresponding costs per employee involved	*-12.4*	*+5.7*
Average number of hours of training among the women involved	-22.8	+27.2
Corresponding costs per employee involved	*-13.9*	*+30.6*

Source: NBB (full presentations only). * The national data originate from Heuse P., Ph. Delhez and H. Zimmer (2007): these figures were calculated for a reduced population over the period 2005 - 2006.

o Types of contract and human resources

At the closing date of the financial year 2006, there were on average three blue-collar workers (2.77) per employee in the iron and steel industry. This ratio tends to decline in all of the branches under review, except for casting of metals, but remains relatively high. It is a feature of this industry. The proportion represented by women among salaried staff tends to rise, since it is up from 5.5 p.c.

in 2004 to 5.8 p.c. two years later. This movement is observable in the majority of the branches under review, except for casting of metals. In 2006, the number of hours worked in companies eligible for the social balance sheet study increased by 7.2 p.c., this rise being attributable both to full time work and to part time work (Table 14).

The number of hours worked in the majority of the iron and steel branches of activity rose in 2006, with the exception of the casting of metals and wire drawing branches (other iron and steel branches of activity). Staff costs rose in broadly the same way, but increased markedly in certain sectors, whilst declining in real terms in the two above-mentioned branches. Thus staff costs rose, on average, by 8.4 p.c. from 2005 to 2006.

The proportion represented by full-time employment in the total labour force employed in 2006 was 96.7 p.c., unchanged from the previous year but slightly less than in 2004 (97 p.c.). Hourly staff costs amounted to 42.2 euro in 2006 (higher than the national average of 33.1 euro), compared to 41.7 euro the previous year. The average cost per FTE amounted to 63,885 euro, a rise of 4.4 p.c. compared to 2005 and markedly higher than the national average (50,667 euro in 2006[33]). This high level is attributable to the range of measures taken recently to accompany certain restructurings in the sector. The Delta Programme rolled out in the years 2002 - 2003 by Arcelor is an example of this, since it put forward a proposal for the revaluation of the amounts of the early retirement allowance and the introduction of a performance assessment plan, with an obvious budgetary impact. After the provisional closure of the Seraing blast furnace in 2005, a 3-Year-Plan was introduced, detailing in particular the whole range of measures to be taken until the complete shutdown of the furnace, at that time planned for 2009[34]: engineering closure, social mobility – reclassification and training of the staff involved – technical performance and communication.

The provision of work by external staff was up sharply in 2006. The numbers of hours worked by hired temporary staff and staff placed at the company's disposal rose by 23.9 p.c. and by more than 500 p.c. respectively. The development in the first category is distributed across all branches, except for wire drawing, and is the result of the decline observed in the previous year, while the six-fold increase in the second corresponds in particular to the additional recruitment of tens of employees placed at the disposal of companies engaged in the manufacture of basic iron and steel and of ferro-alloys, casting of steel and manufacture of steel tubes, whose impact on the percentages is all the greater because in terms of hours worked this category accounts for only 0.7

[33] Annual average calculated for a reduced population.

[34] In the meantime the option of starting up the hot phase at Liège again was considered and actually implemented on 26 February 2008 by starting up the Seraing No. 6 blast furnace again. Market conditions (rise in prices, transport costs, etc.) are responsible for this change of direction. Nonetheless, this decision remains hypothetical in the longer term, in particular due to the increasing environmental restrictions affecting the sector in Europe and especially in Belgium.

p.c. of the total hours worked by own staff, compared to 4.4 p.c.[35] for hired temporary staff. In the same way, there was a large increase in the costs associated with the appointment of external staff, as also shown by Table 14.

- Staff movements

The number of employees (in FTE) appointed more than tripled in 2006 compared to the figure published the previous year. Permanent contracts are the ones that have seen the largest increase, mainly in the branches covering the manufacture of basic iron and steel and of ferro-alloys and the manufacture of steel tubes and cast iron tubes. Consequently, permanent contracts as a proportion of total contracts signed increased on average to 82.4 p.c. in 2006 compared to 53.2 p.c. a year earlier. These appointments were largely offset by terminations of contracts. Moreover, the branches mentioned above also show the highest number of contract terminations during the same financial year, leading to a greatly increased average turnover rate[36] for the iron and steel industry: 22.5 p.c., compared to 7.9 p.c. in 2005 (national average: 14.3 p.c. in 2006).

Regarding the details of recruitment classified by sex and educational level, the finding is clear: women remain a minority of the appointments since they represent only 7.7 p.c. of new contracts in 2006 (a level equivalent to those of the two previous years). In both cases, holders of a Certificate of Secondary Education remain the main beneficiaries of these new contracts, even though the profiles are more varied among the women, who are on average better qualified than their male colleagues, and even though the main increase in recruitments relates to candidates who hold a certificate of higher education, both university and non-university. These observations are borne out in the majority of the branches under review: in 2006, more than 21 p.c. of male recruitments were accounted for by holders of university or non-university diplomas of higher education, compared to 16 p.c. in 2004; among the women, this percentage rose from 44 to 56 p.c. in two years. These trends, which are the result of the technological development taking place in the sector, have naturally brought about a relative decline in recruitments of less qualified staff.

Regarding contract terminations, the fact that they almost tripled is also largely attributable to permanent contracts, which accounted for 89.1 p.c. of the total in 2006 compared to just under 72 p.c. in the previous year. The main reasons given, at more than 79 p.c. of the total, continue to be “other reasons”[37]. The relative increase in this category is obvious whilst dismissals and retirements are in relative decline. While the numbers taking early retirement were still running at a high level in

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[35] This percentage is quite close to that seen in the national average (4.8 p.c. in 2006, reduced population).

[36] The ratio between, on the one hand, the number of departures recorded during t and, on the other, the staff numbers observed at the end of the financial year t minus entries and plus departures recorded during the financial year. For further information, see Heuse P., Ph. Delhez and H. Zimmer (2007).

[37] Essentially voluntary departures and terminations of temporary contracts.

2006, as a result of the major restructuring operations under way, particularly in the branch covering the manufacture of basic iron and steel and of ferro-alloys, they are rather overshadowed by the increase in "other reasons".

- Training

The proportion of men taking part in training courses in 2006 remained quite stable at 60.5 p.c. (a slight reduction, –0.1 p.c.) whereas that for women remained below the 50 p.c. mark, although it increased slightly (from 47.2 to 48.7 p.c.). Furthermore, the women involved devoted more time to training (+27.2 p.c.) while the men spent less time individually (–18,2 p.c.), which contributed to a reduction in the average number of hours devoted to training by each employee from 54.5 to 45.1 per year, as observed in the branch covering the manufacture of basic iron and steel and of ferro-alloys. However, this must be seen in context, since the national average for 2006 was only 30.4 hours. This trend is also confirmed in terms of the proportion of working time set aside for training, which decreased on average from 2.2 to 1.8 p.c., a level that is nevertheless double the national average (0.9 p.c.). Taking into account the developments mentioned above, the training costs allowed per employee increased much more for female than for male staff, namely by 30.6 p.c. and 5.7 p.c. respectively. For all staff, the costs associated with training as a percentage of total staff costs remained at 2.1 p.c., which is above the national average (1.4 p.c.) and above the target of 1.9 p.c. set for 2006 by the Intergenerational Solidarity Pact. Another target was established during the 2003 employment conference, namely that by 2010 at least half of all employees should have the benefit of a training course every year, which seems to be the case already for the iron and steel industry, at least for male employees.

3.4 Investment

3.4.1 Changes

After strong growth at the start of the period, partly attributable to a doubling of investments in the branch covering the manufacture of basic iron and steel and of ferro-alloys between 1998 and 2000 (especially by Sidmar and Cockerill Sambre), the trend was downward in the following years up to 2005. However, following a substantial upturn observed in the iron and steel industry in 2006, average annual growth in the period 1995 - 2006 was 3.3 p.c. at current prices (Table 15) or 2.2 p.c. at constant prices, whilst amounting to 32.8 p.c. in 2006 at current prices, or 29.3 p.c. at constant prices. This large increase is the result of the restructuring under way at ArcelorMittal which benefits, at least in accounting terms, the Ghent works of the steel producer ArcelorMittal Belgium flat carbon steel operation, whilst adversely, if temporarily, affecting Cockerill Sambre, with the decline in the hot phase at Liège, where investment levels declined markedly compared to 2005 (cf. also the explanations above). In the Ugine & ALZ Carinox companies, major investments were recorded in the accounts in 2005 (construction of the new works in 2005, cf. above), which was the cause of the relative drop recorded in 2006. In fact the sums recorded by ArcelorMittal-Stainless Belgium in 2006 failed to reach the cumulative level of 2005 of the two entities U&A Carinox and Ugine & ALZ Belgium, which were separate at that time. There was also a decline at Duferco La Louvière. However, increases were recorded by Carsid - part of the Duferco group - and Duferco Clabecq - new equipment and machines.

