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**DIRECTORATE FOR SCIENCE, TECHNOLOGY AND INNOVATION  
STEEL COMMITTEE**

**EVALUATING THE FINANCIAL HEALTH OF THE STEEL INDUSTRY**

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## FOREWORD

OECD Steel Committee delegates discussed a draft of this report at the Steel Committee meeting on 30 November and 1 December 2015. Delegates agreed to declassify the report in January 2016. The report will be made available on the Steel Committee website: <http://oe.cd/steel>.

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## **EVALUATING THE FINANCIAL HEALTH OF THE STEEL INDUSTRY**

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### **ABSTRACT**

Concerns have been raised about the current health of the steel industry, amidst a context of global excess steelmaking capacity. This paper shows that, notwithstanding considerable firm-level heterogeneity, the steel industry's financial situation is on average weaker than it has been in years, worse than during the last steel crisis of the late 1990s. Even though the industry has experienced crises in the past, the current downturn is of particular concern given its depth and length. Further deterioration in steel demand prospects along with continued capacity expansions are likely to place additional pressure on the financial sustainability of the steel industry. The complex financial situation of the industry and mounting trade disputes calls for immediate action to address underlying imbalances in the steel market.

Keywords: Steel; Firm performance; Finance; Crisis; Capacity

JEL Classification: L61; L250; G30

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## EVALUATING THE FINANCIAL HEALTH OF THE STEEL INDUSTRY

### 1. Introduction

Excess capacity, the economic health of the steel industry, and steel market openness are closely inter-linked. Recent discussions by the Steel Committee have shown that developments across these three dimensions are raising concerns. That is, global crude steelmaking excess capacity has reached record levels and continues to grow, the industry's financial situation has been weak for an extended period of time, and trade actions are escalating. Along with the slowdown in global steel demand and falling prices, many steel producers are facing significant economic difficulties.

Given the seriousness of the problems, in 2013, the OECD Secretariat was asked to examine how the current financial situation of the steel industry compares to the previous steel crisis of the late 1990s/early 2000s, just before governments decided to initiate high-level talks at the OECD on policies to reduce capacity and to work towards strengthening the rules on government support measures (OECD, 2013b). Analysing a large-scale data set of steel-producing firms, that study made three broad conclusions: i) it found that the financial performance of the global steel industry had deteriorated to levels not seen since the steel crisis of the late 1990s, ii) that there was a statistically significant relationship between excess capacity and the industry's profitability, and iii) that the industry's profitability was expected to remain weak due to continued excess capacity, though the future evolution of many other factors that also determine profitability (such as input prices) was highly uncertain.

This document provides an update of the current financial performance of the steel industry and presents some thoughts about ways to improve the analysis of the statistical relationship between the capacity utilisation and profitability of steel companies. This paper confirms the conclusions of the previous study that recent trends in key financial indicators, such as profitability and indebtedness, indicate that the global steel industry remains in a very difficult economic and financial situation. Measures of aggregated free cash-flows for the global steel industry have been negative or barely positive in recent years, indicating that the steel industry is in need of external funds to cover any investment or even to maintain operational activities. As a consequence, debt ratios are rising and, for instance, the ratio of debt to earnings before interest, taxes, depreciation and amortisation (EBITDA) is at such high levels that bring into question the solvency of many companies. Moreover, markets are sending a clear signal that investment opportunities are scarce, if existent at all. Nevertheless, this paper also shows that there is a considerable degree of heterogeneity across companies; while the majority of steelmaking companies are experiencing difficulties, few seem to be performing rather well.

The findings of this paper are relevant for the Steel Committee's work on investment projects and related government support. Recent research conducted internally at the OECD (OECD, 2015d; OECD, 2015e) shows that some governments are incentivising new investments in the steel sector, by supporting lending for projects or through various fiscal measures. Governments influencing commercial decisions in the steel sector – whether for economic development purposes or to meet other policy objectives – can lead to inappropriate investment decisions and increase the challenges facing the global steel sector, particularly when they contradict market signals. In the context of global excess steelmaking capacity, any additional capacity expansions supported by governments should be halted or, at least, fully scrutinised and barriers

to the closure of the least successful plants should be removed as they may be harming the entire industry by limiting the scope for reallocation of resources towards the most successful firms.

The size of some steelmaking companies and the financial links they feature could mean that bankruptcy and/or closures might have serious direct consequences in terms of (localised) job losses as well as indirect costs related to the robustness of the financial sector in some economies. However, signalling that large steelmaking companies have a “safety net” may result in moral hazard issues and provide disincentives for companies to make needed structural changes. On the international front, it is crucial to ensure that investment and trade distortions are removed, so that companies from different economies can compete on a level playing field.

The structure of the paper is as follows. Section 2 tracks the evolution of major financial indicators for the steel industry over the past 23 years, highlighting meaningful trends that may help in understanding the seriousness of the current situation facing the steel industry. Section 3 provides an introduction to the two steel downturns (the current one and the crisis of 1997-2002), and notes some similarities and differences between the two episodes. Section 4 discusses some possible extensions to the work that links excess capacity to the industry’s profitability, followed by an overall conclusion in Section 5.

## **2. The evolution of the global steel industry’s main financial indicators**

Concerns have been raised about the current health of the steel industry, amidst a context of global excess steelmaking capacity (OECD, 2015b). This section tracks the evolution of major financial indicators for the past 23 years, highlighting meaningful trends that may help in understanding the current financial situation of the steel industry. The analysis required constructing a large dataset of financial indicators at the firm level, with around 70 basic variables covering more than 800 steelmaking companies over 23 years. A detailed description of the dataset, which could also be matched with other firm- and plant-level data and used in projects to be developed in the future, is available in Annex 1 of this paper.

The financial data overviewed in this section suggests that:

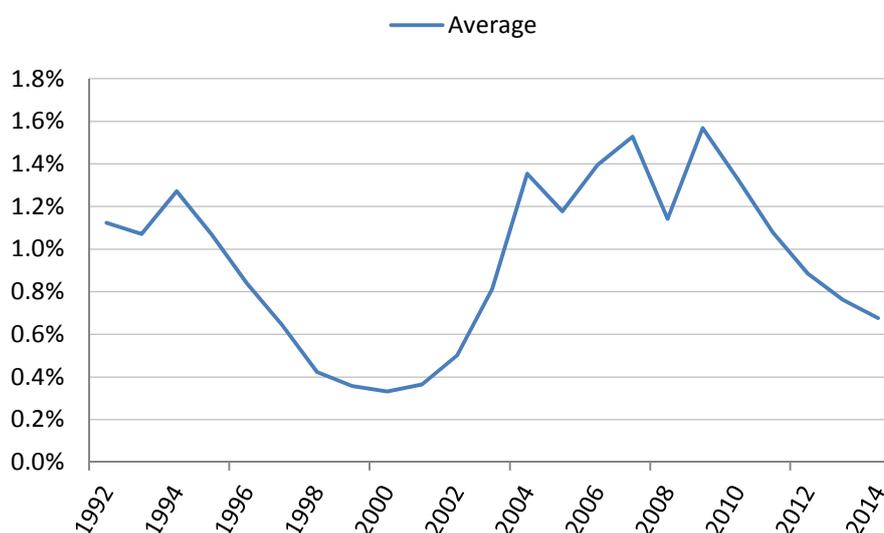
- After a period of robust financial strength during the mid-2000s, the financial performance of the steel industry has been deteriorating rapidly in recent years.
- The industry’s financial performance has reached very weak levels, to some extent close to those of the late 1990s and early 2000s.
- Average operating profitability is well below sustainable levels, and companies appear to be increasingly relying on short-term debt.
- Financial performance varies significantly across companies. While most companies are not performing well, a small number of firms remain resilient.
- Investment has been slowing and, according to financial markets, there is hardly any room for expansion.

Steel is a cyclical industry and, as a consequence, steelmakers’ share prices should react more to macroeconomic downturns and upturns. The relative market value of steelmaking companies compared to total market capitalisation provides a broad indication of the performance of the steel industry relative to other industries (Figure 1). This share has been declining significantly since reaching a peak in 2009. The relative market value in 2014 was at a higher level (0.68%) than the record low of the last two decades (0.33% in 2000). Nevertheless, since 2009, the industry has been losing market value at a much faster pace

than other sectors; steelmakers' market value declined 40.9% compared to an increase in total market capitalisation of 37.1%. As a result, the total loss of market value since the pre-crisis level in 2007 has amounted to 55.4% for steelmaking companies, while the overall market has already recovered to pre-crisis levels.

Although the relative market capitalisation of the steel industry was lower in the late-1990s, this was more of a reflection of the rapid growth of other sectors. Indeed, perhaps due to the boom in the information and communication technology sector, total market capitalisation at that time was increasing much faster than the market value of the steel industry — total capitalisation more than doubled (it increased by 230.1%) between 1992 and 1999 while for the steel industry it increased by 5%, leading to a combined relative loss of 68.2%. Therefore, the current steel market situation appears to be having a more severe effect on steelmaking companies' valuations, compared to the steel crisis of the late 1990s.

**Figure 1. Steel industry's market value relative to total world market capitalisation between 1992 and 2014, %**



Source: OECD calculations based on data from Factset.

Financial performance provides a good indication of how strong and successful a company and an industry is. Financial performance indicators can be derived from the income statements of publicly traded companies (financial accounting) or from the national accounts aggregated at the sector level. EBITDA (earnings before interest, taxes, depreciation, and amortization) gives an indication of the operational profit of a company, as it takes into account sales and operating costs but ignores changes in working capital, capital expenditures, taxes, and interest. EBITDA/sales reveals firms' core operational profitability and is a widely used indicator when assessing the operational performance of a company. National accounts data can provide an indication of the overall profitability of an industry by comparing gross operational surpluses to total output (see Box 1 for more on the two approaches).

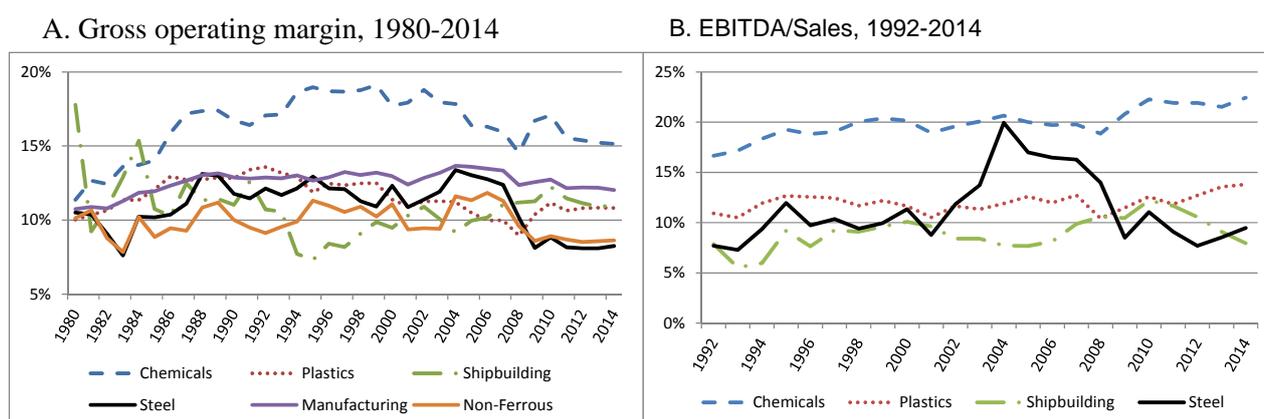
### Box 1. Financial performance indicators

National accounts data provide an indication of the overall financial performance of a sector by taking the ratio of gross operating surplus to production. The corresponding profitability indicator in financial accounting is computed as earnings before interest, taxes, depreciation and amortisation (EBITDA) as a share of total sales. However, the perspectives and accounting principles used in national accounts and financial accounting are substantially different (Rassier, 2013). For example, when comparing gross operating surplus with EBITDA, it is important to acknowledge differences between *i*) intermediate consumption (national accounts) and the cost of sales (financial accounting), as well as *ii*) compensation and taxes on production less subsidies (national accounts) and operating expenses (financial accounting). Moreover, while consumption of fixed capital is based on current cost, depreciation and amortization is based on historical cost. For this reason the comparison between, for example, net operating surplus (which is gross operating surplus minus the consumption of fixed capital, according to the national accounts) and earnings before interest and taxes (EBIT, from company income statements) can be problematic. Therefore, while gross operating margin (national accounts) and EBITDA on sales (income statements) are two related indicators, they are not directly comparable.

Panel A of Figure 2 depicts the evolution of aggregate profitability across different industries between 1980 and 2014, according to national accounts data. It shows that the financial performance of the steel industry has been worse than that of several other industries and the overall manufacturing sector, particularly since the financial crisis in 2009, though less so relative to the non-ferrous basic metal sector. Information collected from the income statements of publicly traded companies in selected sectors also suggests that steelmaking companies have underperformed when compared to companies in other industries in recent years (Panel B of Figure 2).

The steel industry's underperformance compared to other industries warrants further study of its causes. Excess capacity in the steel industry likely plays an important role in the industry's profitability. Innovation and productivity issues are also important. Productivity is one of many factors that determine profits. Recent research suggests that productivity developments in the steel sector have been weak, which may reflect high exit barriers that prevent a reallocation of resources to the most productive firms and hinder the growth prospects of more innovative firms (OECD, 2015c).

