

The importance of physics to the Welsh economy

A report for the Institute of Physics

May 2007

This is a report by the centre for economics and business research to provide the Institute of Physics with an assessment of the importance of physics based sectors to the Welsh economy.

This report has been produced by cebr, an independent economics and business research consultancy established in 1993 providing forecasts and advice to City institutions, government departments, local authorities and numerous blue chip companies throughout Europe.

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1 JOBS, TURNOVER AND VALUE ADDED

This chapter provides an assessment of the importance of physics based sectors to the Welsh economy in terms of employment, turnover and gross value added.

In order to capture the importance of physics to the Welsh economy we have identified the direct contribution made by sectors where the use of physics is 'critical' to their existence. We have measured this in terms of employment, turnover and gross value added.

1.1 Employment

In this section we explore employment within physics based sectors. In particular we look at the range of physics based sectors in the Welsh economy and how many people are employed within them. We analyse trends in employment over time within the physics based sectors and compare this to other sectors in Wales. It should be noted that the majority of people working in physics-based sectors will not be engaged in 'physics' but the existence of their sectors and, as such, their jobs is dependent on physics.

More than 50,000 employee jobs in physics based sectors

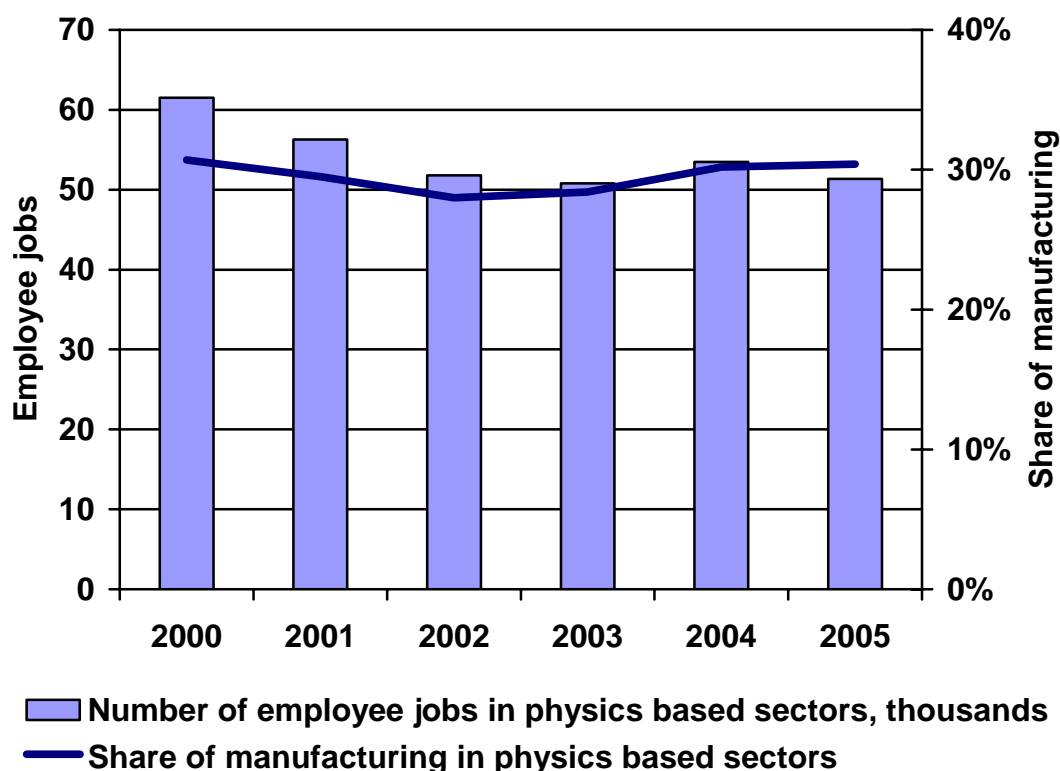
As shown in Figure 1 we estimate that in 2005 there were just over 50,000 employee jobs in sectors where the use of physics based technologies or expertise was critical to the existence of the sector. This equates to around 4.4 per cent of all jobs in Wales.