TABLE 15 **DIRECT INVESTMENT IN THE IRON AND STEEL INDUSTRY**
(millions of euro – current prices unless otherwise stated)

	Year							
Sector	1995	2000	2003	2005	2006	Relative size in 2006 (in p.c.)	Change from 2005 to 2006 (in p.c.)	Average annual change from 1995 to 2006 (in p.c.)
Manufacture of basic iron and steel and of ferro-alloys	211.4	457.9	337.0	265.9	374.1	86.5	40.7	5.3
Casting of metals	10.4	22.4	24.4	8.9	13.5	3.1	52.0	2.4
Other iron and steel branches of activity	80.1	53.6	38.6	50.7	44.7	10.3	-11.8	-5.2
Iron and steel industry	***302.0***	***533.9***	***400.0***	***325.5***	***432.3***	***100.0***	***32.8***	***3.3***
p.m., p.c. of total investment	*0.8*	*1.0*	*0.8*	*0.5*	*0.7*			
For information:								
Non-ferrous	*108.6*	*151.3*	*121.5*	*110.2*	*108.2*		*-1.8*	*0.0*
Manufacture of fabricated metal products	*400.3*	*568.4*	*390.4*	*481.5*	*487.9*		*1.3*	*1.8*
Total	**811.0**	**1253.6**	**911.9**	**917.2**	**1,028.5**		**12.1**	**2.2**

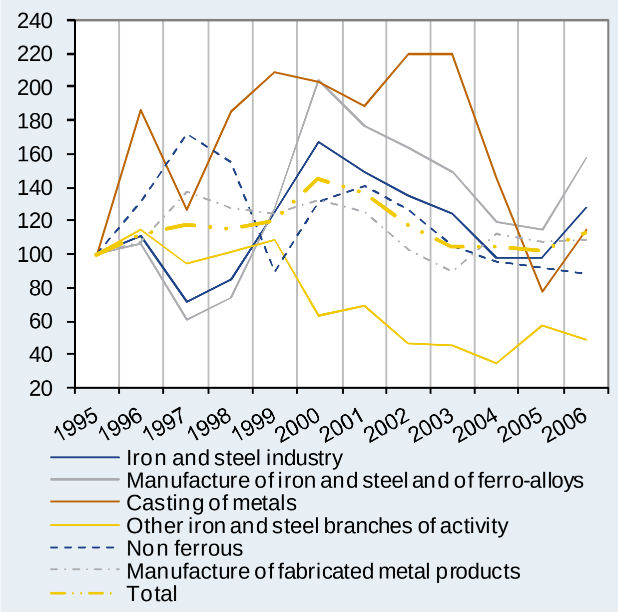
Source: NBB.

As far as the casting of metals branch is concerned, casting of steel in particular, advances were recorded at Arcelor Tailored Blank Liège and Magotteaux Liège. In the other iron and steel branches of activity, the figures at Bekaert (wire drawing) and Sadef (cold forming or folding) were down, partly offset by higher investments at Intersig (wire drawing) and Vento (manufacture of steel tubes).

As a comparison, investment declined slightly in the non-ferrous metals branches but was marginally higher in the manufacture of fabricated metal products branch.

Chart 28 shows the change at constant prices of investments in the branches under review, compared to the other categories of metals sectors. It highlights the causes of the changes seen in the iron and steel industry during the period, as well as the differences to be noted between the latter branch and non-ferrous metals, which peaked in 1997, although the sums recorded in the branch covering the manufacture of fabricated metal products remained quite close to the 1995 figure.

CHART 28 COMPARATIVE INVESTMENT PROFILE FROM 1995 TO 2006
(constant prices)



Source: NBB and own calculations.

In the iron and steel industry, investments in the casting of metals branch – mainly casting of steel – is the area that saw the largest increases, the trough of 1997-1998 being followed by a sharp rise up to 2000, after which there was a continuous decline in the branch covering the manufacture of basic iron and steel and of ferro-alloys that did not stop until the end of the period. The other iron and steel branches of activity in turn saw their investments decline throughout the entire period, which reflects the increasing trend towards concentration in the branch covering the manufacture of basic iron and steel and of ferro-alloys (cf. below).

3.4.2 Concentrations

TABLE 16 TOP 20 IN INVESTMENT IN THE IRON AND STEEL INDUSTRY IN 2006
(millions of euro, current prices)

Position	Company name	Sector	Group	Investment
1	ArcelorMittal Belgium	Manufacture of basic iron and steel and of ferro-alloys	ArcelorMittal	224.5
2	ArcelorMittal-Stainless Belgium	Manufacture of basic iron and steel and of ferro-alloys	ArcelorMittal	57.7
3	Duferco La Louvière	Manufacture of basic iron and steel and of ferro-alloys	Duferco	31.1
4	Carsid	Manufacture of basic iron and steel and of ferro-alloys	Duferco	27.0
5	Bekaert	Wire drawing	Bekaert	17.4
6	Duferco Clabecq	Manufacture of basic iron and steel and of ferro-alloys	Duferco	10.7
7	Intersig	Wire drawing		7.7
8	Cockerill Sambre	Manufacture of basic iron and steel and of ferro-alloys	ArcelorMittal	6.6
9	Sadaci	Manufacture of basic iron and steel and of ferro-alloys	Molymet	4.7
10	Sadef	Cold forming or folding	Voestalpine	4.4
11	Dovre	Casting of iron		4.1
12	Industeel Belgium	Manufacture of basic iron and steel and of ferro-alloys	ArcelorMittal	3.3
13	Vento	Manufacture of steel tubes		2.6
14	Ferromatrix	Manufacture of cast iron tubes	ArcelorMittal	2.2
15	Thy Marcinelle	Manufacture of basic iron and steel and of ferro-alloys	Riva	2.1
16	Arcelor Tailored Blank Liège	Casting of steel	ArcelorMittal	1.9
17	Airkan	Manufacture of steel tubes		1.6
18	K.T.I. Belgium	Manufacture of steel tubes		1.4
19	Europese staal prefabricatie	Cold rolling of narrow strips	ArcelorMittal	1.4
20	Magotteaux Liège	Casting of steel	Magotteaux	1.2
	Total of the top 20			**413.6**

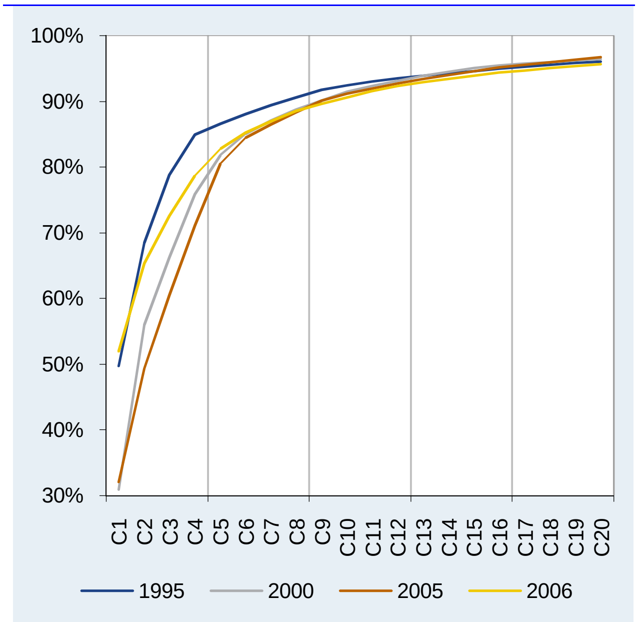
Source: NBB and own calculations.

In this capital-intensive industry, the companies listed in this top 20 (Table 16) correspond year after year to the names appearing in the value added and employment categories. ArcelorMittal and Duferco are the dominant groups there as well. Among the main investments of the first few names heading this Table, the integration of the Liège cluster into ArcelorMittal Belgium, the commissioning of the new pickling and push-pull at Duferco La Louvière, the optimisation of internal procedures and improvement of key product quality at Bekaert, the reorganisation of the blast furnace and cokeworks at Carsid and the integration of the Charleroi and Genk centres into ArcelorMittal-Stainless Belgium, together with the speed-up (*ramp-up*) of the Carinox unit should be mentioned. As is the case with the other variables, this clearly relates to a highly concentrated sector, since in 2006 the first ten companies heading the table account for no less than 90.6 p.c. of the sector's direct investments. If the next ten companies are added, this share rises to 95.7 p.c.