**Figure 2. Evolution of profitability across selected industries**

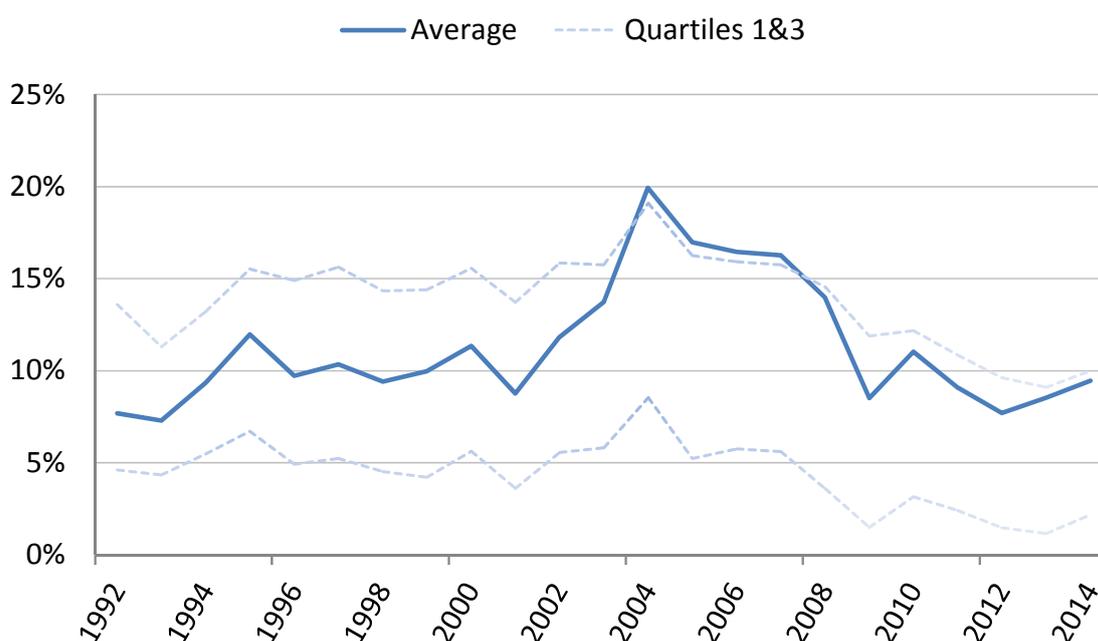


Source: IHS (gross operating margins) and OECD calculations based on Factset (EBITDA on Sales).

Although the average profitability of the steel industry, measured by EBITDA on sales, has been below 10% for the last four years, it has recovered slightly over the last two years after reaching a low of only 7.7% in 2012 (Figure 3). In 2014, profitability stood at 9.5%, thus still raising concerns regarding how

much longer the industry can withstand such low profitability levels.<sup>1</sup> Figure 3 also shows that average EBITDA on sales has been very close to the third quartile of the profitability distribution (upper dashed line) for the last few years. This suggests that while there are a few companies that are doing very well (increasing the average), most companies are experiencing difficulties. Indeed, Figure 3 shows that the first quartile of the distribution (lower dashed line) has been very close to zero since 2009, which means that 25% of the companies in the sample are barely making profits at all. In 2014, profitability levels for 25% of the companies in the sample were below 2.2% and 75% of the sample exhibited profitability levels below 10%.

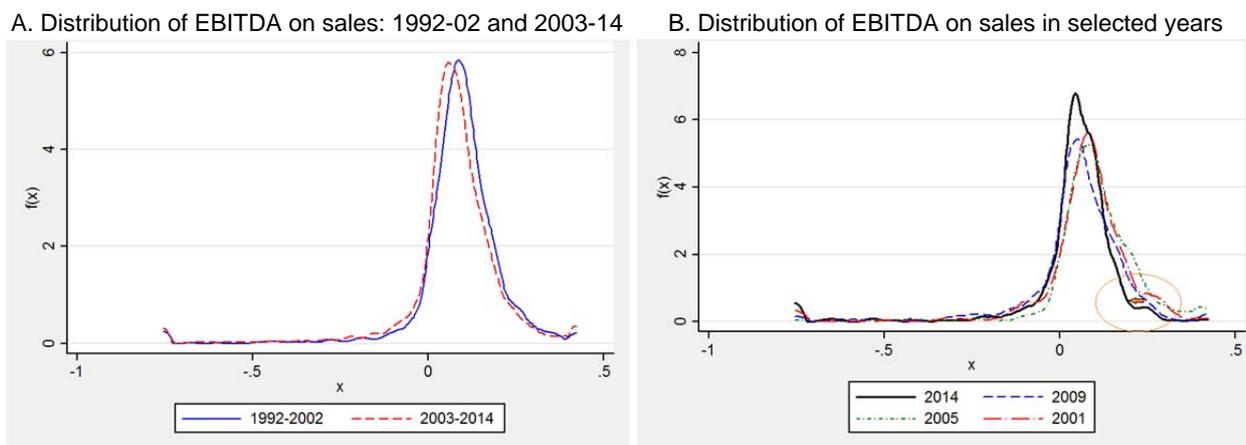
**Figure 3. Ratio of EBITDA to sales between 1992 and 2014, %, steel industry**



*Note:* The dashed lines provide information on the distribution of operating profitability across the firms in the sample: 25% of the companies have operating profitability below (above) the first (third) quartile line. The heavy line depicts the industry average operating profitability.

*Source:* OECD calculations based on data from Factset.

Looking more closely at the profitability distribution, Figure 4 below shows the evolution of profitability through time. While it is clear that there is a shift in the distribution towards the left (i.e. lower profitability) between 1992-2002 and 2003-2014 (Panel A), Figure 4 also shows that the left tail of the distribution became slightly heavier — in other words, there are now more firms with lower profitability levels. Interestingly, the far right tail of the distribution in recent years seems to remain rather similar. By looking at some individual years since 2001 (Panel B), it is clear that that the reduction in average profitability shown in Figure 3 is driven by profitable firms, but not those at the top of the distribution. Indeed, a small number of companies remain highly profitable as indicated by the circled area in Panel B.

**Figure 4. Evolution of the distribution of EBITDA to sales**

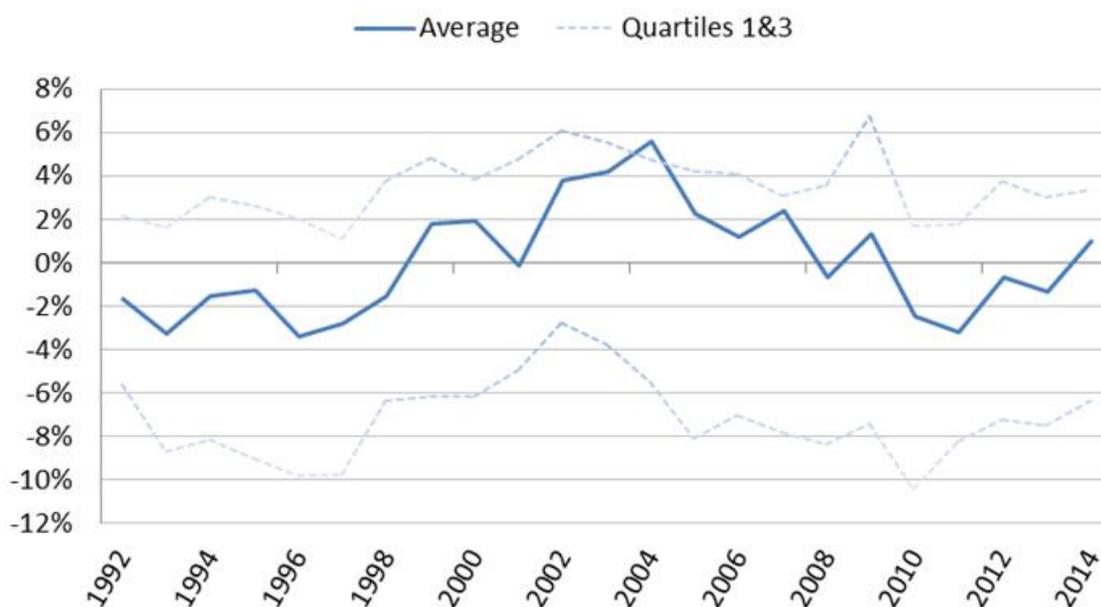
*Note:* These figures plot the distributions of the ratio of EBITDA on sales in different periods (Panel A) or years (Panel B) using kernel density estimates. The kernel density estimate gives an approximation of the probability density function of a given distribution — up to a given point  $x$  in the horizontal axis, the area under this function provides the percentage of observations that have values that are lower or equal to  $x$ . The total area below the curve for each year equals one.

*Source:* OECD calculations based on data from Factset.

Compared to the steel crisis of the late 1990s/early 2000s, the recent profitability decline is much more pervasive across the publicly traded steel companies present in the sample. Although average profitability levels are only a little lower than those experienced during the late 1990s and early 2000s, when values remained above 9%, more companies today are performing below the average. The figures for EBIT on sales, which take into account depreciation and amortisation, show a similar picture (Annex 2).

In line with this low profitability development, steelmaking companies find themselves with low availability of cash. The steel industry's free cash-flow on sales was generally positive between 1999 and 2009, with slightly negative values in 2001 and 2008 (Figure 5).<sup>2</sup> However, in recent years free cash-flow has fallen to very low, negative levels. Taking into account the cash used for investments and replacing capital, the available cash to pay out as dividends or to keep as retained earnings has averaged -1% of sales since 2009, even taking into account a slight improvement in 2014. This implies that companies increasingly have to resort to external funds to cover investment or even operational activities.

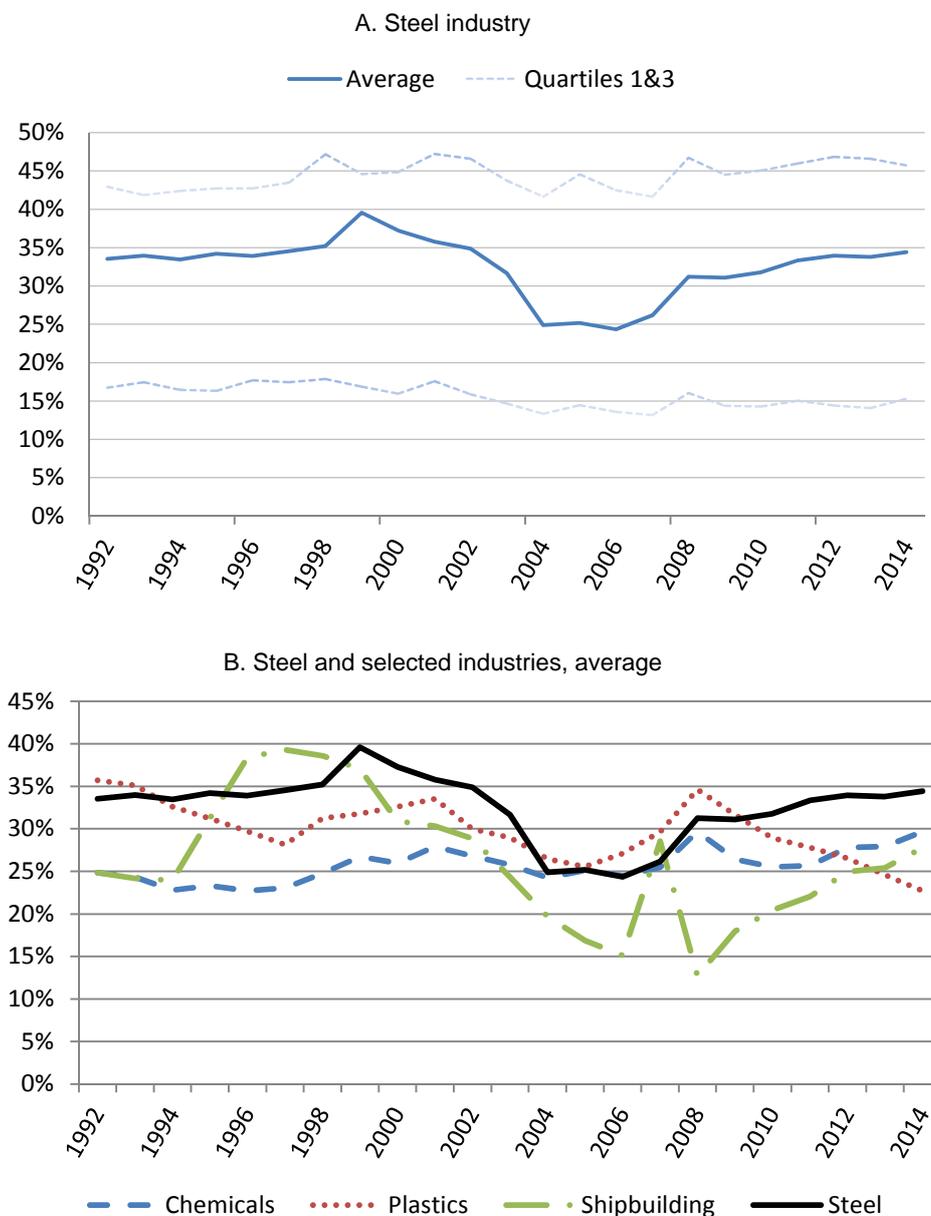
**Figure 5. Free cash-flow on sales between 1992 and 2014, %, steel industry**



Note: The dashed lines provide information on the distribution of free cash flow across the firms in the sample: 25% of the companies have free cash flow below (above) the first (third) quartile line. The heavy line depicts the industry average free cash flow.

