executive briefing

construction products association

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Advanced Institute of Management Research

The Construction Products Sector

Building a better understanding

Written by:

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EPSRC

Engineering and Physical Sciences Research Council

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AIM – the UK's research initiative on management

The Advanced Institute of Management Research (AIM) develops UK-based world-class management research. AIM seeks to identify ways to enhance the competitiveness of the UK economy and its infrastructure through research into management and organisational performance in both the private and public sectors.

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about AIM

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- Working in cooperation with leading international academics and specialists as well as UK policymakers and business leaders…
- Undertaking a wide range of collaborative research projects on management…
- Disseminating ideas and shared learning through publications, reports, workshops and events…
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- Conduct research that will identify actions to enhance the UK's international competitiveness
- Raise the quality and international standing of UK research on management
- Expand the size and capacity of the active UK research base on management
- Engage with practitioners and other users of research within and beyond the UK as co-producers of knowledge about management

contents

AIM research themes

Current AIM research projects focus on:

UK productivity and performance for the 21st century.

How can UK policy makers evaluate and address concerns surrounding the UK's performance in relation to other countries?

National productivity has been the concern of economists, government policymakers, and corporate decision-makers for some time. Further research by scholars from a range of disciplines is bringing new voices to the debates about how the productivity gap can be measured, and what the UK can do to improve the effectiveness of UK industry and its supporting public services.

Sustaining innovation to achieve competitive advantage and high quality public services.

How can UK managers capture the benefits of innovation while meeting other demands of a competitive and social environment?

Innovation is a key source of competitive advantage and public value through new strategies, products, services and organisational processes. The UK has outstanding exemplars of innovative private and public sector organisations and is investing significantly in its science and skills base to underpin future innovative capacity.

Adapting promising practices to enhance performance across varied organisational contexts.

How can UK managers disseminate their experience whilst learning from others?

Improved management practices are identified as important for enhancing productivity and performance. The main focus is on how evidence behind good or promising practices can be systematically assessed, creatively adapted, successfully implemented and knowledge diffused to other organisations that will benefit.

executive review

The construction products sector consists of 36 SIC 4-digit industries, ranging from extraction of raw materials, manufacture of building materials and components, to distribution channels. This report sets out some key data on its productivity and other trends.

Our main findings are:

a In 2003, the sector produced £23 billion in value added (about 2.3% of total value added in the UK) and employed 629,000 people (about 2.2% of the workforce).

b Most employment is in the heavyside division, but employment in distribution is growing.

c Labour productivity in the sector varies substantially both between industries and within each industry. Across the whole sector, in 2001, the firm at the 90th percentile of the productivity distribution produced 5 times as much value added per worker as that at the 10th percentile. Such a ratio is similar when one looks at various parts of the sector e.g. in heavyside in 2001 the spread was 4.5 to 1. Thus much of the variation in productivity is within industries.

d A good deal, although not all, of this variation can be explained by the contribution of tangible inputs like physical capital. Accounting for this, for example, reduces the 2001 heavyside spread to 1.5 to 1. Future work should aim to better understand better this remaining spread: i.e. why firms with the same employment and same capital in the same sector are still able to produce 50% more value added per worker. This might concentrate on the role of technology, skills, different products and management.

e We provide a means to construct key performance indicators in different areas such as capital intensity, labour productivity and total factor productivity. Companies can then use the data from this research to benchmark performance against their peers.

Labour productivity in the sector varies substantially both between industries and within each industry.

introduction

The Construction Products Sector (CPS) is an important contributor to the UK economy. It accounts for 2.3 per cent of the UK's Gross Domestic Product, employs 629,000 people, generates £71 billion in sales, and £23 billion in value added.

With the help of the Office of National Statistics, the Construction Products Association and the Department of Trade and Industry, a team of AIM researchers has taken an in-depth look at productivity levels and growth across the CPS.

More specifically, we looked at the overall industry structure in terms of employment, turnover, the size of companies within the sector and the level of capital used (capital intensity). We also looked at the labour productivity and total factor productivity at different levels of the industry.

While our findings may appear technical in nature, they are of very real relevance to companies operating in the CPS. An integral part of the Construction Products Association's priorities is to develop key performance indicators for the construction products industry.

While our findings may appear technical in nature, they are of very real relevance to companies operating in the CPS.

In 2004 the focus of key performance indicators in the CPS was to measure and monitor performance along the three areas of customer satisfaction, people and environment.

Using the results of our productivity assessment it is possible develop productivity related key performance indicators for the construction products industry measuring capital intensity, labour productivity and total factor productivity. Companies can then use these indicators to benchmark performance against their peers.

The construction products sector

1 The Construction Products Sector Defined

We use the term 'Construction Products Sector' (CPS) to collectively describe the manufacturers and service providers in the construction supply chain.

The CPS covers a wide range of economic activities, from the extraction of raw materials, through the production of semi-manufactured intermediate materials and products and components, right the way to distribution.

To complete our analysis we used data from the government's business survey database, together with the Standard Industrial Classification codes (see box below).

