Report prepared for Committee on Climate Change

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

# Cement Deep Dive

cambridge econometrics
clarity from complexity

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 | 30/3/17 | Graham Hay | Final Report. |

# Contents

## Figures

# Executive Summary

- This report investigates the extent to which climate change policies have affected the competitiveness of the UK cement industry. It analyses indicators on output, demand, investment, trade, energy and labour costs to determine the drivers of sectoral performance. The UK cement sector is compared against sectors in France and Germany.
- Global cement production grew from 1.1bn metric tonnes in 1990 to 4.1bn metric tonnes in 2014. In the UK, cement production was stable over 1995-2007, in line with domestic demand. Variations in turnover and value added reflected fluctuations in prices. However, demand declined markedly after the 2008-09 recession. Contraction in UK construction activity has led to a fall in domestic demand of nearly 40% since 2008. In response, UK production of Portland cement contracted from 12.5m metric tonnes in 2007 to 9.3m metric tonnes in 2014.
- Investment as a proportion of production in the UK cement sector picked up a little over 2002-2007, driven by strong demand from the construction industry as construction of all types of properties boomed. The collapse of the property boom and subsequent fall in demand from construction led to investment collapsing considerably after 2007 and it has not yet recovered. Investment in France and Germany after 2007 contracted less than in the UK.
- About 60% of the sector's energy needs are met by coal, down from over 80% in 2007, with the rest being met largely by electricity. As such, the cost of energy for the UK cement sector has been influenced by trends in international coal prices. These increased roughly four-fold over 2002-08 and drove up the per unit energy cost in the UK. At the same time, UK industrial electricity prices surged upwards over 2004-09, driven by sharp increases in gas prices. The increase in electricity prices in the UK was greater than in other EU countries because of the UK's dependence on gas in the electricity sector. In France, the per unit energy cost remained low and stable over the period.
- The impact of high or volatile coal prices can be mitigated against through the use of fuels derived from waste, but the UK sector was initially slow in switching to alternatives fuels compared to its counterparts in France and Germany. However, substantial progress has been made by the UK sector since the mid-2000s and in 2015 over 40% of the thermal input was derived from alternative waste materials.
- Prior to 2008, the UK cement sector was characterised by relatively high labour costs (per tonne of output) and relatively low labour productivity (measured as tonnes of cement producer per worker), compared to the cement sector in France and Germany. Thus, it is hard to argue that any lack of competitiveness prior to 2008 was down solely to low carbon policies. Since 2008, the labour cost (per tonne of output) has fallen in the UK and is the lowest among the three countries. At the same time, labour productivity in the sector increased

to its highest level since the early-2000s in 2014 and surpassed labour productivity in France.

- Import penetration in the UK increased substantially in recent years. Over 1996-2006, the share of demand met by imports was relatively stable at 8-10% (similar to the rate in France and Germany). However, since 2006 it has risen steadily to around 27%, far higher now than in Germany and France. The share of demand being met by imports has increased because demand has fallen while imports, mostly from within the EU, have stayed flat.
- Climate change policies such as the EU Emissions Trading System (EU ETS), Climate Change Levy (CCL), Carbon Price Support (CPS) and support for low-carbon generation through Renewables Obligations (RO), Feed-in-Tariffs (FiTs) and Contracts for Difference (CfD) increase costs for energy-intensive sectors. However, UK and EU measures such as compensation, exemptions and the awarding of EU ETS free allowances have lowered the cost impact of carbon policies on the UK cement sector.
- As a proportion of the industry electricity price, the 2016 indirect EU ETS carbon cost was 2.2%, 6.7% for Carbon Price Support, 0.6% for Feed-in-Tariffs, 2% for Renewables Obligations and 1.3% for Contracts for Difference.
- Carbon policies have not led to a loss of competitiveness since most UK cement trade is with EU countries which are subject to similar carbon policies, apart from the Carbon Price Support introduced in 2013. The cement sector contends that there has been an impact on competitiveness.
- Over the mid-2000s, the UK cement sector was characterised by relatively high labour costs and relatively low labour productivity. At the same time, it was largely dependent on coal for about 80% of its energy needs, the price of which increased roughly four-fold over 2002-08. The price of electricity, on which is it also dependent, increased sharply because of large rises in the price of gas used in electricity generation. The gross operating rate, a measure for profitability, in the UK cement sector was volatile and in overall decline after 2002. The consolidation observed in the sector over this period was a response to these pressures.
- Additional costs as a result of low-carbon policies and delay or ineligibility in accessing some of the compensation would have weakened the sector's position. However, low-carbon polices were not the primary factor in the sector's decline. The decline in UK cement production over 1990-2016 was driven primarily by the contraction in demand from construction following the global economic crisis over 2007-09, exacerbated by high energy (coal and gas) prices.

# 1 The UK cement sector

## 1.1 Introduction

Cement is an input to concrete, an important construction material. The UK cement sector covers cement manufacturing under classification SIC (2007) 23.51. Data from the Office of National Statistics (ONS) indicates that in 2012 gross output of the UK cement sector was around £420m, which generated around £170m in Gross Value Added (GVA). This compares to £3.7bn in GVA for the broader non-metallic minerals sector in 2012.

According to the Mineral Products Association (MPA) Cement[1], an industry trade body, the main Portland cement manufacturers in the UK are a group of international companies including CEMEX UK, Hanson, Hope Cement, Lafarge Cement and Tarmac (a CRH company). Their operations include eleven manufacturing plants and two grinding & blending plants and ten blending-only plants, producing about 10m tonnes of cement pa which accounts for most UK cement sales.

The overall view of the UK cement sector over the last twenty years is one of two periods: real output was relatively flat over 1995-2007; this was followed by a sharp decline after 2007 from which, even by 2015, production levels have not recovered. This sector deep dive looks at the evolution of the UK cement sector and how climate change policies have affected the competitiveness of the UK cement sector.

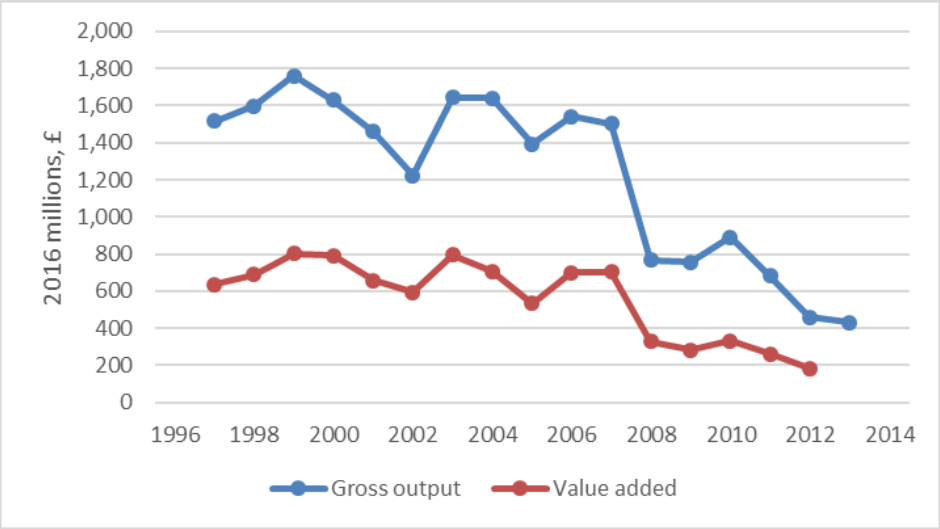
## 1.2 Output in the UK cement sector

*The contraction in UK cement output was driven by the economic crisis of 2007-09*

For context, it is useful to consider the trends in sector output as represented by gross value added (GVA) and gross output. Figure 1.1 shows that output (measured by value, in constant prices) of the cement sector in 2013 was around 70% lower than output levels in the late-1990s and early-2000s; gross value added (GVA, the difference between gross output and purchases of inputs) was also around 70% lower. Despite fluctuations in output levels over 1997-2007, output in 2007 was much the same as in 1997. The main driver of the fall was a sharp contraction over 2007-08, when output fell by around 50%, driven by the collapse in construction activity during the global financial crisis. Output continued falling over 2008-12, as activity in the construction sector (the primary market for the cement sector) remained weak and fragile. The trend in GVA closely mirrors the trend in output.

[1] http://cement.mineralproducts.org/

**Figure 1.1 Gross value added and output in the UK cement sector**

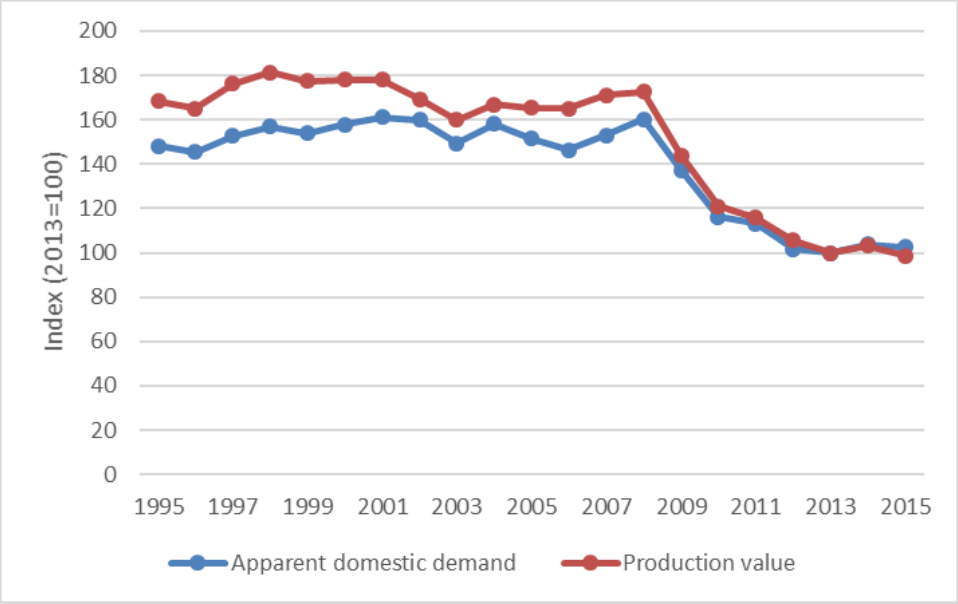



Source: ONS (Annual Business Inquiry and Annual Business Survey), Eurostat (Structural Business Statistics and Short Term Business Statistics), and CE (MDM-E3 and E3ME).

