Report prepared for Committee on Climate Change

Competitiveness impacts of carbon policies on UK energy-intensive industrial sectors to 2030

Steel Deep Dive

Final Report

March
2017

Cambridge Econometrics
Cambridge, UK

gh@camecon.com
www.camecon.com

Cambridge Econometrics' mission is to provide rigorous, accessible and relevant independent economic analysis to support strategic planners and policy-makers in business and government, doing work that we are interested in and can be proud of.

Cambridge Econometrics Limited is owned by a charitable body,
the Cambridge Trust for New Thinking in Economics.
www.neweconomicthinking.org

Authorisation and Version History

Version	Date	Authorised for release by	Description
1.2	23/3/17	GH	Final report.

Contents

Tables

Figures

Executive Summary

The steel sector includes a wide range of activities, from production of crude steel, to the manufacture of semi-finished and finished products.

Steel production in the UK uses either the Basic Oxygen Furnace (BOF) or Electric Arc Furnace (EAF) production process. BOF covers the full range of production stages, from coke-making, to iron-making, to steel production in the oxygen furnace. The EAF process uses secondary feedstock in the form of recycled steel scrap as its main input. While both production processes are electro-intensive, the main energy costs to the BOF process is coking coal, while electricity is the primary energy cost of the EAF process.

The steel sector is highly vertically integrated between iron-making and steel making activities, and steel finishing activities. Hence, most steelmaking in the UK takes place in integrated steelworks, which cover many of these activities. Steel in the UK is mainly produced using the BOF route, through which around 83% of crude steel is produced, with the remaining 17% produced in EAF steelworks.

In addition, there are many specialist downstream manufacturing plants in the UK, such as wire plants, rolling mills, tubes mills, and casting foundries.

The key findings from this study are:

- The real value of production in the UK steel sector contracted by around 30% between the late-1990s and 2015, driven in part by a sharp contraction over 2007-09.
- The supply chain has increasingly globalised, evidenced by increasing import penetration and export shares of output.
- Demand has been weak since the recession in the UK, but also in the EU. Since 2013, falling demand in China has led to a global glut of steel.
- The sector was already declining in the long term before the recession, though a modest recovery in basic steel production occurred over 2000-07. In the earlier years, there were two closures of integrated steelworks in 1992 and 2001, both linked to low profitability driven by, among other things, combinations of weak demand, increasing competition from imports, a strong pound or low global steel prices.
- Since the recession, increased global competition from low-cost producers amid weak demand in the UK and the EU and low steel prices have driven UK closures and plant sales.
- The German steel sector has remained strong, while the French sector contracted by a similar amount as in the UK. However, production output in Germany has been falling since 2012. It appears the relatively early introduction of compensation for climate change policy in Germany has helped support the industry. Compensation in the UK was introduced later and the total value of compensation provided has been a lot lower.

- UK electricity prices are higher than European competitors largely due to wholesale and network costs rather than carbon costs. However, this accounts for compensations and exemptions for a range of climate change policies that had not been fully implemented until 2016.
- The industry appears to have suffered from downturns in demand the early-1990s and at the turn of the century, with a strengthening of the pound in the second half of the 1990s impacting adversely on competitiveness. This appears to have been compounded in the 2000s as the pace of globalisation picked up and it shifted to a global supply chain that was increasingly fragmented and specialised.
- Rather than climate change policies, the key factor behind the decline of the UK steel sector was the combination of cheap imports from China and weak demand in the EU, alongside structural change driven by globalisation.
- The UK steel sector has been buoyed by recent acquisitions of plants formerly owned by Tata. At the same time, a recovery in EU construction sector demand, and future UK public sector infrastructure contracts look set to boost the outlook for the UK steel sector.
- However, cheap imports from China are set to continue as production in the region remains high, despite weaker domestic demand.
- In addition, Brexit has cast uncertainty over the sector's future trade position with the EU, and the extent to which it will be protected from cheap imports and have access to export markets.
- Lastly, while carbon costs form a relatively small to modest share of industrial electricity costs, this share is projected to increase up to 2030. Furthermore, total electricity prices for UK steel producers are project to increase by 53% over 2016-2030. Hence, energy efficiency is crucial to the UK steel sector's future competitiveness.

1 The UK steel sector

Defining the steel sector

In this study we define the steel sector as comprising the following four sub-sectors:

- SIC(2007) 24.1 Manufacture of basic iron and steel and of ferro alloys
- SIC(2007) 24.2 Manufacture of tubes, pipes, hollow profiles and related fittings, of steel
- SIC(2007) 24.3 Manufacture of other products of first processing of steel
- SIC(2007) 24.52 Casting of steel

SIC 24.1 (the basic steel sub-sector from here on) includes activities such as direct reduction of iron ore, production of pig iron in molten or solid form, conversion of pig iron into steel and manufacture of ferro-alloys. It also includes the manufacture of steel products, such as ingots and other primary forms, and semi-finished products including flat rolled products of steel, and bars and rods of steel.

SIC 24.2 (the tubes and pipes sub-sector from here on) includes manufacture of seamless tubes and pipes and manufacture of welded tubes and pipes. SIC 24.3 (the other steel products sub-sector from here on) covers manufacturing of a range of products by cold processing of steel. This sub-sector can be split up further into four classifications: Cold drawing of bars; Cold rolling of narrow strip; Cold forming or folding; and Cold drawing of wire. Lastly, SIC 24.52 (the casting of steel sub-sector from here on) largely covers the activities of steel foundries, including casting of semi-finished steel products, casting of steel castings, manufacture of seamless tubes and pipes of steel by centrifugal casting, and manufacture of tube or pipe fittings of steel.

The steel sector is highly vertically integrated between iron-making and steel making activities and steel finishing activities such as hot-rolling, cold-rolling and casting. Hence, some of the activities undertaken by firms in the tubes and pipes sub-sector, the other steel products sub-sector, and the casting of steel sub-sector may also be covered by the large steel producers classified in the basic steel sub-sector. That said, the activities of the tubes and pipes sub-sector, the other steel products sub-sector, and the casting of steel sub-sector all rely on steel products from firms in the basic steel sub-sector as intermediate inputs. Furthermore, many activities in these classifications, such as the manufacture of welded pipes, and the casting of steel in foundries, tend to be less vertically integrated with the crude steel producers. Hence, for the purposes of this study, these steel sub-sectors will be referred to together as the downstream steel production sub-sectors.

Main products and users

The steel industry primarily supplies the construction sector, the automotive and other transport equipment sectors, the packaging industry, the consumer goods industry (domestic appliances etc.), and the electrical and mechanical engineering sector.

The main data sources for production, demand, investment, and competitiveness data are the Annual Business Survey and Annual Business

Inquiry[1] for the UK, and the Eurostat Structural Business Statistics[2] for France and Germany. For trade data, the main data source is Eurostat's Comext database. The advantage of these data sources is that they provide data based on the Standard Industrial Classification (SIC) or directly comparable equivalents (e.g. NACE, CPA), allowing for sector level comparisons across indicators and countries. A drawback to this data (and indeed all datasets we are aware of at this level of detail) is that it is generally not available before 1996 (and 1999 for Germany). In addition, for the global data on crude steel production and demand for finished steel, we used the World Steel Association Steel Statistical Yearbooks[3].

Chapter structure

The structure of this chapter is as follows. First, we outline the key trends in production, trade and investment in the UK steel sector and sub-sectors. Next, we list the potential drivers of change in the sector that will be assessed in this report. We then analyse each driver of change, to understand the underlying factors affecting the performance of the UK steel sector. Lastly, we assess the outlook for the sector going forward.

1.1 Key trends in the UK steel sector

Production in the steel sector fell by 27% over 1996-2015

Figure 1.1 shows the evolution of the real value of production in the steel sector and in the basic steel sub-sector over 1996-2015. Steel sector fluctuations in production were largely driven by those in the basic steel sub-sector. Overall, production in the steel sector fell by 27% over 1996-2015, driven by a gradual decline over 1997-2005 and sharp falls in 2008 and 2009. Since 2009, the decline has halted. The outturn for production in the steel sector has been driven by the trend in the basic steel sector.

The contraction in the basic steel sub-sector was driven by economic downturns

In the basic steel sub-sector, the real value of production fell by 28% over 1996-2015, driven by a fall over 1998-2001 and sharp contraction over 2007-09. Production in the sub-sector initially contracted by 17% over 1996-2001. Production then stabilised, growing on average by 2.4% pa up to 2007. Over 2007-09, production fell by around a third, and after a pick-up in 2010, production fell in value again to reach a period low in 2012. Over the last few years, production recovered a little, growing by 16% over 2012-15.

[1] https://www.ons.gov.uk/businessindustryandtrade/business/businessservices/bulletins/uknonfinancialbusinesseconomy/previousReleases

[2] http://ec.europa.eu/eurostat/web/structural-business-statistics/data/database

[3] https://www.worldsteel.org/steel-by-topic/statistics/steel-statistical-yearbook-.html

Figure 1.1: Real production value in the UK steel sector and the basic steel sub-sector, 1996-2015

Source: ONS (Annual Business Inquiry and Annual Business Survey), Eurostat (Structural Business Statistics and Short Term Business Statistics), and CE (MDM-E3 and E3ME.

Production in steel tubes and pipes sub-sector grew by 15% overall, driven by strong growth over 2013-15

Figure 1.2 shows the real production value of each of the downstream steel production sub-sectors over 1996-2015. Production in the tubes and pipes sub-sector fell in real value by 29% over 1997-2003. Over the next decade, the value of production in the sub-sector fluctuated around £1.8bn and £2.1bn. Production grew strongly in recent years, by 47% over 2013-15, such that in 2015 total production in the tubes and pipes sub-sector was 10% higher in value than in 1997.

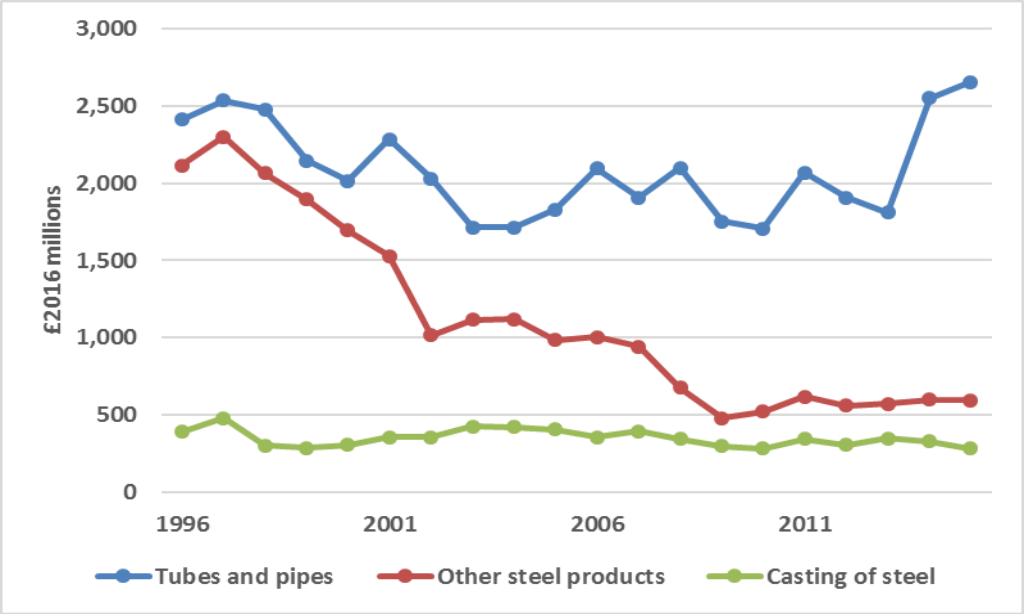
Production in the other steel products sub-sector fell sharply, by 72% over 1997-2015

The other steel products sub-sector saw the largest contraction in real production value, falling by 72% over 1997-2015. This was driven by a sharp contraction over 1997-2009 of 77%. Over these years, three of the four smaller sub-sectors that comprise manufacture of other products of first processing contracted severely: cold rolling of narrow strip by 92%; cold drawing of wire by 87%; and cold drawing of bars by 89%. On the other hand, the cold forming or folding sub-sector grew a little, by 6% in real production value over 1996-2009. Over 2009-15, production in the larger sub-sector grew slowly, by 3.6% pa on average, driven partly by a resurgence of the cold drawing of bars sub-sector, where production grew by around 78%. Table 1.1 shows the growth in real production over 1996-2009 and 2009-15 in each of the four sub-sectors of the other steel products sub-sector

Production in the casting of steel sub-sector fell by 18% over 1996-2015

In the casting of steel sub-sector, production fell by around 40% over 1998-1999. Production then recovered up to 2003, growing by 48% overall but then began to fall, reaching a period low in 2010. Production was a little higher in some years after 2010, but in 2015 equalled the period low again. Overall the real value of production in the steel castings sub-sector fell by 28% over 1996-2015.