After consultation with the Construction Products Association we decided thirty-six SIC 4-digit industries were the key contributors to the Construction Products Industry (*see table on page 18*). Whilst this is not an exhaustive list, it includes industry classifications where the vast majority, if not all, of their activities relate to the supply of construction products.

The UK Standard Industrial Classification of Economic Activities (UKSIC)

In 1948 the United Kingdom introduced a Standard Industrial Classification (SIC) for classifying business establishments by the type of economic activity in which they are engaged.

The SIC uses a hierarchical five digit system of classification. At the highest level of aggregation there are 17 sections denoted by a letter A to Q. Some are divided into subsections represented by two letters. Two digits denote the next divisional letter. This is further divided into sectors denoted by four digits – the 4-digit level.

In some cases business groups at a four digit level will still be involved in a fairly disparate range of activities. The 36 SIC 4-digit industries covered by the study were selected a significant proportion, but not necessarily all, of their activities were deemed to be related to the supply of construction products. Similarly, other firms may be excluded if the classification to which they have been designated by ONS includes a high proportion of non-construction product enterprises, e.g. manufacturers of asphalt who are included in a general category covering 'other treatment of petroleum products'. It is also important to understand that firms are classified to particular SIC industries based on the bulk of their output. In practical terms this means that diversified businesses are allocated to a single SIC even though they may produce output covering more than one SIC.

Enterprise

We use the term enterprise as defined by the Office of National Statistics: 'The smallest combination of legal units that is an organisational unit producing goods or services.' (ONS, 2002).

Productivity in the CPS was considered on four levels:

- **Sectoral level.** This refers to the 36 SIC 4-digit industries combined;
- **Divisional level.** This refers to a further division of the sector into manufacturing and distribution. Manufacturing can be further sub-divided into heavyside and lightside;
- **Categorical level.** This divides the sector along two dimensions: types of raw material (clay, wood, chemical products, plastic products, other nonmetallic products, metallic products); stages of production (production of raw materials, intermediate production, final production and distribution);
- **4-digit level.** This level corresponds to the SIC definition for each industry.

2 Dissecting the CPS

When we analysed the CPS we looked at: Employment and turnover; capital investment; and industry concentration.

(i) Employment and turnover

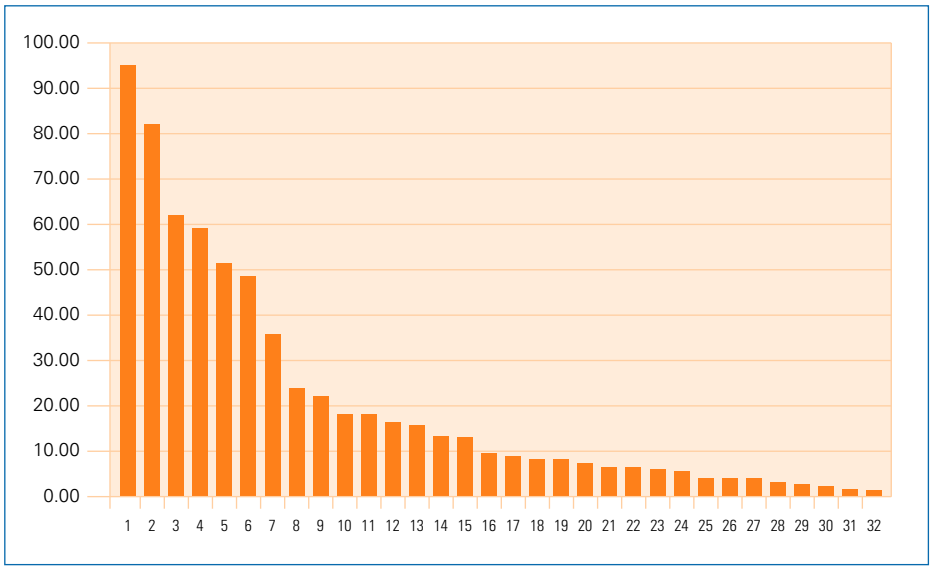
Employment and turnover figures give an idea of the size of the sector and how it changed between 1998 and 2003. According to the UK Annual Business Inquiry, see figure 1, in 2003 there were more than thirty thousand enterprises operating in CPS, providing 629,000 jobs and generating more than £71 billion in sales. On average, each enterprise had roughly £2 million worth of sales per year and employed 20 people.[1]

Figure 1:
Employment, turnover and value-added in the construction products sector

	Number of enterprises	Total employment (thousands)	Total turnover (£ billion)	Average turnover (£ million)	Average employment	Value added (£ billion)
1998	28.892	628	59.048	2.043	21	20.081
1999	29.288	640	60.016	2.049	22	20.094
2000	29.565	648	61.856	2.092	22	20.608
2001	29.885	640	64.052	2.143	21	20.973
2002	30.550	661	65.823	2.154	22	21.942
2003	30.705	629	71.103	2.31	20	23.280

Figures 2 and 3 show average employment (in thousands) and turnover (in millions) across industries.[2] The two industries with the largest employment per establishment, both over 80, are wholesale of construction materials and manufacture of metal structural products and the two smallest are manufacturing of mortars and fibre cement. The largest industries in terms of turnover per are in wholesaling, which is not surprising given that these are not value added figures.