## 1.3 Domestic demand and supply for cement in the UK

Figure 1.2 shows that apparent domestic demand over 1995-2008 was stable and only grew marginally overall. The 2008 economic contraction however triggered a major decline in the sector with demand falling by almost 40% overall between 2008 and 2013. The evolution of production value – a proxy for domestic supply – reflects developments in domestic demand: low volatility, low growth over 1995-2008 and collapse over 2008-2013, albeit by slightly more than the fall in demand. As of 2015 both demand and supply were still below their respective pre-2009 averages.

**Figure 1.2 Demand and supply in the UK cement sector**

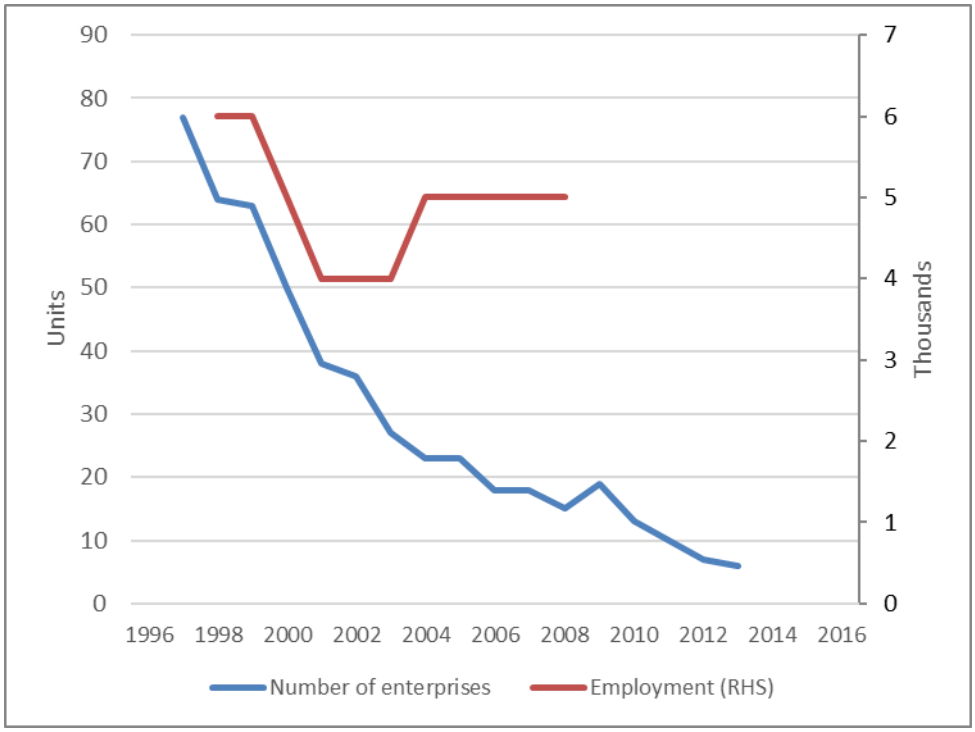



Source: Comext and Prodcom/Eurostat (Structural Business Statistics).

*Consolidation in the UK cement sector has driven decline in the number of enterprises and employment has fallen over the last decade*

Figure 1.3presents the trends in sectoral employment and the number of enterprises manufacturing cement. After falling over 1998-2001, employment recovered partly in 2004. However, in 2008 employment was still below the 1998 level. It is not possible to fully assess employment dynamics after 2008 due to lack of data. Nevertheless, a recession-gripped UK economy after 2008, and the continuing overall fall in the number of enterprises, would lead one to conclude that cement sector employment did not recover during this period. The MPA estimated employment in 2013-2014 at around 2,500[2]. ONS data indicate that the number of enterprises manufacturing cement declined steadily over 1997-2013. With output levels relatively stable, this suggests the decline in the number of enterprises was driven by consolidation over 1997-2007. While this trend is likely to have continued after 2008, the decline in the number of enterprises is also likely to have been driven by some firms exiting the sector (in the face of weaker demand and greater uncertainty). According to ONS data, there were just six enterprises involved in the manufacture of cement in 2013; this increases to 13 if the manufacture of lime and plaster is included. MPA data indicate there were 11 manufacturing plants, along with nine blending plants (two of which also carried out grinding).

**Figure 1.3 Employment and firm count in the UK cement sector**




Source: ONS (Annual Business Inquiry and Annual Business Survey).

[2] http://cement.mineralproducts.org/documents/DL-Cement-Industry-leaflet-29-05-14web.pdf

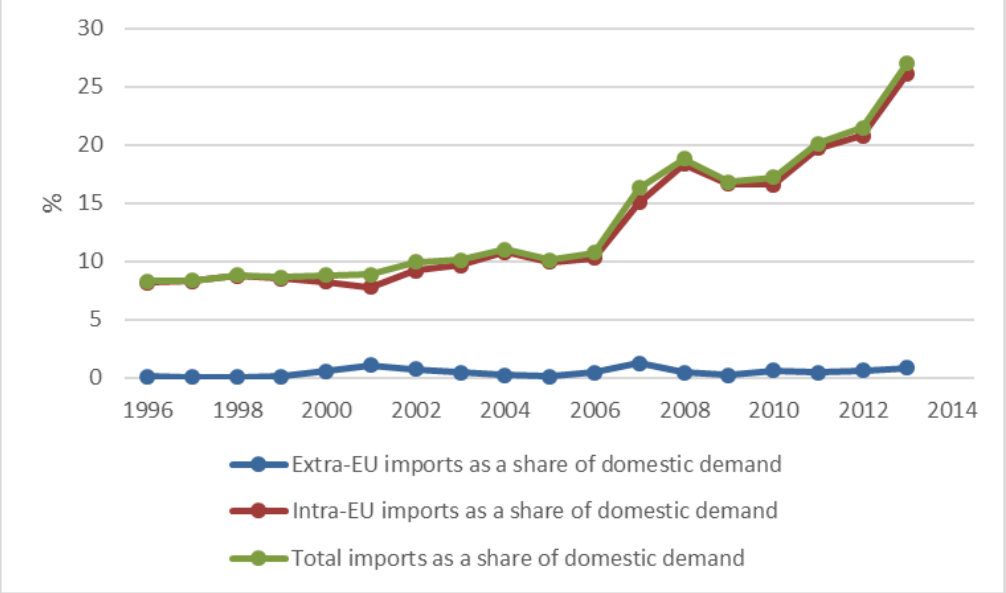
## 1.4 Import penetration and trade in the UK cement sector

*Imports increased their share of domestic demand from 10% in 2006 to 27% in 2013*

We also look at cement imports which appear to have evolved distinctly in the periods before and after 2006. In Figure 1.4 we see that import penetration (the ratio of imports to domestic demand) was stable over the ten years to 2006 and only rose from 8% to 11%. EU-originated cement accounted for most of the imports while imports from outside the EU were at most 1% of domestic demand.

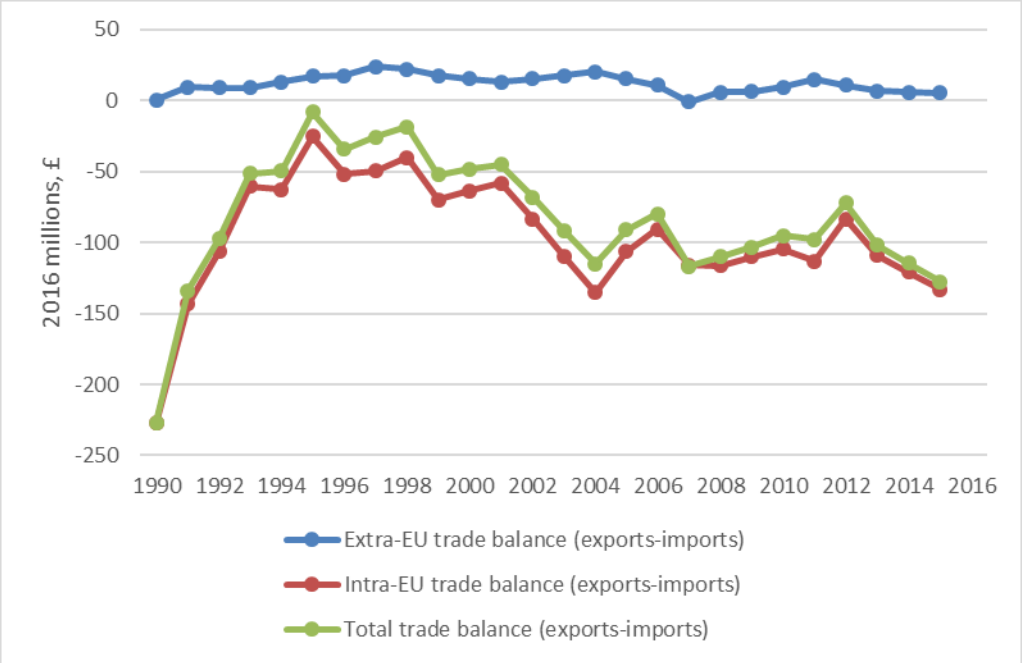
The post-2006 period saw imports penetrate the UK cement market further with total imports meeting 27% of demand in 2013. The value of imports (in current prices) was largely flat between 2006 and 2013, and so the increased import penetration was the result of falling domestic demand (see Figure 1.2). Figure 1.5 also shows the UK cement trade balance improving over 1990-1995 before deteriorating thereafter. While the UK had a cement trade deficit with the EU for the 1990-2015 period, it mostly had a trade surplus with non-EU cement trade partners.

**Figure 1.4 Import penetration in the UK cement sector**




Source: Comext and Eurostat (Structural Business Statistics).