Figure 1.2: Real production value in the downstream steel production sub-sectors, 1996-2015



Source: Eurostat (Structural Business Statistics and Short Term Business Statistics), and CE (MDM-E3 and E3ME.

Table 1.1: Real production growth in the sub-sectors of the other steel products sub-sector, 1996-2009 and 2009-15

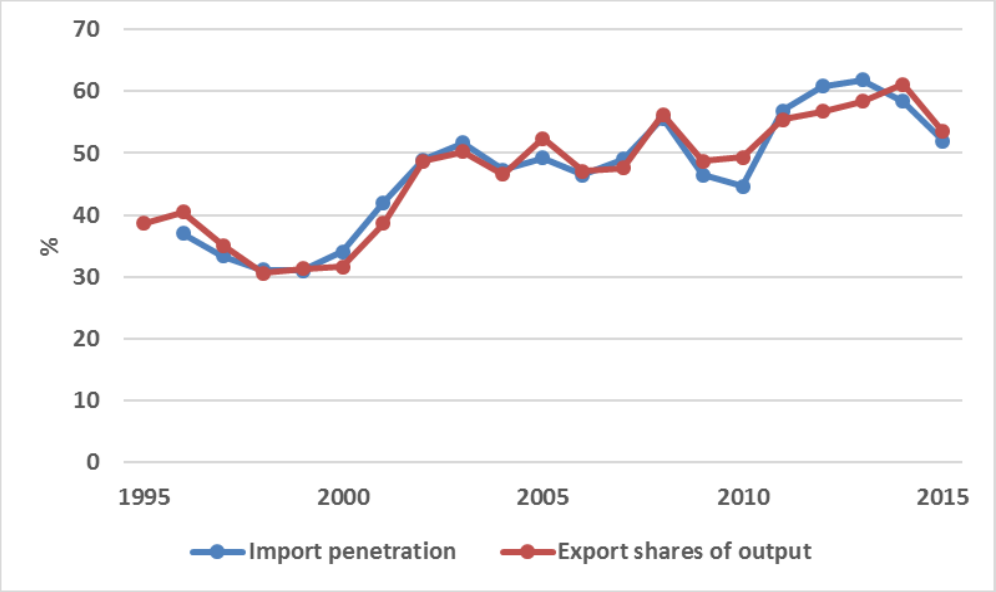
	1996-2009		2009-2015	
	£2016 millions	%	£2016 millions	%
Cold drawing of bars	-340.9	-88.8	33.8	78.2
Cold rolling of narrow strip	-267.7	-92.4	7.2	32.6
Cold forming or folding	18.3	6.2	87.2	27.9
Cold drawing of wire	-602.2	-87.5	-5.0	-5.8

Source: Eurostat (Structural Business Statistics and Short Term Business Statistics), and CE (MDM-E3 and E3ME.

Trade shares in the steel sector have increased as production has globalised

The steel sector is characterised by large international corporations with extended supply networks. Intra-trade between large firms with production plants in different countries has grown as the steel supply chain has globalised. This is reflected in trade shares of the basic steel sub-sector; import penetration and export shares of output have moved together, increasing from around 40% in 1996 to a peak of around 60% in 2012 and 2013, before falling back to just over 50% in 2015. Figure 1.3 shows import penetration and export shares of output in the basic steel sub-sector:

Figure 1.3: Import and export shares in the basic steel sector, 1995-2015



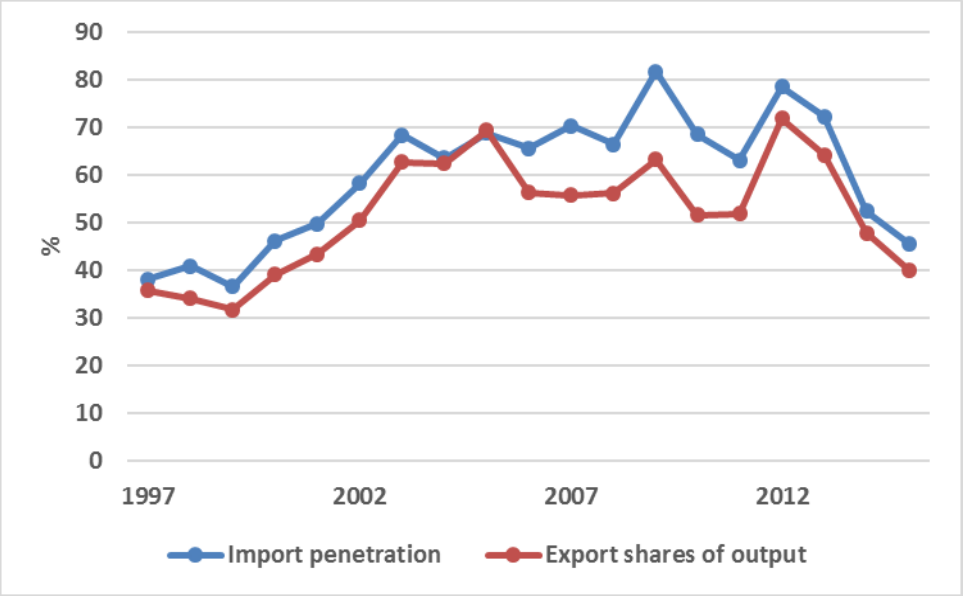
Note: Import penetration data unavailable for 1995.

Source: Comext, Eurostat (Structural Business Statistics) and ONS (Annual Business Inquiry and Annual Business Survey).

A similar degree of co-movement between import penetration and export shares of output is present in the tubes and pipes sub-sector and the other steel products sub-sector. Figure 1.4 shows trade shares in the tubes and pipes sub-sector. Both trade shares increased notably over 1999-2003. Over 2005-06 the gap between import penetration and export shares widened, and stayed that way until 2011, suggesting increased domestic demand in the sub-sector in these years. Over 2012-15, the trade shares fell sharply, almost import penetration at 46% and export shares of output at 40%.

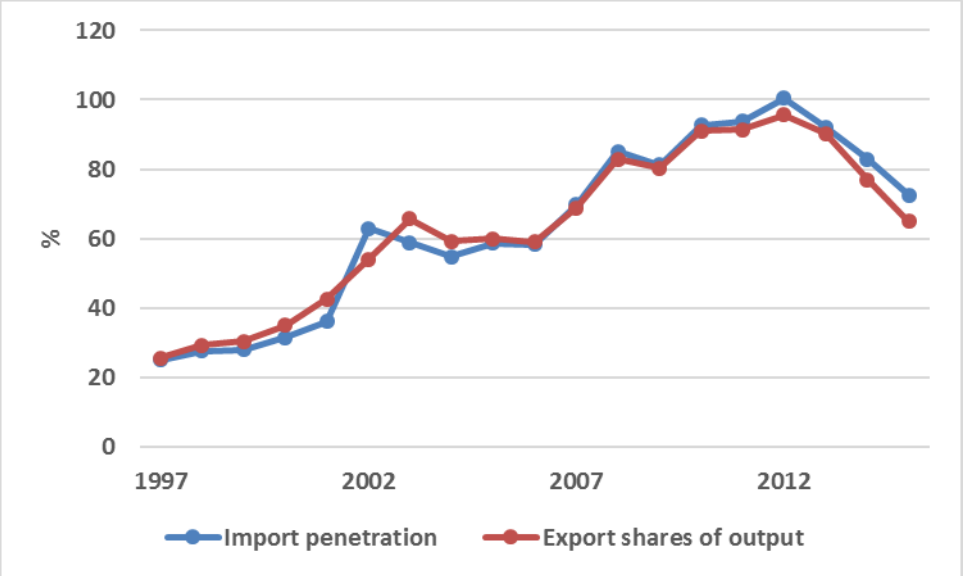
In the other steel products sub-sector, import penetration and export shares of output moved closely together throughout the period of study. This is shown in Figure 1.5 below. Trade shares in the other steel products sub-sector rose at a fast rate over 1997-2012 from around 20% each in 1997 to 100% import penetration and a 95% export share of output in 2012. Over 2012-15, these trade shares fell to 73% and 65% respectively.

Figure 1.5: Import penetration and export shares in the tubes and pipes sub-sector



Source: Comext, Eurostat (Structural Business Statistics) and ONS (Annual Business Inquiry and Annual Business Survey).

Figure 1.4: Import penetration and export shares of output in the other products of first processing sub-sector



Source: Comext, Eurostat (Structural Business Statistics) and ONS (Annual Business Inquiry and Annual Business Survey).

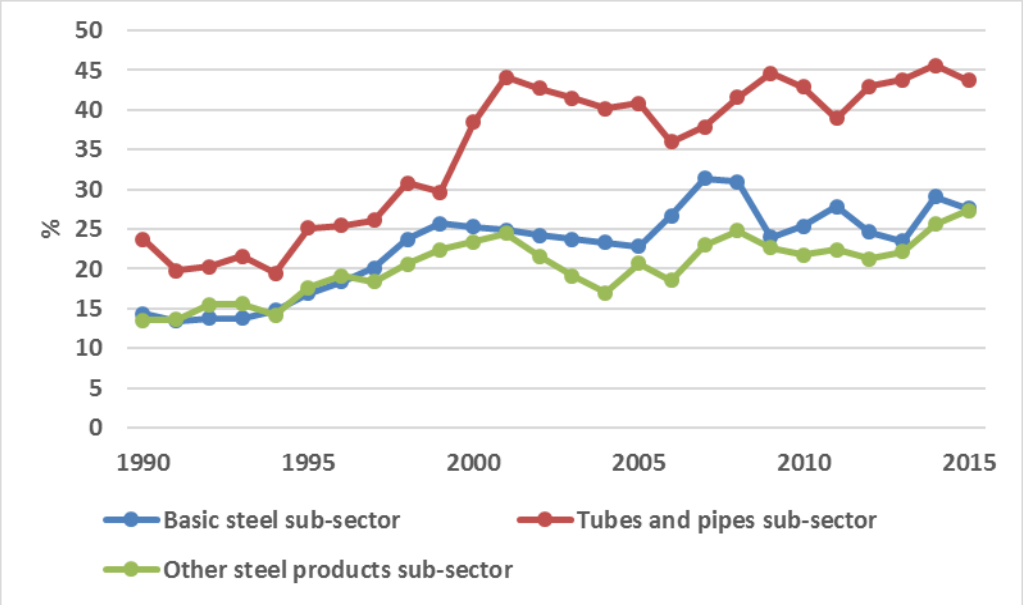
Trade volumes in casting of steel are relatively low

Trade volumes in the casting of steel sub-sector are relatively low. Import penetration stood at 3.4% of domestic demand in 2015, while export shares of output stood at 2%. This marks a small increase from 1.5% and 1.2% respectively. This is because foundries, which are highly specialized and dominated by SMEs, tend to locate close to their customers. Furthermore, many large manufacturers, such as in the transport equipment sector, own their own foundries. These would not show up in the casting of steel sub-sector data, which only includes producers whose primary activity is in casting of steel.

Extra-EU imports have increased as a share of total imports in the steel sector

The share of extra-EU imports in total imports has increased in each of the three highly traded steel sub-sectors – basic steel, tubes and pipes, and other steel products. In the basic steel sub-sector and the other steel products sub-sector, these shares increased overall from around 15% in 1990, to 23% in 2015. In the manufacture of tubes and pipes sub-sector, the share of extra-EU imports increased rapidly over 1991-2001, from 20% to nearly 45%. The share fell back to around 36% over 2000-2005, but then increased again to reach 45% in 2009 and, barring a temporary dip in 2011, stayed around that level up to 2015.