Figure 2: Average employment in the SIC 4-digit industries (in thousands of employees)

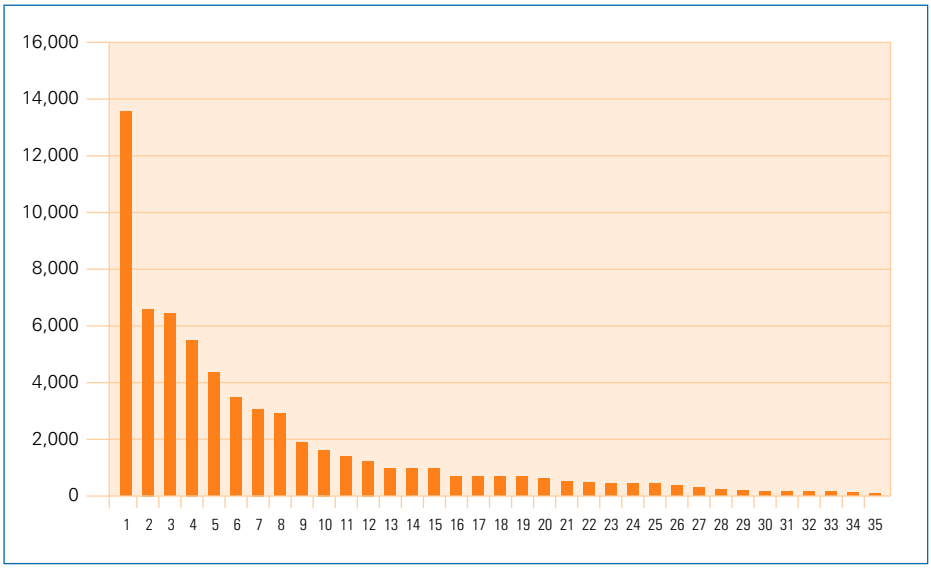


Key

1 5153 Wholesale of wood, construction materials
2 2810 Manufacture of metal structural products
3 2811 Manufacture of metal structures
4 2523 Manufacture of builders' ware of plastic
5 5154 Wholesale of hardware, plumbing and heating equipment and supplies
6 2030 Manufacture of builders' carpentry and joinery of wood
7 2923 Manufacture of non-domestic cooling and ventilation equipment
8 2661 Manufacture concrete products for construction purposes
9 3150 Manufacture of lighting equipment and electric lamps
10 1421 Operation of gravel and sand pits
11 2812 Manufacture of builders' carpentry and joinery of metal
12 2913 Manufacture of taps and valves
13 2612 Shaping and processing of flat glass
14 2863 Manufacture of locks and hinges
15 2010 Saw milling and planing of wood, impregnation of wood
16 2640 Manufacture bricks, tiles and construction products, in baked clay
17 2822 Manufacture of central heating radiators and boilers
18 2670 Cutting, shaping and finishing of stone
19 2682 Manufacture of other non-metallic mineral products
20 2020 Manufacture of veneer sheets, manufacture of plywood, laminboard, particle board, fibre board and other panels and boards
21 2622 Manufacture of ceramic sanitary fixtures
22 2663 Manufacture of ready mixed concrete
23 2651 Manufacture of cement
24 1422 Mining of clays and kaolin
25 1412 Quarrying of limestone, gypsum and chalk
26 1411 Quarrying of ornamental and building stone
27 2630 Manufacture of ceramic tiles and flags
28 2666 Manufacture of other articles of concrete, plaster and cement
29 2662 Manufacture of plaster products for construction purposes
30 2611 Manufacture of flat glass
31 2664 Manufacture of mortars
32 2665 Manufacture of fibre cement

According to the UK Annual Business Inquiry… there were more than thirty thousand enterprises operating in CPS…

Figure 3: Average turnover in the SIC 4-digit industries (in £ millions)