Manufacturing has a large role in physics based sectors

Total employment in Wales has increased by around nine per cent between 2000 and 2005. This has been supported by growth in service sectors such as retail trade, public administration and defence, social security, education and health and social work, which accounts for over half (54 per cent in 2005) of all employment in Wales. Collectively, employment in these sectors has expanded by almost a fifth (19 per cent) between 2000 and 2005.

However, employment in physics based sectors has fallen. This is reflected in the 16 per cent decline in employment in the manufacturing and production industries in Wales between 2000 and 2005. Although our classification of physics based sectors does not exclusively consist of businesses in the manufacturing sector, in 2005 manufacturing accounted for 78 per cent of employee jobs in sectors where the use of physics based technologies or expertise was critical to the existence of the sector. This, in part, explains the decline in employment in physics based sectors as illustrated in Figure 1.

Figure 1: Employment in physics based sectors in Wales

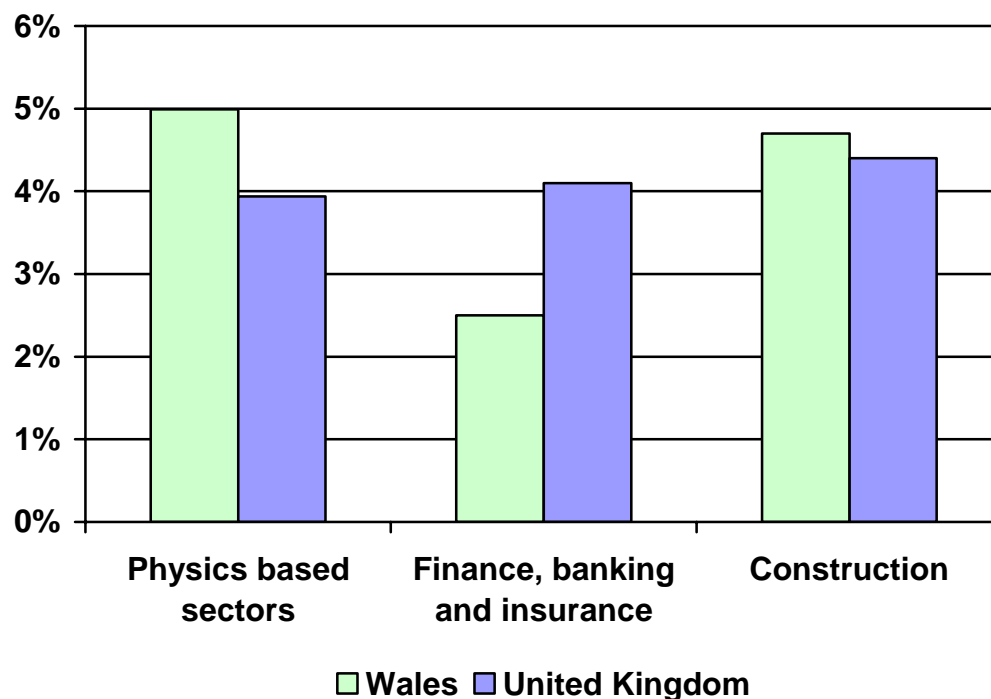


Source: The Office for National Statistics, *Annual Business Inquiry 2005* and cebr analysis

Employment in physics based sectors is higher than in construction

In Figure 2 we compare the share of total national employment accounted for by physics based sectors to that in other sectors between 2000 and 2005. Our analysis reveals that, on average, physics based sectors accounted for around 5.0 per cent of total employment in Wales between 2000 and 2005. This compares to 3.9 per cent in the United Kingdom. In addition, employment in physics based sectors is larger than that of the finance, banking and insurance sector (which accounts for just 2.5 per cent) and the construction sector (4.7 per cent) in Wales.