Source: OECD calculations based on data from Factset.

As cash flows directly affect the need for resorting to external funds (debt), another trend observed recently is increasing indebtedness among steelmaking companies. Debt levels on total assets amounted to 34% in 2014, having increased from 25% in 2004 (Figure 6, Panel A). Nevertheless, the current level of indebtedness still remains below the 1999 peak of 39%. When compared to several other industries, steelmaking companies appear to have relatively high levels of indebtedness (Figure 6, Panel B). Even though debt can be a valuable source of funds for investment activity, it can also become a drag on profitability through increased interest expenses. In fact, the share of interest expenses on total assets for steelmaking companies has increased by 34% since 2007.

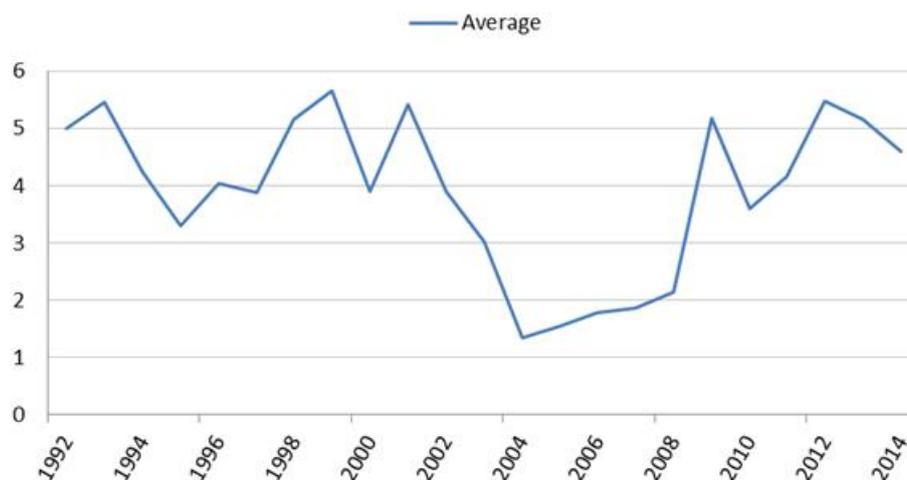
**Figure 6. Share of debt on total assets between 1992 and 2014, %, steel industry**

*Note:* The dashed lines in panel A provide information on the distribution of debt on total assets across the firms in the sample: 25% of the companies have debt on total assets below (above) the first (third) quartile line. The heavy line depicts the industry average debt on total assets.

*Source:* OECD calculations based on data from Factset.

These results raise an important question: How have steel companies been able to sustain such high levels of indebtedness and for how long can they continue to do so? Should steelmaking companies continue to experience low profitability levels, it is unlikely that they can continue to service their debts. The industry average debt-on-EBITDA ratio is well above the recommended levels of three times operating profit levels in one year. The ratio reached 4.6 in 2014, having remained above 3 since the onset of the global financial crisis (Figure 7).

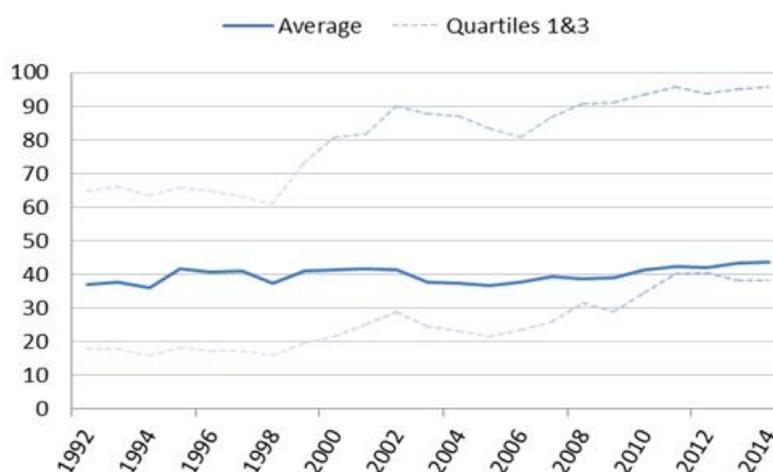
**Figure 7. Ratio of debt to EBITDA between 1992 and 2014, steel industry**



Source: OECD calculations based on data from Factset.

An interesting feature observed recently is an increasing reliance on short-term debt (Figure 8). Although the average short-term debt as a share of total debt has remained relatively stable at around 40%, an increasing number of firms are resorting to short term liabilities, as indicated by the quartile distributions in Figure 8 (the dashed lines that represent the top and bottom 25% companies). In 2014, short-term debt accounted for 38.4% of total debt for more than 75% of steelmaking companies and 25% of these companies had ratios above 95.6%. The increasing preponderance of short-term debt in total debt suggests that either firms are facing difficulties in obtaining long-term loans for investment purposes — in line with recent general trends (OECD, 2013c) — or are using debt (e.g. bank overdraft) to cover their operational activities. The comparison of distributions across periods (in the next section) provides a clearer picture of this increased focus on short-term financing.

**Figure 8. Share of short-term debt in total debt between 1992 and 2014, %, steel industry**

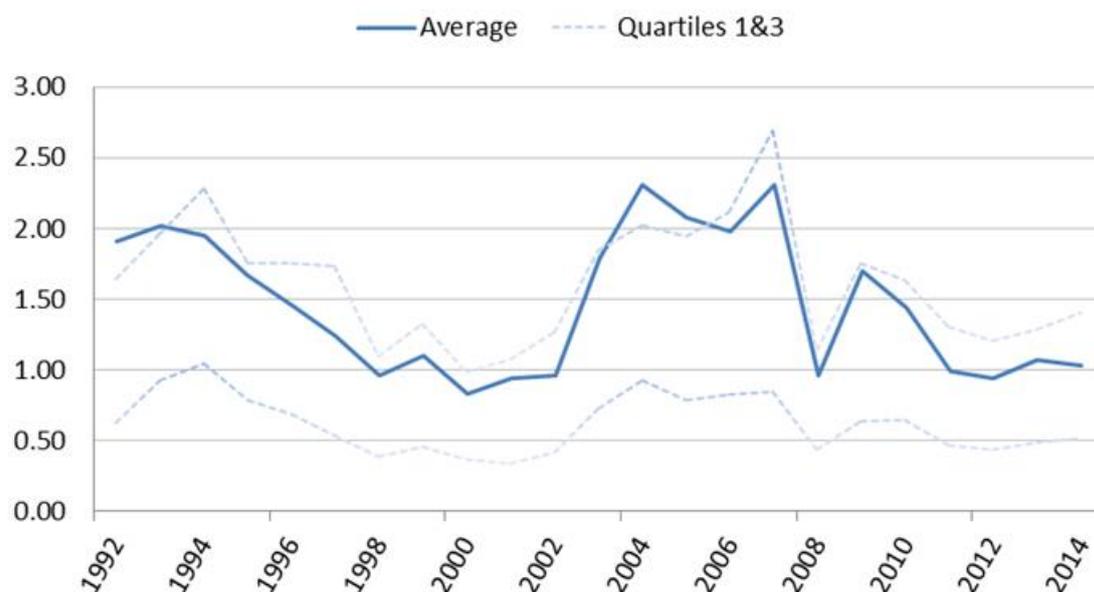


Note: The dashed lines provide information on the distribution of short to long-term debt across the firms in the sample: 25% of the companies have short to long-term debt below (above) the first (third) quartile line. The heavy line depicts the industry average short to long-term debt.

Source: OECD calculations based on data from Factset.

Investment opportunities are increasingly scarce in the steel industry, as indicated by recent industry price-to-book figures (Figure 9).<sup>3</sup> Price-to-book ratios reveal markets' expectations about companies. In 2012, this ratio was 0.94, but has since hovered near a value of one. Values below one suggest that the market values a company below its total asset value. This is often regarded as a signal that companies are earning poor (or negative) returns on assets and should not commit to new investments.

**Figure 9. Price-to-book ratio between 1992 and 2014**



*Note:* The dashed lines provide information on the distribution of price-to-book ratio across the firms in the sample: 25% of the companies have price-to-book ratio below (above) the first (third) quartile line. The heavy line depicts the industry average price-to-book ratio.

*Source:* OECD calculations based on data from Factset.

Even though recent price-to-book values are slightly higher than those observed during the early 2000s, it is interesting to note that low investment opportunities are more persistent in steel than in other industries. Table 1 below summarises the persistence of low price-to-book ratios across selected industries. Between 2009 and 2014, more than 30% of steelmaking companies in the sample continued to have price-to-book ratios below unity after three years, the highest percentage amongst the selected industries. At the end of the period, the perceptions of the markets regarding steelmaking companies continued to be very low for almost 7% of the steelmaking companies in the sample.

**Table 1. Persistence of low investment opportunities**

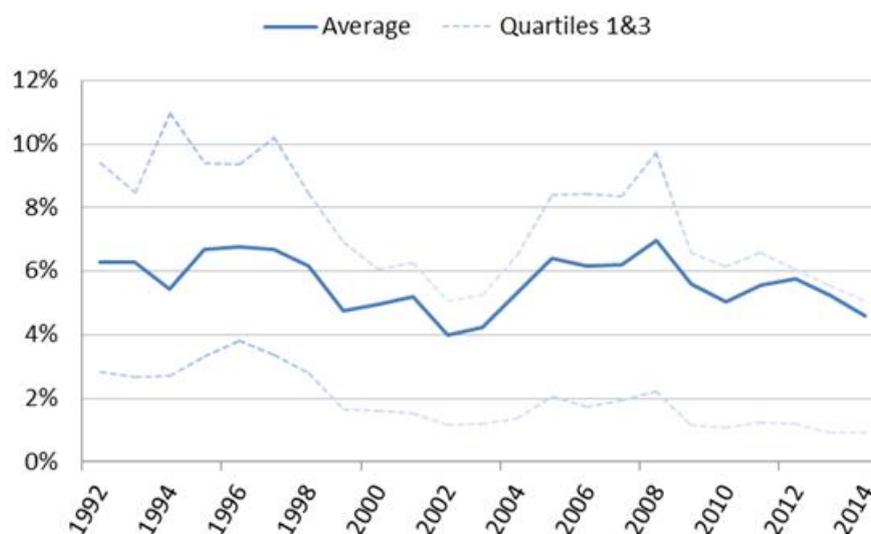
2009-2014

Industry	Percentage of firms with low investment opportunities in consecutive years after...				
	1 Year	2 Years	3 Years	4 Years	5 Years
Chemicals	62.5%	41.6%	25.7%	13.7%	5.9%
Plastics	68.0%	46.1%	29.0%	16.3%	6.4%
Shipbuilding	62.4%	39.8%	23.5%	11.1%	4.9%
Steel	70.2%	48.1%	30.3%	16.4%	6.9%

*Note:* Low investment opportunities are defined as a price-to-book (Q) ratio below unity for each year. Industries are defined at the 3-digit NACE Rev. 2. Persistence is measured in consecutive years with low investment opportunities. Some firms may well exhibit low Q in one year, Q above unity in the next year and then Q below unity again one (or more) year later — these are not taken into account here.

*Source:* OECD calculations based on data from Factset.

Despite low profitability and few investment opportunities, it is interesting to note that investments in physical capital are still being made. Investment figures are nevertheless relatively low, with 75% of steelmaking companies investing less than 6.3% of their assets, compared to 9.7% in 2008 (the top dashed line in Figure 10). Conversely, 75% of the steelmaking companies in the sample were still investing more than 1% of their assets in 2014 and the average investment on assets was 4.6% in 2014, higher than that in 2002 (4.0%). Given still weak prospects for steel demand growth (OECD, 2015a), the extent to which any of this investment feeds into new capacity additions can further deteriorate the already challenging global excess capacity situation (OECD, 2015b).

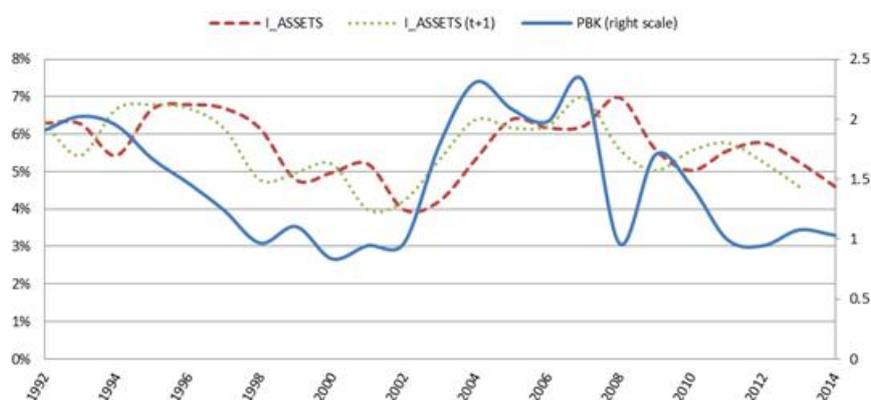
**Figure 10. The share of investment on total assets between 1992 and 2014, %, steel industry**

*Note:* The dashed lines provide information on the distribution of investment on total assets across the firms in the sample: 25% of the companies have investment on total assets below (above) the first (third) quartile line. The heavy line depicts the industry average investment on total assets.

*Source:* OECD calculations based on data from Factset.