Key

1 5153 Wholesale of wood, construction materials
2 5154 Wholesale of hardware, plumbing and heating equipment and supplies
3 2810 Manufacture of metal structural products
4 2811 Manufacture of metal structures
5 2523 Manufacture of builders' ware of plastic
6 2923 Manufacture of non-domestic cooling and ventilation equipment
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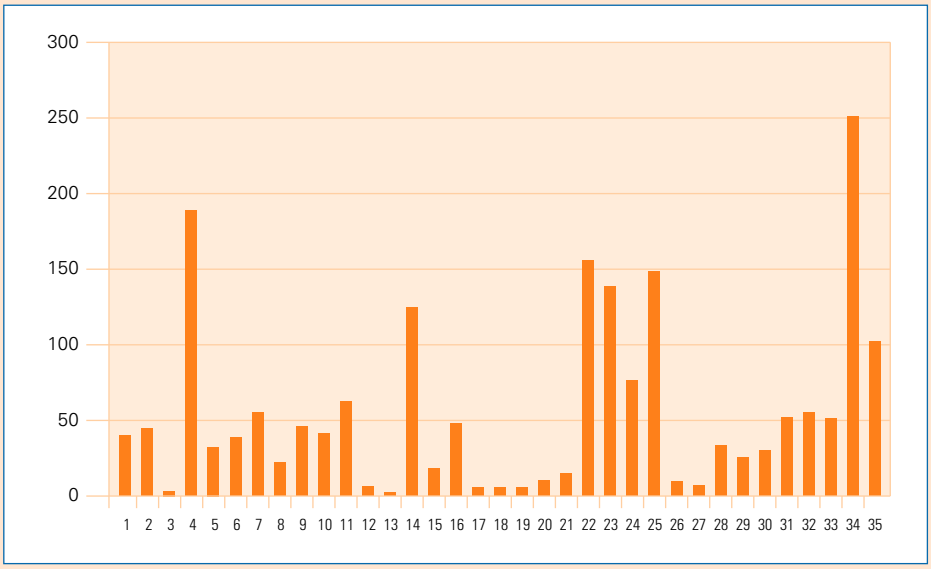
25 2622 Manufacture of ceramic sanitary fixtures
26 1411 Quarrying of ornamental and building stone
27 2670 Cutting, shaping and finishing of stone
28 2611 Manufacture of flat glass
29 2630 Manufacture of ceramic tiles and flags
30 2666 Manufacture of other articles of concrete, plaster and cement
31 2664 Manufacture of mortars
32 2665 Manufacture of fibre cement
33 2652 Manufacture of lime
34 2653 Manufacture of plaster
35 1413 Quarrying of slate

(ii) Capital investment

Another way of looking at the sector is to see how different industries use capital such as machinery, plant and buildings. Figure 4 shows the wide variation in investment, with a maximum of around £250m in wholesale of wood.

Fig 4: Average annual capital investment (in £ millions) in 4-digit industries between 1998-2003



Key

1 1411 Quarrying of ornamental and building stone
2 1412 Quarrying of limestone, gypsum and chalk
3 1413 Quarrying of slate
4 1421 Operation of gravel and sand pits
5 1422 Mining of clays and kaolin
6 2010 Saw milling and planing of wood, impregnation of wood
7 2020 Manufacture of veneer sheets, manufacture of plywood, laminboard, particle board, fibre board and other panels and boards
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30 2863 Manufacture of locks and hinges
31 2913 Manufacture of taps and valves
32 2923 Manufacture of non-domestic cooling and ventilation equipment
33 3150 Manufacture of lighting equipment and electric lamps
34 5153 Wholesale of wood, construction materials
35 5154 Wholesale of hardware, plumbing and heating equipment and supplies

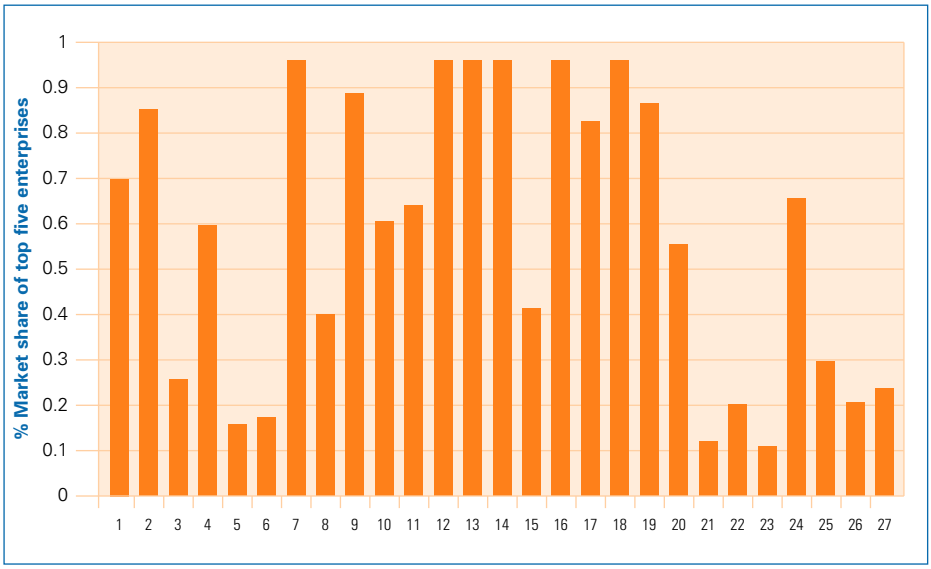
(iii) Industry concentration

In six industries the five largest firms hold more than 90% market share…

A commonly used measure of industry structure is the concentration ratio, the fraction of output (or employment) accounted for by the largest firms in the industry. Note that, as in other studies, we only have production or employment of domestic manufacturers, so these data understate the shares of global production to the extent that the industry faces global competition.