Figure 2: Share of total employment in Wales, average for period between 2000 and 2005



Source: The Office for National Statistics, *Annual Business Inquiry 2005* and cebr analysis

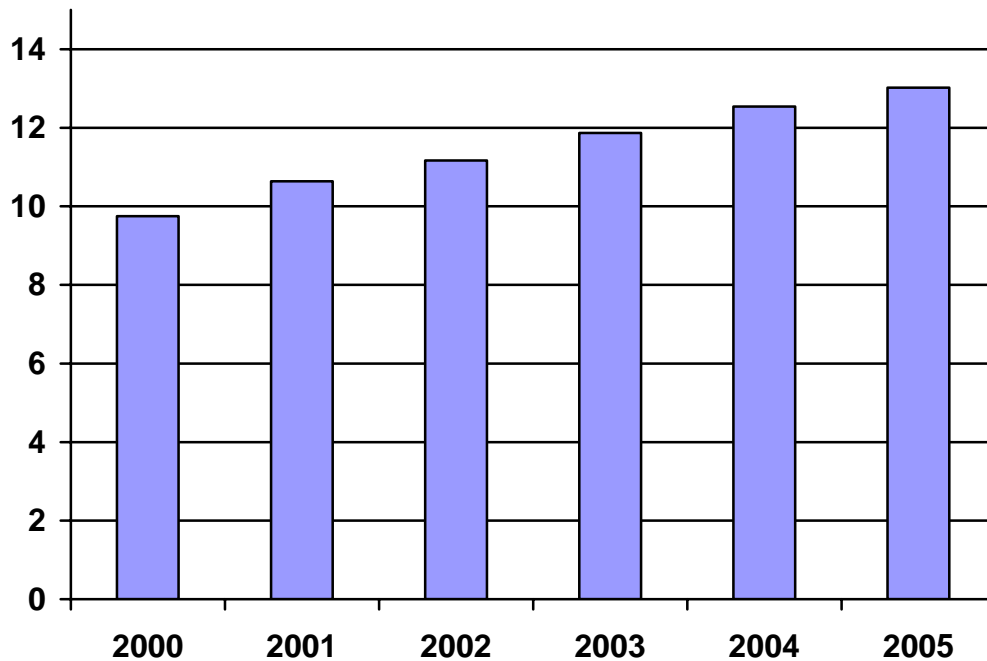
1.2 Turnover

We now focus on the contribution of physics to the Welsh economy in terms of the turnover generated by the physics based sectors.

Figure 3 shows that the turnover of physics based sectors was around £13 billion in 2005 – making up 14.3 per cent of all total business turnover in Wales.

Whilst employment in physics based sectors has declined, its turnover has increased. The rise in turnover in physics based sectors between 2000 and 2005 was greater than that of the national total – 33.5 per cent compared to 28.4 per cent – further highlighting the contribution of physics based sectors to the economy.