Figure 1.6: Share of extra-EU imports in total imports in the basic steel sub-sector, the tubes and pipes sub-sector and the other steel products sub-sector, 1990-2015

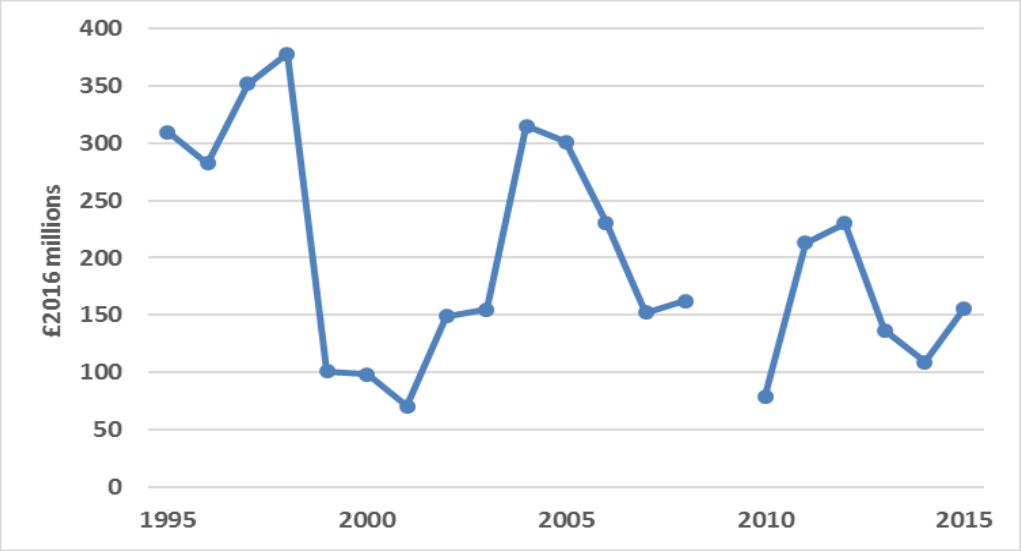


Source: Comext.

Investment in the basic steel sub-sector followed a downward trend over 1997-2015

Investment was highly volatile in the basic steel sub-sector over 1997-2015, though with a clear downward trend. Gross investment has been mainly for replacement and modernisation, rather than capacity expansion. Over 1995-98 investment in each year was relatively high, reaching a peak of around £380m in 1998. Real investment then fell over 1998-99, falling by around 75% or £280m in that year alone. Real investment stayed low over the next few years, falling further in 2001, to £70m. Over 2001-04, investment picked up again, growing rapidly to around £315m in 2004, and falling only slightly in 2005 to around £300m. This resurgence in investment was short lived, as it plummeted again, falling from £300m to £80m in 2010, before once more rebounding to around £230m in 2012. Investment in the last few years was no more steady, falling by 53% over 2012-14, before recovering partially in 2015.

Figure 1.7: Real investment in the UK basic steel sub-sector, 1995-2015



Note: Data unavailable for 2009.

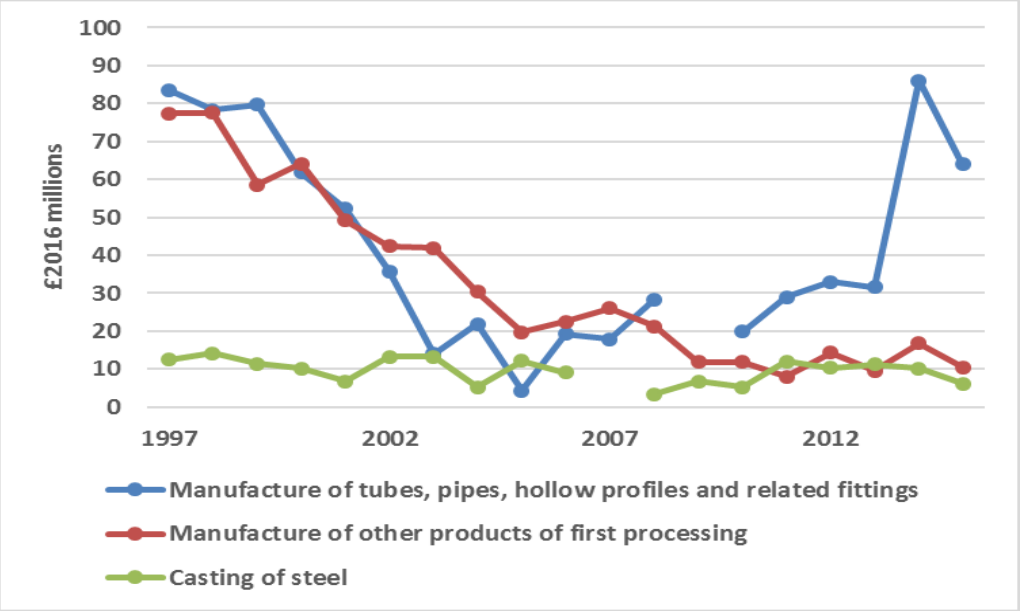
Source: ONS (Annual Business Inquiry and Annual Business Survey), Eurostat (Structural Business Statistics and Short Term Business Statistics), and CE (MDM-E3 and E3ME.

Figure 1.8 plots investment in each of the steel downstream sub-sectors. Investment in the tubes and pipes sub-sector, investment fell in most years over 1997-2005, bottoming out in 2005 at over £3m (in real prices), compared to around £83m than in 1997. However, investment was higher in the subsequent years, at between £20m and £30m until 2014, when investment almost tripled to reach a period high, and stayed relatively high in 2015. The recent surge in investment in the sub-sector underscores the stronger production figures seen in recent years.

Investment in the other steel products sub-sector mirrored the sub-sector's production output trend over 1997-2015. Investment fell sharply over 1997-2009, and then stabilised over the period 2009-15 at around £10m.

Lastly in the casting of steel sector investment was far more stable over the period of analysis. Overall, investment in the sub-sector was around 52% lower in 2015 than in 1997, though over 2011-14 investment was closer to, though still below its 1997 level.

Figure 1.8: Real investment in the UK steel downstream production sub-sectors, 1997-2015



Note: Data for the tubes and pipes sub-sector unavailable for 2009 and data for the casting of steel sub-sector.

Source: ONS (Annual Business Inquiry and Annual Business Survey), Eurostat (Structural Business Statistics and Short Term Business Statistics), and CE (MDM-E3 and E3ME.

In conclusion, the basic steel sub-sector, which forms most UK steel sector output, has driven an overall contraction in production of 22% over 1997-2015. For the most part, this contraction occurred during the economic downturn, with production in the basic steel sub-sector falling by around a third over 2007-09, and failing to recover since. Production in the downstream sub-sectors followed different paths. The other main contributor to the contraction of the steel sector is the other steel products sector, which saw a marked and steady decline over 1996-2009 and has not recovered. The tubes and pipes sub-sector, which experienced the greatest increase in import competition over the period, also contributed to the decline, but to a lesser extent: the downward trend was downward but more gradual and production recovered over 2010-15. The casting of steel sub-sector has been more stable, but represents only a very small share of steel sector output. Trade has played an increasingly important part as globalisation gathered pace and production in UK became a link in a global supply chain, with greater focus on serving a global market. The result has been rising import penetration and export shares of output since the late-1990s, and an increasing share of extra-EU imports in the sector over time. However, trade shares peaked in 2012 and have fallen back a little since. Lastly, investment has broadly followed the movements in production output in the sub-sectors over 1997-2015.

2 Drivers of change in the UK steel sector

2.1 Introduction

The UK steel sector has declined overall, as evident from the falling production and investment. What have been the drivers of this overall decline? In this section, we investigate the following factors:

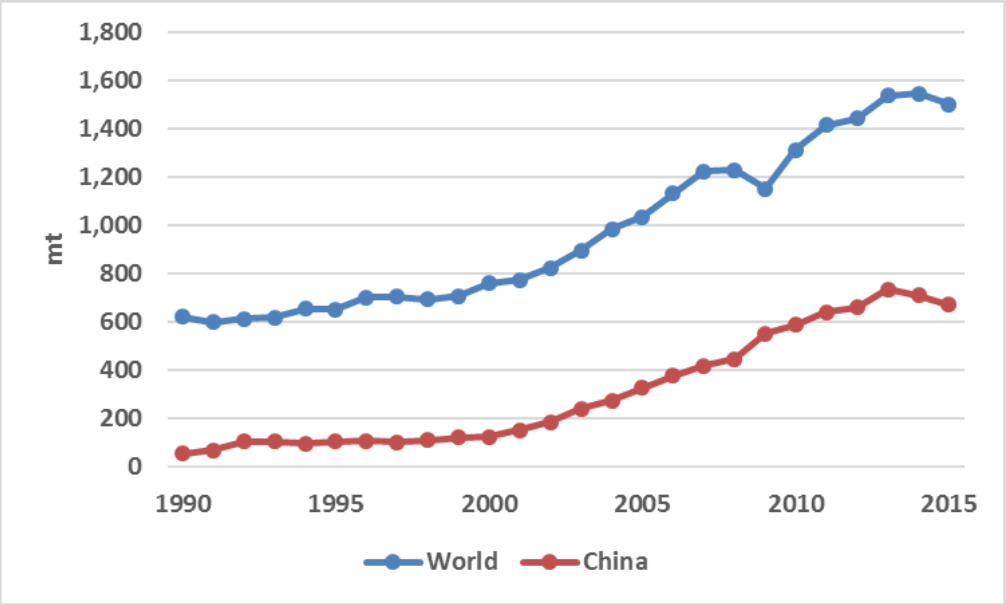
- Global trends in finished steel demand and crude steel production
    - Steel products are often traded on a global scale, and hence global demand provides a measure of the size of the world market for steel (and its growth), and therefore the potential export market for UK-produced steel. Global production data shows the key competitors on the global stage. Comparing global demand and supply indicates whether there is oversupply of steel, which can damage competitiveness.
- Domestic demand in the UK
    - Domestic demand is a key driver of domestic industry performance. Strong domestic demand reduces the dependence of the domestic sector on demand from external markets. The key indicator of domestic demand is measured by subtracting net trade from total production in each year.
- Structural changes in the UK sector
    - Steel production is achieved through different production processes, with different cost structures. It is crucial to understand the developments in each of these areas to get a full picture of the steel sector.
- Comparative production in France and Germany
    - We will compare the production trends in the UK with France and Germany, to assess whether the decline of steel has been felt to the same extent among European competitors.
- Changes in input costs, productivity and profitability
    - Changes in input costs and productivity are drivers of sector performance and competitiveness. We compare UK unit labour costs, labour productivity, and unit energy costs with those in France and Germany, to assess the drivers of change in the UK steel sector. We also compare the gross operating rate, to gauge profitability in the steel sector.
- The impact of UK and EU policies on sector competitiveness
    - We assess the role of UK and EU policies on sector competitiveness with a focus on the impact of climate change policies.

2.2 Global demand for finished steel

Global demand for steel grew rapidly, driven by China

Global demand for finished steel increased rapidly over 1990-2015, from around 620mt to 1500mt. China's rapid economic expansion in the 2000s drove global demand, demand in China increasing from 56mt in 1990 to 672mt in 2015 – around 45% of global steel demand. Figure 2.1 charts global demand for final steel over 1990-2015. Notably, global demand fell over 2014-15, for the first time since the recession of 2008-09. This fall in demand was driven by falling demand in China, which also saw falling demand in the previous year.

Figure 2.1: Global demand and demand in China for finished steel, 1990-2015

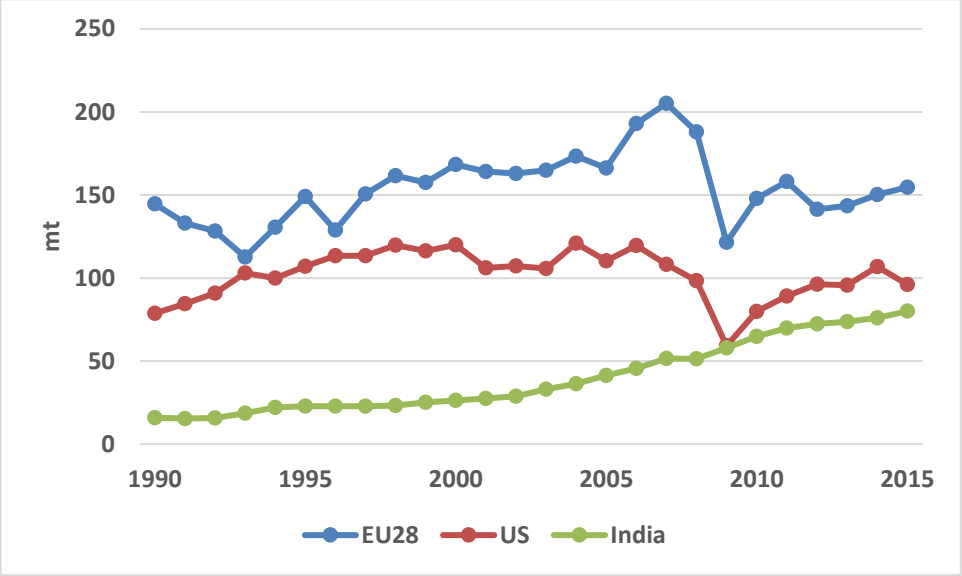


Source: World Steel Association (Steel Statistical Yearbooks).