Figure 5 shows the average concentration ratios in the 4-digit industries, by plotting the percentage of market share held by the five largest firms in each 4-digit industry. In six industries the five largest firms hold more than 90% market share (Manufacture of flat glass [2611], Manufacture of cement [2651], Manufacture of lime [2652], Manufacture of plaster [2653], Manufacture of plaster products [2662] and Manufacture of mortars [2664]). In other industries the largest five enterprises hold as little as 12% market share. We also looked at changes but in general changes in concentration are quite small.

Figure 5: Concentration ratios (CR5) in 4-digit industries



Key

1 1411 Quarrying of ornamental and building stone
2 1422 Mining of clays and kaolin
3 2010 Saw milling and planing of wood, impregnation of wood
4 2020 Manufacture of veneer sheets, manufacture of plywood, laminboard, particle board, fibre board and other panels and boards
5 2030 Manufacture of builders' carpentry and joinery of wood
6 2523 Manufacture of builders' ware of plastic
7 2611 Manufacture of flat glass
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27 5154 Wholesale of hardware, plumbing and heating equipment and supplies

1 About Productivity

Productivity is a measure of the ability to create goods and services per unit of labour, capital, land, materials, knowledge or some combination of these factors. We get x output per acre, per pound invested, or per worker for example.

A number of factors affect the level of productivity. There is the quantity and quality of the capital inputs and the employees and the efficiency with which those inputs are used will also affect productivity.

(i) Labour productivity

Labour productivity is measured here as output per worker. We have no reliable industry-level data on hours worked.

Labour productivity can be used to benchmark individual enterprises, industries, and even nations.

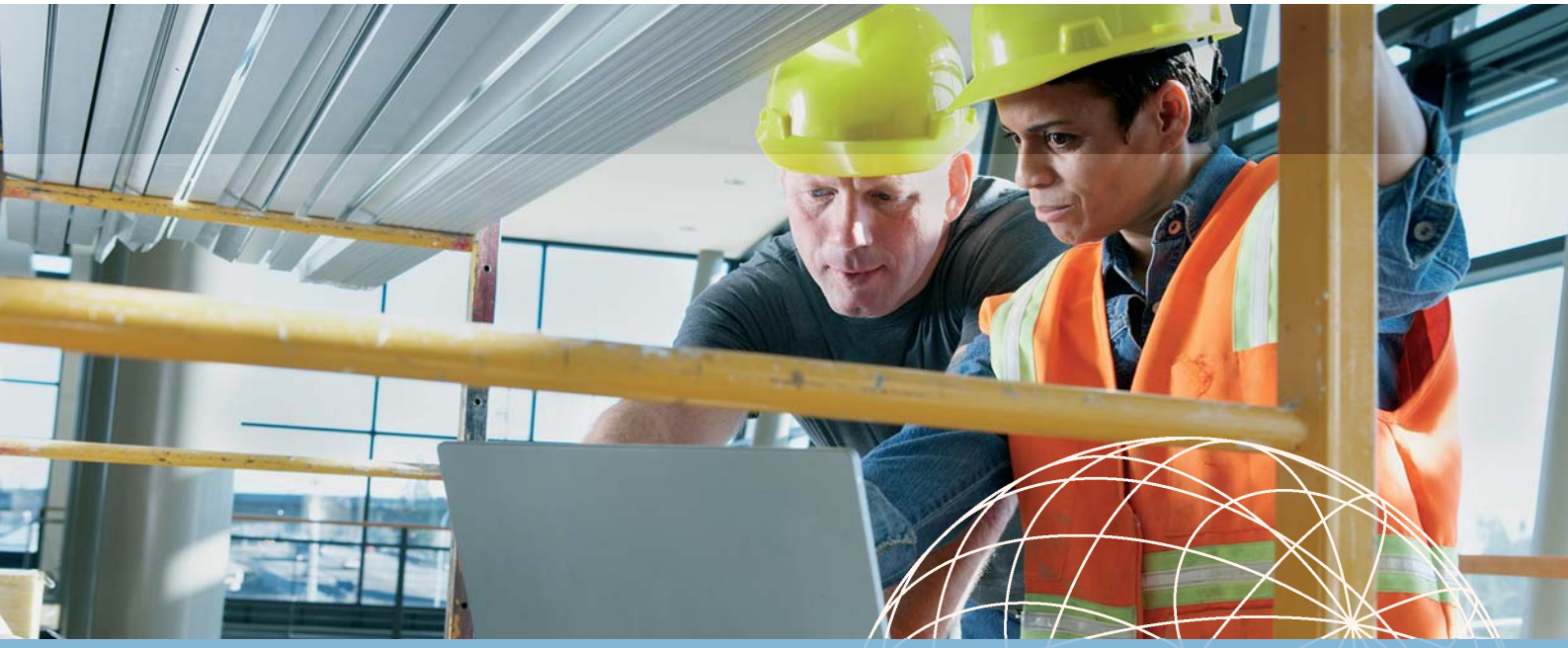
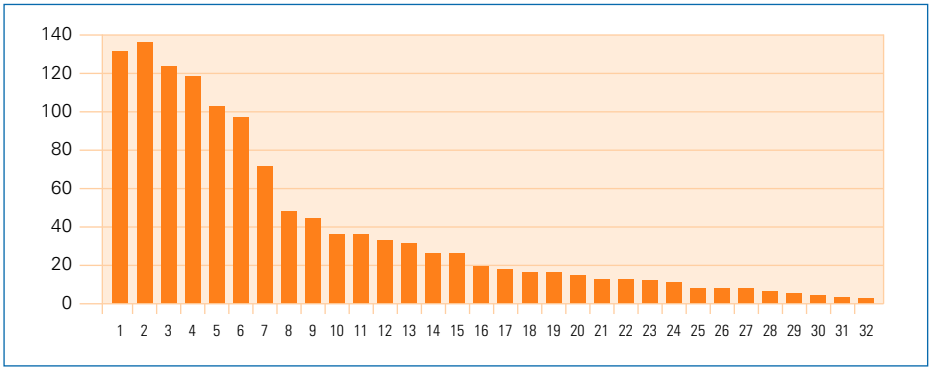