Theory predicts that investment should be relatively highly correlated with the price-to-book ratio (e.g. Hayashi, 1982; Chirinko, 1993), if not fully explained by the ratio (see Annex 1, A3). Figure 11, however, shows that the correlation is quite lagged when it comes to the steel sector. Investment often continues to increase for some time despite falling price-to-book ratios, a situation that occurred in the early /mid-1990s and again in the aftermath of the global financial crisis. Investments in the steel sector have been thus very slow to react to a steep decline in the price-to-book ratio.

**Figure 11. Price-to-book ratio and investment/assets in the steel sector**



Source: OECD calculations based on data from Factset.

Overall, the evolution of the financial performance of steelmaking companies over the past 21 years has been irregular. The mid-2000s period of financial strength in the industry was preceded and followed by periods of lower profitability, higher debt and sluggish investment. Two important features should be highlighted in recent developments. First, the shift towards short-term debt hints at external financing challenges. Second, the assessment of future opportunities by financial markets clearly signals that new investment, if any, should be carefully considered.

Fears that the steel industry is in a new crisis of the scale seen in the late 1990s and early 2000s have been raised. The analysis in this section points to some potential similarities. Profitability and indebtedness have recently reached serious levels, close to or even past the levels observed before. A more detailed analysis comparing the two periods may unveil additional features that deserve due consideration.

### 3. A comparison of recent steel downturns

#### 3.1 Brief background

Several steel crises have been observed over the past several decades, with at least one crisis having recurred every decade since the 1970s. These crises have been associated with broader regional or global economic recessions. While the internal structural problems of the industry are usually at the origin of steel crises, external events usually trigger them, resulting in severe and protracted downturns in the sector. During these crises, the industry typically experiences unstable and deteriorating conditions, while trade measures proliferate to protect domestic industries from unfair trade practices.

The Asian financial crisis is often seen as triggering the steel industry crisis of the late 1990s. However, an earlier event – the breakdown of the Soviet Union and associated decline in investment and industrial activity across the Commonwealth of Independent States (CIS) region – set the background. The severe economic contraction in the CIS region in the 1990s led to a shift in some countries away from

industry towards agriculture and services. The economic decline persisted until the late 1990s, and had a profound impact on the global steel industry. As steel consumption in these economies collapsed, their exports increased significantly throughout the 1990s, even amidst declining steel production. Previously net importing countries in the 1980s, the CIS economies became the world's largest net exporters by the end of the 1990s, with net exports amounting to around 50 million metric tonnes (mmt) by the end of the decade.

The Asian economic crisis, which began in 1997, intensified the situation and added to trade tensions. The economic crisis led to a collapse in the region's demand for steel, with demand for steel in Southeast Asia falling by some 35-40 million tonnes in 1998 (accounting for approximately 5% of global consumption that year) but by smaller amounts in subsequent years. On the supply side, large investments in greenfield steel projects had been made in the region just prior to the crisis, supported by the perception that regional demand would grow strongly in the future. Although some projects were eventually withdrawn as demand declined and the crisis deepened, the region's excess capacity grew significantly and steelmakers increasingly turned to export markets to sell their output.

As a result of these economic shocks, global trade flows underwent significant fluctuation during the 1990s and trade actions escalated. Stronger economic growth in the United States and the EU translated into a strong influx of steel products into these economies particularly from East Asia and the CIS region. A series of antidumping and countervailing duty cases were filed, which eventually culminated in a number of safeguard actions in 2001-2003. Although the escalation of trade remedies in the late 1990s involved a wide range of steel products, hot-rolled flat products accounted for much of the friction. More than half of the cases during this period were filed by the United States, the EU, Canada, Mexico, and Argentina, and the remainder by a number of emerging and developing economies in South America, Africa and East Asia. Many of the filing countries were also accused of dumping hot-rolled steel in foreign markets.

The steel industry downturn that began in 2008 was also triggered by an economic and financial shock, but one that was broader than the external shocks observed in the 1990s. Although indications of a steel market slowdown were already emerging in some OECD countries prior to the onset of the financial crisis in the autumn of 2008, on a global level the market remained buoyant owing to continued growth in steel demand in emerging economies. The financial market shock, however, brought demand growth even in emerging economies to a complete halt towards the end of 2008, as many countries experienced a sharp decline in exports of manufactured goods, and thus also in their demand for intermediate inputs such as steel.

The immediate reaction by steel producers differed to some extent from previous market downturns. In late 2008 and early 2009, production was curbed sharply, which helped bring supply much closer in line with demand and thus prevented a steeper decline in prices. At that time, increased global consolidation and the past restructuring of the industry were cited as factors that had helped the industry adjust better to the global crisis. Indeed, in many of the previous cyclical downturns, steel producers had tried to maintain operations at a level of low average costs in hopes of finding new demand at lower prices on domestic and foreign markets. But, because too many producers pursued these incentives, the end result was typically excess supply and, as a consequence, sharp price declines.

Global demand for steel began to recover in late 2009, but this was supported mainly by a stimulus-led recovery in China while many economies continued to suffer from deep recessions. The recovery in steel demand has since been uneven. In addition to China, major players such as Brazil, India, Korea, Russia, and Turkey saw demand return to pre-crisis levels relatively quickly, i.e. within one to three years following the crisis. On the other hand, recovery in the European Union, Japan and the United States has been slower.<sup>4</sup> To make matters worse, the economic slowdown in China (which accounts for more than

50% of global apparent steel use) and in several other emerging economies are leading to renewed weakness in steel demand since 2014 (see OECD, 2015a).

As described in the preceding section, the financial situation of steelmakers has rapidly deteriorated over the last few years. Recent developments suggest that the steel market has further deteriorated during 2015.<sup>5</sup> The situation is critical and perhaps even worse than the economic challenges faced during the early 2000s. A formal comparison of key financial indicators between the two steel downturns (1997-2002 and 2009-2014) is discussed below.

### **3.1 Financial performance of the steel sector: 1997-2002 and 2009-2014**

The steel industry is currently facing significant challenges. This section provides a more formal comparison of the two periods (1997-2002 versus 2009-2014) and unveils a number of similarities and differences between these periods. In particular, the financial data analysed suggest that

- The recent years (2009-2014) are different from the period 1997-2002 in many respects (e.g. profitability, indebtedness, R&D investment).
- The overall financial performance of steelmaking companies as a whole is now worse than it was during the 1997-2002 crisis.
- A number of factors raise some concerns about the short-term performance of steel companies, these include: *i*) lower operating profitability levels; *ii*) an increasing focus (either voluntary or not) on short-term credit; and *iii*) very low levels of investments in R&D, despite relatively similar levels of physical capital investment.

#### **Box 2. How to interpret the charts in this section**

In order to relate the current financial situation of steelmaking companies with that of late 1990s and early 2000s, a distinction between two five-year time periods is made, 2009-2014 versus 1997-2002. Two approaches are used to make the comparisons. The first relies on visualising the two distributions through a quantile-quantile plot. After ranking each distribution, this type of chart is very useful for comparing two distributions because it contrasts values in the same quantile. Therefore, values above the symmetry line ( $y=x$ ) indicate that the distribution of a given variable for the period 1997-2002 dominates the distribution of the same variable for the period 2009-2014. The reverse is true for values below the symmetry line.

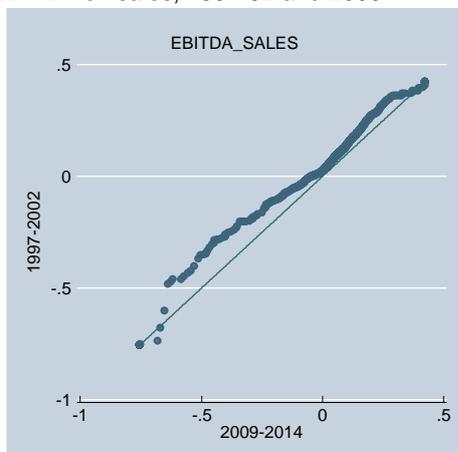
Second, the distributions of two specific years (2014 versus 2002) are compared using charts with the kernel density estimate. The kernel density estimate gives an approximation of the probability density function of a given distribution — up to a given point  $x$  in the horizontal axis, the area under this function provides the percentage of observations that have values that are lower or equal to  $x$ .

The technical note at the end of this document provides formal tests comparing the two periods. The tests provide an indication of how statistically significant differences in industry variables (e.g., profitability, debt, costs, market valuation, R&D, investment, and other main variables of interest) are between the two periods. They also show in which period each of the industry variables were higher or lower.

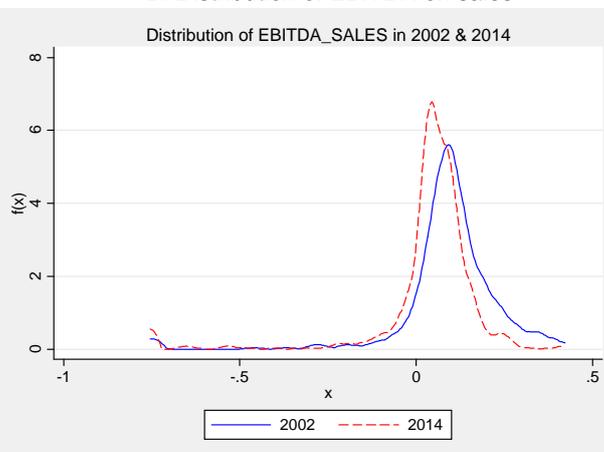
Steelmaking firms during the period 1997-2002 showed better core profitability figures than in recent years (2009-2014), measured as EBITDA on sales. Interestingly, comparing EBITDA on sales between the last two years of the periods under analysis (Figure 12) reveals that in 2014 there are many less firms with sustainable profitability levels.<sup>6</sup> This is in line with the trends uncovered in Section 3. It is however important to note that a small number of companies (3%) still performed rather well in 2014, with profit levels above 20%.<sup>7</sup>

**Figure 12. Comparison of profitability levels between the two periods**

A. EBITDA on sales, 1997-02 and 2009-14



B. Distribution of EBITDA on sales



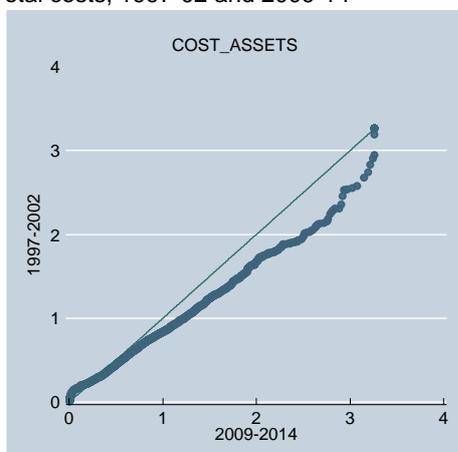
*Note:* Quantile-quantile plots for EBITDA on Sales and cash-flow on total assets, as well as the kernel density estimates for EBITDA on Sales in 2002 and 2014.

*Source:* OECD calculations based on data from Factset.

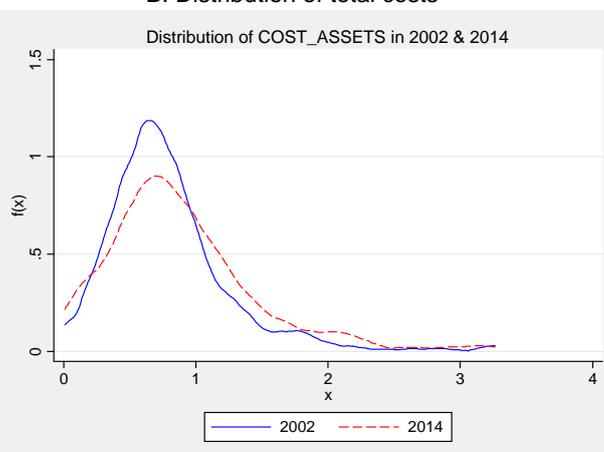
Lower profitability in 2014 has been associated with higher costs, especially in terms of the variable cost component. Figure 13 clearly shows higher variable costs for the recent years. A remarkable feature that can be observed from the comparison between 2002 and 2014 is a shift in the whole variable cost distribution towards higher levels. This means that the increase in variable costs was felt across the board, affecting not only the least but also the most cost-effective companies. Part of the increase in variable costs might result from increases in raw material prices (notably between 2009 and 2012), whereas in the past changes in raw material prices did not seem to affect variable costs to the same extent. A comparison of the evolution of variable costs and raw material prices is provided in Annex 2.