**Figure 1.5 Trade in the UK cement sector**



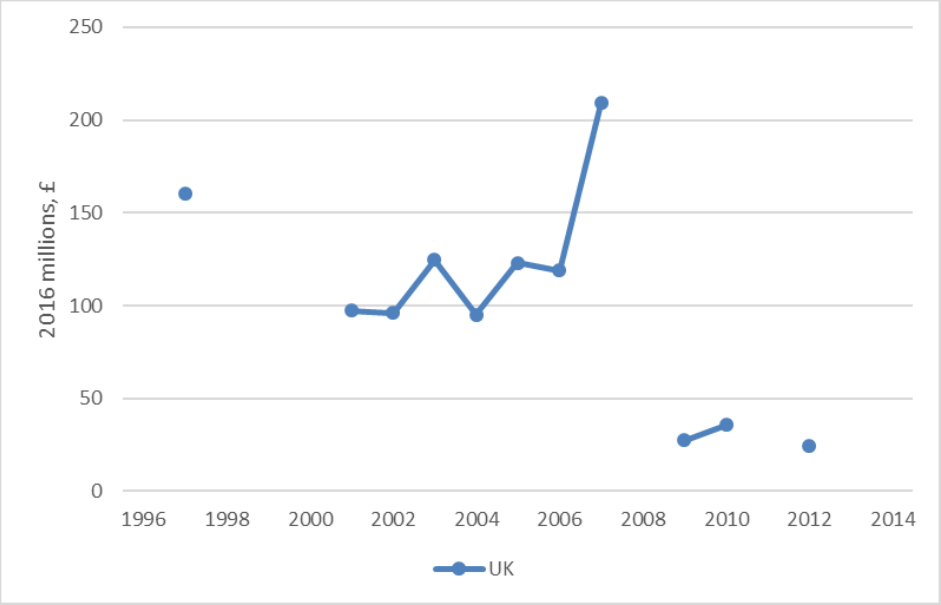

Source: Comext and Eurostat (Structural Business Statistics).

## 1.5 Investment in the UK cement sector

*UK investment fell to a record low after 2007*

Investment tends to fluctuate a lot and this is evident even based on the limited data available in Figure 1.6, possibly as a result of the investment cycles associated with long life-cycle plants. After an overall fall of nearly 40% between 1997 and 2001, real investment rose from £97m to £209m over 2001-2007, a growth rate of nearly 14% pa. However, the 2007 peak gave way to a sharp contraction as real investment collapsed to £27m by 2009. Despite the lack of comprehensive investment data, limited activity in the construction sector and collapse in the housing market after 2007 would suggest that investment is yet to return to the 2007 level. Such a drop in investment, if it persists, is likely to lead to further sectoral decline.

**Figure 1.6 Investment in the UK cement sector**




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

# 2 The international cement sector

## 2.1 Global production

*Emerging markets are the top cement producers*

Global cement production has grown over the last twenty-five years, going from 1.1bn metric tonnes in 1990 to 3.3bn metric tonnes in 2010, 4.1bn metric tonnes in 2015 and forecast to reach 4.8bn metric tonnes by 2030.[3] Data from the Global Federation of Competitive Councils (GFCC) shows that global production is dominated by China which accounted for more than half of global production in 2015 at 2.4bn metric tonnes. Other major producers making the top five list are: India (270m metric tonnes), the US (83m metric tonnes), Turkey (77m metric tonnes) and Brazil (72m metric tonnes). The top EU producers in 2015 were Germany (32m metric tonnes) and Italy (23m metric tonnes). In comparison, the UK produced around 9m metric tonnes of cement in 2014.

## 2.2 Trends in the global trade for cement

*The UK is a small player in international cement trade*

Ranked by share of the global cement trade, the top five cement exporters in 2015 were China (11%), Thailand (9.1%), Turkey (7.6%), Germany (7.1%) and Spain (6.8%). France and the UK respectively accounted for 3.6% and 0.73% of global cement exports[4].

The main cement importers in 2015 were the USA (18%), France (6.9%), Singapore (6.7%), the Netherlands (5.1%) and Malaysia (3.5%). The UK accounted for 1.8% of global imports. Singapore and the Netherlands, despite their relatively small sizes, are among the top cement importers because they lack suitable limestone resources, the major ingredient in cement manufacturing. In fact, the Netherlands has one clinker production installation located close to the Belgian border. In addition, as homes to major shipping ports, both countries have the capacity to engage in cement trade.

*Germany, Ireland and France are the top destinations for the small quantities of UK cement exports*

As illustrated above, trade plays a relatively small role in the overall UK cement sector. Of the small volume of cement products that the UK sector exports, ordered by share of UK cement exports received in 2015, Germany (12.1%), Ireland (9.7%), France (6.1%), the Russian Federation (2.7%) and Sweden (2.1%) were the top five destinations for UK cement exports. These are exports for all cement types including Portland cement, aluminous cement, slag cement, super-sulphate cement and similar hydraulic cements, coloured or non-coloured or in the form of clinker.[4] While Germany and France are among the leading cement trading partners for the UK (the two countries receive over 18% of UK exports), the value of UK exports is much smaller compared to imports, as illustrated in Figure 1.5.

[3] https://www.statista.com/statistics/373845/global-cement-production-forecast/

[4] http://decoder.thegfcc.org/explore/trade_destinations?utf8=%E2%9C%93&year=2015&country_name=United+Kingdom&commodity_category_id=4&commodity_id=1014

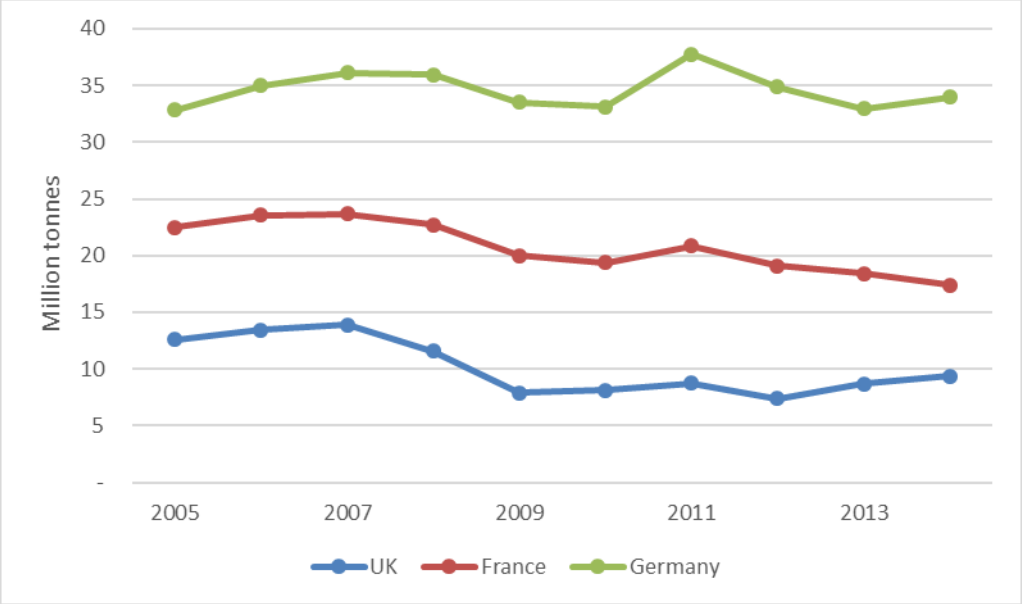
## 2.3 Cement demand and supply in the UK, France and Germany

*Demand and supply declined by more in the UK than in France and Germany over 2006-2014*

Figure 2.1 shows that between 2005-2014 around 35m metric tonnes pa were produced in Germany, 20.8m metric tonnes pa in France and 10.2m metric tonnes pa in the UK.[5] Also shown is the slump in output volumes after 2007 linked to the economic crisis. In Figure 2.2 we see an overall drop in domestic demand in the UK and Germany over 1999-2015 however, the contraction in Germany had happened by 2008 with demand stable thereafter. In contrast, UK demand was stable over 1995-2008, but collapsed thereafter. (Figure 2.2, solid lines). Demand in France grew by 30% over 1996-2008 but then fell to its 1996 level where it remained as of 2015.

Using production value to proxy supply, Figure 2.2 (dotted lines) shows that supply and domestic demand evolved closely in France and to some extent, in the UK. In both countries supply contracted by slightly more than demand over 1996-2013. For Germany, domestic demand and supply evolved more independently with a bigger drop observed in domestic demand compared to supply over 1999-2013. This is in line with Germany's position among the top global cement exporters.

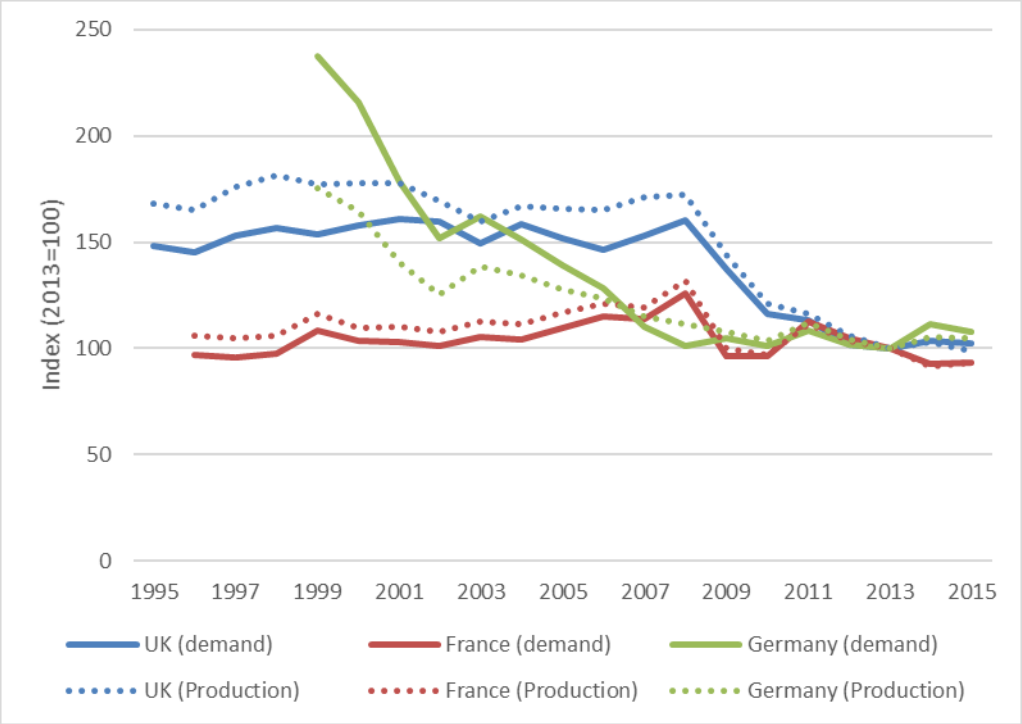
**Figure 2.1 Total cement production volume in the UK, France and Germany**




Source: World Business Council for Sustainable Development/ Cement Sustainability Initiative.