Demand for steel in the EU28 and the US has been relatively low since the global recession

In 2015, the top three consumers of steel after China were the EU28, the US and India. Figure 2.2 plots the evolution of steel consumption in these regions. India has followed a similar trend to China, with consumption rapidly expanding as the economy has developed. On the other hand, steel consumption in the EU28 grew strongly over 1993-2000, but stagnated in the first half of the 2000s. Over 2005-07, EU28 steel consumption boomed, leading up to a huge fall in steel consumption during the economic downturn, driven by falls in real GVA over 2008-09 of 21.4% in the manufacture of fabricated metal products sector, 21% in the transport equipment sector, 13% in the manufacture of electrical equipment sector and 7% in the construction sector. Since 2009, steel consumption in the EU28 recovered partially, but remained suppressed compared to its level in the 2000s. Among the key downstream sectors, the manufacture of fabricated metal products was still 10% lower in real GVA in 2014 compared to 2008, and the construction sector contracted further, at 18% lower in real GVA against 2008. The transport equipment sector, however, recovered strongly from the recession, at around 11% higher in real GVA in 2014 compared to 2008, while the manufacture of electrical equipment sector also recovered to around 5% higher in real GVA in 2014 compared to 2008. Like the EU28, in the US, consumption of steel fell hugely during the recession, and has not fully recovered since.

Figure 2.2: Demand for finished steel in the EU28, the US and India, 1990-2015



Source: World Steel Association (Steel Statistical Yearbooks).

2.3 Global production of crude steel

Global crude steel production more than doubled since 1990,

Global production of crude steel more than doubled over 1990-2015, to reach 1,620mt in 2015. Global steel production growth was especially high in the 2000s, growing by 91% over 2000-15 at an average rate of 4.4% pa. The recession brought a sharp drop in crude steel production volumes of 8% over 2008-09, but a strong recovery ensued in the subsequent years. However, steel production fell in 2015 for the first time since the recession, by 3%, in response to falling global demand.

China, Japan and India are the largest global steel producers

Table 2.1 lists the top ten global producers of crude steel in 2015, and average production growth rates over selected years. China is by far the largest producer of crude steel, at 800mt in 2015 – just under half of total world production. Japan is the second largest producer, but with a much smaller share, at 6.5% of world production in 2015. The third largest producer of crude steel in 2015 was India at 5.5% of world production, while the US was the fourth largest, at 4.9%.

China led global steel production growth, followed by India

Global growth in crude steel production was driven by China's rapid economic expansion, steel production growing by 10.5% pa on average over 1990-2015, and a staggering 19% pa over 2000-08. Production in Japan, the largest global steel producer in 1990, was quite stable overall, though production has fallen since the recession, by 1.7% pa over 2008-15. India saw the second fastest growth in crude steel production, production growing by 7.4% pa on average over 1990-2015. South Korea and Turkey also saw strong growth in crude steel production, at 4.5% pa and 4.9% pa respectively over 1990-2015.

Table 2.1: The top ten global producers of crude steel (mt), and average growth rates since 1990

	Production (mt) in 2015	% pa 1990-2015	% pa 2000-2008	% pa 2008-15
China	803,825	10.5	19.0	6.6
Japan	105,134	-0.2	1.4	-1.7
India	89,026	7.4	10.0	6.4
United States	78,845	-0.5	-1.3	-2.2
Russia	70,898	n.a.	1.9	0.5
South Korea	69,670	4.5	2.8	3.8
Germany	42,676	0.4	-0.1	-1.0
Brazil	33,256	1.9	2.4	-0.2
Turkey	31,517	4.9	8.1	2.3
Ukraine	22,968	0.0	2.0	-6.7

Source: World Steel Association (Steel Statistical Yearbooks).

Germany, Italy and France are the largest EU28 producers

Table 2.2 lists the top ten EU28 producers of crude steel in 2015, and average production growth rates over selected years. The largest producer in the EU28 is Germany, at 43mt in 2015, 2.6% of world production, and 26% of total production in the EU28. Italy was the second largest producer of crude steel in the EU28 in 2015, at 22mt, 13% of EU28 production. The third largest producer was France, at 15mt, 9% of production. The UK produced 11mt of crude steel in 2015, making it the fifth largest producer of crude steel in the EU28.

Global steel production fell overall in the EU28, driven by large falls since the recession

Crude steel production in the EU28 fell sharply during the recession, and in line with demand in the region, has not recovered since, falling by 2.5% pa on average over 2008-2015. This brought overall growth to a fall of 0.5% pa over 1990-2015, although production grew by 0.3% over 2000-08. Italy was particularly hard hit, crude steel production falling by 4.6% pa on average over 2008-15. In Germany, production fell over 2008-15, though more slowly than the EU average at 1% pa. In the UK, crude steel production fell the fastest of the top ten steel producers over 1990-2015, by 1.9% pa. Over 2008-15, UK production of crude steel fell by 3% pa on average.

Table 2.2: Top ten crude steel producers in the EU28 and growth since 1990 (mt)

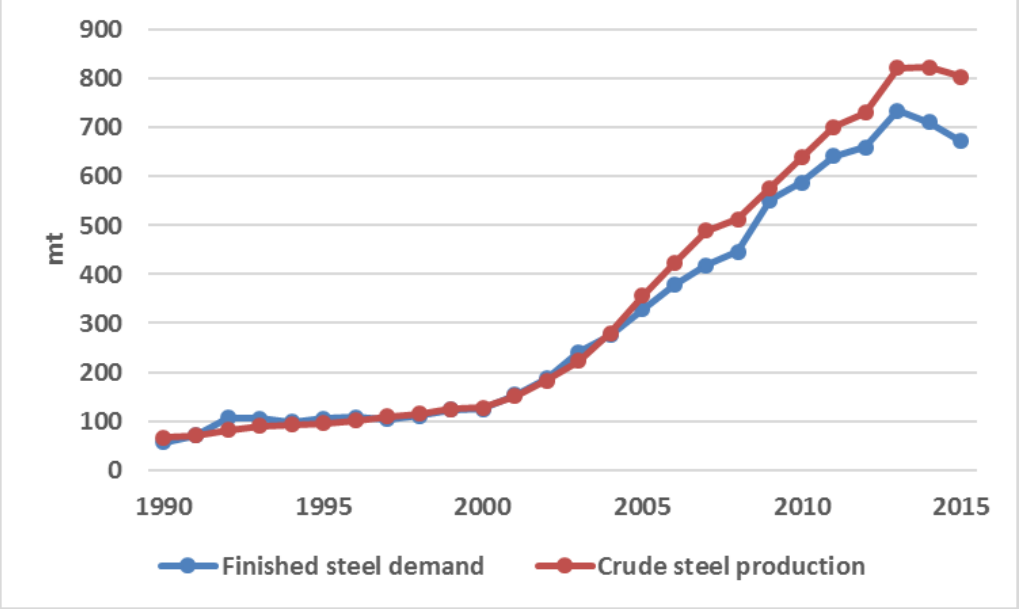
	Production (mt) in 2015	% pa 1990-2015	% pa 2000-2008	% pa 2008-15
EU28	166,116	-0.5	0.3	-2.5
Germany	42,676	0.4	-0.1	-1.0
Italy	22,018	-0.6	1.7	-4.6
France	14,984	-0.9	-2.0	-2.5
Spain	14,845	0.6	2.0	-3.2
United Kingdom	10,907	-1.9	-1.4	-3.0
Poland	9,198	-1.6	-0.9	-0.8
Austria	7,687	2.4	3.6	0.2
Belgium	7,257	-1.8	-1.1	-5.4
Netherlands	6,995	2.7	2.4	0.3
Czech Republic	5,262	n.a	0.3	-2.7

Source: World Steel Association (Steel Statistical Yearbooks).

Over-production of steel in China has led to a global glut of steel in recent years

Figure 2.3 shows domestic demand for finished steel and production of crude steel in China over 1990-2015. Production growth of steel has outstripped growth in demand since 2005. Furthermore, the fall in demand over 2013-15 in China was stronger than the fall in production. Hence, China has driven a global glut in the world steel market, pushing down global steel prices, ramping up the pressure on steel producers in Europe.

Figure 2.3: Domestic demand for and production of steel in China, 1990-2015



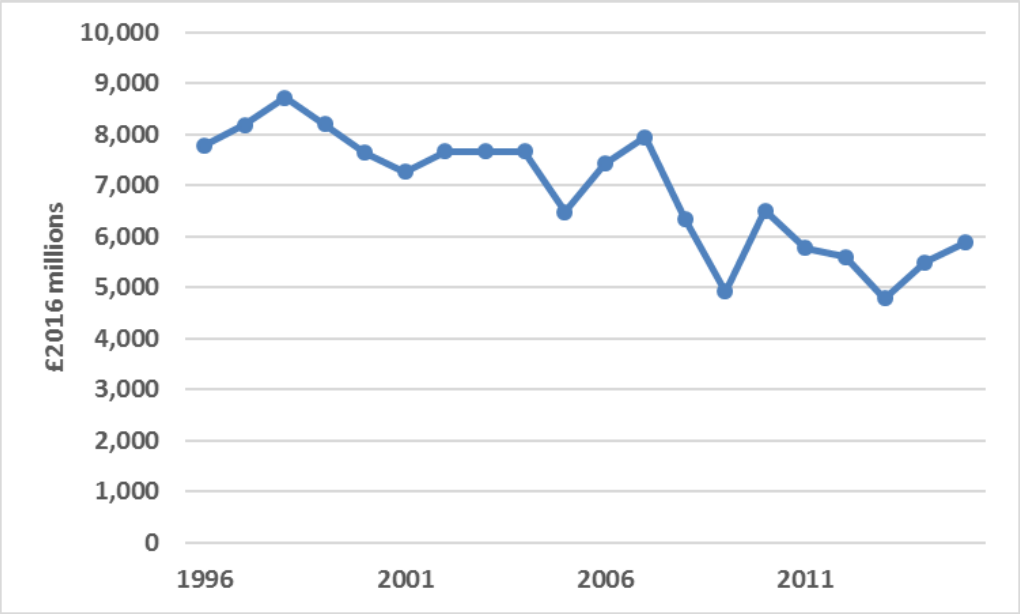
Source: World Steel Association (Steel Statistical Yearbooks).