Figure 6 shows the relative productivity performance of the 4-digit industries calculated as the sum of value added over 1998-2003 by industry divided by the sum of employment by industry. The most productive industry, by this measure, is the manufacturing of plaster products, at over £120,000 per worker, and the least the manufacturing of ceramic tiles (at £23,000 per worker).

Figure 6: Average labour productivity in the 4-digit industries (per head in £ thousands)



Key

1 1411 Quarrying of ornamental and building stone
2 1412 Quarrying of limestone, gypsum and chalk
3 1421 Operation of gravel and sand pits
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30 3150 Manufacture of lighting equipment and electric lamps
31 5153 Wholesale of wood, construction materials
32 5154 Wholesale of hardware, plumbing and heating equipment and supplies

2 Comparison of labour and total Factor Productivity in the CPS

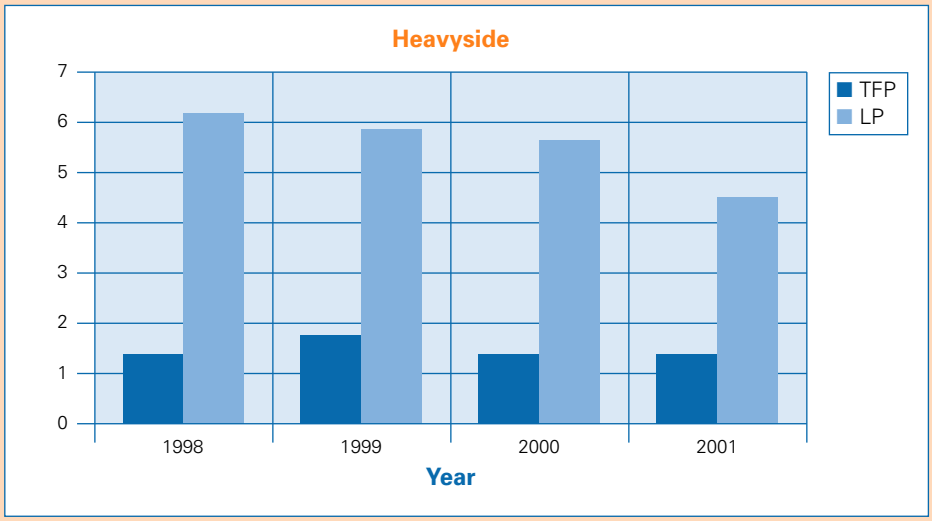
(ii) Total factor productivity

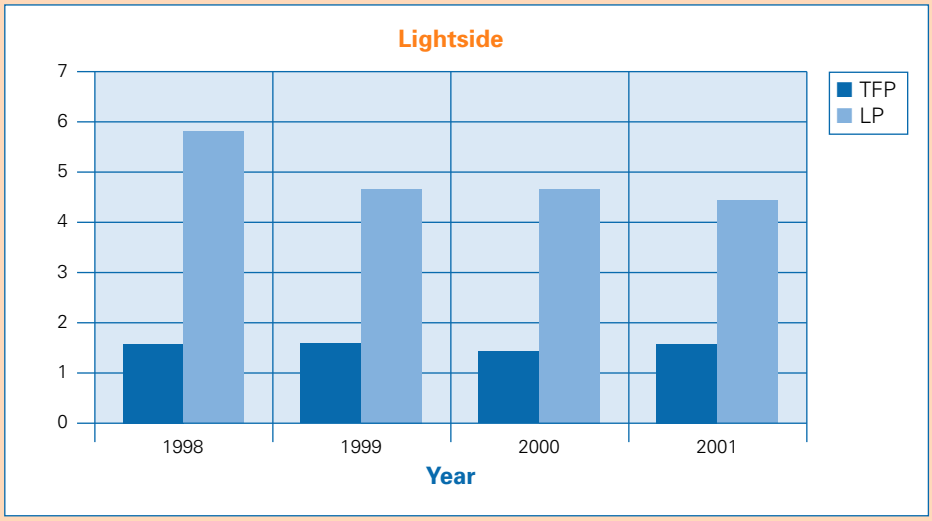
Whilst labour productivity is a helpful start, there are other inputs besides labour that contribute to productivity. Total factor productivity is the output per units of inputs of labour, capital, raw materials etc. Of course, there are also intangible inputs, which are hard to measure, that also affect productivity and hence would cause differences in total factor productivity between firms. Such intangible inputs include innovation, managerial skill and organisation, all of which are not conventionally well measured by simple measures of labour and capital. TFP is interesting because while capital inputs – physical and human – have to be paid for, some improvements to TFP can be made at relatively small or zero cost to the firm.