[5] http://wbcsdcement.org/GNR-2014/index.html

**Figure 2.2 Demand and production value in the cement sectors of the UK, France and Germany**




Source: Eurostat (Prodcom database).

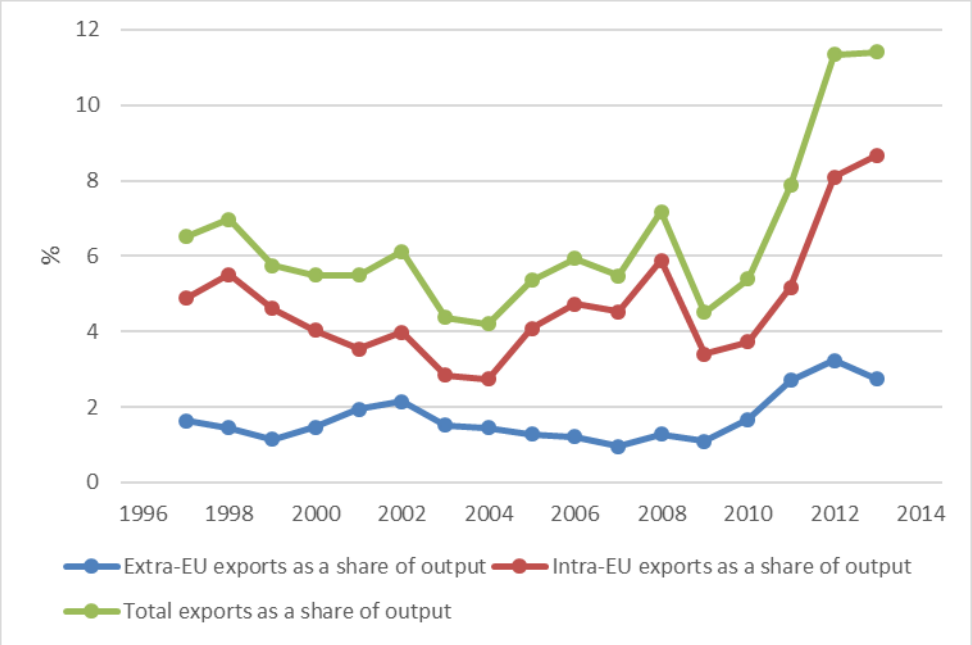
## 2.4 Cement trade in the UK, France and Germany

*Imports account for a bigger share of demand in the UK compared to France and Germany*

Exports and imports plotted in Figure 2.3 and Figure 2.4 provide insight on cement trade in the UK, France and Germany. Figure 2.3 shows the UK ratio of exports to gross output fell from 7% to 4% over 1997-2004 before recovering by 2008. The crash in 2009 was followed by a sharp increase for which the ratio of exports-to-output more than doubled over 2009-2012 to reach over 11%. Such strong performance of exports relative to output is uncharacteristic of the UK cement sector given that the export-to-output ratio remained within the 4%-7% range until 2009. This rise was due to an increase in exports even as gross output fell after 2009. UK exports to the EU were at least twice exports to outside the EU. Specifically, the surge in the exports-to-output ratio after 2009 was mainly in exports to the EU. Nevertheless, looked at in the context of Figure 1.5 which shows a deteriorating UK trade balance post-2009, this export performance is not so impressive. In addition, UK exports are much smaller compared to exports from Germany and France. To illustrate, GFCC data show that in 2013 the UK exported around $40m worth of cement products to Germany, France, Ireland and Russia combined. In contrast, German cement exports to the Netherlands alone were $178.5m in the same year. At the same time, France exported around $100m worth of cement products to Germany, the US and the UK, combined.[6]

[6] http://decoder.thegfcc.org/explore/trade_destinations?utf8=%E2%9C%93&year=2013&country_name=France&commodity_category_id=4&commodity_id=1014

**Figure 2.3 Exports from the UK cement sector**



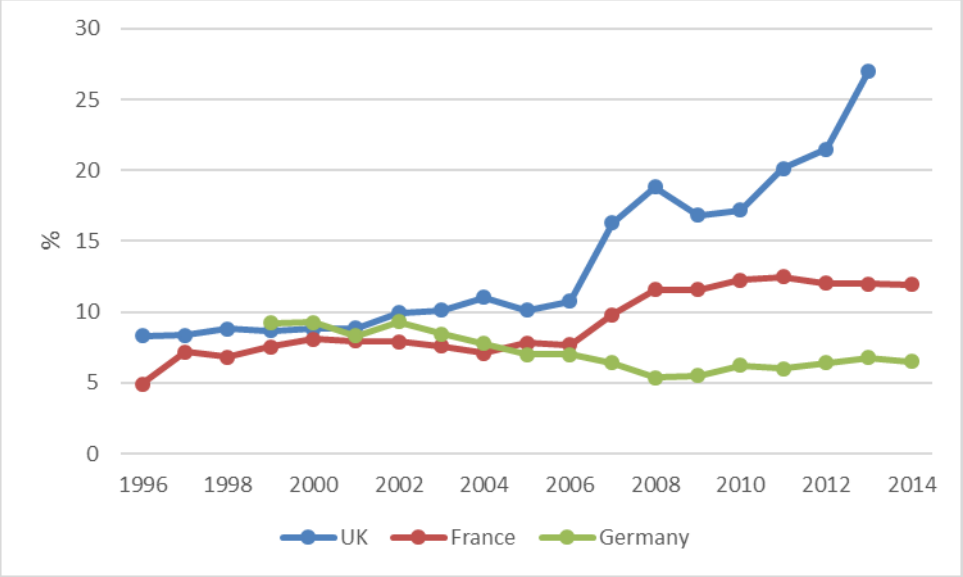

Source: Comext and Eurostat (Structural Business Statistics).

Cement imports are also analysed via import penetration, the ratio of imports to domestic demand. Figure 2.4 suggests two periods for characterising import penetration: before and after 2006. The pre-2006 period is defined by low volatility and low growth across the three markets. For example, the ratio of UK imports-to-demand rose from 8% to 11% over 1996-2006 while France saw no overall change between 1997 and 2006. However, the import-to-demand ratio in all three markets diverged significantly after 2006. The UK saw the biggest change with the share of demand being met by imports nearly tripling to 27% over 2006-2013. This is because demand fell over this period, while imports (by value, constant prices) were flat.

The import share of demand also grew in France from 8% to 12% with much of this growth taking place during 2006-2008. In contrast, the import-to-demand share in Germany declined slightly over the same period. Indeed, imports relative to demand in Germany had been falling since 2002 and only reversed the decline after 2008. Over 2004-07, there was a surge in cement imports into Spain from outside the EU (which fell away quickly after 2007), Exports from Spain to the rest of the EU grew steadily over the same period, but not as fast as imports into Spain from outside the EU. However, exports of cement from Spain to the rest of the EU have accelerated since 2009. This suggests some restructuring of the sector in Spain following the surge in extra-EU imports, which has boosted intra-EU competitiveness.

The overall indication from Figure 2.4 is that import penetration in the UK accelerated after 2006. A similar phenomenon happened in France to a lesser extent. In addition, the increase in import penetration in France stabilised in 2008. On the other hand, Germany reduced its overall import penetration over 1999-2014. In Germany, intense competition in the domestic market led to a price war in the 2000s and this is likely to have made the German market a less attractive export destination.

**Figure 2.4 Import penetration (ratio of imports-to-demand) in the UK, France and Germany**




Source: Comext and Eurostat (Structural Business Statistics).

## 2.5 Investment in the cement sectors in the UK, France and Germany

*The rate of investment to production in the UK is more volatile than in France and Germany*

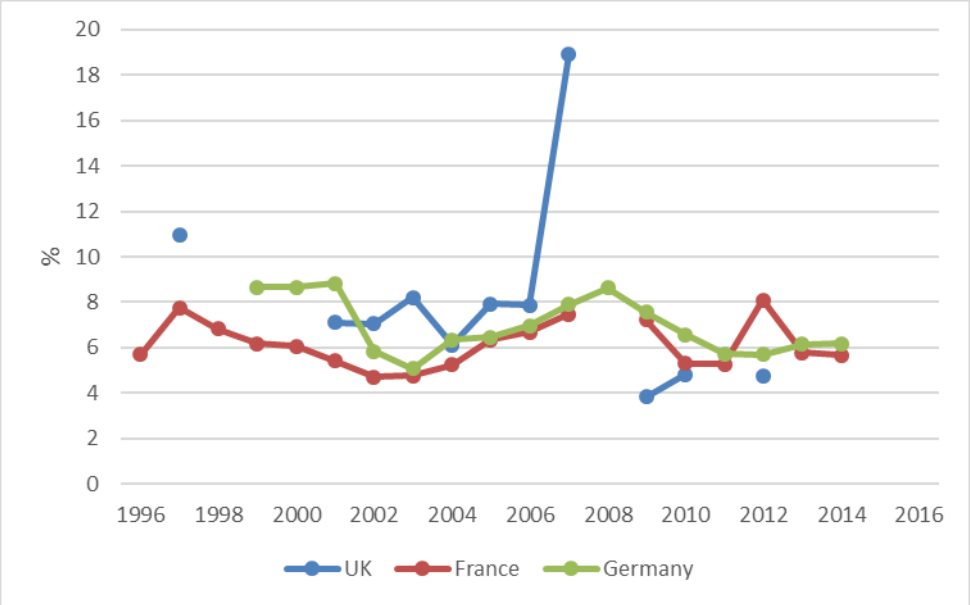
Investment is one of the major determinants of long-term sectoral performance. Figure 2.5 shows that the rate of investment to production in the UK is more volatile compared to rates for France and Germany. Over the ten years to 2006 the UK rate of investment to production declined from 11% to 8% while remaining mostly above rates in France and Germany. There was a sharp increase in the UK rate in 2007, possibly linked to a £200m investment by Cemex at its Rugby Works plant. This plant had the largest kiln in the UK, was one of the most modern cement plants in the world and had a production capacity of 1.8m tonnes of cement pa. Cemex also invested in the use of Climafuel, a waste-derived fuel, to partly replace coal in heating the cement kiln at Rugby Works.[7] After the steep rise in 2007, the UK rate fell below rates in France and Germany. By 2009 the UK rate had fallen to a record low, half its 2006 value and just slightly below rates in France and Germany.