2.4 Domestic demand for steel

UK domestic demand has fallen at a similar rate to the decline in production

Despite the globalised nature of steel production, the contraction of the UK sector since 1996 generally appears to have been driven in part by domestic demand. Figure 2.4 plots real apparent domestic demand in the UK basic steel sub-sector over 1996-2015. Demand fell noticeably, though not as fast as production over 1998-2001, although the fall in tonnes of crude steel was less steep, due to a significant fall in prices over this period. Aside from a brief fall in 2005, demand was then fairly stable up to 2007. As in the EU28, UK demand fell sharply over 2007-09, by around 38%. This was driven by sharp falls in demand over 2007-09 from key downstream users: the transport equipment sector contracted by 15% in real GVA; the manufacture of fabricated metal products sector contracted by 21% in real GVA; the manufacture of electrical equipment contracted by 24% in real GVA; and the construction sector contracted by 15% in real GVA. The recovery in domestic demand for steel has been weak – after a partial recovery in 2010, demand fell each year up to 2013, falling slightly below its recession low. Demand picked up over 2013-15, but was still much lower than its pre-recession levels, as output amongst most of the major downstream sectors remained suppressed, barring transport equipment, which grew as the motor vehicles sector and the aerospace sector flourished

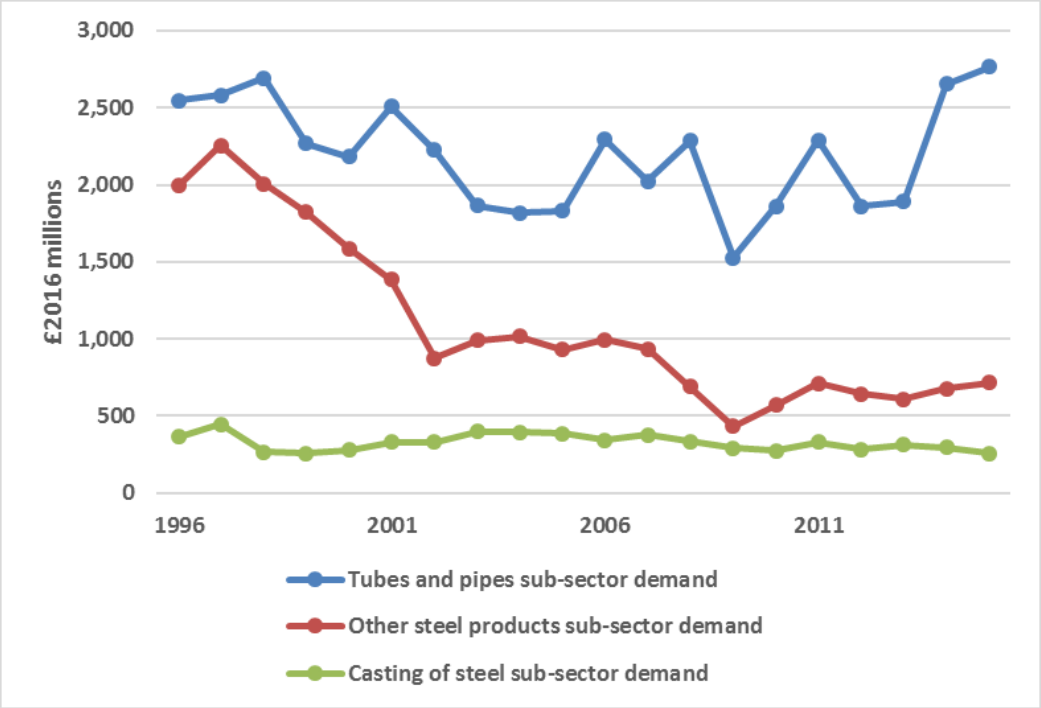
Figure 2.4: Apparent real domestic demand in the UK basic steel sub-sector, 1996-2015



Source: Comext and Eurostat (Structural Business Statistics).

In the downstream sub-sectors domestic demand also appears to have driven production trends in the UK. Figure 2.5 plots apparent domestic in the downstream steel sub-sectors over 1996-2015. Demand moved very closely with production in each of the sub-sectors. In the manufacture of pipes and tubes sub-sector, domestic demand was considerably higher than production in most years up to 2012, due to the particularly high rates of import penetration in these years. However, the recent pick of demand over 2014-15 was met by a similar level of production, suggesting an increase in the domestic supply of the sub-sector in recent years. In the other products sub-sector, the large fall in output over 1997-2009 also appears to have been driven by domestic demand, which fell at a similar rate over the period.

Figure 2.5: Apparent real UK domestic demand and production in the downstream steel sub-sectors, 1996-2015



Source: Comext and Eurostat (Structural Business Statistics).

2.5 Structural development in the UK steel sector

There are two main production routes for steel in the UK:

- Basic oxygen furnace (BOF)
- Electric arc furnaces (EAF), using secondary feedstock in the form of recycled steel scrap

Basic oxygen furnace steelmaking occurs in large integrated steelworks, which perform the full range of production stages, from coke-making, to iron-making, to steel production in the oxygen furnace. The integrated steelworks also undertake steel finishing. BOF steel making has very high direct emissions.

Alternatively, electric arc furnace steelworks produce steel from secondary feedstock, in the form of recycled steel scrap. Emissions per tonne are far lower, but the production process is highly electro-intensive, and so also accounts for indirect emissions, which vary depending on the source of electricity.

The majority of UK steel output has traditionally come from integrated BOF steelworks. There are two integrated BOF steelworks in the UK and four integrated EAF steelworks in the UK, which cover steel-making as well as finishing activities. BOF steelworks produced 10.9mt of crude steel in 2015, while electric arc furnaces produced a 1.9mt. In addition, the UK has several specialised downstream production plants: around five wire plants, four coating plants, six other rolling mills, and three tube mills[4].

[4] http://www.eef.org.uk/uksteel/About-the-industry/Steel-facts/Steel-production-facilities---UK.htm

Integrated BOF steelworks closed in 1992 and 2001 due to falling profits and competitiveness pressures

The UK steel sector saw two major closures of integrated BOF steelworks before the 2008-09 recession. Firstly, in 1992 the Ravenscraig steelworks in Scotland, owned by British Steel, closed during the UK recession of 1991-92. The Ravenscraig steelworks included the largest hot rolling mill in Western Europe. Its closure, attributed to falling profit levels, was contentious since British Steel had agreed to keep the plant open until 1994 as a condition of its privatisation, subject to market condition. But the industry experienced another downturn in the late 1980s and early 1990s, and Ravenscraig's fate was sealed, despite government attempts to keep the plant ticking over until the market improved. Of the key downstream sectors, the construction sector was particularly weak during this period, with real GVA falling by 13% over 1990-92, while real GVA in the transport sector also fell sharply, by 10%. In 2001 a second integrated steelworks, Llanwen in Wales, was closed by Corus. Corus argued that the closure was brought about by competitiveness pressures arising from weak demand for steel and oversupply in Europe, and a strong pound[5]. Certainly, UK demand in real value appears to have fallen over 1998-2001 (driven both by a fall in the volume of demand and a fall in prices), and while demand in the EU increased by 40-50% over 1993-2000, the effective sterling exchange rate appreciated by nearly 20% over the same period, undermining the price competitiveness of UK-produced steel.

UK steelworks have suffered since the recession, Teesside Steelworks closing in 2015

Since the recession, UK steel has come under increasing pressure amid the weakened demand in Europe, and cheap imports stemming from overproduction in China. The largest casualty since the recession is Teesside Steelworks, an integrated BOF producer, which closed in 2015. The plant was owned by Thai multinational SSI, who bought the plant in 2011 from Tata. Tata had stopped production at the steelworks in 2009, following the termination of a major contract to buy steel at cost[6], in the backdrop of weak global demand and rising energy prices (see section 2.8 for more discussion around rising energy prices). It seems fair to attribute the cutback in production to weak demand in Europe or the US, and although demand in other countries (e.g. China, India, S Korea, Turkey) was growing quickly, so too were the domestic steel industries in each of these (see Table 2.1 above). SSI closed the steelworks in 2015, blaming the closure on competitiveness pressures arising from low global steel prices and falling demand for steel in China. The price of steel billet fell from around US$480 per tonne at the start of 2015 to US$100 per tonne in the summer of 2015[7] (having previously fallen from around US$500 per tonne at the start of 2013 to US$100 per tonne in mid-2014). At the same time, the evidence presented above on Chinese demand for finished steel would appear to support the claim about falling demand from China.

Tata Steel sold British Steel in 2016, while the future of Port Talbot is uncertain

The two-remaining integrated BOF steelworks in the UK are Port Talbot, owned by Tata Steel, and British Steel in Scunthorpe, owned by Greybull Capital. British Steel was bought from Tata in 2016, following Tata's announcement that it intends to restructure its UK operations. This announcement also cast uncertainty over the future of the Port Talbot steelworks, amid fears that it would be sold, or closed if Tata could not find a

[5] http://news.bbc.co.uk/1/hi/business/1105397.stm

[6] https://www.publications.parliament.uk/pa/cm200910/cmselect/cmneast/279/279.pdf

[7] https://www.quandl.com/data/LME/PR_FM-Steel-Billet-Prices

buyer. But Tata has instead announced a plan to keep the Port Talbot operation as part of a joint venture with the German ThyssenKrupp steel division. However, the merger is far from certain, and in part depends on Tata's ability to spin out its pension fund, formerly of the State-owned British Steel Corporation, with liabilities of £15bn.

Liberty House Group has emerged as a major player, focusing on low-carbon energy strategy

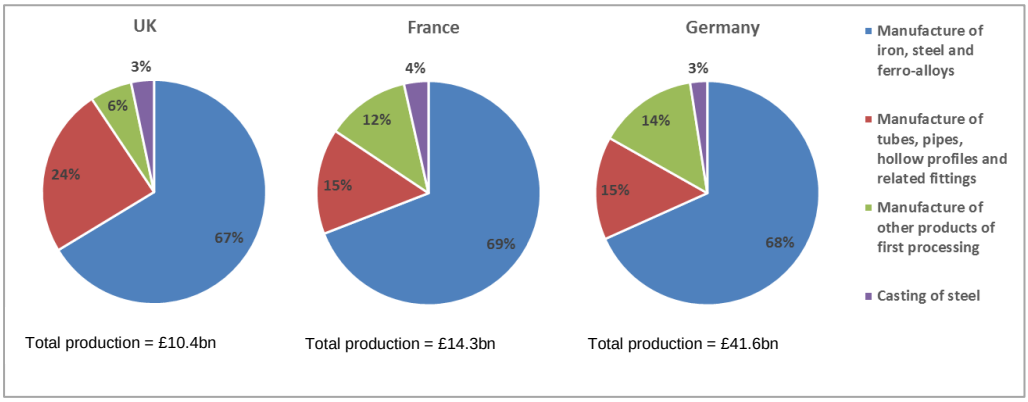
Liberty House Group has emerged as a major player in the UK steel sector, having acquired steelmaking facilities in Newport and Kent in 2016[8].Liberty House's strategy aims to fully integrate steel production in the UK, underpinned by EAF steel production powered by low-carbon, renewable energy.

2.6 Production in the UK, France and Germany

Germany has the largest steel sector in the EU

Germany has the largest steel sector in the EU, with total production value of £41.6bn in 2014, compared to £14.3bn in France and £10.4bn in the UK. Figure 2.6 shows the shares of total production value in each steel sub-sector in 2014 in the UK, France and Germany. The basic steel sub-sector accounts for a similar share of total sector production in each of the three countries, at between 67% and 69%. In France and Germany, the tubes and pipes sub-sector accounts for around 15% of total production, while in UK, the share is much larger, at around 24%, owing to strong growth in the sub-sector in recent years. On the other hand, the share of the other steel products sub-sector in total production value is larger in France and Germany compared to the UK, at 12% and 14%, compared to 6%. Lastly, the casting of steel sub-sector forms the smallest part of overall production in each country's steel sector, at 3% in the UK and Germany, and 4% in France.

Figure 2.6: Production in the steel sub-sectors in the UK, France and Germany, 2014



Source: ONS (Annual Business Inquiry and Annual Business Survey), Eurostat (Structural Business Statistics and Short Term Business Statistics).

[8] Furthermore, in February 2017 Liberty House Group signed an agreement to acquire Tata's Speciality Steel business. At the time of writing, this acquisition had not yet been completed.