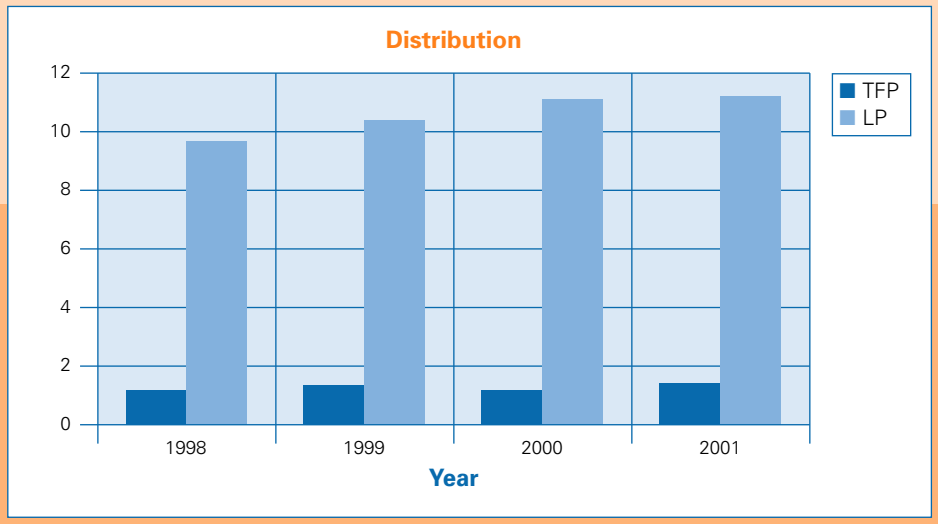
Whilst labour productivity is a helpful start, there are other inputs besides labour that contribute to productivity.

Figure 7 shows the spread[3] of labour and total factor productivity in three divisions. In heavyside for example, the labour productivity spread is about 6:1, whereas the TFP spread is about 1.4:1. Thus there are two main points. First, using the TFP spread helps explain quite a lot of the labour productivity spread. Thus a good proportion of the initial spreads that we saw are accounted for by tangible inputs such as the use of capital. This is particularly so in services. Second, there do however, remain differences between firms in their TFP. A spread of 1.4 to 1 for example suggests that even after accounting for capital, some firms are 40% more productive than others.

Figure 7: TFP spread for the three divisions







benchmarking

The Construction Products Association (CPA) is developing key performance indicators for the sector. These will enable companies to benchmark their performance against competitors across different criteria.

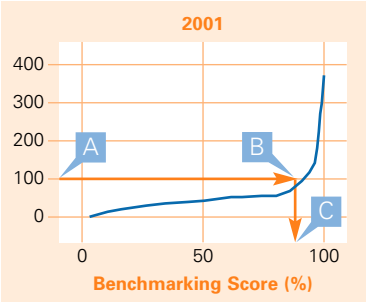
In 2004 the CPA concentrated on key performance indicators in the areas of customer satisfaction, people and environment.

However, it is possible to use our data to construct key performance indicators (KPIs) in different areas such as capital intensity, labour productivity and total factor productivity. Companies can then use the data from this research to benchmark their performance against their peers.

So far we have calculated the productivity distribution for selected 4-digit industries and represented as key performance indicator charts.

Benchmarking graphs

The representation follows the CPI KPI chart style and can be read and used accordingly:



Company X wishes to benchmark its performance on labour productivity against its peers in the 4-digits industry Y in a given year Z (see also CPI KPI handbook, 2004)[4]

- Select the appropriate graph
- Plot the measured labour productivity for your company on the vertical axis (A)
- Read across to the labour productivity graph line (B)
- Read down to the horizontal axis (C). This is the company's benchmark

In the example depicted above, a company with a labour productivity of 100,000 GBP per employee in 2001, reaches a benchmark score of roughly 90 per cent. This means that in terms of labour productivity 90 per cent of companies in the industry perform equal or less than our company X, whereas only 10 per cent of companies perform better.

conclusion

Our analysis of the productivity of the construction products sector has revealed a number of interesting findings about the performance over time of individual industries. Perhaps as important, however, is that it has made it possible to create productivity related benchmarking tools, which can be used by companies in the sector to gauge their relative performance.