*Investment to production rates in the UK, France and Germany were similar in the early 2000s and after 2009*

The evolution of the French and Germany rates was a lot more synchronised, especially after 2003. However, after falling as they converged between the late 1990s to 2003, the two rates tracked each other closely. From 2003 they rose steadily to a 9% peak in 2008 after which both rates fell in each successive year until 2011. For almost all of the 1996-2014 period, investment relative to production in France was lower than in Germany.

[7] http://www.cemex.co.uk/cemex-uk-granted-permit-to-introduce-climafuel-at-rugby-works.aspx

**Figure 2.5 Investment to production value ratio**




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

# 3 Competitiveness of the UK cement sector

The following discussion considers the competitiveness of the cement sectors in the UK, France and Germany. Competitiveness is partly revealed by comparing factors such as input costs that affect the production process and profit margins. These include labour costs, productivity, energy costs and the gross operating rate. Also included is the Balassa index which reflects the degree of export specialisation by a sector relative to a reference area.

## 3.1 Labour costs and labour productivity

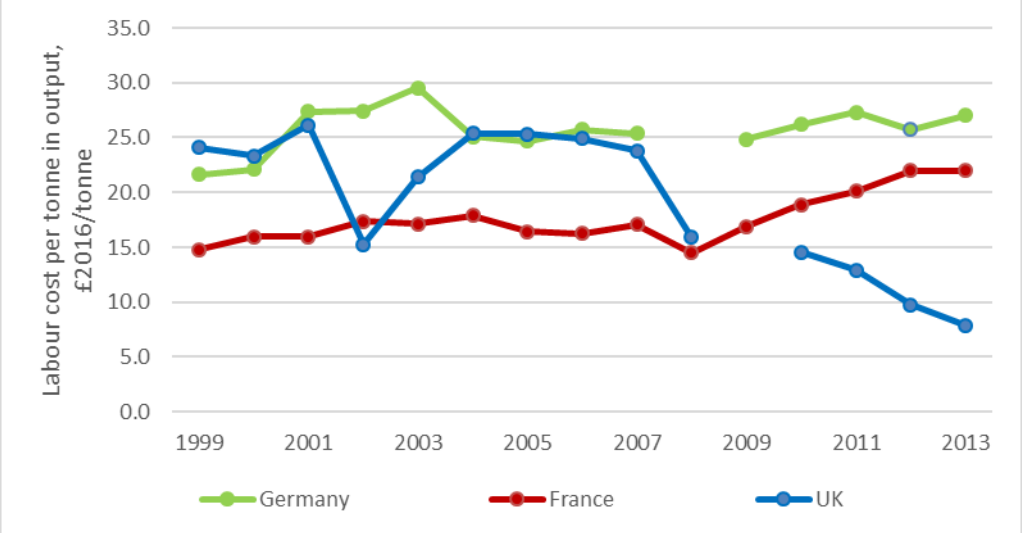
*The labour cost per tonne of output in the UK was relatively high but is now lower than those in Germany and France*

Figure 3.1 shows that labour costs per metric tonne in the UK were relatively high over 1999-2007, broadly in line with German labour costs (per tonne of output) and considerably higher than those in France. The sharp fall in labour costs in the UK in 2002 was driven by a marked fall in the wage bill (driven, it appears, by a sharp fall in employment)[8]. Aside from that fall, labour costs (per tonne of output) were relatively stable in the UK up to 2007. Thereafter, they fell sharply in 2008 because, in response to falling demand, producers cut back employees' working hours (but not employment) and therefore, their wage bill; at the same time, physical production volumes held up before falling sharply in 2009. The decline in per tonne labour costs in the UK has continued as physical production steadied over 2010-13 while the wage bill continued to fall as employment contracted[9]. As a result, per tonne labour costs in the UK are now lower than in France, where the cement sector enjoyed much lower labour costs (because of higher labour productivity) initially but then saw them rise as productivity fell; and Germany, where labour costs have been relatively high and largely flat over the historical period.

[8] The value for the level of employment in 2002 is withheld by ONS, but the values for total labour costs and GVA are published. Values for all three indicators in 2001 and 2003 are published. Given average labour costs and labour productivity in these years, the given employment cost in 2002 implies employment in the UK cement sector fell to around 3,000 people in 2002.

[9] Poor data availability makes it difficult to ascertain why the wage bill fell, but data from the Mineral Products Association indicate that the cement sector employed around 2,500 people in 2013/2014. This represents a decline on the roughly 5,000 that were employed in 2008.

**Figure 3.1 Labour costs in the cement sectors of the UK, France and Germany**




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

*Labour productivity in the UK cement sector was low before 2008 but had risen above levels in France and Germany by 2014*

It's difficult to make direct comparisons with labour productivity in Germany using monetary-based measures. Labour productivity in Germany was distorted by the price war in the early 2000s, which has clearly impacted on profits (see Figure 3.3), one of the components of GVA, and thus labour productivity. Instead, we compare trends in labour productivity using measures based on physical production quantities.

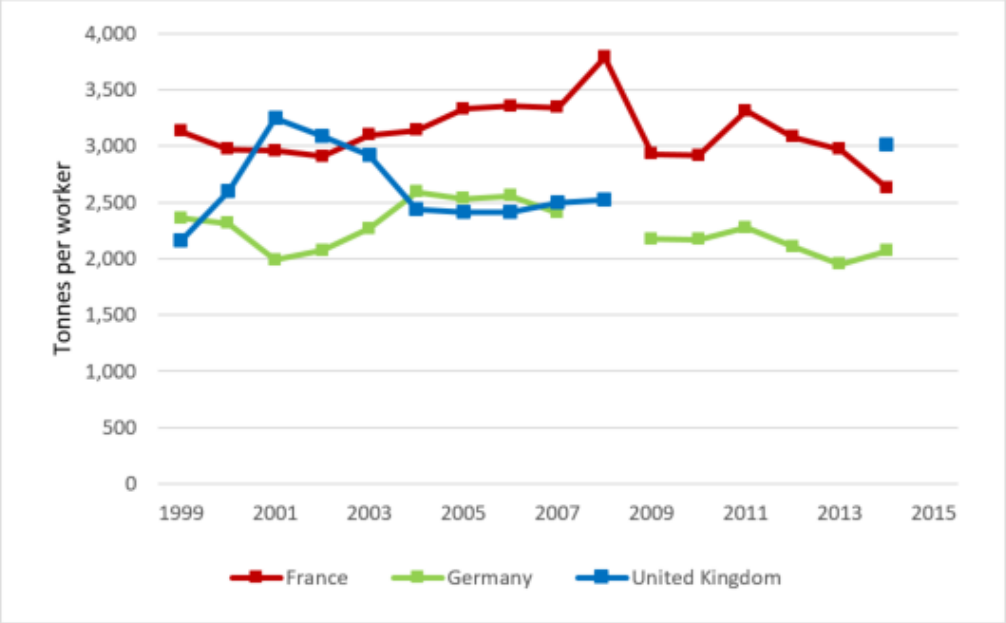
Despite marginally lower rates of investment (as a proportion of production) in the late-1990s and early-2000s than in the UK and Germany, the cement sector in France typically enjoyed the highest levels of labour productivity over 1999-2008, at around 3,000 tonnes per worker in the late-1990s rising to 3,500 tonnes per worker in 2008. It fell markedly during the global economic crisis, continued falling over 2011-2014 and is now lower than labour productivity in the UK cement sector. The high levels up to 2008 were underpinned by sustained growth in gross output and value added over the period, in contrast to the UK experience, where gross output and value added were flat or fell.

In contrast, labour productivity in the German cement sector has historically been markedly lower, at around 2,000-2,500 tonnes per worker. However, production volumes and employment appear to have been largely unaffected by the global economic crisis. Helped by labour reforms in the early to mid-2000s and a clearing out of the least efficient or profitable producers during the price war. As a result, labour productivity in the German cement sector has been relatively flat since the crisis and is not that different from pre-crisis levels.

In the UK cement sector, labour productivity has tended to fall between labour productivity in France and Germany. Over 1999-2004 it increased sharply, to overtake labour productivity in France, driven in part by consolidation (and the closure of some less efficient plants) as production levels held up while employment was scaled back. It then eased back to German levels as

production fell slightly and producers held employment steady. Between 2004 and 2008, labour productivity was stable at 2,500 tonnes per worker. Data on employment after 2008 are not available from official sources, so it is not possible to analyse the trend after 2008. However, using an estimate of employment published by the Mineral Products Association in 2014[10], we estimate that labour productivity in the UK cement sector was higher than in France and Germany in 2014, at around 3,000 tonnes per worker.