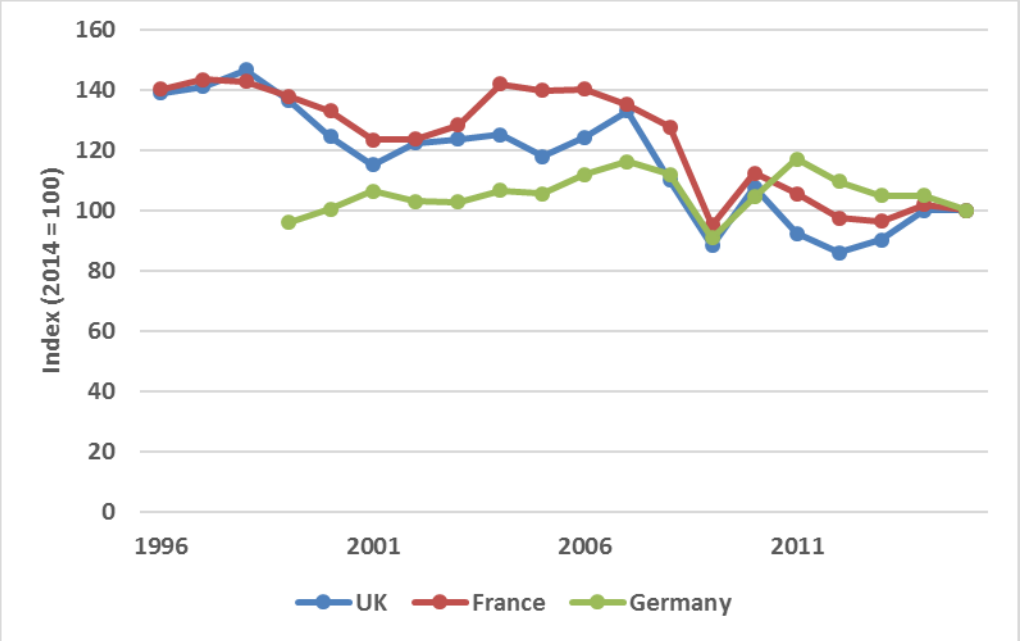
Production of basic steel in Germany in 2015 was around the same level as in 1999

Figure 2.7 below shows the real production value in the basic steel sub-sector in the UK, France and Germany over 1997-2015. In Germany, the basic steel sub-sector produced around the same output in real value in 2015 as in 1999. Over 1999-2007, production grew strongly over 1999-2007, by around 2.4% pa. This was followed by a sharp fall over 2008-09, as the recession brought low demand both domestically and globally. Production looked to have recovered fully from the downturn by 2011, reaching a period high, despite continue weak demand in Europe. However, since 2011 production has been falling, at a rate of 3.8% pa on average as European demand for steel has not picked up on a sustained basis.

In France, production in the basic steel sub-sector by a similar amount to the UK

In France, the real value of production in the basic steel sub-sector fell by the same amount as in the UK overall from 1996 to 2015. Production in France fell over 1998-2001, before recovering to its 1996 level by 2004. In 2006, production began to decline again. The decline was accelerated by the recession, which production falling overall by 29% over 2008-09. Production recovered partially in the next year, before weakening again thereafter.

Figure 2.7: Real production value in the basic steel sub-sector in the UK, France and Germany, 1997-2015



Note: Data for Germany unavailable before 2009.

Source: ONS (Annual Business Inquiry and Annual Business Survey), Eurostat (Structural Business Statistics and Short Term Business Statistics), and CE (MDM-E3 and E3ME.

While in the UK the pipes and tubes sub-sector grew since 2008, it contracted strongly in France and Germany

Table 2.3 shows average growth in the downstream steel production sub-sectors in the UK, France and Germany over the whole historical period and in the periods before and after 2008. The tubes and pipes sub-sector in France fell overall by 2.1% pa on average over 1996-15, driven by a sharp fall after the recession, with production falling by 8.6% pa over 2008-15. In Germany, the sub-sector grew strongly in the pre-recession period, averaging 5.5% pa growth over 1999-2008. As in France, the German tubes and pipes sub-sector was sharply affected by the recession, production falling by 4.5% pa on average over 2008-15. In contrast, the UK sub-sector grew strongly since 2008, by 3.4% pa, driven by strong growth over 2013-15.

As in the UK, the other steel products sub-sector contracted in France overall, but it grew in Germany

In the other steel products sub-sector, neither France nor Germany experienced a contraction similar to the UK sub-sector in severity. However, production in the French sub-sector contracted overall, falling quickly though not as fast as in the UK in the pre-recession years, by 3.6% pa on average over 1996-2008 (compared to 9.1% pa in the UK). In contrast, the German sector grew slightly over 1999-2008, by 1% pa on average. Over 2008-15, the other steel products sub-sector fell overall in all three countries, by 1.9% pa in the UK, 1.5% pa in France and 0.9% pa in Germany.

Casting of steel fell in France over 1996-2015, but grew in Germany

There was a sustained decline in the production value of the casting of steel sub-sector fell sharply in France, by 2.6% pa on average over 1996-2015. In Germany, casting of steel grew very quickly over 1999-2008, by 8.3% pa, but then fell sharply during the recession, by 42% over 2008-09. The sector recovered partially up to 2015, with overall average growth positive at 2.3% pa over 1999-2015.

Table 2.3: Average annual growth rates of real production in the steel downstream production sub-sectors in the UK, France and Germany

	UK			France			Germany		
	1996-2015	1996-2008	2008-15	1995-2015	1996-2008	2008-15	1999-2015l	1999-2008	2008-15
Tubes and pipes sub-sector	0.5	-1.2	3.4	-2.1	1.9	-8.6	1.0	5.5	-4.5
Other steel products sub-sector	-6.5	-9.1	-1.9	-2.8	-3.6	-1.5	0.1	1.0	-0.9
Casting of steel sub-sector	-1.7	-1.1	-2.7	-2.6	-2.9	-2.2	2.3	8.3	-4.8

Source: ONS (Annual Business Inquiry and Annual Business Survey), Eurostat (Structural Business Statistics and Short Term Business Statistics), and CE (MDM-E3 and E3ME.

2.7 Labour productivity, labour costs and profitability in the UK, France and Germany

The previous section found that production in the basic steel sub-sector saw a similar contraction in France as in the UK over 1996-2015. On the other hand, production in the German basic steel sub-sector was around the same level in 2015 as in 1999. In this section, we analyse the historical trends in labour productivity, unit labour costs, and profitability (through the gross operating rate) in the basic steel sub-sector, to further unpack the differing fortunes of the basic steel sub-sector across the three countries.

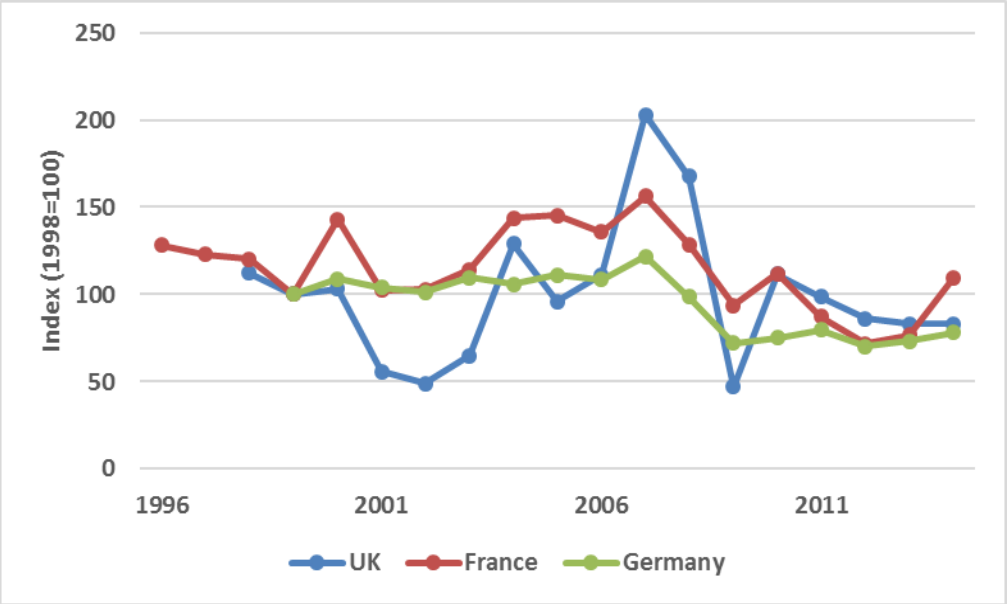
UK labour productivity in the basic metals sub-sector was highly volatile compared to France and Germany, in part due to structural changes

Figure 2.8 graphs real labour productivity[9] in the basic steel sub-sector in the UK, France and Germany over 1996-2015. Labour productivity (measured as value added per worker) in the UK exhibits striking fluctuations relative to in France and Germany. These fluctuations were driven by swings in profitability in the sub-sector, indicating, from a commercial perspective, relatively greater difficulty in operating successfully in the UK compared to abroad. Firstly, labour productivity fell by around 50% over 2000-2002, though this largely reflects the closure of the Corus integrated steelworks in Llanwen. Then, labour productivity doubled over 2006-07, driven by a boom in European steel demand with Corus seeing soaring profits after successfully restricting its UK operations[10]. Labour productivity in the UK then plunged during the recession before stabilising in the post-recession years, until 2015 where it picked up sharply. In contrast, labour productivity in Germany was more stable, growing slowly over 1999-2007, then falling by around 40% over 2007-09, and remaining lower up to 2015. In France labour productivity in the basic metals sub-sector initially fell over 1996-1999, but grew by around 50% over 2003-04 and stayed around that level up to 2007. Labour productivity then fell by around 50% over 2007-09, and fell further over 2010-12. In the final years, labour productivity grew strongly in both the UK and France – particularly so in the UK, by around 60%.

[9] Labour productivity and unit labour costs are a composite measure derived from GVA and employment and labour productivity and average wages respectively. For that reason, care must be taken when interpreting trends or changes in these measures, to understand what is driving the change. In individual years either measure can be prone to swings as a result of structural change. It can be more informative to look at the trend over time.

[10] https://www.theguardian.com/business/2006/nov/29/money1

Figure 2.8: Real labour productivity index in the basic steel sub-sector in the UK, France and Germany, 1996-2015



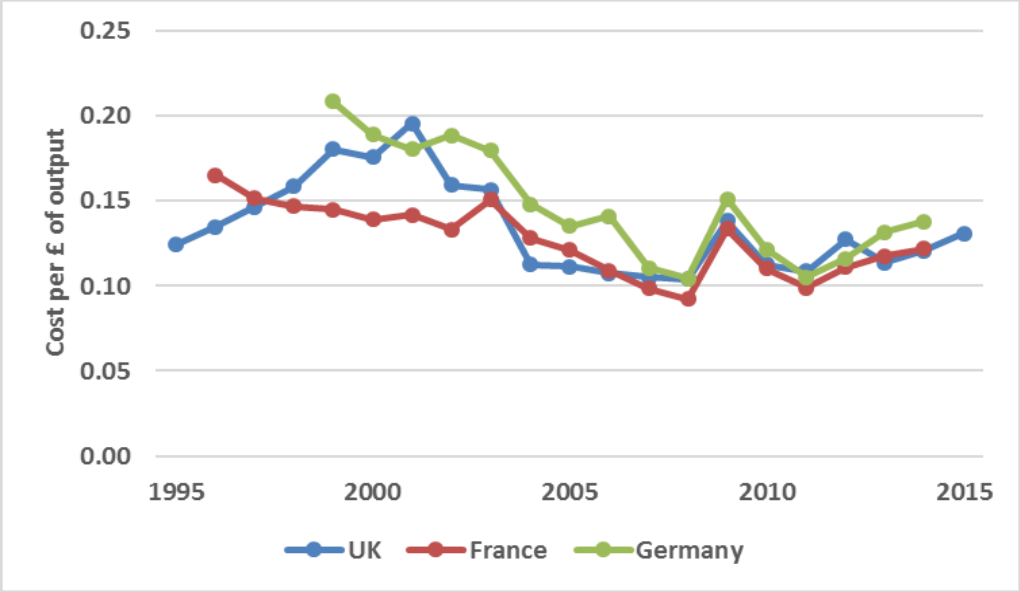
Note: Data unavailable for Germany before 1999. Data unavailable for the UK before 1998.

Source: ONS (Annual Business Inquiry and Annual Business Survey), Eurostat (Structural Business Statistics.

Unit labour costs in the basic steel sub-sector converged up to 2008

Unit labour costs have converged in the basic steel sub-sectors in the UK, France and Germany over 1995-2015. In the UK, unit labour costs increased from around £0.125 to £0.2 over 1995-2000, reaching a similar level to the German sub-sector in the latter year. Unit labour costs then fell sharply over 2001-04, before stabilising up to 2008. In Germany, unit labour costs fell steadily over 1999-2008, from over £0.2 to the same level as in the UK, at just over £0.1. In France, unit labour costs were generally lower than in the UK and Germany in the earlier, years falling slowly up to 2008, where they were a little below France and Germany. From 2008 onwards, unit labour costs generally moved together in three countries basic steel sub-sectors, increasing sharply over 2008-09, before falling back over 2009-11. Unit labour costs grew in all three countries in the most recent years, particularly so in Germany. Figure 2.9 shows unit labour costs in the basic steel sub-sector in the UK, France and Germany over 1995-2015.