**Figure 13. Comparison of cost levels between periods**

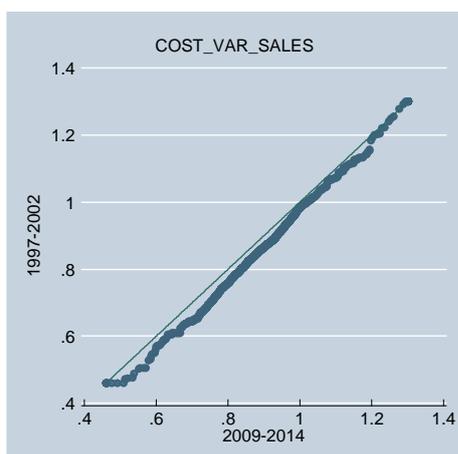
A. Total costs, 1997-02 and 2009-14



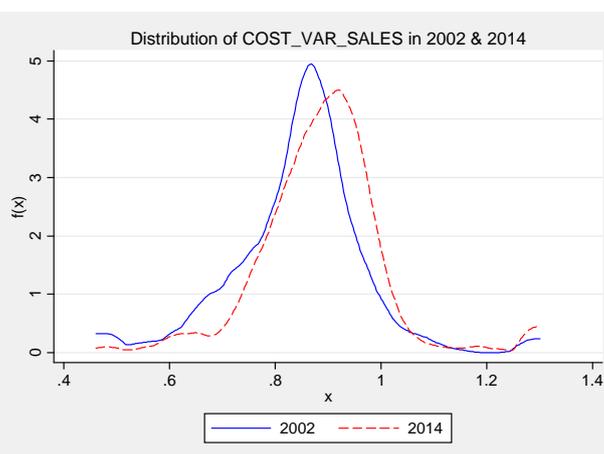
B. Distribution of total costs



C. Variable costs, 1997-02 and 2009-14



D. Distribution of variable costs

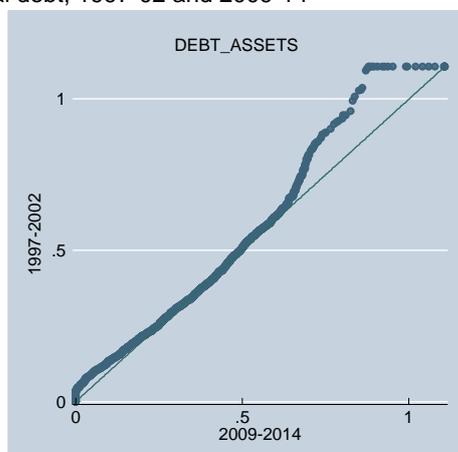


Source: OECD calculations based on data from Factset.

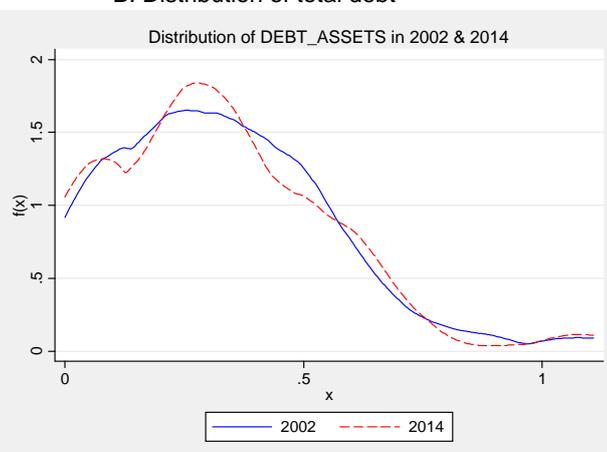
Even though steelmaking companies were slightly more indebted during the 1997-2002 crisis (Figure 14, Panel A), they now rely more on short term debt than they used to (Panel C). This evolution is likely to reflect difficulties in obtaining longer-term debt. Tighter credit conditions for steel companies than before would be in line with the conditions facing the broader economy, especially with regards to access to long-term financing.<sup>8</sup>

**Figure 14. Comparison of indebtedness between periods**

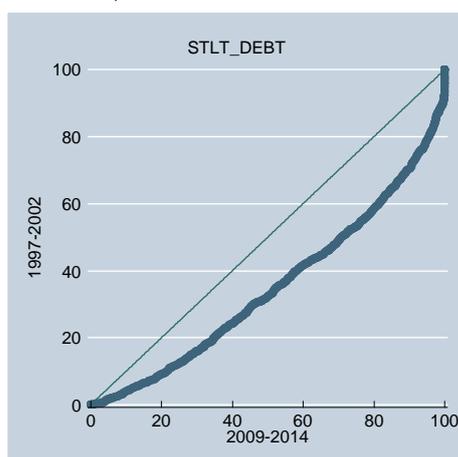
**A. Total debt, 1997-02 and 2009-14**



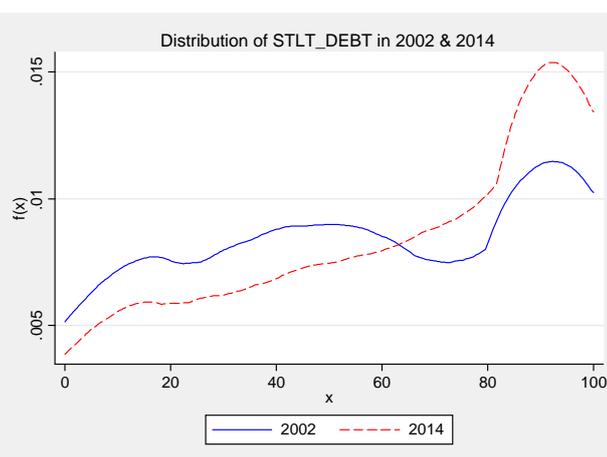
**B. Distribution of total debt**



**C. Short-term debt, 1997-02 and 2009-14**



**D. Distribution short-term debt**



Source: OECD calculations based on data from Factset.

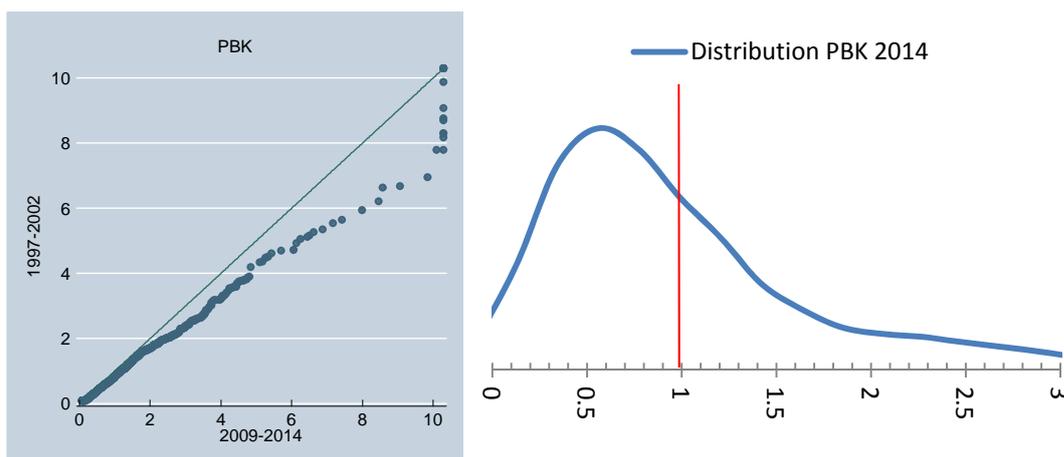
The market’s assessment of steelmaking companies relative to assets (price-to-book ratio) is now higher than in 1997-2002 (Figure 15). However, panel A of Figure 15 also suggests that this effect was more pronounced in firms at the higher end of the distribution. In addition, companies exhibited high ratios during the years 2009 and 2010, reverting to unity or below in the years after (c.f. Figure 12 in the previous section). The latest data for 2014 (Figure 15, Panel B) shows that the majority of steelmaking companies are now valued by the market below the value of their assets (52%, the same as in 2002). It is nevertheless of concern the financial markets’ assessment of good investment opportunities for a significant number of steelmaking companies, given the current excess capacity situation.

There are no visible differences between investment expenditures in 1997-2002 and 2009-2014, nor between 2002 and 2014, even though the formal tests available in the Technical Note (row 10 of the corresponding table) suggest higher value in the former period. Nevertheless, when it comes to efforts to introduce innovation, the two periods are very different (Figure 16). Even though there is no clear-cut differences in R&D investments between the selected years 2002 and 2014 (Panel B), between 2009 and 2014 steelmaking companies invested much less in R&D than they did in 1997-2002 (Panel A). This is interesting as R&D investment can be an important driver of productivity growth (OECD, 2013d; OECD,

2015c) and is important for the steel industry to move towards increased energy efficiency and environmental performance in the future (IEA, 2015). It is however important to note that, during downturns when short-term cash needs are more pressing, firms may decide to reduce investments into R&D, notably if the returns on such investments (e.g. gains in efficiency or cost reductions) are only accrued over the longer run.

**Figure 15. Comparison of investment opportunities between periods**

A. Price-to-book ratio during 1997-2002 and 2009-2014      B. Distribution of price-to-book ratio, 2014

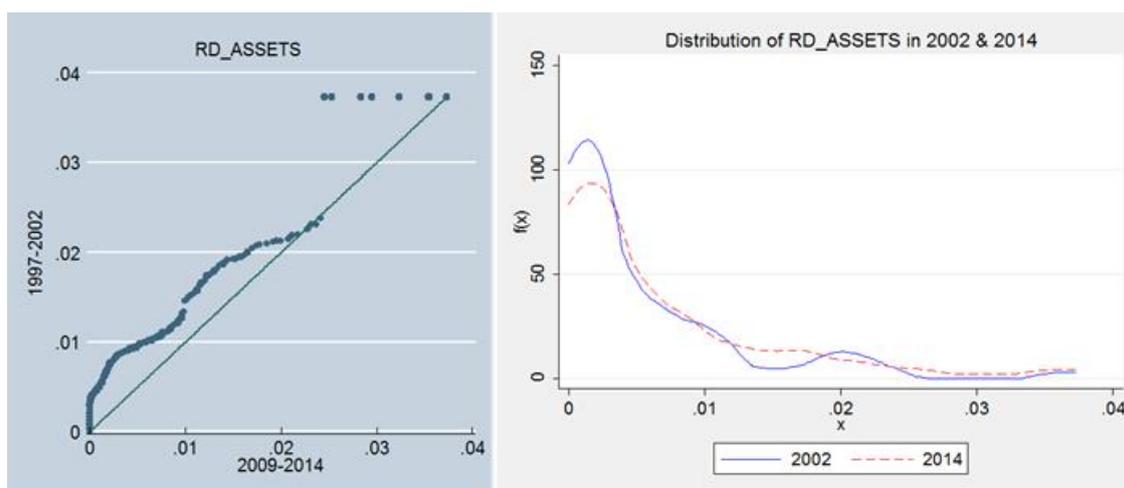


*Note: The red line depicts the threshold (value of one), above which a company could and/or should increase its assets, thus is a proxy for investment opportunities. Ratios below 1 (to the left of the red line) indicate that, if a company would sell all its assets, it would not even meet the market value. Please refer to Annex 1, Section A3 for further details on the interpreting this variable.*

Source: OECD calculations based on data from Factset.

**Figure 16. Comparison of R&D investment levels between periods**

A. R&D investments during 1997-2002 and 2009-2014      B. Distribution of R&D investments, 2002 and 2014



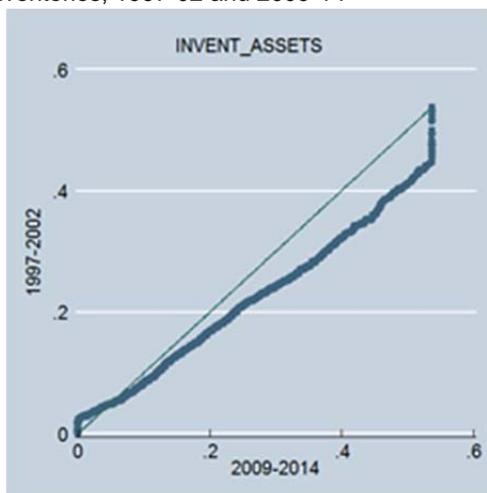
Source: OECD calculations based on data from Factset.

The storage of inputs and production outputs may be particularly advantageous if markets (and prices) are very volatile as they work as a buffer. Interestingly, inventories are substantially higher in the recent period than they were in 1997-2002 (Figure 17, Panel A). This is particularly true with respect to

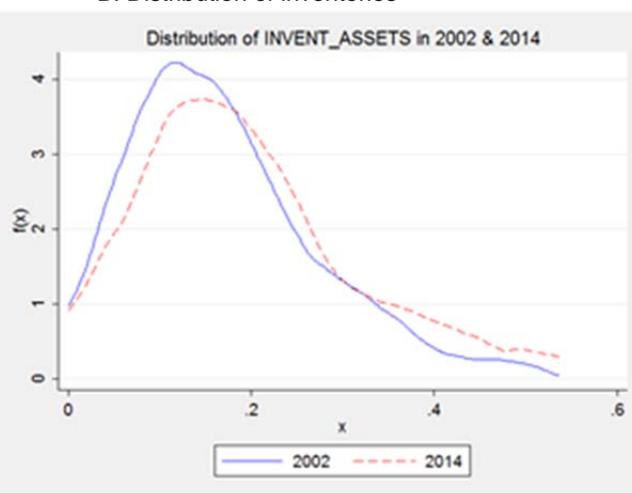
inventories of raw materials (Figure 17, Panel C). A possible explanation for this relates to the changes in the way raw material prices are set — especially with regards to the change from contract-based to spot iron-ore prices — and increase in prices (Annex 2).