**Figure 3.2 Labour productivity in the cement sectors of the UK, France and Germany**




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

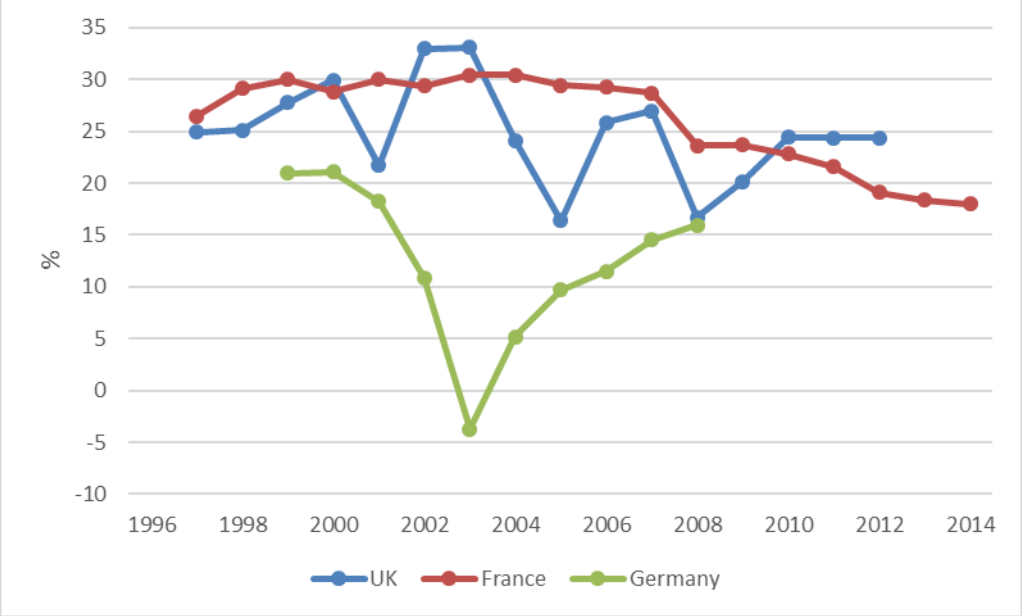
## 3.2 Gross operating rate

*The gross operating rate in the UK and French cement sectors has been in decline, but with greater volatility in the UK*

The gross operating rate (GOR), the ratio of GVA less labour costs to gross output, is one measure of profitability. Figure 3.3 indicates that until 2007 the French cement sector had the highest profitability average, followed by the UK with Germany sector in third position. The UK rate fluctuated around a 25% average with no overall change over 1997-2012. GOR in the French sector deviated little from 30% for much of 1998-2007. However, it fell by 10 percentage points between 2007 and 2014, highlighting the effect of severe contraction in the construction sector. The UK rate fluctuated the most while French rate was mostly stable. Germany had the lowest GOR over 1999-2008 with the persistent slowdown turning negative in 2003. The German rate recovered after 2003 and matched the UK rate by 2008. The post-2009 period is characterised by convergence in GORs with the UK out-performing France whose rate continued to fall below its long-term average. It appears that the UK has a higher gross operating rate than France and possibly Germany from 2009.

[10] http://cement.mineralproducts.org/documents/DL-Cement-Industry-leaflet-29-05-14web.pdf

**Figure 3.3 Gross operating rate for the cement sectors of the UK, France and Germany**




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

## 3.3 Energy cost in the cement industry

*Energy costs in the UK cement sector were driven by rising coal prices*

Cement production is highly energy-intensive, a fact that makes energy cost an important indicator of sectoral competitiveness. The energy mix in the cement industry consists of thermal and electric energy. Data published by BEIS indicate that in 2007 over 80% of the sector's energy came from coal[11], with around 15-20% from electricity. As such, the cost of energy in the UK cement sector over the early- and mid-2000s was heavily influenced by trends in international coal prices. Figure 3.4 shows the strong upward trend in European coal prices over 1999-2008, which mirrors the trend in the energy cost share of output in Figure 3.5[12]. More recently, the influence of coal prices on energy costs has waned, as the share of thermal energy now met by coal has fallen to under 60% while the share met by waste-derived fuels has increased, according to the MPA.

*There is increasing use of waste-derived fuels in the UK as an alternative to coal*

The impact of high or volatile coal prices can be mitigated against through the use of fuels derived from waste. This was adopted quite early on by the sector in France and Germany, but later in the UK, where the use of alternatives to fossil fuels (coal) lagged significantly by the mid-2000s. This may be down, in part, to slow implementation of EU waste landfilling and waste (co-) incineration directives in the UK and a strong culture (in the mid-2000s) of

[11] See Table 4.05 in *Energy Consumption in the UK* (November 2016 update), published by BEIS and available from: https://www.gov.uk/government/statistics/energy-consumption-in-the-uk

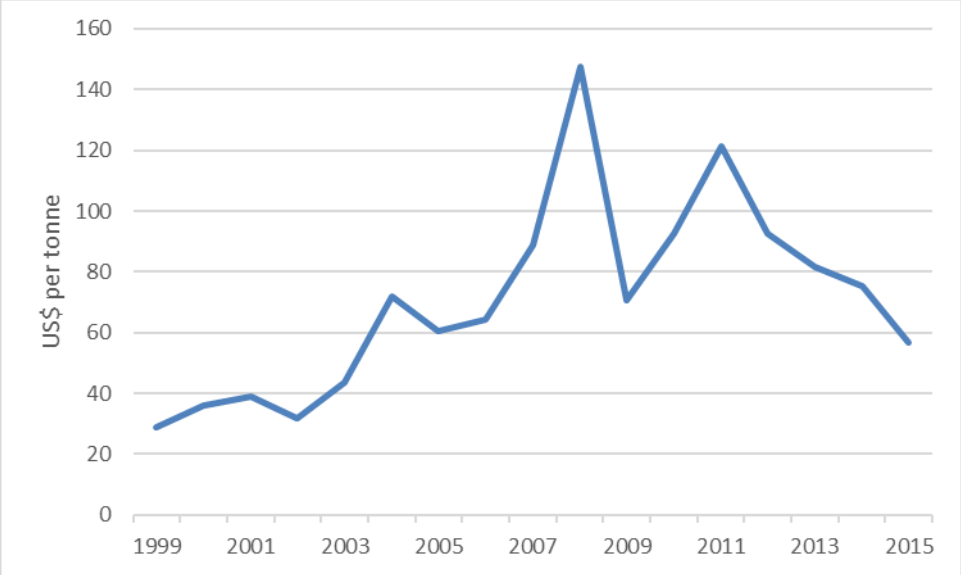
[12] Data for purchases of energy products by SIC 23.51 (Manuf. of cement) are not available after 2010. The same data for SIC 23.5 (Manuf. of cement, lime and plaster), which is dominated by SIC 23.51, are available after 2010. However, the data imply that the energy cost per unit of output in SIC 23.51 increased after 2011, which seems at odds with the fall in coal prices since 2011.

sending waste to landfill. Since the mid-2000s, however, substantial progress has been made on switching to alternatives fuels in the UK cement sector and in 2015 42% of the thermal input was sourced from waste derived fuels[13]. Further progress has also been made in Germany in 2005, but less so in France.

*Sharp increases in gas prices also pushed up electricity costs*

At the same time, UK industrial electricity prices surged upwards over 2004-2009, driven by sharp increases in gas prices. As the UK's electricity supply is particularly dependent on gas compared to continental Europe[14][15], the increase in electricity prices in the UK was greater than in competitor countries such as France and Germany. Our analysis of industrial electricity prices confirms that a higher wholesale price was a key factor in 2016 in pushing UK industrial electricity prices above those faced by EU competitors. The same analysis also found that network costs were significantly higher in the UK in 2016.

**Figure 3.4 European Coal Price**




Source: Quandl.com (https://www.quandl.com/data/BP/COAL_PRICES-Coal-Prices).

To varying degrees, all three countries had increases in their energy costs relative to output, according to Figure 3.5. Of the three countries, the UK energy cost per £ of output was the most volatile but remained comparable to the cost in Germany. The high volatility in the UK rate for the cement sector may have been driven by energy costs – especially the prices for coal and gas – but may also be due to fluctuations in output (e.g. the fall in 2003 is driven by output growing faster than energy costs, while the increase in 2005 is driven by energy costs continuing to rise as output fell). In France, where extensive use of nuclear power helps to explain the low volatility and the low

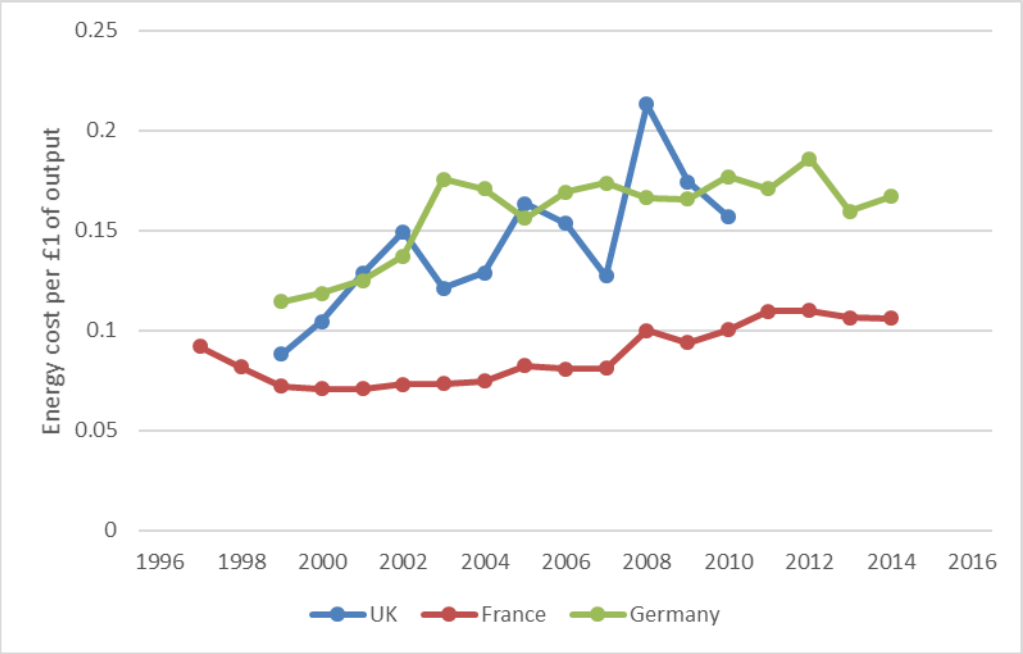
[13] http://cement.mineralproducts.org/current_issues/climate_change/greenhouse_gas_reduction_strategy/waste_derived_fuels_and_material.php

[14] http://rwecom.online-report.eu/2005/ar/reviewofoperations/environment/economicenvironment/ukelectricityprices.html

[15] http://rwecom.online-report.eu/2008/ar/reviewofoperations/environment/economicenvironment/ukelectricitypricesia.html

cost of energy, the energy cost per £ of output remained well below the UK cost over 1998-2014. In Germany, the energy cost per £ of output in the late-1990s was similar to that in the UK. It increased, as coal prices rose, but the early shift to alternative fuels mitigated later increases in coal prices and kept the energy cost per £ of output relatively flat over 2003-2012 at £0.17. Meanwhile, the UK cement sector saw a significant increase in energy costs per £ of output from £0.09 in 1999 to £0.17 in 2009, well above levels for France and Germany.