Figure 2.9: Unit labour costs in the basic steel sub-sector in the UK, France and Germany, 1995-2015



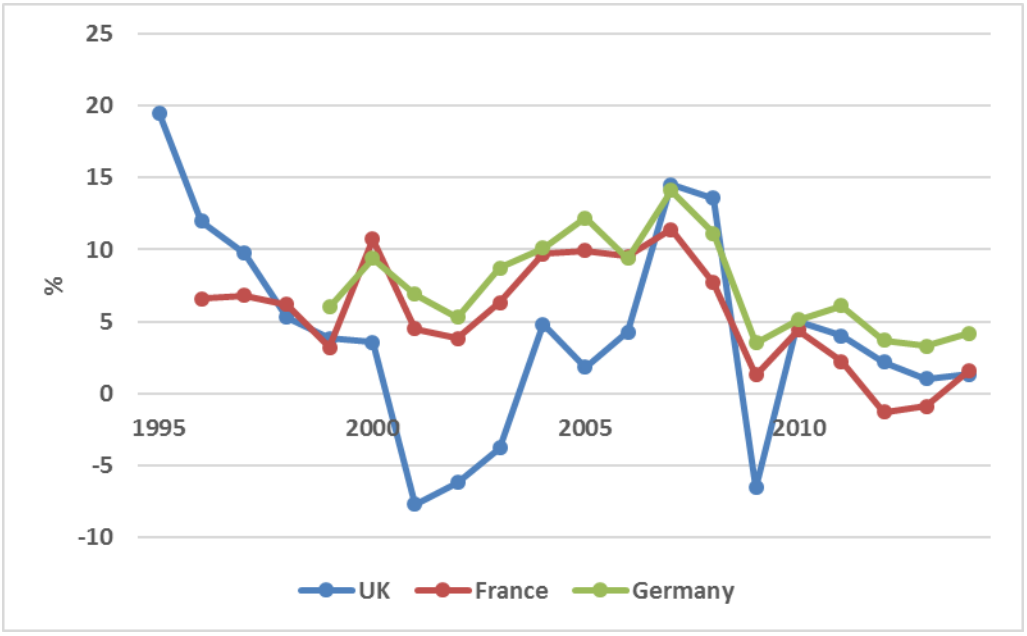
Note: Data unavailable for Germany before 1999 and in 2015. Data unavailable for the France in 1995 and in 2015.

Source: ONS (Annual Business Inquiry and Annual Business Survey), Eurostat (Structural Business Statistics.

Profitability fluctuated in the UK basic steel sub-sector, while it was generally highest in Germany

The gross operating rate fluctuated in the UK basic steel sub-sector overall, with a period of negative profitability in the UK steel sector over 2000-04, and relatively high profitability in 2007 and 2008. Given that output was relatively stable over much of this period (see Figure 1.1), this implies the swings in profitability were driven by fluctuations in spending on inputs. It is interesting to note that the sharp fall in profitability in 2001 and the improvement to 2004 coincides with a sharp increase in unit energy costs in 2001, followed by a weakening in unit energy costs to 2004 (see Figure 2.11 below). When unit energy costs picked up in 2005 and 2006, the improvement in profitability stalled; profitability jumped sharply in 2007 as unit energy costs fell sharply. However, an important driver of these swings in profitability will have been plant closures in the UK. In contrast, the gross operating rate in the French and German sectors was similar in the pre-recession years, though a little higher in the German sector. After the recession, the gross operating rate fell sharply in France, falling below zero in 2012 and 2013. The German sector's gross operating rate was also lower post-recession, but still higher than in France and the UK, at around 5%.

Figure 2.10: Gross operating rate in the basic steel sub-sector in the UK, France and Germany, 1995-2014



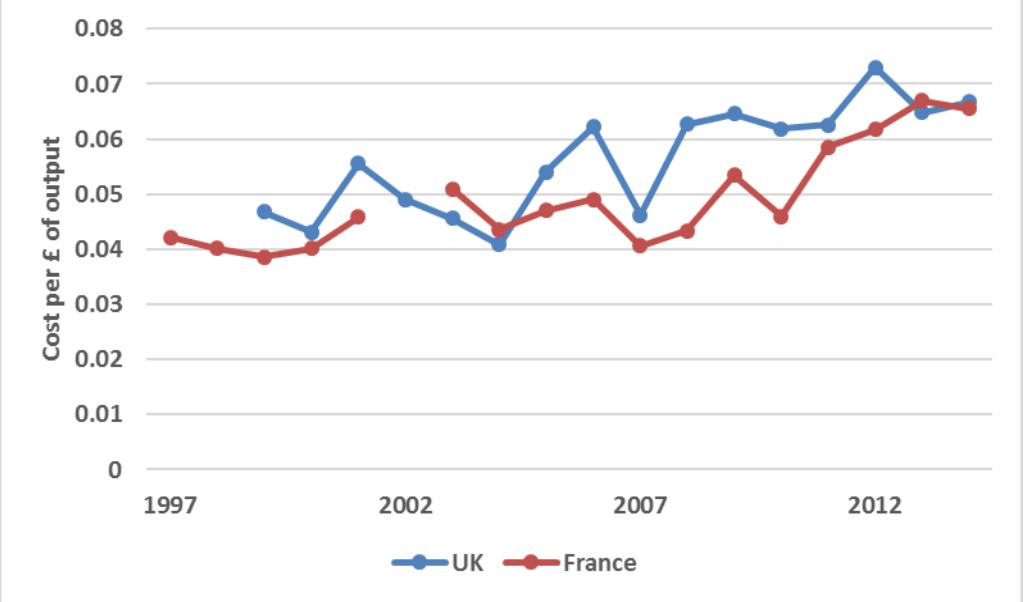
Note: Data unavailable for Germany before 1999. Data unavailable for the France in 1995.

Source: ONS (Annual Business Inquiry and Annual Business Survey), Eurostat (Structural Business Statistics and Short Term Business Statistics) and CE (MDM-E3 and E3ME).

Unit energy costs were generally higher in the UK basic steel sub-sector, and increased in both the UK and France

Figure 2.11 shows unit energy costs in the basic steel sub-sector in France and the UK over 1997-2015. In both countries, unit energy costs increased substantially over 1997-2015. In the UK basic steel sub-sector, unit energy costs fluctuated between £0.04 and £0.06 up to 2007. Unit energy costs in the UK were then higher from 2008 onwards, at between £0.06 and £0.07 in most years (with the exception of 2012 when unit energy costs increased above £0.07), and profitability relatively low. In the French basic steel sub-sector, unit energy costs were generally lower than in the UK, fluctuating between £0.04 and a little over £0.05 up to 2010. Over 2010-14, unit energy costs increased and converged towards the UK level, arriving at around £0.065 in 2014. Higher unit energy costs in the UK reflects UK industrial electricity prices, which surged over 2004-09, and were generally above those in France, which benefits from a large nuclear energy supply. The other main energy input to production, coke, is traded on the global commodity markets, and so broadly the same price across countries. In the later years, the converging of French unit energy prices towards the UK, may in part reflect improved government compensation for energy intensive industries from 2011. It could also be an effect of major closures by ArcelorMittal in France over 2012-13, leading to a temporary fall in output relative to energy costs.

Figure 2.11: Unit energy costs in the basic steel sub-sector in the UK and France, 1997-2014



Note: Data unavailable for the UK before 1999. Data unavailable for France in 2002.

Source: ONS (Annual Business Inquiry and Annual Business Survey), Eurostat (Structural Business Statistics).

2.8 The role of climate change policies

The impact of the EU ETS on steel producers was mitigated by over-allocations of free allowances

In terms of EU policy, the key climate change policy affecting the industry is the Emissions Trading Scheme (ETS). However, the impact of the ETS on the steel sector has been limited because, as one of the sectors identified as at risk to carbon leakage, steel was granted protection from the scheme in the form of free allowances. These allowances were over-allocated in the first stages of the ETS, driving the carbon price down. CE Delft (2016) argued that steel producers across the EU actually profited over 2008-14 from over-allocation of allowances, including those in the UK, as well as in Germany and France. Likewise, CEPS (2013b) note that the main EU regulatory cost to the BOF steel producers is environmental regulation rather than the ETS, because the over-allocation of emissions allowances compensated for indirect costs arising from increased electricity prices. On the other hand, EAF producers are more exposed to indirect costs of the ETS, as they are far more electro-intensive.

High electricity prices in the UK are driven by a higher wholesale prices and network costs

Electricity prices are higher for industrial consumers in the UK compared to major European competitors, but our analysis of industrial electricity prices in chapter two of the main report points to factors other than climate change policies as the underlying cause. We found that in 2016, BOF and EAF steel producers faced a higher wholesale price component in electricity costs than in France and Germany, and far higher network costs. UK producers faced a higher carbon price then France or Germany, though without the major contributor to the carbon price in the UK, the Carbon Price Support, French and German producers would face a higher carbon price due to the higher carbon content of their marginal power plants. The share of other policies in the electricity price was also higher in France and Germany than in the UK. In any case, the higher wholesale price and network costs in the UK were the main factor behind higher industrial electricity prices in 2016

The UK government was slow to provide relief to energy intensive industry for climate change policies

Though our analysis of industrial electricity prices in the UK and other countries found that carbon costs form a relatively small component of electricity costs paid by UK steel producers in 2016, this includes the effect of relief for energy intensive industries only recently implemented. The key policies affecting electricity prices for UK steel producers are the Climate Change Levy (CCL), the Renewables Obligation (RO), Feed in Tariffs (FiTs), the ETS, the Carbon Price Support (CPS) and Contracts for Difference (CfD). Compensation and exemptions for many of these policies was only introduced significantly after their introduction, through the Energy Intensive Industries (EII) package. The EII was introduced by the government in 2011 to be implemented in 2013, following pressure from industries facing rising electricity prices. However, most of the package was not implemented until 2016. The following policies are covered by the EII:

- The RO, introduced in 2002. The EII grants 85% compensation to the steel sector for the RO, but this was only implemented in 2016
- FiTs, introduced in 2008. Again, the 85% compensation was not implemented until 2016
- The ETS and the CPS – the EII compensates for around 85% of the carbon cost. However, the ETS was introduced in 2005, eight years before EII compensation was introduced (although most of the lag was due to a delay in state aid rules allowing compensation). The CPS was compensated for since its introduction in 2013
- The CCL, introduced in 2001 – the EII grants a 100% exemption to all metallurgical processes. Previously, the steel sector was able to obtain an 80% discount through CCAs (rising to 90% in 2013)
- CFD, introduced in 2014 – the EII provides an 85% exemption, but only due to start in 2017

Evidently, most the EII was not fully implemented until 2016 (and even then, exemptions for the CFD had not yet been introduced). Indeed, according to a BIS Select Committee report (2015), the delay in implementing the EII 'directly affected the competitiveness of the UK steel industry and was a contributory factor to the current crisis'. Nevertheless, our findings from the analysis of industrial electricity prices in the UK and other countries suggest that even without accounting for compensations and exemptions, industrial electricity prices in the UK would be higher than most European competitors due to higher wholesale costs and network costs.

Relief for the cost of renewables was introduced earlier in Germany

Energy-intensive industries in European competitors received government support earlier in response to some EU and domestic climate change policies. For example, the EEF (2016) note that the German government introduced exemptions for the cost of renewables support far earlier than in the UK. Furthermore, they argue that such compensation in Germany is far greater than in the UK. Indeed, Germany has provided large exemptions for energy-intensive industry for its key renewables act, the Renewable Energy Sources Act (EEG), introduced in 2000. Industry exemptions for the EEG surcharge grew steadily from around 37 terawatt hours (7% of electricity consumption) in

2004, to 106 terawatt hours (20% of electricity consumption) in 2014[11]. In 2015, industry exemptions from the EEG surcharge in Germany stood at around €4.8bn (£3.5bn) to 2,000 companies[12]. In contrast, the UK government has paid compensation of over £400m since August 2013. The total is made up of amounts on individual schemes: over £90m for the EU Emissions Trading System (ETS), over £140m for the Carbon Price Support (CPS) mechanism and over £170m for Renewables Obligation (RO) and small scale Feed in Tariffs (FiTs). The government has paid over £130m in compensation to the steel sector since 2013.