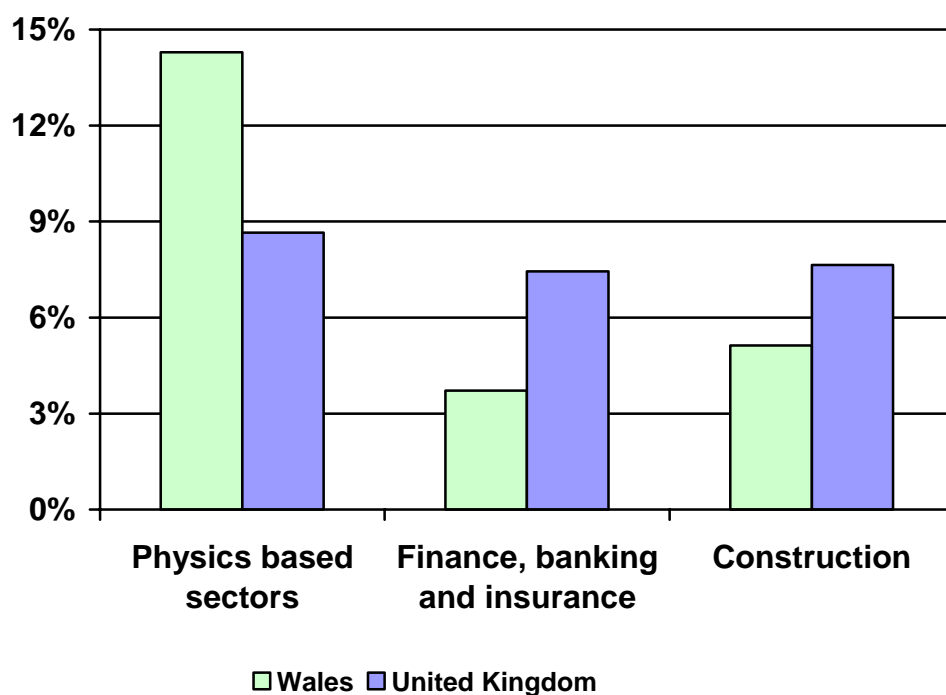
Figure 3: Turnover in physics based sectors in Wales, £ billion, current prices



Source: The Office for National Statistics, *Annual Business Inquiry 2005* and cebr analysis

Figure 4 shows that, between 2000 and 2005 turnover in physics based sectors accounted for 14.2 per cent of the national total. This contribution was significantly greater than that of the construction sector and 'banking finance and insurance' sectors, which accounted for 5.1 per cent and 3.7 of total turnover in Wales respectively. Physics based sectors in the United Kingdom accounted for 8.6 per cent of total turnover, over the same period.

Figure 4: Share of total turnover in Wales, average for period between 2000 and 2005

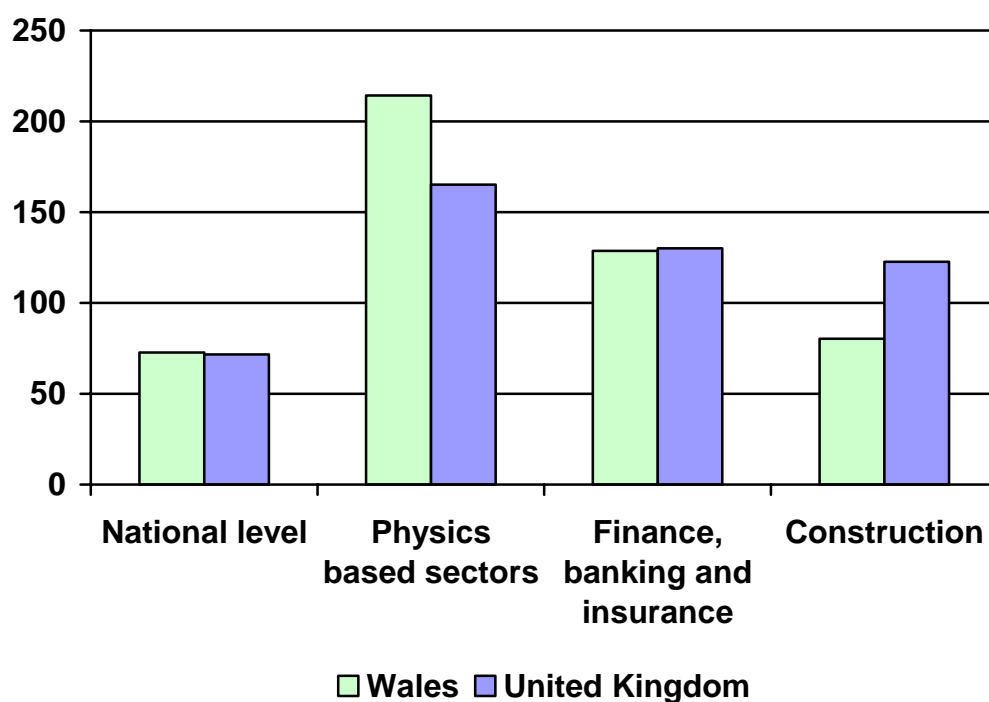


Source: The Office for National Statistics, *Annual Business Inquiry 2005* and cebr analysis