**Figure 17. Comparison of inventories between periods**

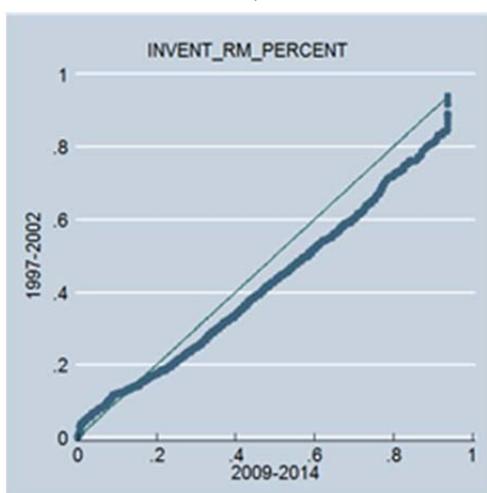
A. Inventories, 1997-02 and 2009-14



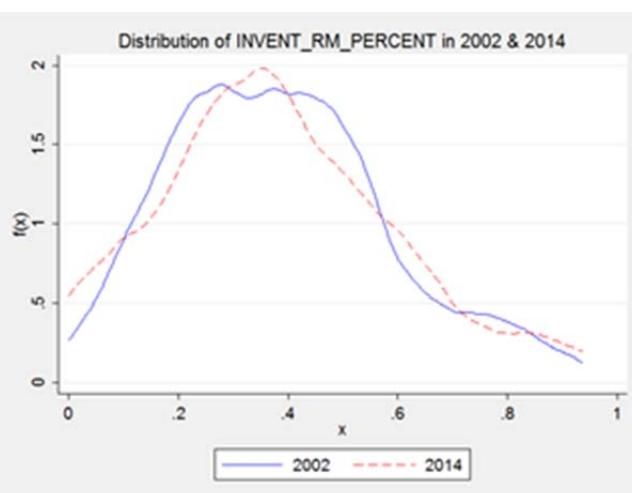
B. Distribution of inventories



C. Inventories raw materials, 1997-02 and 2009-14



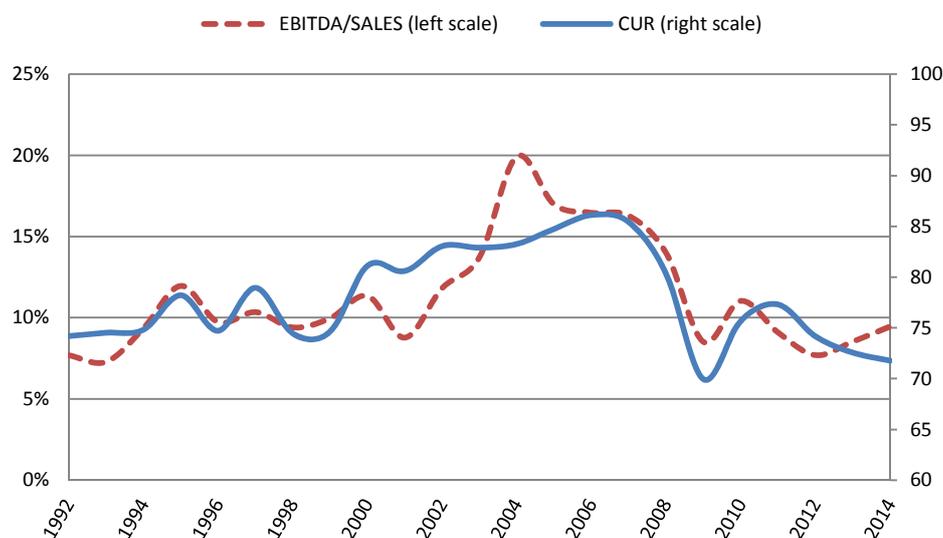
D. Distribution of inventories raw materials



Source: OECD calculations based on data from Factset.

#### 4. Linking financial performance to capacity utilisation

Steel production has not been keeping up with increases in capacity, resulting in a declining trend in the global capacity utilisation rate (CUR) since 2006, despite some recovery in 2010 and 2011. This has occurred while the industry’s aggregate operational profitability, measured as EBITDA on sales, has declined (Figure 18). With the exception of the period 2003-2007 characterised by a rapid increase in steel demand and booming raw material markets, Figure 17 suggests that CUR and profitability move more or less in line.<sup>9</sup>This raises the question as to what extent global excess capacity affects the operational profitability of steel producers. The question is not new and has been addressed at previous OECD Steel Committee meetings.

**Figure 18. Profitability and Capacity Utilisation Rate (%)**

Source: OECD calculations based on data from Factset.

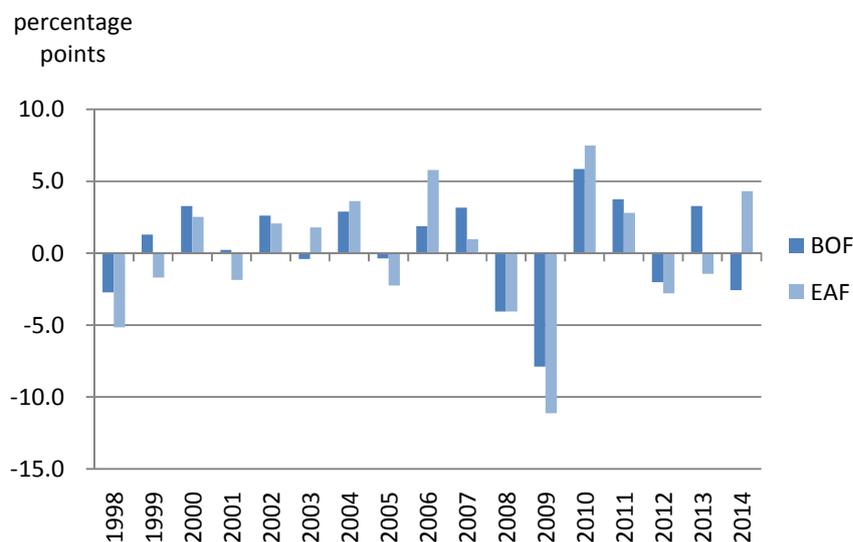
Excess capacity affects profitability through a number of channels. Two main channels are costs and prices. For example, in periods of low capacity utilisation, economies of scale are not fully exploited and thus costs are higher and profits lower. Prices also tend to be lower during periods of low capacity utilisation, thereby directly impacting profits. At the global level, the effects of excess capacity are transmitted through trade; excess capacity can lead to export surges, leading to price declines and market share losses for import-competing domestic producers. Preliminary analysis discussed at previous Steel Committee sessions suggests that there is a strong relationship between the global capacity utilisation rate and the operating profitability of firms (OECD, 2013b). However, that analysis also found that profitability is driven by a vast and heterogeneous group of factors, from global trends to firm-level behaviour and characteristics.

The OECD Secretariat is currently examining ways to improve the analysis of the impact of capacity utilisation on profitability. Changes in the global capacity utilisation rate may affect profitability through a number of channels, as discussed above, including firms' ability to adjust to changes in the global steel market. Even though during challenging market periods — notably in the presence of import surges — all firms suffer significantly, companies might be more or less flexible to accommodate shocks depending on the steelmaking technology they employ as well as their exposure to international markets. For example, differences between EAF and BOF technologies may have implications upon their flexibility to adjust production. Compared to BOF, the EAF route tends to provide companies with a higher degree of flexibility in setting their production, which in turn allows them to better cope with volatile steel demand and supply shocks.

As a result, profitability is also likely to be affected by the production technology employed, i.e. by the degree of flexibility to adjust production. To illustrate this argument, assume that there are two steel plants with distinct technologies (EAF and BOF) facing a negative demand shock. While a BOF plant will mostly be affected by price (because quantity adjustments may be more difficult in the short term), an EAF plant will be affected by price but can adjust quantity. Should prices fall below marginal cost, the EAF plant would stop (or reduce) production to save on variable costs, but the BOF plant might carry on with losses because they have a larger share of fixed (or semi-fixed) costs. Figure 19 presents annual changes in the capacity utilisation of EAF and BOF steelmakers using plant-level information. While the data are not fully representative of the population of steel plants, they generally do indicate greater variation in the

capacity utilisation rates of EAF plants in response to changes in the market, relative to BOF plants, at least since the previous market downturn in the late 1990s.

**Figure 19. Annual changes in capacity utilisation rate by steelmaking technology**



*Note:* The plant-level data are not fully representative of the population of steel plants.

*Source:* OECD calculations based on data provided by James King.

Matching profitability data with production technology at the firm level through time is however challenging. Further efforts are needed to collect data that matches financial performance, capacity and technology at the firm level in order to provide robust estimates of the effect that changes in the global steel market situation, notably in terms of capacity utilisation, may have upon the financial health of the industry.

## 5. Conclusion

In the context of excess steelmaking capacity, the steel industry's financial situation is weaker than it has been in years. Even though the steel industry has experienced crises in the past, the current downturn is of particular concern given its depth and length. This report suggests that financial performance of the industry is perhaps worse now than during the crisis of the late 1990s. Moreover, recent trends in key financial indicators raise serious concerns and suggest that the global industry is in a very difficult economic and financial situation. Nevertheless, financial performance is heterogeneous, as some firms appear to be resilient and are performing rather well. Further work is needed to better understand why this is the case and identify strategies that can be used to increase the performance of steelmaking companies.

A further deterioration in steel demand prospects along with continued capacity expansions are likely to place further pressure on the financial sustainability of the steel industry. The complex financial situation of the industry and mounting trade disputes calls for immediate action to address underlying imbalances in the steel market. Governments should be aware of the financial risks facing the sector when considering policies that promote new capacity expansions and should work to facilitate the closure and/or restructuring of inefficient producers, while mitigating associated social costs. In addition, private and government-related financial institutions facilitating capacity expansion projects in the steel sector should take into further consideration existing supply-demand imbalances, as newly installed steel capacities could face serious short- to medium-term financial sustainability risks and further amplify the extent of the capacity challenge.

Further research is, however, still needed to explain the differences in performance between different industries and more specifically across steelmaking companies, as well as to analyse policy options to promote a more efficient and viable steel industry. Further efforts are also needed to collect and combine firm-level data and policy indicators, in order to provide robust evidence in this and other areas of steel related policymaking.

## NOTES

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- <sup>1</sup> A presentation by McKinsey at the 1-2 July 2013 OECD Steel Committee meeting suggested that 16% is the sustainability threshold for steel companies.
- <sup>2</sup> Free cash-flow to sales is an additional profitability indicator. This variable provides information on firms' capacity to generate cash after investments and covering costs of replacing capital (depreciation and amortisation). Free cash flow is the amount of cash that a firm generates and is available for either paying out dividends to shareholders or retaining as cash holdings for use in future periods (revealing expectations about the future state of the market).
- <sup>3</sup> The price-to-book ratio indicates how the market evaluates a firm, relative to its assets. If the ratio is above 1, it suggests that a company can and/or should increase its assets, i.e. it is a proxy for investment opportunities. Ratios below 1 indicate that if a company would sell all its assets, it would not even meet the market value.
- <sup>4</sup> Please note that in some of these regions, significant efforts have been made to close down production capacity, amidst the demand slowdown. For data on steelmaking capacity developments, please refer to the OECD Steelmaking Capacity Portal, available at: <http://oe.cd/steelcapacity>.
- <sup>5</sup> Steel market developments during 2015 suggest that the financial situation is rapidly deteriorating, leading to bankruptcy events, closures of steel plants across the world and mounting trade disputes. For additional information on recent market steel market developments, please visit the dedicated OECD Steel webpage available at: <http://oe.cd/stlmktdev>.
- <sup>6</sup> A presentation by McKinsey at the 1-2 July 2013 OECD Steel Committee suggested that 16% is the sustainability threshold for steel companies. This threshold is, according to McKinsey, the amount of EBITDA no sales required to cover debt, taxes, equity and capital expenditure. This estimate, however, may be subject to different views.
- <sup>7</sup> For comparison purposes, 14% of the companies in the sample had profits above 20% in 2007; 9% of the sample had profits above 20% in 2001.
- <sup>8</sup> The World Economic Forum compiles data on the ease of access to loans by country (e.g. Schwab, 2012). Access to loans was shown to have significantly decreased since the financial crisis (see OECD 2013c, pp. 200 for a comparison). The OECD has also developed substantial work on long-term investment, available at: [www.oecd.org/finance/lti](http://www.oecd.org/finance/lti).
- <sup>9</sup> In periods of rapid demand growth, capacity increases may not be sufficient to accommodate the expected growth in demand because capacity is slow to build up. In such circumstances prices (and ultimately profitability) may increase quite rapidly — the steel market experienced a situation alike during the run up to the financial crisis — this is corroborated by internal OECD research (OECD, 2014).

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## ANNEX 1. DATA AND METHODOLOGICAL CONSIDERATIONS

### A1. Dataset

This paper employs a new, very broad, and rich dataset that includes, *inter alia*, financial information, market valuation, ownership structure, mergers and acquisitions, and R&D investment for steelmaking companies. It includes over 70 basic variables covering more than 800 steelmaking companies over 23 years.

The information to build this database was obtained from Factset, a commercial data provider. The financial information obtained from this database is provided on a standardised basis and is therefore comparable. Information from company filings was taken as given and was not validated, implying that any results from the analysis should be taken with some caution. When necessary, the information was complemented with further research done by the OECD Secretariat.

Most of the variables analysed were only available since 1992. Therefore, the sample of steelmaking companies covers the period 1992-2014 (23 years), which is sufficient to allow comparisons of the current situation with that in the late 1990s and early 2000s.

An important limitation of this dataset is the reduced availability of information for firms that are not listed in stock markets (e.g. privately-owned and subsidiary firms). Even if non-listed firms are observed in the data, country coverage is reduced and information is usually very incomplete.

Additionally, during the period 1992-2014, some firms were created or became publicly traded, on the one hand, or were liquidated, merged or became private on the other. This implies that the same firm might not be observed over the full time span. The panel of firms is thus unbalanced and screening out the exact motives for entry/exit of the sample still remains a challenge.