Chart 29 shows the development regarding the concentration of investment in the iron and steel industry between 1995 and 2006.

The investments were concentrated mainly at the start of the period, at least as far as the sector's biggest investors were concerned. The change from 2005 to 2006 is largely explained by the major restructuring operations noted above, initially carried out by the sector's largest companies, after the beginning of the decade had been marked by a number of major investments which, in accounting terms, were more widely distributed across infrastructures especially in the branch covering the manufacture of basic iron and steel and of ferro-alloys.

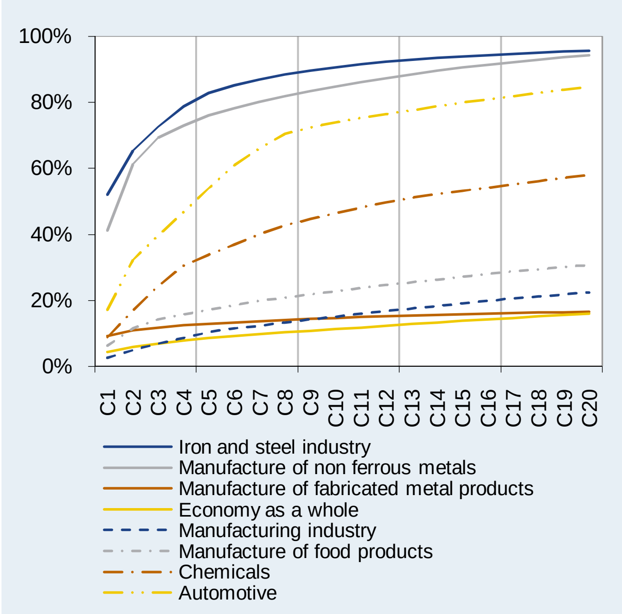
CHART 29 CONCENTRATION OF INVESTMENT IN THE IRON AND STEEL INDUSTRY, HISTORICAL COMPARISON
(millions of euro – current prices)



Source: NBB.

In 2006 the top 20 in terms of investments in the iron and steel industry puts the latter very close to the concentration observed in the branch covering the manufacture of non-ferrous metals. These curves are tracked by the curve representing the automotive industry (Chart 30). The more companies in this category that are added, the more the curves representing the branches of the iron and steel industry and the manufacture of non-ferrous metals approach one another. These two industries are among the sectors in which investments are most concentrated, in the hands of a few companies. Less concentrated from this point of view are investments in the chemical industry, and much less so in the manufacture of food products and the manufacture of fabricated metal products industries, the latter being located downstream of the iron and steel industry.

CHART 30 CONCENTRATION OF INVESTMENT IN THE IRON AND STEEL INDUSTRY IN 2006, COMPARISON WITH OTHER BRANCHES OF MANUFACTURING INDUSTRY
(millions of euro – current prices)



Source: NBB.

3.5 Indirect value added and indirect employment

This point concerns the activity generated upstream of the iron and steel sector. The assessment of the indirect effects revolves around value added and employment generated by all the suppliers to the iron and steel companies under review, whether they are located in a direct line or higher up in the chain of sub-contractors. In fact this assessment goes beyond the first level of suppliers and extends to an infinite level.

The combined total of indirect value added (Table 17) and direct value added (Table 10) puts the overall economic impact of the activities of the iron and steel industry at just under 6 billion euro in 2006, 1.9 p.c. of Belgium's GDP. This result is higher than that recorded in 2000 (1.8 p.c.) but lower than the 1995 figure (2 p.c.).

TABLE 17 INDIRECT VALUE ADDED GENERATED BY THE IRON AND STEEL INDUSTRY
(millions of euro – current prices unless otherwise stated)

Sector	1995	2000	2003	2005	2006	Relative size in 2006 (in p.c.)	Change from 2005 to 2006 (in p.c.)	Average annual change from 1995 to 2006 (in p.c.)
Manufacture of basic iron and steel and of ferro-alloys	1,091	1,591	1,804	1,847	2,160	74.5	+16.9	+6.4
Casting of metals	103	123	131	142	175	6.0	+23.8	+5.0
Other iron and steel branches of activity	455	403	379	450	565	19.5	+25.4	+2.0
Iron and steel	***1,648***	***2,116***	***2,314***	***2,439***	***2,900***	***100.0***	***+18.9***	***+5.3***

Source: NBB.

Table 17 also allows the multiplier effect of the activity under review to be highlighted. In fact, relating the total of direct and indirect value added to direct value added on its own expresses the global impact produced by one unit of value added in the iron and steel sector. In other words, the manufacture of basic iron and steel and of ferro-alloys branch, although on its own accounting for 2.4 billion euro of value added in 2006 (cf. Table 10), generates 2.2 billion euro of value added in the whole of the chain of its suppliers. Thus one euro of value added produced directly by this branch will result in an overall creation of wealth of the order of 1.9 euro.

The indirect impact of the sector is also assessed in terms of the employment generated upstream of the branches under review (Table 18). Thus in 2006, in addition to its own workforce, the iron and steel industry accounts for some 34,000 FTE in the whole of its chain of suppliers. This is markedly higher than the figure recorded in the previous year. In contrast to value added, which is up in both direct and indirect terms, the change in indirect employment, which is positive, turns out to be the opposite to that of direct employment, which is negative. These observations are consistent with the finding that the productivity of labour is constantly improving in the iron and steel industry, while sub-contracting is developing upstream of the sector.

When combined, direct (cf. Table 12) and indirect employment involves no fewer than 59,000 FTE, or 1.6 p.c. of Belgian domestic employment or 1.9 p.c. of our country's salaried labour force. These figures rose compared to the previous year, when they amounted to 1.5 and 1.8 p.c. respectively, although they are down slightly compared with the remainder of the period (1.8 and 2.1 p.c. in 1995).

TABLE 18 **INDIRECT EMPLOYMENT GENERATED BY THE IRON AND STEEL INDUSTRY**
(FTE, unless otherwise stated)

Sector	1995	2000	2003	2005	2006	Relative size in 2006 (in p.c.)	Change from 2005 to 2006 (in p.c.)	Average annual change from 1995 to 2006 (in p.c.)
Manufacture of basic iron and steel and of ferro-alloys	16,363	24,463	25,324	24,361	24,734	73.3	+1.5	+3.8
Casting of metals	2,613	2,773	2,406	2,538	2,562	7.6	+1.0	-0.2
Other iron and steel branches of activity	7,641	6,591	5,321	5,486	6,457	19.1	+17.7	-1.5
Iron and steel	***26,618***	***33,828***	***33,051***	***32,385***	***33,753***	***100.0***	***+4.2***	***+2.2***

Source: NBB.

The NBB assessment of the possible repercussions on employment that could result from the complete closure of Arcelor's Liège blast furnaces made after 2005[38], the year ArcelorMittal shut down BF No. 6, its Seraing blast furnace, put the global impact of such an action at just over 7,000 FTE, of which 2,700 FTE would be direct. That assessment was a short-term theoretical evaluation based on the methodology developed in this report but not taking into account either the initiatives taken in the meantime in terms of the restructuring of the local economic fabric and the reclassification of the staff concerned or sub-contractors' ability to redeploy their workers on other markets in the medium term. In fact, since that time, a decision was finally taken to maintain operations beyond 2009, in particular with the re-start of the BF No. 6 at Seraing in early 2008[39].

The upstream inter-sector linkages underlying all these calculations are explained in Annex 3, as are the downstream linkages relating to the impact on the cost structure of the branches of industry that are users of iron and steel. Very close links exist between the activity under review and the manufacture of non-ferrous metals, on the one hand, and the manufacture of fabricated metal products, on the other.