Cheap extra-EU imports and weak European demand have been the main drivers of UK steel's decline, though high electricity prices played a part

Though high electricity prices played a part, the overarching factor in the decline of the UK steel sector is the combination of weak demand since the recession in the domestic market and EU export markets, combined with more recent oversupply from low-cost foreign producers, led by China. In the UK, a large proportion of domestically produced steel products are subject to intense price competition on a global scale, thus placing huge pressure on the sector when prices are low. For example, the closure of Teesside steelworks, which was bought by SSI mainly to export steel plates to Thailand, was inevitable after plate prices fell substantially, amid competition from the lower cost producers in China and Russia. Allwood (2016) notes that BOF steel facilities in the UK were constructed in the 1960's and as such, despite efforts to modernise the technologies used, they are at a disadvantage to newly installed plants in China.

[11] https://www.agora-energiewende.de/fileadmin/downloads/publikationen/Impulse/EEG-Umlage_Oeko-Institut_2014/Impulse_Summary_Revision_of_EEG_Exemptions_EN.pdf

[12]http://www.eef.org.uk/uksteel/Publications/energy-costs-and-the-steel-sector-a-uk-steel-briefing.htm

3 Sector outlook

Recent plant acquisitions have allayed fears after Tata began to withdraw from the UK

When Tata announced in 2016 its intention to restructure its UK operations, the UK steel sector faced an uncertain future. However, recent acquisitions have gone some way to secure the sector's future, at least in the short term. British Steel in Scunthorpe, now owned by Greybull Capital, announced in early 2017 that it made a profit in its first year of trading, having won 'significant contracts'. In addition, Liberty House Group has emerged as a major player in the UK steel sector, having acquired steelmaking facilities in Newport and Kent in 2016. Liberty House Group have outlined a strategy for UK EAF integrated steelmaking based on low-cost renewable energy.

European demand looks set for a moderate recovery

European demand for steel was weak since the recession, in large part due to suppressed construction activity. However, Eurofer forecast a mild recovery in EU demand for steel in 2017 and 2018, driven by a rebound in the construction sector as the residential sector in Western Europe recovers, and EU infrastructure projects raise construction activity in central Europe and Poland. Furthermore, EU demand for steel in the transport equipment sector, including the UK's growing motor vehicles and aerospace sectors, is set to continue growing.

The UK government has offered support to British suppliers

The UK government announced their intention in 2016 to support British steel by requiring public sector steel contracts to consider UK steel suppliers. Examples of government procurement from British suppliers include Network Rail, which sources around 96% of total aggregate steel demand from the Scunthorpe steelworks, and Crossrail, which estimates that 85% of its steel supply chain is UK based[13]. Looking forward, the government recently announced its intention to use three million tonnes of steel for infrastructure projects by 2020, which will include the High-Speed rail project and Hinkley Point[14].

China will continue to put pressure on EU producers

Cheap imports from China are set to maintain competitive pressure on EU steel producers. Chinese steel capacity continued to grow in 2016 despite slowing domestic consumption. Eurofer (2016) note that supply of some products in the EU in 2016 was dominated by extra-EU imports, with hot-dipped metal coated sheets imports from China accounting for 62% of total EU imports. In response to the persisting problem of unfair imports, the EU has recently implemented new anti-dumping measures on China, of between 65.1 percent and 73.7 percent on imports of heavy plate non-alloy or other alloy steel[15].

Brexit has added uncertainty to the steel sector's future direction

Since the UK voted to leave the EU in 2016, the future of the UK's trade relationship with the EU has been cast into question. Rhodes (2016) notes that this uncertainty may hinder the current efforts of Tata to find buyers or partners for its UK operations in the short term. In any case, Britain's future trade policy with the EU – the UK steel sector's main trade partner – is surely crucial to the sector outlook. Furthermore, the UK's exposure to low cost

[13] https://www.gov.uk/government/news/government-publishes-steel-pipeline-and-new-procurement-guidance

[14] http://www.building.co.uk/steel-pipeline-published-in-bid-to-help-british-suppliers/5085406.article

[15] http://www.reuters.com/article/us-china-europe-steel-idUSKBN16716C

imports on China will no longer be protected by EU policy, so the UK government will likely need to implement some measures to support the domestic steel sector. In addition, the depreciation of the pound following the referendum will have made UK steel exports cheaper, but increased the price of imported inputs, namely coal and iron ore, which the BOF steelworks in Scunthorpe and Port Talbot rely on.

The impact of carbon costs on industrial electricity prices looks set to increase, though by less than in France and Germany

The impact of carbon costs on overall electricity prices to the steel sector was projected to increase in other parts of this study[16]. We projected that the cost of carbon together with carbon price support for the steel sector was estimated at around 5.2% of the total electricity price in 2016. According to our projections, this cost component is set to increase to around 6.3% of total electricity prices in 2030, while total electricity prices are projected to increase by 53%. However, the carbon cost component will increase by more in Germany and France steel sectors, from 2% to 12% of electricity prices in Germany over 2016-30, and from 3.8% to 17.9% in France over the same period.

[16] See chapter two of the main report which presents an analysis of industrial electricity prices in the UK and other countries.

4 Conclusions

Production in the UK steel sector contracted by 27% over 1996-2015

Production in the UK steel sector contracted by 27% in real value over 1996-2015 driven in part by a sharp fall over 2007-09 in the basic steel sub-sector. Production in the downstream sub-sectors followed different paths; the tubes and pipes sub-sector and the casting of steel sub-sector were more stable, whereas as the other steel products sub-sector contracted sharply.

The supply chain has increasingly globalised

The steel sector has become increasingly globalised across the supply chain, resulting in both rising import penetration and export shares of output. There has also been an increasing share of extra-EU imports in the sector over time.

Falling demand in China has led to a global glut of steel. Demand is also weak in the EU

Global demand for steel grew rapidly since the 1990s, driven by growth in China. The recession severely weakened demand in global regions including the EU28 and the US, though China was unaffected. However, demand in China has been falling since 2013 as economic growth has slowed. Global crude steel production more than doubled since 1990 in line with global demand. Global steel production fell overall in the EU28, driven by large falls since the recession as consumption fell from key downstream sectors. The recent fall in demand from China was stronger than the fall in production resulting in a global glut of steel on the world markets.

Domestic demand weakened after the recession

UK production fell at a similar rate to the decline in demand overall. UK demand has been weak since the recession, in line with the European trend. Weak demand in Europe has intensified the competitiveness pressures arising from the growing supply of cheap Chinese imports.

The sector was declining before the recession

The UK steel sector has been declining since the early 1990s, with the number of integrated BOF steelworks in the UK has falling from five to two. British Steel closed the Ravenscraig steelworks in 1992 amid falling profits, and Corus closed the Llanwen steelworks in 2001 citing falling profits due to competitiveness pressures.

Global competition amid weak demand has driven closures and plant sales

Since the recession, the pressure from global competition on UK steelworks has intensified. Teesside Steelworks closed in 2015 following a significant fall in alloy plate prices. Tata Steel has sold off several plants, including the Scunthorpe integrated BOF steelworks in 2016, and the Speciality Steels business in 2017. The future of Port Talbot steelworks is uncertain, though Tata have recently proposed to keep part ownership of the plant in a joint venture with ThyssenKrupp.

The German sector has remained strong, while French steel fell

The German steel sector, which benefits from demand from the strongest manufacturing sector in the EU, has maintained its overall output over 1999-2015, but the French sector contracted to a similar degree as in the UK. However, real production has been falling in the German steel sectors since 2012, around the time that Chinese import penetration began to pick up.

The UK steel sector has not benefited from improvements in labour productivity or unit labour costs

Over the historical period, the UK steel sector does not appear to have benefited from stronger growth in labour productivity or lower unit labour costs compared to its counterparts in France and Germany. Labour productivity in UK fluctuated but there was no clear upward or downward trend over the whole period and there is no clear sign it has improved or deteriorated relative to labour productivity in France and Germany. At the same time, the has UK never enjoyed lower unit labour costs than in France and Germany. In the early 2000s, the UK steel sector had the highest but in recent years unit labour costs in each country have been virtually identical.

UK electricity prices were higher due to wholesale and network costs rather than carbon costs

The impact of the EU ETS on steel producers was largely mitigated by free allowances, which may even have benefited steel producers due to over allocation in the second phase of the EU ETS. Nevertheless, UK industry has faced higher electricity prices than its European competitors, though mainly due to high wholesale costs and network costs.

The UK was slower to provide relief to industry compared to Germany

The UK government introduced a compensation package, the Energy Intensive Industries (EII) package in 2011, but until 2016 had only implemented part of the package. In 2015, a House of Commons BIS select committee acknowledged that this delay had directly affected the competitiveness of the UK steel industry. Industry has argued that relief for many climate change policies was introduced earlier in other European countries, Germany in particular, where substantial relief from the Renewable Energy Sources Act (EEG) has been available to energy-intensive industries since the early 2000s.

The key driver of UK steel's decline was import pressure from China amid weak demand

Despite the higher electricity costs faced by UK producers, the main driver of the sector's recent weakness appears to have been strong growth of extra-EU imports, particularly from China, after Chinese demand fell below production levels around 2012-13. The UK steel sector is fundamentally disadvantaged to Chinese producers, who benefit from lower labour costs, lower energy costs, and newly built plants featuring the latest technologies. Weak demand in Europe and the UK was also a key driver of the sector's contraction.

Recent investment is encouraging for the UK steel sector

The UK steel sector's prospects have received a boost from investment by new players in the domestic market. Greybull Capital bought the Scunthorpe Steelworks in 2016, and have reported a profit in their first year of ownership. Liberty House Group have emerged as a major player in the UK steel sector, focusing on a strategy for UK EAF integrated steelmaking based on low-cost renewable energy.

European demand is set to rise, while UK public sector contracts will boost the domestic sector

After years of weak demand, European demand is forecasted by Eurofer to recover moderately over 2017-18, driven by a recovery in the construction sector, as well as continued growth in the transport equipment sector. The UK sector has also received a boost from the government's recent commitment to 'buy British' for public sector contracts, and the announcement that government infrastructure projects will require three million tonnes of steel up to 2020.

Cheap imports from China are set to continue as production grows

Cheap imports from China are set to continue putting pressure on EU steel producers. Chinese steel capacity continued to grow in 2016 despite slowing domestic consumption. In response to the persisting problem of unfair imports, the EU have recently implemented new anti-dumping measures on China, of between 65.1 percent and 73.7 percent on imports of heavy plate non-alloy or other alloy steel.

Brexit has cast uncertainty over future trade

Brexit has added a further element uncertainty to the future of the steel sector, casting future UK trade policy into question, and causing a sudden depreciation of the pound that has mixed implications.

The share of carbon costs in electricity costs is projected to increase

Lastly, the analysis of industrial electricity prices undertaken for this study[17] projected that the share of carbon costs in overall electricity prices (arising from the ETS and the CPS) is set to increase in the UK from 5.2% to 6.3% 2030 in the UK, having accounted for compensation and exemptions. In comparison, the share of carbon costs (arising from the EU ETS only) in electricity prices is projected to increase by more in France and Germany. Nevertheless, total electricity prices are projected to increase by 53% for the UK steel sector, indicating the importance of energy efficiency to the sector's future competitiveness.

[17] See chapter two of the main report, which presents an analysis of industrial electricity prices in the UK and other countries.

Appendices

Appendix A References

Agora Energiewende (2014) 'Proposal for a Revision of the Industry Exemption rules under the German EEG'

Business, Innovation and Skills Select Committee (2015) 'The UK steel industry: Government response to the crisis'

CE Deflt (2016) 'Calculation of additional profits of sectors and firms from the EU ETS'

CEPS (2013) 'The Steel Industry in the European Union: Composition and drivers of energy prices and costs'

CEPS (2013b) 'Final report - Assessment of Cumulative Cost Impact for the Aluminium Industry'

Climate Strategies (2014) 'Carbon Control and Competitiveness Post 2020: The Steel Report'

Eef (2016) 'Energy Costs and the Steel Sector: A UK Steel Briefing'

Eurofer (2016) 'Economic and Steel Market Outlook 2016-2017'

Rhodes, C. (2016) 'UK Steel Industry: statistics and policy'

Thomas, G. (2016) 'The Steel Industry: an in-depth look'

University of Cambridge (2016) 'A Bright Future for UK Steel'

World Steel Association (2015) 'Fact Sheet – Energy Use in the Steel Industry'