The data thus far includes all companies that are either classified as “Steel” in Factset (code 1105) or their activity belongs to SIC codes 3312, 3316, and 3317. This raw sample includes 982 companies over the 23 year period, resulting in 11 527 firm-year observations.<sup>10</sup> However, this sample includes companies that have major mining activities. As the analysis was intended to focus on steel companies, some companies whose operations were heavily focussed on mining had to be excluded. To do so, cleaning procedures were applied. For example, companies with mines and no steel activity were excluded, as well as companies that did not have the terms “steel” or “metal” in their names or their business descriptions, but did have “iron ore”, “mining”, and/or “minerals”.

Given the characteristics of the dataset, and after undertaking the above-mentioned cleaning procedures, the final dataset results in an unbalanced panel of 890 firms covering the period 1992-2014, corresponding to a total of 10 611 firm-year observations.

### A2. Methodological challenges

**Sample representativeness:** Ensuring the representativeness of smaller steelmaking companies is challenging. Nevertheless, the approach followed consisted in constructing weights based on Sales, which allow for a correction of biases in trend and econometric analysis (Sections 3 and 5.1, respectively). The

OECD Secretariat is confident that this approach minimises the impact of sample biases. Full representativeness by country, region and size is not guaranteed, meaning that results should always be taken with a grain of salt. Nevertheless, this is, to date, the most comprehensive sample of financial information for steelmaking companies available.

**Ownership, control and SOE definition:** Ownership links are complex. Entities can own companies through direct and indirect ownership positions. Additionally, it is not clear if a given percentage ownership actually results in control. In fact there might be some degree of dissociation between ownership and control. For example, the government could have substantial influence, without necessarily holding a majority of shares. Definitions of SOEs vary across countries and might not cover the full extent of state control. This report relies on data from both Factset to obtain state-ownership shares as well as ownership links. SOEs were defined in this study as firms that are owned by the government either through direct or combined indirect ownership links. Ownership is defined as holding more than a 50% share in a given company. The definition is based on the ultimate parent company, i.e. ownership is traced back, through the different ownership links, to the company/agency that ultimately owns the target steel company. Ownership by a government related agency is identified by searching a number of keywords in the ultimate parent company name. Keywords include "Gov" "Province" "City" "State". Nevertheless, a number of government related agencies and/or companies might still not be captured, thus ownership by a government related agency might be underrepresented. In 2014, 22 companies out of a total of 609 companies in operation were identified as SOEs and had a combined market share of 17.68%. China accounts for an important share of SOEs in the sample (82%) followed by Egypt, India and Indonesia (5% each).

**Groups and consolidated accounts:** Many firms are part of a larger group and, normally, the only accounts available are consolidated. It is therefore challenging to disentangle the financial performance of subsidiary companies. This is particularly relevant if there is high variation of profitability levels across the different firms that make up the group, especially if these firms operate in distinct industries. A company may also operate in mining sectors or produce other types of metals and products. It is therefore important but also challenging to isolate the different operations. Given that the dataset available does not cover all subsidiary firms, the analysis of financial performance focuses only on firms/groups for which consolidated financial information is made available.

**Localisation:** Data collection can be rather challenging due to differences between the country where the steelmaker operates and the country where the firm or the corresponding parent firm/group is legally registered. Increased cross-border investment activity and the existence of multiple foreign subsidiaries impose additional challenges to country identification. For simplification purposes the company headquarters is taken as a measure of localisation and assign the corresponding country to that firm. Results are nevertheless presented at the global level.

**Privately held companies:** Financial information on privately held companies is very scarce. These companies do not have the same information disclosure requirements as firms listed in stock markets. This is particularly the case for ownership and certain financial variables that involve market valuation such as share price or earnings per share. Please note that while publicly traded companies are required to disclose a large number of financial data, this is not the case for privately owned companies.

**Business cycles, nominal values and deflators:** Ideally, the effects of cycles should be filtered taking into account both fluctuations across countries and industries. In this analysis only global fluctuations are explicitly controlled for. Fluctuations at the macro-regional level are captured through year and region dummies. Price changes might also impose some difficulties and require the use of deflators. However, since selected variables for analysis are constructed as ratios (see Annex 1, Section A3), it is assumed that the relative price is constant, thus no deflators are used.

### A3. Variable definitions

The choice of financial performance indicators followed two principles. First, indicators should be informative about either the profitability or indebtedness of a firm. Second, indicators should be available in Factset, for the maximum number of firms in our sample. This implies that some variables (e.g. industry metrics, number of employees) are not necessarily included in this analysis to avoid any biases resulting from underrepresentation.

**EBITDA\_SALES:** Ratio between earnings before interest, tax, depreciation and amortization (EBITDA) and total revenue. EBITDA indicates a firm's operating profitability. Provides a good measure of core profitability because it excludes depreciation and amortization. The ratio to total revenue allows for comparability of core profitability between firms. Below zero, companies are making losses. A presentation by McKinsey at the 1-2 July 2013 OECD Steel Committee suggests that 16% is the sustainability threshold for Steel companies. This threshold is, according to McKinsey, the amount of EBITDA to sales required to cover debt, taxes, equity and capital expenditure. This estimate, however, may be subject to different views.

**EBIT\_SALES:** EBIT/Sales is an alternative measure of operational profitability that takes into account depreciation and amortization

**CF\_ASSETS:** Cash-flow scaled by total assets is a measure of profitability that takes into account depreciation and amortization as well as taxes. Along with EBITDA, this gives insights into how a company finances short-term capital.

**CF\_FREE\_SALES:** Free Cash-flow to sales is an additional profitability indicator. This variable provides information of firms' capacity to generate cash after investments and covering costs with replacing capital (depreciation and amortisation). Free cash flow is the amount of cash that a firm generates and is available for either paying out dividends to shareholders or retaining as cash holdings for use in future periods (revealing expectations about future states of the market).

**CS\_ASSETS:** Cash stocks scaled by total assets. This is an indicator of firm's immediate liquidity. Firms may have higher cash stocks to face expected negative shocks in the future or to take advantage of future investment opportunities (if external finance is difficult to obtain).

**DEBT\_EBITDA:** Debt to EBITDA reveals firms' ability to service debt. Healthy firms should have a ratio below 3. The indicator is only meaningful for positive values of EBITDA, thus for all companies making losses this indicator is not computed. An alternative indicator was constructed as the ratio between average DEBT and average EBITDA over all firms for a given year. This avoids difficulties with negative EBITDA figures that are diluted when the average across firms is taken. This alternative indicator is used in the time trend analysis.

**DEBT\_ASSETS:** Debt to assets. Ratio between total debt and total assets. Indicates the percentage of a company's assets that have been financed through debt. Accordingly, it measures the degree of leverage of a firm. Includes both short-term and long-term debt.

**STLT\_DEBT:** The share of short-term debt in total debt indicates whether a company is focusing on financing for operational issues. The ratio varies between zero and one and will depend on the extent to which firms are investing or not. The difference to unity will provide the share of long-term liabilities.

**PBK:** Price-to-Book ratio indicates how the market evaluates a firm, relative to its assets. If the ratio is above 1, it suggests that a company could and/or should increase its assets — proxying investment opportunities. Ratios below 1 indicate market doesn't recognise enough value in company's books. In other

words, if a company would sell all its assets, it would not even meet the market value. In the economics literature, this ratio is also known as “average Q”, an approximation to the theoretical marginal Tobin’s Q (Tobin 1969; Hayashi, 1982). If not summarising all relevant information for a firm’s investment decision, this indicator should, at least, be highly correlated with investment.

**I\_ASSETS:** Investment in fixed assets normalised by total assets. Investment is defined as additions to plant, property and equipment.

**TRADE\_CREDIT:** Difference between accounts payable and accounts receivable. A positive value indicates that the company is a net receiver of trade credit, negative values indicate that a company is a net provider of trade credit. For analysis purposes, this indicator is scaled by total assets (**TRD\_CREDIT\_ASSETS**)

**RD:** R&D expenses provides an indication of whether a firm is making efforts to innovate. Missing R&D values are assumed to be 0. For analysis purposes, R&D investments are also scaled by total assets (**RD\_ASSETS**). R&D investments as a percentage of total investments, which proxy firms’ propensity to invest in R&D (**RD\_INVEST\_PERCENT**) is also analysed.

**AGE:** Constructed as the difference of current date to founding date plus one. The construction of this variable is rather challenging due to the large number of mergers and acquisitions (M&As) in the past.

**DIV\_ASSETS:** Dividend payments scaled by total assets. Dividend payments signal that a firm is being able to generate enough cash to pay shareholders. Conditional on investment and cash holdings figures, it reveals a strategic preference for paying out dividends instead of investing or retaining profits.

**COST:** Total cost is calculated as the sum of variable costs (proxied by costs of sales) and fixed costs (proxied by depreciation and amortization). The variable is scaled by total assets.

**COST\_VAR\_SALES:** Variable costs are costs of goods sold minus depreciation and amortisation expenses.

**SLOPE:** Slope of the variable cost curve. The cost curve is calculated by ranking all firms in a given year by their variable costs and then adding up their sales on a cumulative basis. The slope is calculated through a simple OLS regression of variable costs on cumulative sales and reflects the increase in cost per additional output sold. The evolution of the slope indicates how different steelmaking companies in their production efficiency are. The steeper the curve, the more heterogeneous are companies. This curve also provides an approximation of the theoretical supply curve in the global steel market. This approach is used by some consultancies to assess the profitability of steelmaking companies.

**INVENT\_ASSETS:** Inventories scaled by total assets. Changes in inventories are highly dependent upon upstream (inputs, e.g. raw materials) and downstream (output, e.g. automotive sector) market conditions. Additionally, inventories can work as a buffer during periods of high market volatility.

**INVENT\_RM\_PERCENT:** Percentage of Raw Materials inventories in total inventories. This provides an indication of whether steelmaking companies are hoarding raw materials, which would signal expectations on future raw material prices.

**SOE:** Binary indicator of whether a company is an SOE. When used in time trend or regression analysis, this variable is scaled by the number of firms in the sample, providing a proxy for the percentage of state ownership in a given year. In this paper, SOEs are defined as firms that are owned by the government either through direct or combined indirect ownership links. Ownership is defined as holding more than a 50% share in a given company.

**GROUP:** Binary indicator of whether a company belongs to a group. When used in time trend or regression analysis, this variable is scaled by the number of firms in the sample, providing a proxy for the percentage of firms belonging to a group in each year.

**REGION:** Information on company headquarters (by country) is aggregated into the following regions: Western European, Eastern European, North America, South America, India, China, Turkey MENA, Southeast Asia, Asia-Pacific. This variable does not take into account that firms headquartered in one country may have operations in a different country. However, the aggregation into regions minimises this issue to some extent.

**M&As:** Information from Factset on mergers and acquisitions (M&As) was retrieved in order to build an indicator of concentration in the global steelmaking industry. Only M&As that have been completed between 1992 and 2012 are considered. The indicator is constructed as the natural logarithm of sum of all M&As in a given year. M&As should be able to provide an indication of restructuring in the steel industry.

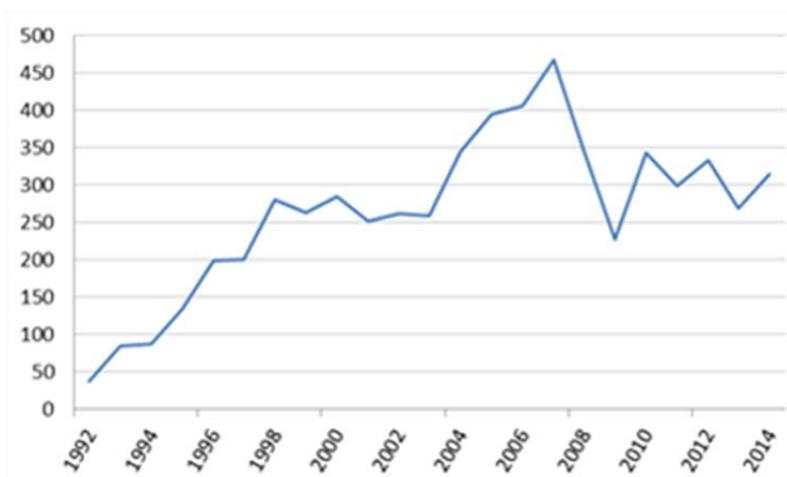
**CUR:** Capacity utilization ratio is defined here as the ratio, for a given year, of global crude steel production, provided by the World Steel Association, to the level of global crude steelmaking capacity in nominal terms, provided by the OECD.

**MKT\_VAL:** Market value reflects the market capitalisation of each company obtained from Factset. For each year, total steelmakers' market capitalisation is constructed as the sum of companies' market value. For the purpose of trend analysis (Section 3), this value is scaled by total market capitalisation (World Bank, 2013) and reflects the weight of steelmaking companies in stock markets. Annex 2. Selected additional charts

**ANNEX 2. SELECTED ADDITIONAL CHARTS**

According to data from Factset, the number of M&As in the steel industry have significantly increased over the years up to 2007 (Figure A2.1). After a sharp decrease in 2008 possibly associated with the financial crisis, industry restructuring activity appears to have stabilised.