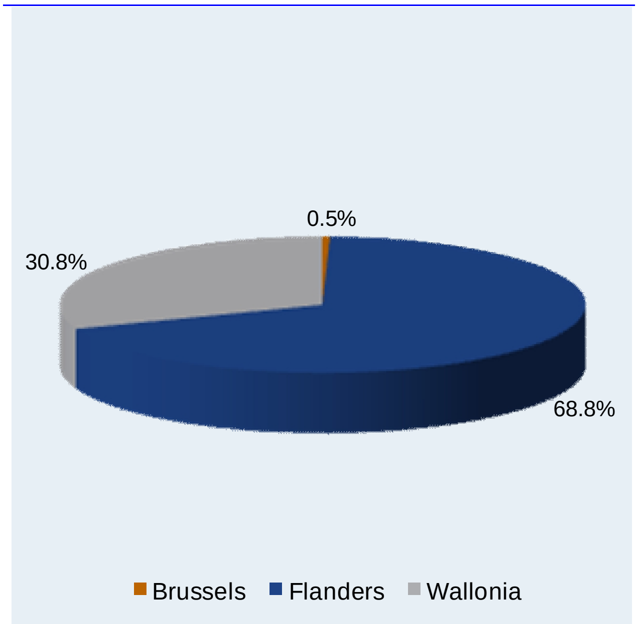
38 See Lagneaux F. (2005).

39 This re-opening, without being called into question on principle, was only set to last for a short period, because operations started up at the end of February 2008 and were suspended on 23 October of the same year due to the economic slowdown. This suspension is planned to last a minimum of three months. The modernisation of the installations at Chertal has not, however, been called into question.

3.6 Regional distribution of data

The figures mentioned below relate to the distribution by administrative region (Brussels, Flanders and Wallonia) of the activity of the companies under review, namely direct value added and direct employment. This distribution is based on regional data (regional accounts, NAI) relating to the operating sites of the companies under review. This covers the registered office in the case of companies referred to as "single location establishments" and the registered office and operating units in the case of companies "established in more than one location".

CHART 31 REGIONAL DISTRIBUTION OF DIRECT VALUE ADDED OF THE IRON AND STEEL BRANCH OF ACTIVITY IN 2006
(millions of euro)



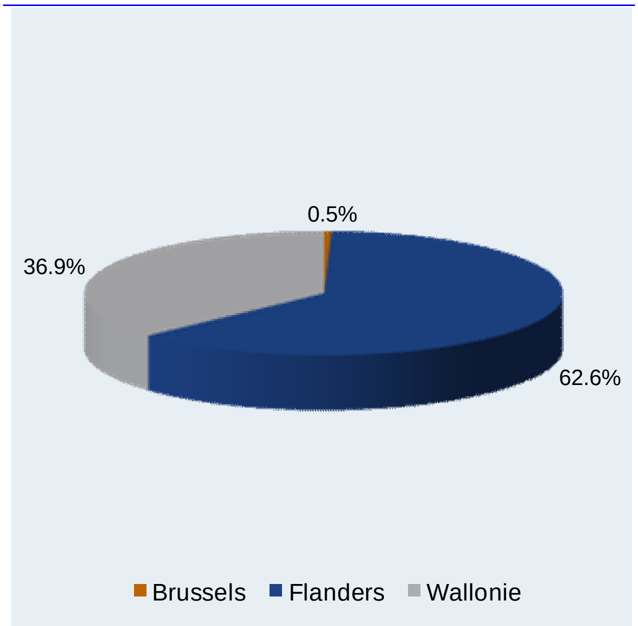
Source: NBB and own calculations.

Wallonia accounted for just under 42 p.c. of the country's iron and steel activity in 2006, with Flanders taking a share of 57.9 p.c. (Chart 31). This distribution underwent a slight change compared to a year earlier when the figures recorded were 39.8 p.c. for Wallonia and 59.7 p.c. for Flanders .

The iron and steel industry does not represent an important element of the Brussels economy in real terms. On the other hand it accounts for 0.8 p.c. of the total value added of the Flemish region and 2.1 p.c. of that of Wallonia.

In labour force terms, the iron and steel industry accounts for 0.5 p.c. of the employment in the Flemish region compared to 1.6 p.c. in the Walloon region.

CHART 32 REGIONAL DISTRIBUTION OF DIRECT EMPLOYMENT IN THE IRON AND STEEL BRANCH OF ACTIVITY IN 2006
(FTE)



Source: NBB and own calculations.

In 2006, 54 p.c. of the employment in the iron and steel sector was accounted for by operations in Flanders, with Wallonia representing over 45 p.c. (Chart 32), percentages which should be compared with those of the previous year, namely 50 p.c. and 47.4 p.c. respectively. Thus the regional distribution remains slightly in favour of Flanders. Thus the movements observed between 2005 and 2006 are reflected in opposite directions between value added and employment, changes which are clearly attributable to the movements observed within the ArcelorMittal group (cf. above).

CONCLUSION

The iron and steel industry plays a key role in the economy because it supplies the basic materials needed to produce a large number of industrial goods. In this context, steel constitutes an essential factor in economic development. This is the reason why, at the end of the Second World War, iron and steel production began to rise very sharply, fuelled by the countries of Europe, the United States and Japan. As a result of the first oil crisis demand dried up in these economies and the iron and steel industry entered a long period of weak growth which, in conjunction with considerable productivity gains, brought about a massive wave of restructurings. In the second half of the 1990s world production gathered pace again, following the surge in demand from China and the other emerging economies. Subsequently this recovery continued apace: from 2000 to 2007 global production averaged annual growth of 7 p.c. Furthermore, in absolute terms the steel market's potential is far from exhausted, since the majority of the world's regions show consumption levels that continue to fall far short of western standards. It goes without saying that the current economic crisis could have far-reaching consequences for the global iron and steel market. Previsions indicate a sharp decline of global demand in 2009.

For the last fifteen or so years, the major iron and steel producers have been relocating their production capacities to regions with large potential, in particular China, India, Brazil and the countries of the former USSR. This movement is intensified by a number of factors such as the growing presence of customers for the iron and steel industry and lower production costs in these geographical areas, as well as new regulations associated with environmental protection. In this respect the impact of the Kyoto Protocol on the competitiveness of European industry, in terms of the emission trading scheme, raises questions. Estimates worked out to date lead to the conclusion that there is a limited global impact on existing production costs. However, the impact on marginal costs, i.e. the cost of all additional production, will be considerably larger, especially as regards oxygen furnaces. Obviously these estimates are likely to be revised upwards in future because of the tightening of the allocation conditions announced by the European Commission. Thus the implementation of the Kyoto Protocol might affect the competitiveness of the industries of the old continent and as a result stimulate relocation to areas outside the European Union. In the context of the fight against global warming, this carbon leakage phenomenon will be all the more paradoxical because the European industry shows an energy intensity that is low compared to the rest of the world, in particular the emerging economies.

In the past few years, the strength of global demand has brought about a sustained rise in steel prices, which has to be seen against a background of generally higher raw material prices. In the iron and steel industry, the markets for iron ore and scrap iron have come under severe pressure which has affected the price of steel, since these two materials represent more than half of steel producers' cost prices. In this context, the strategy adopted by steel producers consisted primarily of ensuring maximum security of supply, either by taking shareholdings in the mining sector or by securing long-term deliveries. Steel producers have also attempted to reach a critical size in order to strengthen their negotiating power and also, more generally, to benefit from economies of scale. In fact the level of concentration in the global iron and steel industry continues to be low, due in particular to the fragmentation of the Chinese iron and steel industry. On the other hand the concentration of the European iron and steel industry is considerably greater. This is the result of far-reaching structural changes relating to capital ownership but also to the nature of production and to commercial relations.

Over the 1995 – 2006 period as a whole, the sector's value added grew by an annual average of 1.7 p.c., which is lower than GDP growth. In 2006 the highest – double digit – rate of growth was seen in the branch covering the manufacture of basic iron and steel and of ferro-alloys, where the major part of the activity is concentrated and large groups, such as ArcelorMittal and Duferco, operate while value added remained stable over the period in the casting of metals branch and declined markedly in the other iron and steel branches of activity. The sector directly accounts for just under 1 p.c. of our country's GDP, or close to 1.9 p.c. if the activity generated upstream (indirect effects) is added. Employment has seen an average annual decline of 2.8 p.c. over the same period, although between 2005 and 2006 staff numbers at the companies under review rose again, up by 1.1 p.c. This apparent strengthening of the labour force is mainly an accounting phenomenon: it originates in particular from the inclusion in the iron and steel industry of certain activities classified until then in the branch covering the manufacture of fabricated metal products. The decline in the Belgian iron and steel industry is reflected primarily at staff level: whereas the sector still represented 1 p.c. of our country's domestic employment in 1995, eleven years later this figure was down to just 0.7 p.c. If the indirect effects are added, this share currently amounts to 1.6 p.c. Investments declined appreciably until 2005 compared to the situation seen in the late 1990s. There were various reasons for this, the most obvious being the restructuring of the sector and the recent removal of the hot phase. However, this does not take into account the upturn recorded in 2006. Compared to the other industries of importance to our economy, the iron and steel industry continues to be by far the most concentrated, in terms of value added, employment and investment.