**Figure 3.5 Energy costs as a share of output in the cement sectors in the UK, France and Germany**




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

## 3.4 Cement export specialisation

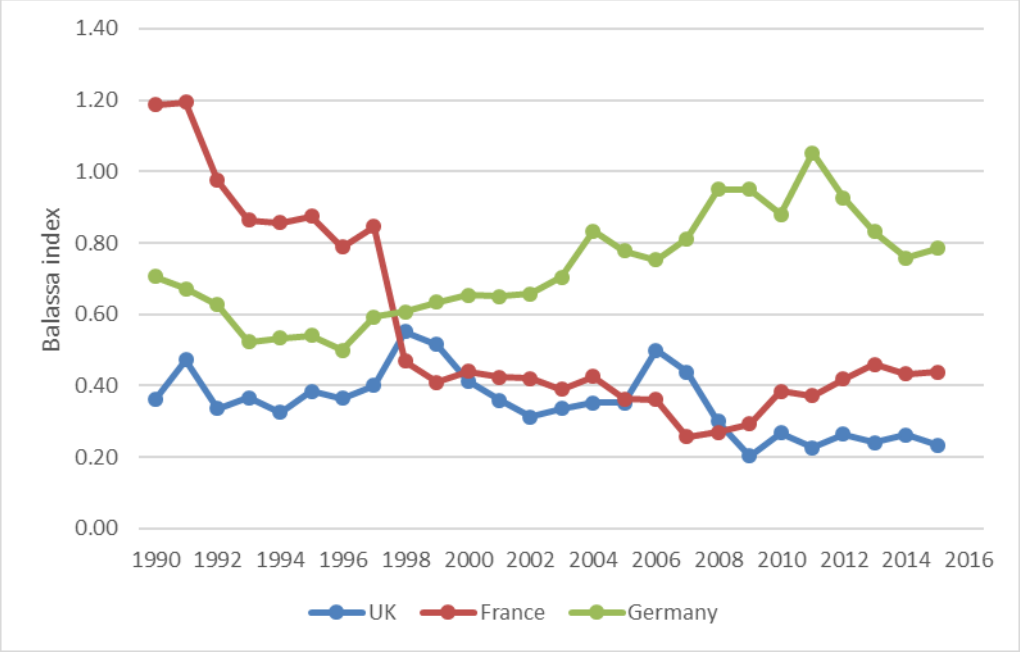
Looking at the revealed comparative advantage in each country gives insight on the relative importance of their cement exports. A country is a specialised cement exporter if it has a Balassa index (BI) value of 1; meaning that cement exports account for a larger share of that country's total exports compared to a comparator country or group of countries. Figure 3.6 shows that only France in 1990-1991 and Germany in 2011 had comparative advantage, otherwise all three countries had a BI of less than 1. This is possibly because cement is not a commonly exported material and only makes up small ratios of exports from the UK, France and Germany. For clinker, a more commonly traded material, the Balassa index is similarly low for the UK (typically in the region of 0-0.1) over 1990-2016[16].

As all country Balassa indices are mostly under 1, none of the three countries enjoys significant comparative advantage. However, Figure 3.6 indicates that

[16] This holds for the first half of the 1990s and the period after 2004. Anomalies in the trade data generated spurious estimates for the intervening period.

Germany has a far stronger comparative advantage in cement production relative to the UK and France. The UK is the least specialised.

**Figure 3.6 Revealed comparative advantage**




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

# 4 Climate change policies and the cement sector

*Compensation and exemptions have mitigated some of the costs of climate change policies to the cement sector*

The main climate change policies affecting the cement sector include Renewables Obligation (RO), small scale Feed-in-Tariffs (FiTs), Contracts for Difference (CfD), the Climate Change Levy (CCL), the EU Emission Trading Scheme, Carbon Price Support (CPS) and Capacity Market. The UK cement sector is highly energy-intensive (energy costs account for between 10%-30% of total costs of production) and, therefore, can be sensitive to the costs of climate change policies. When Phase I of the EU ETS was implemented, the sector relied on coal for just over 80% of its energy needs and electricity for 15-20% of its needs. The sector faces direct costs of low-carbon policy (as it is included within the EU ETS) and indirect costs (for example, due to higher energy prices arising from policies to promote renewable electricity generation). Nevertheless, mitigating measures at the EU level and via the UK Government Energy Intensive Industries (EII) package allow the sector to lower the costs of climate change policies:

- The sector receives free emissions permits in relation to the EU ETS up to the level of 'benchmark' plants (the top 10% most carbon-efficient plants in the EU). However, in Phase III (2013 – 2020) the cross sectoral correction factor (CSCF) has reduced the allocation below the benchmark.
- The Climate Change Levy (CCL) was introduced in 2001. Since the 2013 UK budget, energy used for mineralogical processes (which includes cement manufacturing) has been exempt from the CCL. In addition, before the 2013 budget exemption, signing up to a Climate Change Agreement (CCA) to meet energy efficiency targets or reduce carbon emissions enabled cement manufacturers to qualify for a discount of 65% on fuels and 90% in relation to the CCL.
- The Renewables Obligation, which was introduced in 2002, and the small-scale Feed-in-Tariff, which was introduced in 2010, are paid through their electricity bills. Since the end of 2015, the cement sector has also been eligible for compensation for up to 85% of Renewables Obligations (RO) and small scale FiTs costs, and will in future be exempt from up to 85% of costs related to ROs, FiTs and CfDs, subject to State aid approval.[17]

Whilst many energy-intensive industries receive compensation for the indirect carbon costs of the EU ETS price and CPS, the UK cement sector does not have access to this compensation. Our analysis of electricity prices faced by industries in the UK and its main trading partners found that costs associated with climate change policies were small relative to electricity costs for the sector. As a proportion of the industry electricity price (after compensation), the 2016 indirect EU ETS cost was 2.2%, 6.7% for Carbon Price Support, 0.6% for FiTs, 2% for ROs and 1.3% for CfDs.

[17] However, some manufacturers could not access the compensation because the structure of their businesses makes it difficult to meet the required 20% electricity intensity threshold.

*There is little evidence of direct carbon leakage to outside the EU…*

Initially, there was concern that the EU ETS would make the UK cement sector uncompetitive at the international level (outside the EU) in addition to raising the risk of carbon leakage – where cement manufacturing moves to countries with less stringent emissions regulations (and in some cases faster growing markets). With nearly all UK cement imports coming from within the EU (which are also subject to the EU ETS) and UK imports from outside the EU increasing only slightly since 2008, there is little evidence of direct carbon leakage to outside the EU. The cement sector is also awarded free emissions permits, which limits the impact of the EU ETS.

*…but indirect carbon leakage may have occurred*

There may have been indirect carbon leakage where an EU country imports cement from outside the EU and then exports it to the UK. For example, Spain had increased cement imports from outside the EU over 2004-2007 and increased exports to the UK over the same period. UK imports from Spain also increased sharply over 2014 and 2015, when imports into Spain from outside the EU were low and in decline; so the evidence is not conclusive.

The sector contends that there has been carbon leakage and that the Carbon Price Support and ineligibility for compensation for the indirect cost of the EU ETS cost the sector an estimated £17m - £20m in 2016 (Leese, 2016). It is estimated that the Carbon Price Support contributed 6.7% to the UK sector's 2016 electricity price.

While the share of output exported to outside the EU increased in recent years, this was driven by falls in output rather than an improved export performance. Indeed, the volume of exports to outside the EU in 2015 was around half the level in the mid-2000s. This suggests there has been no improvement in the competitiveness of UK cement exports to outside the EU.

*The UK introduced compensation and exemptions to the cement sector for some climate change costs later than did Germany. Compensation in the UK was also less than in Germany*

Energy-intensive sectors in various EU countries received government support for the impact of some climate change policies much earlier than their UK counterparts. For example, Germany introduced exemptions for the cost of renewables support earlier than the UK and even when the UK introduced compensation, it was less than in Germany. Germany provided for large exemptions for energy-intensive industry for its Renewable Energy Sources act (EEG) which was introduced in 2000. Industry exemptions for the EEG surcharge grew from around 37 terawatt hours (7% of electricity consumption) in 2004, to 106 terawatt hours (20% of electricity consumption) in 2014[18]. In 2015, industry exemptions from the EEG surcharge in Germany was around €4.8bn (£3.5bn) to 2,000 companies[19]. In contrast, the UK government has provided compensation to energy-intensive sectors such as cement of over £400m since August 2013. This total is made up of amounts on individual schemes: over £90m for the EU ETS, over £140m for the CPS mechanism and over £170m for RO and small scale FiTs.