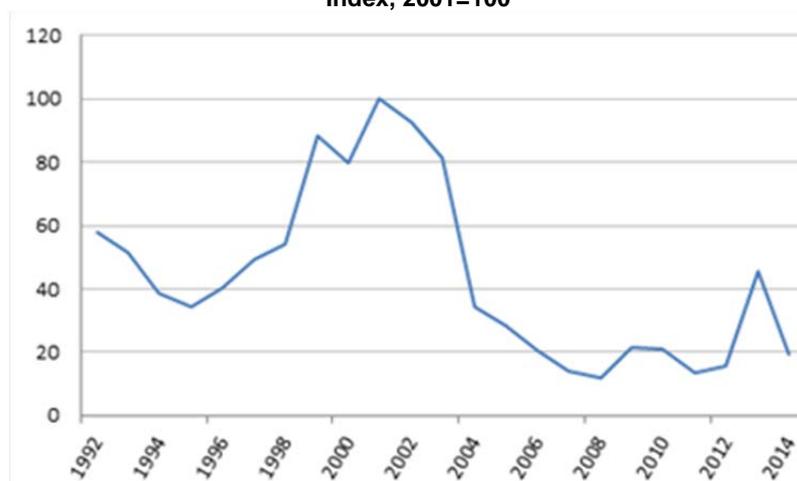
**Figure A2.1: Number of M&As in the steel industry**



Source: OECD calculations based on data from Factset.

Figure A2.2 depicts the evolution of the estimated slope of the cost curve (see Annex 1, A3 for a detailed description of this variable). The slope seems to have significantly decreased and remained at lower levels after a height during the early 2000s. This suggests that nowadays steelmaking companies are more homogenous in terms of their production efficiency than they used to be.

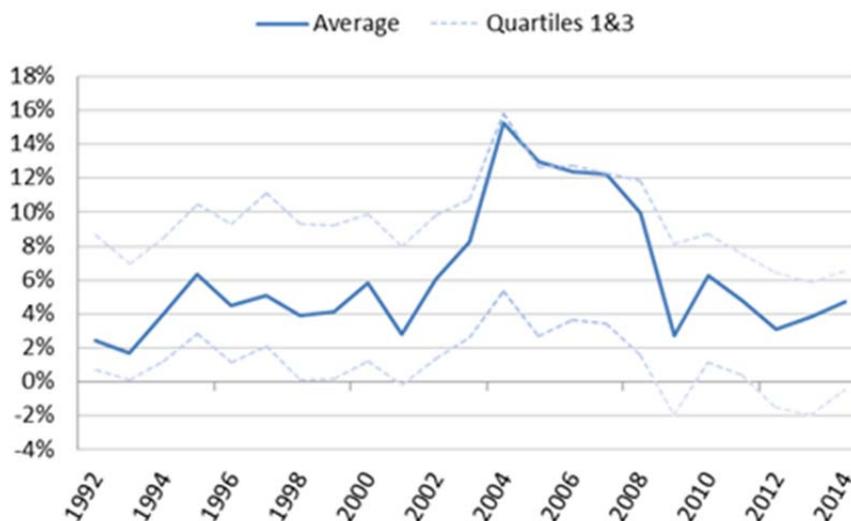
**Figure A2.2. Evolution of the slope of the cost curve  
Index, 2001=100**



Source: OECD calculations based on data from Factset.

Figure A2.3 shows the annual evolution of EBIT on sales. In comparison with EBITDA on sales, this ratio takes into account amortisation and depreciation. The evolution of this indicator supports the decline in profitability since 2007, as discussed in Section 3. From 12.2% in 2007, average EBIT on sales reached 3.1% in 2012 and then improving to 4.7% however higher than the levels reached in 2001 (2.8%).

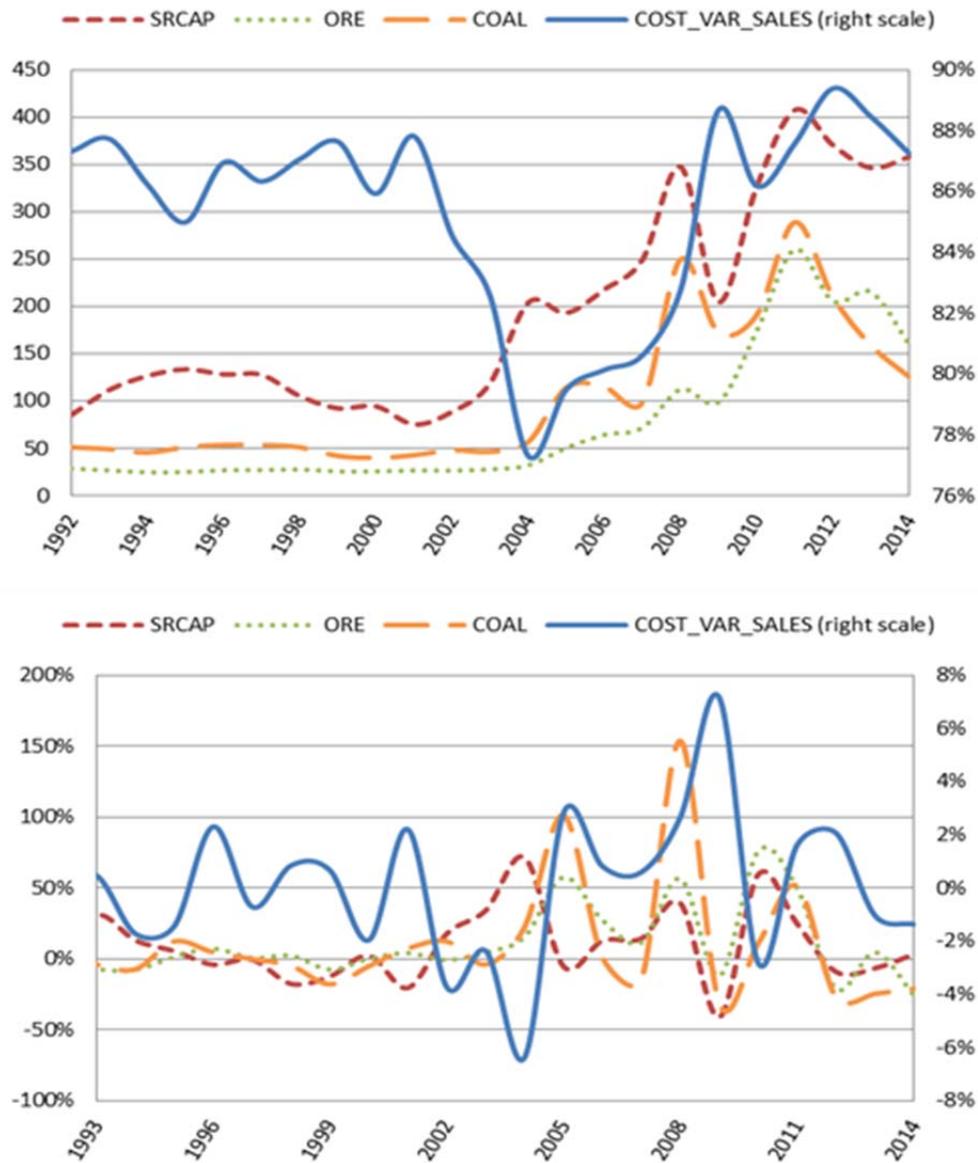
**Figure A2.3: Annual evolution of EBIT on sales between 1992 and 2014**



Source: OECD calculations based on data from Factset.

Figure A2.4 compares the annual evolution of variable costs against the evolution of raw material prices. This figure suggests that during the 1990s variable costs were not so affected by changes in raw material prices — both in levels (panel A) and growth rates (Panel B). After reaching a share of 87% of sales, the weight of variable costs on sales has steeply decreased until 2004. During the second half of the 2000s, the increase in raw material prices was accompanied by a significant increase in the weight of variable costs. In 2014, the share of variable costs was almost 90% (87.2%). This indicates both a shift in the steelmaking production process, where fixed costs have become less important and raw materials appear to have an increasingly preponderant role.

Figure A2.4: The evolution of variable costs and raw material prices



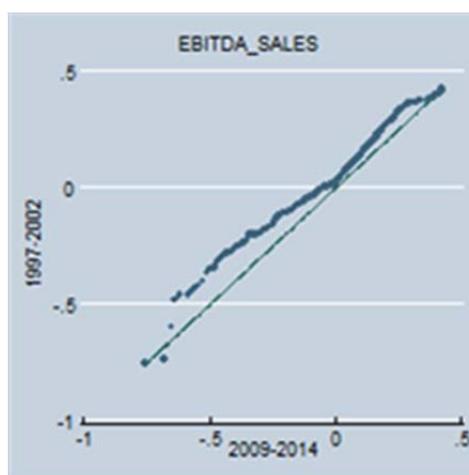
Source: OECD calculations based on data from Factset and raw material prices obtained from American Metal Market, CUR Monitor and SBB.

### TECHNICAL NOTE: HOW TO INTERPRET THE CHARTS AND STATISTICS

In order to relate the current financial situation of steelmaking companies with that of late 1990s and early 2000s, a distinction of time periods is made, on a six year window. The distribution of relevant financial variables during the period 2009-2014 is compared against the distribution of the same variable over the period 1997-2002.

Two approaches are followed. The first relies on visualising the two distributions through a quantile-quantile plot. After ranking each distribution, this type of chart is very useful for comparing two distributions because it contrasts values in the same quantile. Therefore, values above the symmetry line ( $y=x$ ) indicate that the distribution of a given variable for the period 1997-2002 dominates the distribution of the same variable for the period 2009-2014. The reverse is true for values below the symmetry line. In the example below, given that most of the values stand above the symmetry line, it is possible to argue that the profitability distribution during 1997-2002 dominates that of 2009-2014.

Example of quantile-quantile plot



Second, two formal nonparametric tests (Kolmogorov-Smirnov and Fligner-Policello tests) are performed in order to provide additional evidence on the relationship between the two periods (see Table below). The advantage of using non-parametric test is avoiding complications with the likely non-normality of distributions and unequal variances that classical tests may not account for. In the table below, columns (1) and (3) contain the test statistics for the Kolmogorov-Smirnov and Fligner-Policello tests, respectively. Columns (2) and (4) provide the corresponding p-values that allow identifying whether the distribution of each variable during 2009-2014 is statistically different from that in 1997-2002. For example if the p-value is lower than 0.01 for a given variable, the two periods can be considered statistically different with a level of confidence of 99%. In addition, the sign of values in column (3) also indicates whether the values of a variable during the 2009-2014 period were higher (positive) or lower (negative) than during 1997-2002.

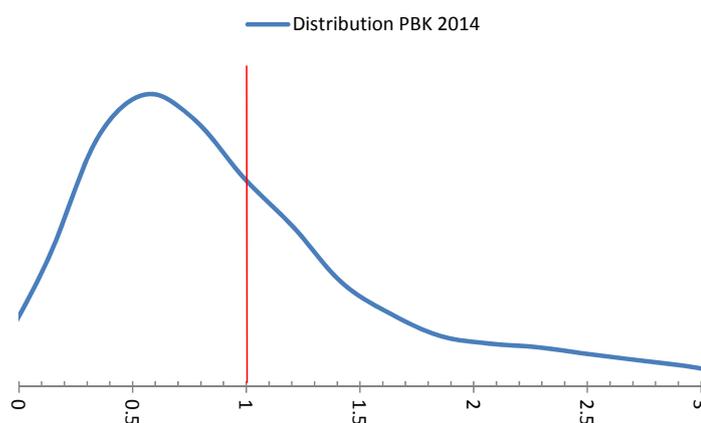
**Two sample comparison tests: 1997-2002 against 2009-2014**

VARIABLE	K-S Test (1)	K-S Statistic (2)	F-P Test (3)	F-P Statistic (4)
EBITDA_SALES	0.21	0.00	16.20	0.00
CF_ASSETS	0.13	0.00	9.38	0.00
COST_ASSETS	0.13	0.00	-8.74	0.00
COST_VAR_SALES	0.19	0.00	-13.02	0.00
DEBT_ASSETS	0.05	0.00	1.81	0.07
STLT_DEBT	0.20	0.00	-14.54	0.00
PBK	0.11	0.00	-7.97	0.00
ROE	0.03	0.19	-0.33	0.74
MKT_VAL	0.05	0.00	-0.68	0.50
L_ASSETS	0.09	0.00	7.01	0.00
RD_ASSETS	0.31	0.00	11.47	0.00
RD_I_PERCENT	0.29	0.00	11.18	0.00
TRD_CREDIT_ASSETS	0.10	0.00	1.22	0.22
INVENT_RM_PERCENT	0.13	0.00	-8.23	0.00
INVENT_ASSETS	0.14	0.00	-10.52	0.00

*Note:* This table shows the Kolmogorov-Smirnov D (column 1) and Fligner-Policello U (column 3) test statistics as well as their respective p-values (columns 2 and 4) that provide the basis for deciding on whether to reject null hypothesis of equality of distributions (values close to zero indicate that there is a difference between periods). If the Fligner-Policello U test statistic (column 3) is positive (negative), the values of the corresponding variable were higher (lower) for the period 1997-2002 than they were for the period 2009-2014.

In addition, the distributions in two specific years are compared using charts with the kernel density estimate. The kernel density estimate gives an approximation of the probability density function of a given distribution — up to a given point  $x$  in the horizontal axis, the area under this function provides the percentage of observations that have values that are lower or equal to  $x$ . The total area below the curve for each year equals one. In the example below, the area below the curve until the vertical line gives the percentage of firms in the sample that had price-to-book ratios below unity in 2014 (52%), while the total area under the curve equals one.

**Figure 20. Example of Kernel density estimate**



<sup>10.</sup> For comparison purposes, financial information on companies operating in selected companies was also retrieved from Factset. This includes companies in the Chemicals (SIC codes 28), Plastics (SIC codes 30) and Shipbuilding sectors (SIC codes 373).