The economic environment of the past few years, fuelled by soaring global demand, particularly originating from Asia, has been exceptional up to and including the first six months of 2008. In our country it allowed the contemplation of the development in the short and medium term of operations hitherto considered to have little future. This period of euphoria was also reflected in freight volumes recorded in the maritime ports and of course in the figures for value added, employment and investment for the sector under review. However, this did not take into account the onset of the global economic crisis in 2008. This crisis directly affects the development of the sector's output, accompanied by the suspension of certain operations, specifically that of ArcelorMittal's blast furnace No 6 at Seraing, at the end of October 2008. This group has also announced a sharp reduction in the activity of Carinox at Châtelet, while the Italian group Duferco has temporarily shut down the Carsid site at Marcinelle. During this time operations involving electric arc furnaces seem to have been relatively unaffected.

BIBLIOGRAPHY

ADEME (2007), *Evaluation of energy efficiency in the EU-15: indicators and measures*, ADEME Éditions, Paris.

ArcelorMittal (2007), *Lettre aux actionnaires - juin 2007* (www.arcelormittal.com).

Bleischwitz S.; K. Fuhrmann et E. Huchler (2007), *The sustainability impact of EU Emissions Trading System on the European industry*, College of Europe, Bruges European Economic Policy Briefing n°17.

Chalmin P. (2007), *Cyclope 2007 - Les marchés mondiaux*, Paris, Economica.

CNUCED (2008), *Information de marché dans le secteur des produits de base: filière de l'acier* (www.unctad.org), Genève.

Commodity Research Bureau (2007), *The CRB commodity yearbook 2007*, New Jersey, John Wiley & sons Inc.

Convery F., D. Ellerman et C. De Perthuis (2008), *The European carbon market in action: lessons from the first trading period*, University College Dublin, Massachussets Institute of Technology et Caisse des dépôts, www.caissedesdepots.fr.

Coppens F. (2005), Indirect effects: a formal definition and degrees of dependency as an alternative to technical coefficients, NBB, Working Paper No.67 (Research series), Brussels

Federal Planning Bureau (2006), "Decomposition analysis of changes in CO_2 emissions by the Belgian industries", *Headlines Belgian economy*, Brussels, Federal Planning Bureau.

Fusulier B., J. Vandewattyne et C. Lomba (2003), *Kaléidoscopie d'une modernisation industrielle - Usinor, Cockerill Sambre, Arcelor*, Louvain-la-Neuve, Presses universitaires de Louvain.

International Energy Agency (2006), *CO2 Emissions from Fuel Combustion (2006 edition)*, OECD/IEA.

International Energy Agency (2006), *World energy outlook 2006*, OECD/IEA.

International Energy Agency, *World energy outlook 2008*, OECD/IEA.

International Labour Office (1997), *The Iron and Steel industry of the twenty-first century*, Genève, International Labour Office.

International Monetary Fund (2009), "World economic outlook - update", Washington D.C., International Monetary Fund.

Kindleberger C. (1986), "International public goods without international government", *The American economic review*, 76 (1).

Lagneaux F. (2005), *Importance économique du Port Autonome de Liège: rapport 2003*, Banque nationale de Belgique, Bruxelles.

Lagneaux F. (2008), *Economic Importance of Belgian Transport Logistics*, Banque nationale de Belgique, Bruxelles.

Lepeltier S. (2004), "Mondialisation: une chance pour l'environnement ?", Rapport n°233, fait au nom de la délégation du Sénat pour la planification, Session ordinaire de 2003-2004, Paris.

Loyer J.-L. (2007), "La hausse récente du cours des minerais et des métaux: causes et conséquences", *La note de veille n°83*, Centre d'analyse stratégique, www.strategie.fgouv.fr.

McKinsey et Ecofys (2005), *Review of EU emissions trading scheme - survey highlights*, European Commission, Directorate General for Environment.

McKinsey et Ecofys (2006), *EU ETS Review - report on international trading scheme*, European Commission, Directorate General for Environment.

Ministère français de l'Économie, des Finances et de l'Industrie - DiGITIP (2001), "La sidérurgie française: Une industrie en pleine refonte", *Les 4 pages des Statistiques industrielles n° 143*, Paris.

Ministry of Energy, Technology and Industry (2004), *Interim Report by Global Environmental subcomittee, Environmental Committee, Industrial Structure Council: Future Measures for Global Warming*, August

Moreau A. (2005), *L'acier en mouvement - transformation des marchés mondiaux 1874-2004*, École des mines, Paris.

Paribas (1999), "La nouvelle crise de l'acier: structurelle ou cyclique?", *Bulletin de conjoncture*, Paris.

PriceWaterhouseCoopers (2007), *Mine: Riding the wave - Review of the global trends in the mining industry 2007*, www.pwc.com.

PriceWaterhouseCoopers (2007), *Forging ahead - Mergers and acquisitions activity in the global metals industry, 2006*, www.pwc.com.

Reinaud J. (2005), *Industrial competitiveness under the European Union emissions trading scheme*, International Energy Agency information paper, OECD/IEA.

Robert B. et L. Dresse (2005), "L'industrie en Belgique: évolutions passées et défis futurs", *Revue économique de la Banque nationale de Belgique*, III-2005, 7–46.

Rubin J. et B. Tal (2008), "Will soaring transport costs reverse globalization ?", Strategecon, CIBC World Markets Inc.

The Boston Consulting Group (2007), "Beyond the boom - The outlook for global steel", www.bcg.com.

United Nations Conference on Trade Development (2007), *Review of maritime transport 2007*, United Nations, New-York and Geneva.

United States Geological Survey (2008), "Mineral commodity survey 2008", Washington, United States Government Printing Office.

ANNEX 1: METHODOLOGY

Methodology

Branches covered

In the NACE classification, the branches covering the manufacture of iron and steel and of non-ferrous metals have codes beginning with the number 27.

However, the activity is sub-divided into two sub-branches, namely the manufacture of iron and steel and the manufacture of non-ferrous metals:

Manufacture of iron and steel:

NACE Code	Definition
27100	Manufacture of basic iron and steel and of ferro-alloys (ECSC[40])
27210	Manufacture of cast iron tubes
27220	Manufacture of steel tubes
27310	Cold drawing
27320	Cold rolling of narrow strips
27330	Cold forming or folding
27340	Wire drawing
27510	Casting of iron
27520	Casting of steel

The commentary will focus on the branches listed above. We will refer to the iron and steel industry, to facilitate presentation of the figures.

The developments observed within the iron and steel branches of activity under review will be analysed in terms of three major categories of activities:
(1) Manufacture of basic iron and steel and of ferro-alloys (NACE 27100);
(2) Casting of metals (NACE 27510 and 27520);
(3) The other iron and steel branches of activity (NACE 27210, 27220, 27310, 27320, 27330 and 27340)

The results tables will follow this sector classification.

To put this into context, a results table is also provided for the manufacture of non-ferrous metals branches.

[40] European Coal and Steel Community.

Manufacture of non-ferrous metals:

NACE Code	Definition
27410	Precious metals production
27421	Aluminium production
27422	First processing of aluminium
27431	Lead, zinc and tin production
27432	First processing of lead, zinc and tin
27441	Copper production
27442	First processing of copper
27451	Other non-ferrous metal production
27452	First processing of other non-ferrous metals
27530	Casting of light metals
27540	Casting of other non-ferrous metals

The manufacture of iron and steel is at the heart of this report. Only a few aggregated references will deal with other metals-related branches as well as with the activity relating to the manufacture of fabricated metal products, which is covered by NACE code 28 and located downstream of the branches under review. A number of comments and charts will also highlight the development of the activity as a whole recorded on the territory while others will deal with the branches covering manufacturing industry as a whole (NACE branches 15 to 37), of which the activities mentioned above obviously form a part.

Because the presentation requires the inclusion of figures, the iron and steel branches of activity will be divided into three categories:
1) manufacture of basic iron and steel and of ferro-alloys, NACE branch 27.100;
2) casting of metals, covered by NACE branches 27.510 and 27.520;
3) the other iron and steel branches of activity, i.e. all the other branches included in the list "Manufacture of iron and steel" (cf. above).

Economic analysis: impact study

Calculation of direct effects

This part of the report deals with the analysis of the annual accounts of private companies belonging to the sectors under review.