Research implications

Finally, our investigations have raised some fundamental questions about the key drivers of productivity in the sector that have wider implications and merit further investigation:

What are the origins of the productivity changes? Our research shows that the reallocation of resources within industries, such as the expansion of productive enterprises and the shrinking of unproductive ones, may account for a high proportion of productivity changes. Identifying the causes of productivity changes will help identify the extent of influences resulting from different sources.

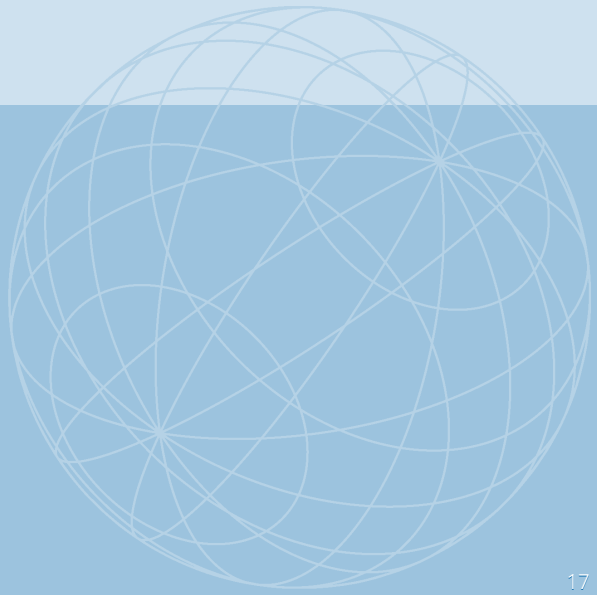
Is size important? The extent to which the size of an enterprise affects its productivity performance needs researching.

Is location important? Similarly, we need to know how decisive a factor the location of enterprises is in determining productivity levels.

Does capital investment make a difference? In this study, we found that capital investment correlates to productivity level. This finding needs econometric research.

What part does competition play? Although concentration ratios in the construction products sector didn't change much between 1998-2002, further research is required to assess to what extent this factor influences cross-industry variations in productivity performance.

How much difference do R&D, innovation, and skills make? Most of the growth of total factor productivity is contributed by these three related factors. By matching data from other surveys, such as the community innovation survey, we can analyse how important these factors are to the catching up of construction products sector with manufacturing.



the construction product sector table

	Stone, slate sand and clay	Wood products	Chemical products	Plastic products
Raw material	**4%** 1411 Quarrying of ornamental and building stone 1412 Quarrying of limestone, gypsum and chalk 1413 Quarrying of slate 1421 Operation of gravel and sand pits 1422 Mining of clays and kaolin			
Intermediate products	**1%** 2651 Manufacture of cement 2652 Manufacture of lime 2653 Manufacture of plaster 2670 Cutting, shaping and finishing of stone	**3%** 2010 Saw milling and planing of wood, impregnation of wood 2020 Manufacture of veneer sheets, manufacture of plywood, laminboard, particle board, fibre board and other panels and boards		
Final products	**8%** 2622 Manufacture of ceramic sanitary fixtures 2630 Manufacture of ceramic tiles and flags 2640 Manufacture bricks, tiles and construction products, in baked clay 2661 Manufacture concrete products for construction purposes 2662 Manufacture of plaster products for construction purposes 2663 Manufacture of ready-mixed concrete 2664 Manufacture of mortars 2665 Manufacture of fibre cement 2666 Manufacture of other articles of concrete, plaster and cement	**8%** 2030 Manufacture of builders' carpentry and joinery of wood		**10%** 2523 Manufacture of builders' ware of plastic
Distribution				

Note: **1** % indicates employment share in the UK in 2002
2 Italics indicates industries in the lightside division
3 The total sum of employment shares exceeds 100% due to rounding.

Sources: author's calculations using IDBR data

	Other non-metallic products	Metallic products	Services
	3% 2611 Manufacture of flat glass 2612 Shaping and processing of flat glass		
	3% 2682 Manufacture of other non-metallic mineral products 2863 Manufacture of locks and hinges	**38%** 2810 Manufacture of metal structural products 2811 Manufacture of metal structures 2812 Manufacture of builders' carpentry and joinery of metal 2822 Manufacture of central heating radiators and boilers 2913 Manufacture of taps and valves 2923 Manufacture of non-domestic cooling and ventilation equipment 3150 Manufacture of lighting equipment and electric lamps	
			23% 5113 Agents involved in the sales of timber and building materials 5153 Wholesale of wood, construction materials 5154 Wholesale of hardware, plumbing and heating equipment and supplies

[1] Unless otherwise indicated all calculations are from the Annual Business Inquiry.

[2] Average employment here means the average taken between 1998-2002.

[3] The spread is measured as the ratio of labour and total factor productivity of the firm at the 90th percentile of the labour or total factor productivity distribution to the firm at the 10th percentile.

[4] CPI KPI (2004) Construction Products Industry – Key Performance Indicators: Handbook, Construction Products Association in partnership with Constructing Excellence, London.

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