In summary, climate change policies have increased costs for the UK cement sector. The EU ETS put a price on carbon emissions. While the sector qualifies for a proportion of its allowances for free, it still faces an indirect cost passed on by electricity suppliers subject to the EU ETS. Although mineralogical processes are now exempt from the CCL, this has only been

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

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

since April 2014, with the sector paying the discount rate of the levy prior to this date. The sector has also been affected by costs relating to support for low-carbon generation (RO/FiTs/CfD) and will face costs towards the Capacity Market. However, the relatively recent (2016) introduction of compensation for RO/FiTs, and other support to the sector that was introduced after much of the decline had happened, could mean that UK producers were previously at a disadvantage compared to EU competitors. In future, the UK cement sector will likely be exempt from up to 85% of costs from ROs, FiTs and Contracts for Difference, continuing the mitigation of the effect of climate change policies to some extent on the sector.

# 5 Outlook for the UK cement sector

*A few multinational firms dominate UK cement production*

The European cement industry has undergone major changes during the last few years notably, the merger of Lafarge and Holcim in July 2015 to create the world's biggest cement producer, the acquisition of Italcementi by HeidelbergCement in 2016, and the gradual recovery of Cemex from its huge post-2009 debt problems. These developments mean that the UK sector will increasingly be dominated by a handful of multinational cement firms. Furthermore, a decrease in European cement demand has resulted in excess production capacity. These very significant changes in the cement industry will undoubtedly have had a major influence on companies' future strategies and decisions with regard to, financial focus, cost reduction, investment constraints, asset rationalisation, European versus Asian and global strategy and short-term versus long-term focus.

*The UK cement sector is domestic-oriented, so its future performance will be influenced by how the UK construction sector evolves*

In the UK, the sector is recovering somewhat from the sharp contraction seen during the financial crisis. Construction activity over the last couple of years has encouraged demand and investment in the sector. For example, Hanson Cement in early 2017 created 20 new jobs by re-opening a grinding plant at Teesport Docks in Middlesbrough.[20] This £2m investment re-opened a plant that had been mothballed in 2009 because of the recession. Investment to upgrade existing plants and make them more energy efficient and reduce $CO_2$ emissions has also been undertaken recently: Hanson at its Kelton and Purfleet plants in 2014 and Hope Cement in new rail-fed depots to expand its market presence.

The domestic focus of the UK cement sector suggests that developments in the construction sector, and therefore the cement sector, will be driven by how the broader UK economy evolves. In this regard, a pick up in the UK housing market, including home building and other types of construction, should have a positive effect on demand for cement. This will be complemented by projected increases in the UK Government's spending on infrastructure out to 2021 and beyond, especially in transportation (Infrastructure and Projects Authority, 2016).

*Climate change policies are unlikely have a dominant or direct effect on the competitiveness of the UK cement sector*

Given that UK cement trade is largely with EU countries, uncertainty about the nature of UK-EU trade relations post Brexit makes it difficult to gauge the impact of Brexit on the long-term UK-EU cement trade. UK cement trade with markets outside the EU is likely to remain limited in size and any loss of competitiveness compared to other EU producers will likely be minimised by UK and Europe-wide policies, but this will not be the case for any loss of competitiveness compared to non-EU producers, to which some production may have indirectly leaked in recent years.

The drive for low carbon manufacturing in Europe is likely to continue and this will continue to affect the cement sector both directly (the carbon price) as well as indirectly via costs passed on from electricity generation. Notably, in future the sector will operate under higher energy prices which are projected to increase in the UK. However, the relatively small component of carbon policy costs in the overall cost base of the sector, as well as mitigating measures

[20] http://www.hanson.co.uk/en/hanson-reopens-teesport

being introduced by authorities, suggest that carbon policies may not greatly affect the competitiveness of the UK cement sector.

# 6 Conclusions

*Domestic demand was relatively stable up to 2006, after which it has shrunk drastically*

The development of the UK cement sector over the last twenty years has two distinct periods: 1995-2007, over which real output was relatively flat; and then the period after 2007, characterised by a sharp decline in 2007 and 2008, driven by the adverse impacts of the financial crisis and the subsequent recession on property investment and the demand for cement, from which, even by 2015, production levels have not recovered.

*Falling demand and steady import volumes have reduced the market for UK producers*

Production in the cement sector has closely followed the trend in domestic demand. Historically, some demand has been met by imports (mainly from the EU), but import penetration in the sector was low, at around 10%. However, the share of demand met by imports increased steadily over 2006-2013 to 27%. This is because demand fell over the period while imports held up.

*The sector is becoming more export oriented, but it is starting from a low base*

At the same time, the UK sector appears to have been unable to benefit from the strong growth in the global market. Global production has roughly quadrupled since 1990, but the UK accounted for less than 1% of global exports in 2015; in the same year Germany and Spain accounted for around 7%. However, in recent years, the export share of UK output has increased, to 11% in 2012 and 2013. This is around double the average over 1997-2009 and has been driven by export growth and inflated by falling domestic output.

*Faced with weak prospects, investment in the sector has weakened*

Investment in the UK cement sector picked up a little over 2002-2007, driven by strong demand from the construction industry as construction of all types of properties boomed. Investment collapsed following the financial crisis. Weak growth in construction since the 2008-2009 recession (the volume of construction output only returned to its pre-recession level in 2015) has kept demand for cement low. At the same time, an increasing share of demand is being met by imports. Against this backdrop, investment has not recovered following the 2008-09 recession. Investment in the cement sectors in France and Germany also declined after the financial crisis, but to a lesser extent because the fall in demand was markedly smaller. The sectors in these countries faced less import competition. In Germany, this likely reflects the surplus capacity and very competitive pricing in the German cement market, and healthy export demand for German cement products. In France, it's likely due to the high degree of market concentration, relatively high levels of productivity and relatively low and stable energy costs. In both cases, this allowed producers in each country to compete on price against imports.

*In the UK, labour costs are lower, and labour productivity has improved*

Labour costs per metric tonne in the UK were relatively high over 1999-2007, broadly in line with German labour costs (per tonne of output) and considerably higher than those in France. They fell sharply in 2008 because, in response to falling demand, producers cut back employees' working hours (but not employment) and, therefore, their wage bill by more than production volumes. The decline in per tonne labour costs in the UK has continued. As a result, per tonne labour costs in the UK are now lower than in France and Germany. Meanwhile, labour productivity in the UK cement sector, has tended to fall between levels in France and Germany. However, after 2008 labour productivity in the UK cement sector rose and was higher than in France and Germany in 2014, at around 3,000 tonnes per worker.

*Energy costs have risen more strongly and are higher in the UK cement sector*

Energy costs per unit of output value in the UK almost trebled between 1999 and 2013, far faster and higher than in France and Germany.

About 60% of the sector's energy needs are met by coal, down from over 80% in 2007, with the rest being met largely by electricity. As such, the cost of energy for the UK cement sector has been influenced by trends in international coal prices. These increased dramatically over 2002-08 and drove up the per unit energy cost in the UK. At the same time, UK industrial electricity prices surged upwards over 2004-09, driven by sharp increases in gas prices. As the UK's electricity supply is particularly dependent on gas compared to continental Europe[21][22], the increase in electricity prices in the UK was greater than in competitor countries such as France and Germany. In France, where the extensive use of nuclear power helps to explain the low volatility and the low cost of energy, the energy cost per unit of output remained well below the UK cost over the period.

*Profitability is relatively high but volatile*

Although volatile, profitability in the UK cement sector has remained relatively high and is comparable to profitability in the French cement sector. On average, the French cement sector was the most profitable followed by the UK with Germany, which has been subject to domestic price wars, third profitable. However, after 2010 the UK profitability topped both France and Germany. Profitability also fluctuated much less in France compared to the UK and Germany.

*Carbon related costs are small compared to the cost of electricity to the cement sector*

Low-carbon policies such as the EU Emissions Trading Scheme (EU ETS), Climate Change Levy (CCL), Carbon Price Support (CPS) and support for low-carbon generation through Renewables Obligations (RO), Feed-in-Tariffs (FiTs) and Contracts for Difference (CfD) increase costs for energy-intensive sectors. However, UK and EU measures such as compensation, exemptions and the awarding of EU ETS free allowances have lowered the cost impact of carbon policies on the UK cement sector.

Additional costs because of low-carbon policies and delays or ineligibility in accessing some of the compensation would have weakened the sector's position. However, low-carbon polices were not the primary factor in the sector's decline. The decline in UK cement production over 1990-2016 was driven primarily by the contraction in demand from construction following the global economic crisis over 2007-09, exacerbated by high energy (coal and gas) prices.

[21] http://rwecom.online-report.eu/2005/ar/reviewofoperations/environment/economicenvironment/ukelectricityprices.html

[22] http://rwecom.online-report.eu/2008/ar/reviewofoperations/environment/economicenvironment/ukelectricitypricesia.html

# 7 References

Boyer, M. a. P. J.-P., 2013. Economic analysis of the European cement industry. *CIRANO.*

Global Federation of Competitiveness Councils, 2017. *Competitiveness decorder.* [Online]
Available at: http://decoder.thegfcc.org/
[Accessed 02 2017].

Infrastructure and Projects Authority, 2016. *National infrastructure delivery plan 2016-2010,* London: UK Government.

Leese, R., 2016. *UK Parliament House of Commons.* [Online]
Available at: https://www.parliament.uk/documents/commons-committees/energy-and-climate-change/Correspondence/Energy-intensive-industries-correspondence-MPA-to-CHAIR.pdf
[Accessed 01 March 2017].

Mineral Products Association, 2017. *Climate change and energy policies.* [Online]
Available at:
http://cement.mineralproducts.org/current_issues/green_taxes/climate_change_and_energy_policies.php
[Accessed 20 2017].

Neuhoff, K. e. a., 2014. *Carbon Control and Competitiveness Post 2020: The Cement Report,* s.l.: Climate Strategies.

Newbery, D., 2009. *The role of carbond markets in preventing dangerous climate change. The forth report of the 2009-10 session,* London: UK Parliament House of Commons Environmental Audit Select Committee.

Sandbag, 2017. *The cement industry of the future - how border adjustment measures can enable the transition to a low-carbon cement industry,* s.l.: s.n.