For the period 1995 – 2006, the main developments are presented in terms of the development of the following variables:

- Value added (VA) at current prices[41]: the value that the company adds to its inputs during the financial year based on the production process. The VA gives an indication as to the company's contribution to the wealth of the country or region in which it is established (cf. percentages of GDP). From an accounting point of view, VA is calculated as the sum of the

[41] Unless otherwise stated, value added is reported at current prices throughout the text. Changes at constant prices are clearly indicated. Value added at constant prices was calculated using the gross value added deflator.

staff costs, depreciations and writedowns, the company's results, the provisions for contingencies and charges, and certain operating charges.

- Employment in full-time equivalents (FTE): average of salaried staff during the financial year, direct employment concerning only salaried staff employed in the companies of the population, indirect employment including also the figures relating to self-employed workers.
- Investment at current prices[42]: this corresponds to the acquisitions of fixed assets during the financial year, including fixed assets produced.

These three variables account for the economic impact of the sectors under review. Employment, however, in the same way as the social balance sheet, also concerns the analysis of their social impact. This point deals in particular with the composition, movements and training of staff.

Assessment of indirect effects

Indirect value added and indirect employment

The indirect impact of the sectors reviewed, which complements the direct effects, can be highlighted in two ways: the classical sector approach, which consists of the calculation of indirect value added and indirect employment, on the one hand, and the underlying calculation of the "linkages", on the other. This technique is based on the assessment of the mutual relations that the branches maintain with one another in terms of output.

This paragraph provides a brief overview of the method used to calculate the indirect effects, while annex 3 deals with the calculation of the "linkages".

The NAI[43] data allow an estimate to be made of the indirect effects of the steel industry as a whole on the Belgian economy. In practice, the firms of the population generate indirect VA and indirect employment upstream based on the provision of services by their sub-contractors. The calculation, for each year, is based on three types of data:

- the proportion represented by the population studied in each SUT branch (three-digit NACE-Bel- classification) at national level;
- the national data of VA and employment;
- the inter-branch relations deduced from the SUT and reported by the IOT. This also involves national data.

Once these estimates have been made for each SUT branch, the total for indirect VA and indirect employment is easily obtained for the sectors studied as a whole, a total which it is then broken down by sector.. For each year, this breakdown highlights the importance of each sector (from the

42 Unless otherwise stated, investment is reported at current prices throughout the text. Changes at constant prices are clearly indicated. Investment at constant prices was calculated using the gross fixed capital formation deflator.

43 The "tableaux des ressources et des emplois", published by the NAI, are usually referred to in French by the English acronym SUT (supply and use tables). This also allows the branches listed in these tables and which correspond to the three-digit NACE-Bel codes to be referred to by way of an abbreviation. To estimate the indirect effects, the latest figures published by the NAI (SUT for 1995, 1997, 1999, 2000, 2001, 2002, 2003 and 2004) and by the Federal Planning Office (Input-Output Tables or IOT for 1995 and 2000) are the ones that are used for each year.

point of view of direct VA and direct employment). The estimate does not confine itself to the first level of suppliers (Level 1) but continues upwards to the indirect effects observed upstream for the chain as a whole to an infinite level. It is these levels as a whole which are retained in the total amount of the indirect effects. This total, for VA and for employment, is given as an indication for each year, also taking into account the indirect employment of those working on a self-employed basis. Thus the global economic impact of the steel industry can be estimated based on the sum total of the direct and indirect effects.

Inter-sector linkages

In theory, the branch-to-branch linkages can be estimated based on two approaches: the upstream and the downstream approach. The first, according to Leontief's model, focuses on the relations between the sectors under review and their suppliers, and consequently is used to estimate indirect value added and indirect employment. The second, according to the Ghosh model, makes it possible to measure the impact in terms of the costs or prices that a sector charges its users or customers. These two approaches are used with the aim of quantifying the upstream and downstream relations that arise between the iron and steel branches of activity and the rest of the economy. The data used in this context are national and originate from the input-output table or IOT (represented theoretically in Table 1). The most recent version of the IOT published by the Federal Planning Office corresponds to the year 2000.

TABLE 1 **INPUT-OUTPUT TABLE**

	1	*2*	...	*n*	*f*	*x*
1	x_{11}	x_{12}	...	x_{1n}	f_1	x_1
2	x_{21}	x_{22}	...	x_{2n}	f_2	x_2
...	...	...	...	...	...	...
n	x_{n1}	x_{n2}	...	x_{nn}	f_n	x_n
m	m_1	m_2	...	m_n	m_f	
va	va_1	va_2	...	va_n		
x	x_1	x_2	...	x_n		

Source: NBB.

Key:
- *n* — number of industries in the economy
- x_{ij} — output of industry *i* supplied to industry *j*
- *va* — value added
- *m* — imports
- *f* — final demand

The cells x_{ij} symbolise the transactions from sector i to sector j.
f_i represents the final demand addressed to sector i.

The upstream and downstream technical coefficients can be calculated based on this Table. The Leontief *L* and Ghosh *G* matrices which are derived from them allow quantification of the inter-sector impact in terms of inputs (goods and services, production factors) and outputs (cost structure) respectively. These two models, geared to demand and supply, are complementary.

Table 2 includes some formulae used in estimating these linkages. The part relating to the "key sectors" (Oosterhaven & Stelder net multiplier) highlights, based on a calculation employing the Leontief technical coefficients, the sectors whose impact on the rest of the economy is dominant.

TABLE 2 CALCULATION OF INTER-SECTOR LINKAGES: FORMULAE

Technical coefficients (first level)	upstream	$TIC_{ij} = a_{ij}$	linkage of sector *j* vis-à-vis its first level supplier *i*	relative to the output of sector *j*
	down-stream	$TOC_{ij} = b_{ij}$	linkage of sector *i* vis-à-vis its first level customer *j*	relative to the output of sector *i*
Cai and Leung linkages (all levels)	upstream	$BL_j = \frac{\sum_{i=1}^{n} l_{ij}}{l_{jj}}$	linkage of sector *j* vis-à-vis its suppliers	relative to the output of sector *j*
	down-stream	$FL_i = \frac{\sum_{j=1}^{n} g_{ij}}{g_{ii}}$	linkage of sector *i* vis-à-vis its customers	relative to the output of sector *i*
Decomposed linkages (all levels)	upstream	$BDec_{ij} = \frac{g_{ij}}{g_{jj}}$	linkage of sector *j* vis-à-vis its supplier *i*	relative to the output of sector *i*
	down-stream	$FDec_{ij} = \frac{l_{ij}}{l_{ii}}$	linkage of sector *i* vis-à-vis its customer *j*	relative to the output of sector *j*
Key sectors	$\frac{\text{Leontief multiplier for j} \times \text{final demand of j}}{\text{output of j}}$		If the ratio > 1, then sector *j* is more important for the other sectors than vice versa.	

Source: NBB.

Key

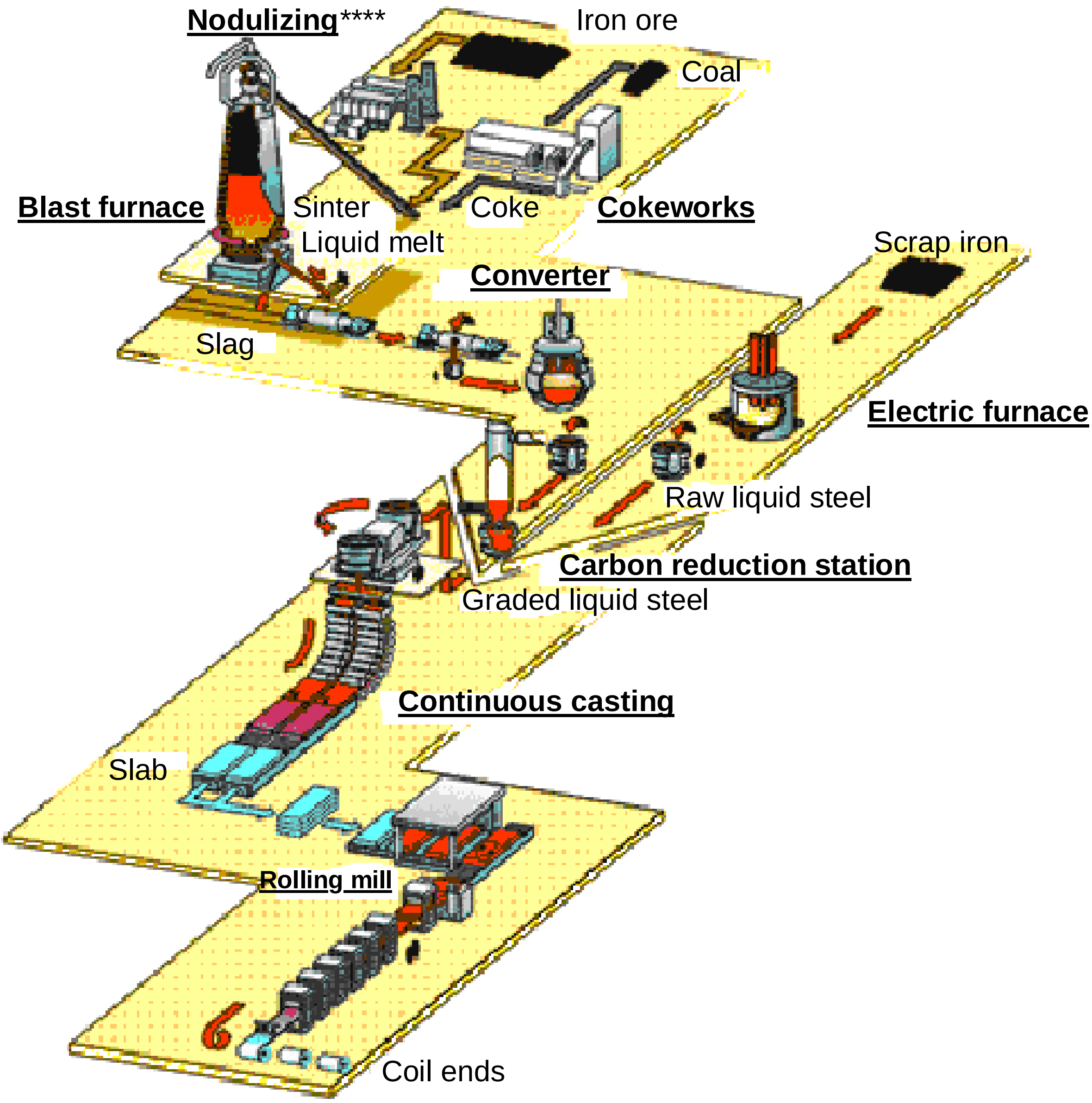
TIC_{ij} : Technical input coefficients
TOC_{ij} : Technical output coefficients
BL_j : Cai and Leung upstream linkages
FL_i : Cai and Leung downstream linkages
$BDec_{ij}$: Decomposed upstream linkages
$FDec_{ij}$: Decomposed downstream linkages
l_{ij} : Element of matrix L -Leontief-, row i and column j; such as $\Sigma_i\, l_{ij}$ = Leontief multiplier for j
l_{jj} : Diagonal element of matrix L
g_{ij} : Element of matrix G -Ghosh-, row i and column j
g_{ii} : Diagonal element of matrix G

The full methodology is given in Coppens (2005) and has already been the subject of applications within this collection, as in Lagneaux (2008).

ANNEX 2: THE STEEL PRODUCTION PROCESS[44]

From iron ore to steel

Steel cannot be obtained from iron ore alone. Steel production in practice involves three raw materials: iron ore, metallurgical coke* and scrap iron. Recycling represents a large proportion of the inputs for the manufacture of steel. When passed through a blast furnace, iron ore plus coke produce the pig iron from which steel is obtained.



Source: USINOR

There are two ways of manufacturing steel, depending on whether it is produced from iron ore or originates from recycling scrap iron.

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[44] Source: UNCTAD.

- First production method: the pig iron process

After being crushed, screened and then nodulized or pelletized, the iron ore is put into a blast furnace in layers alternating with coke, the purpose of the latter being to supply sufficient heat for the operation. A temperature of about 2000°C is necessary to cause the gangue and the iron to melt after the iron oxides from the ore have been reduced by the gas originating from this combustion. The iron, alloying with the carbon, produces pig iron. At regular intervals the molten pig iron and slag** are tapped off separately using tapholes. Although useless in the subsequent operations, the slag has a market outlet in the building sector and in public works as highway surfacing.

1.7 tonnes of iron ore and 450 to 650 kilograms of coke are needed to produce one tonne of primary melt pig iron.

On leaving this first stage, the pig iron is transferred to an apparatus called a converter. There are two main types of converter: the one devised by Henry Bessemer around 1850 and the Thomas Gilchrist converter designed in Great Britain in 1878. The principle is the same: once inside the retort*** (crucible), the conversion takes place at high temperature. Air is blown in through tuyeres (nozzles) located at the base of the vessel. Oxygen present in the air allows the combustion of impurities contained in the crude metal, as well as the removal of a proportion of the carbon by oxidation. Conversion of the pig iron into steel is complete.

Thomas Gilchrist's invention in the late 19th century enabled the treatment of pig irons containing phosphorus by lining the converter walls with basic materials (dolomitic limestone), thus allowing the phosphorus to be absorbed.

- Second production method: the electric arc furnace process, or steel production without passing through pig iron

The forerunner of the electric arc furnaces as used today is the Martin-Siemens furnace (open hearth refining), a system no longer used anywhere in the world except in Eastern Europe for about 10 p.c. of world production. The principle of this furnace was developed in the 19th century. It could be acidic or basic. In the first type of furnace, the refining relates to only certain elements (carbon, silicon and manganese), sulphur and phosphorus remaining untouched. On the other hand the basic Martin-Siemens furnace allowed all these products to be removed. The system underwent little development until the 1960s, when it began to be superseded by electric arc furnaces.

The electric arc furnace allows a very high degree of refining to be achieved. Initially it was reserved for the production of special steels, but has since conquered the markets for reinforced concrete. Heating takes place by an electric arc struck between carbon electrodes and the materials put into the furnace. After melting, the refining is carried out using various slags. The operation then continues to the final phase, when materials are added to obtain the required grade of steel.

- The latest generation of treatment processes

This last production method dates from the 1950s and 60s. It is also carried out via an electric arc furnace. However, as the basic process, a blast of oxygen-enriched air is blown in during the oxidising period to improve and speed up the process. Various processes nowadays use pure oxygen. The steel thus obtained is called "oxygen steel". These steels have come to dominate the market.

A few dates marking advances in technology:

1) Vertical lance blowing: LD (1949-52) and LD Pompey (1957) for haematitic pig irons, OLP and LD-AC (1958) for phosphoric pig irons
2) Rotating furnaces and lance blowing: Kaldo (1948-55), Rotor (1952-56); practically disappeared,
3) Blowing by tuyeres in the base of the retort: LWS and OBM (1970) for haematitic and phosphoric pig irons; AOD and (Cl. U) for stainless steels,
4) Mixed blowing by lance and tuyeres: allows an increase in the proportion of scrap iron, extension of the range of grades, automatic operation and a reduction in nitrogen content (from 0.008 to 0.002 p.c.).

At the end of the process, whether traditional or electric, the steel is then cast continuously in the form of slabs, blooms, billets, round bars or ingots. These products are finally converted into finished products such as rolled steel joists or sheet pile rails.

Glossary

*Coke: combustible fuel produced by pyrolysing hard coal and used as the reducing agent in the production of pig iron.

Metallurgical coke
Coke performs three main roles in a blast furnace: it promotes the circulation of the ascending gases (permeabilizing role), supplies the heat needed for the reaction to proceed, and ensures the reduction and carburization of the iron. To enable it to play its permeabilizing role, especially at the base of the blast furnace where the ore becomes viscous, the coke must have a homogeneous particle size and must be lightweight and mechanically strong. In addition its sulphur content must be low to avoid it contaminating the pig iron with this element. It is obtained in coke ovens by heating, in the absence of air, a type of coal, “coking coal”, which contains about 96 p.c. of carbon.

**Slag: calcium and aluminium silicates, which forms in blast furnaces (blast furnace clinker, composed of the silicates of aluminium and lime, floating on the molten metal).

***Retort: a vessel with an elongated curved neck used for distillation.

****Nodulizing by sintering: sintering at a temperature below the melting point (solid phase sintering) allows powders of metals, ceramics, glasses or plastic materials to be agglomerated together to give them sufficient cohesion and rigidity without resorting to complete melting. It can take place with or without charging during the heating, depending on the type of alloy required.

ANNEX 3: INTER-SECTOR LINKAGES IN TERMS OF PRODUCTION OR OUTPUT

This annex presents in summary form the most important linkages noted between the branches under review - 27A1 and 27B1[45] - and the other branches of the Belgian economy. These relations were observed based on the input-output table for 2000[46], both upstream (*backward linkages*) and downstream (*forward linkages*) of the iron and steel branches of activity. The calculations used in this context are explained briefly in Annex 1.

1. Upstream linkages

An analysis of the input-output table for 2000 allows, among other things, a study of the linkages with the sectors situated upstream of the manufacture of iron and steel activity (or *backward linkages*), i.e. the linkage coefficients connecting the branches under review with the branches supplying them with goods and services.

o First level suppliers:

The manufacture of basic iron and steel and of ECSC[47] ferro-alloys branch (27A1) has, apart from with itself and with the first processing of steel and the production of non-ECSC ferro-alloys branch (27B1), important relations with the following branches, in decreasing order of importance:
- treatment and coating of metals, general mechanical engineering;
- wholesale trade and trade intermediaries;
- production and distribution of electricity, gas, steam and hot water;
- freight transport and removal activities by road, transport via pipelines.

The first processing of steel and the production of non-ECSC ferro-alloys branch (27B1) has, apart from with itself and with the manufacture of basic iron and steel and of ECSC ferro-alloys branch (27A1), very important links with the following branches, in decreasing order of importance:
- wholesale trade and trade intermediaries;
- production and distribution of electricity, gas, steam and hot water;
- freight transport and removal activities by road, transport via pipelines.

The branches mentioned above exert a primary effect on the operations of their customer, the iron and steel industry, and vice versa.

[45] The NACE branches with five-digit codes shown at the beginning of Chapter 3 correspond to those with three digits relating to 27A1 and 27B1. 27A1 covers branches 27.100, 27.210, 27.220. 27B1 includes the other sub-branches listed in Table 9.

[46] The input-output table for 2005 published by the Federal Planning Office will be available in principle from mid-2009 onwards.

[47] European Coal and Steel Community.

o At an infinite level:

Moving upwards to the levels situated further upstream to include in the analysis the whole chain of suppliers, all suppliers' suppliers, etc., one obtains the decomposed upstream linkage coefficients calculated based on Ghosh matrix elements (see Annex).

With regard to the manufacture of basic iron and steel and of ECSC ferro-alloys branch, this shows important links, taking into account the whole of the upstream chain, with the following suppliers (in decreasing order), apart from with itself and the first processing of steel and the production of non-ECSC ferro-alloys branch:
- treatment and coating of metals, general mechanical engineering *;
- inland water transport;
- manufacture of cement, lime and plaster;
- transport via railways;
- sea and coastal water transport;
- sewage and refuse disposal, sanitation;
- production and distribution of electricity, gas, steam and hot water;
- manufacture of ceramic products;
- staff selection and supply;
- freight transport and removal activities by road, transport via pipelines.

The first processing of steel and the production of non-ECSC ferro-alloys branch shows important links, taking into account the whole of the upstream chain, with the following suppliers (in decreasing order), apart from with itself and with the manufacture of basic iron and steel and of ECSC ferro-alloys branch :
- treatment and coating of metals, general mechanical engineering *;
- inland water transport;
- production and distribution of electricity, gas, steam and hot water;
- wholesale trade and trade intermediaries;
- sewage and refuse disposal, sanitation;
- freight transport and removal activities by road, transport via pipelines;
- collection, purification and distribution of water;
- staff selection and supply;
- education;
- renting of machinery and equipment and of other personal and household goods.

The branch marked with an asterisk is part of the sector category covering "manufacture of fabricated metal products". It is interesting to note that part of this entity, in addition to being one of the iron and steel industry's major customers, is also its main supplier.

o Key sectors:

The iron and steel industry is a key sector of the country's economy, given the fact that the ratio (Oosterhaven & Stelder net multiplier) calculated based on the Leontief technical coefficients, is greater than one in the following two cases:

Oosterhaven & Stelder net multiplier =
1.22 for the manufacture of basic iron and steel and of ECSC ferro-alloys branch
1.08 for the first processing of steel and production of non-ECSC ferro-alloys branch

Thus the branches covering the iron and steel industry have a greater impact on the rest of the economy than the other branches of the economy have on the iron and steel industry. In other words, the complete disappearance of the iron and steel industry would be very damaging to the country's economy, since the position it occupies remains central.

2. Downstream links

Traditionally the following sectors, among many others, are considered to be very closely linked to the iron and steel industry: construction, the automotive industry and the manufacture of food products industry, as well as IT, shipbuilding, the aviation industry and the energy industry.

An analysis of the input-output table for 2000 confirms these introductory observations, via a study of the linkages with the sectors located downstream of the iron and steel industry activity (or *forward linkages*), i.e. the linkage coefficients connecting the branches under review with the user branches:

o First level customers:

The manufacture of basic iron and steel and of ECSC ferro-alloys branch (27A1) has, apart from with itself and with the first processing of steel and production of non-ECSC ferro-alloys branch (27B1), important relations with the following branches, in decreasing order of importance:
- construction of buildings or civil engineering works;
- manufacture of cutlery, tools and general hardware *;
- manufacture of light metals and of other metal elements for the construction industry *;
- treatment and coating of metals, general mechanical engineering *;
- manufacture of furniture.

The first processing of steel and production of non-ECSC ferro-alloys branch (27B1) has, apart from with itself and with the manufacture of basic iron and steel and of ECSC ferro-alloys branch (27A1), very important links with the following branches, in decreasing order of importance:
- manufacture of light metals and of other metal elements for the construction industry *;
- construction of buildings or civil engineering works;
- manufacture of cutlery, tools and general hardware *;
- treatment and coating of metals, general mechanical engineering *;

- manufacture of bodies (coachwork), trailers and caravans, and of parts and accessories for motor vehicles;
- construction of railways, highways and airfield runways.

The branches mentioned above exert a primary effect on the operations of their supplier, the iron and steel industry, and vice versa. Those marked with an asterisk are well placed among the principal direct customers of the iron and steel industry because they are part of the sector category covering the manufacture of fabricated metal products.

o At an infinite level:

Moving downwards to the levels further downstream to include in the analysis the whole chain of users, all the customers' customers, etc., one obtains the decomposed downstream linkage coefficients calculated based on the elements of the Leontief matrix (see Annex).

The manufacture of basic iron and steel and of ECSC ferro-alloys branch (27A1) has, apart from with itself and with the first processing of steel and production of non-ECSC ferro-alloys branch (27B1), important relations with the following branches, in decreasing order of importance:
- manufacture of motorcycles and bicycles, and of other transport equipment;
- treatment and coating of metals, general mechanical engineering *;
- manufacture of cutlery, tools and general hardware *;
- manufacture of light metals and of other metal elements for the construction industry *;
- manufacture of furniture;
- construction of buildings or civil engineering works;
- collection, purification and distribution of water;
- construction of railways, highways and airfield runways;
- manufacture of electric motors, generators and transformers;
- manufacture of cement, lime and plaster;
- installation works.

The first processing of steel and production of non-ECSC ferro-alloys branch (27B1) has, apart from with itself and with the manufacture of basic iron and steel and of ECSC ferro-alloys branch (27A1), very important links with the following branches of industry, in decreasing order of importance:
- manufacture of light metals and of other metal elements for the construction industry *;
- treatment and coating of metals, general mechanical engineering *;
- manufacture of cutlery, tools and general hardware *;
- construction of railways, highways and airfield runways;
- manufacture of bodies (coachwork), trailers and caravans, and of parts and accessories for motor vehicles;
- construction of buildings or civil engineering works;
- manufacture of accumulators, primary cells, electric lamps and lighting fittings;
- installation works;
- manufacture of electric motors, generators and transformers.

The branches of industry mentioned here effectively exert an influence as customers on the iron and steel branch of activity. Those marked with an asterisk are well placed among the principal direct and indirect customers of the iron and steel industry because they are part of the sector category covering the manufacture of fabricated metal products. The uses of steel, whether it involves flat or long products[48], are also very numerous and of interest to a wide spectrum of user sectors, the main ones being, in decreasing order, construction, where steel is by far the main metal used, the automotive industry, since 55 to 70 p.c. of the weight of a vehicle - chassis, bodywork, engine – is made of steel, the manufacture of food products industry - packaging, kitchen utensils, etc., cf. the “manufacture of cutlery, tools and general hardware” sector mentioned above -, and many other sectors such as computer equipment and telecommunications, but also energy and the chemical industry.

[48] The flat products in sheets or on rolls (coils) comprise plates, strips and thin metal sheets, bare or coated. The long products comprise mainly heavy profiles of the rolled steel joist type, bars and wires. These are the "semi-finished" products used as raw materials in manufacturing processes in various industries extending from building and food canning to electronic components or the hulls of some ships. Source: OECD.

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