The comparatively high level of turnover generated in physics based sectors is reflected in higher levels of turnover per employee in the sector. Figure 5 shows that turnover per employee between 2000 and 2005 in physics based sectors was, on average, £214,000 per annum. This is £141,000 more than the Welsh national average where turnover per employee equates to £73,000. It is also much greater than that of banking, finance and insurance as well as the construction sector in Wales.

The equivalent figure for turnover per employee in physics-based sectors in the United Kingdom was £165,000 (the UK national average is £72 000)

Figure 5: Turnover per employee, average between period 2000 and 2005, £ thousands, current prices



Source: The Office for National Statistics, *Annual Business Inquiry 2005* and cebr analysis

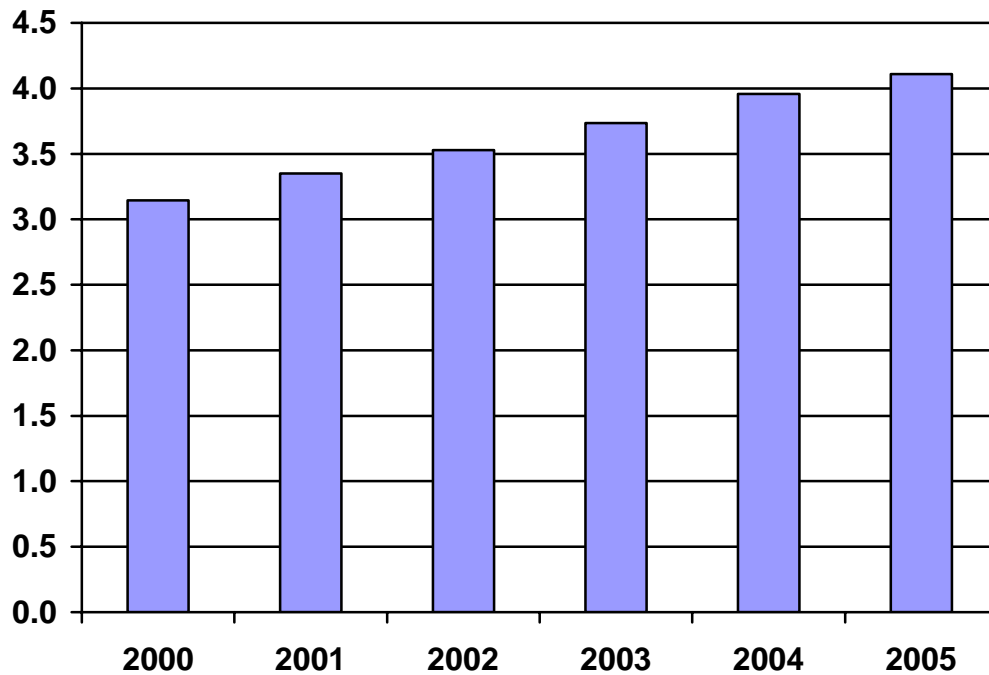
1.3 Value added

We now focus on the gross value added of physics based sectors to the Welsh economy.

Physics based sectors generate £4.1 billion of GVA

Figure 6 shows that the gross value added of the physics based sectors currently stands at £4.1 billion – making up 10 per cent of total economic output in Wales. Overall, this has grown over the last four years – in part reflecting the falling cost of raw materials used as inputs. Technological advances will have helped physics based sectors to keep the cost of inputs down in terms of the price of machinery and equipment as well as lower wage costs through a more capital intensive approach. This is evident in the rise in gross value added per head shown in figure 8.

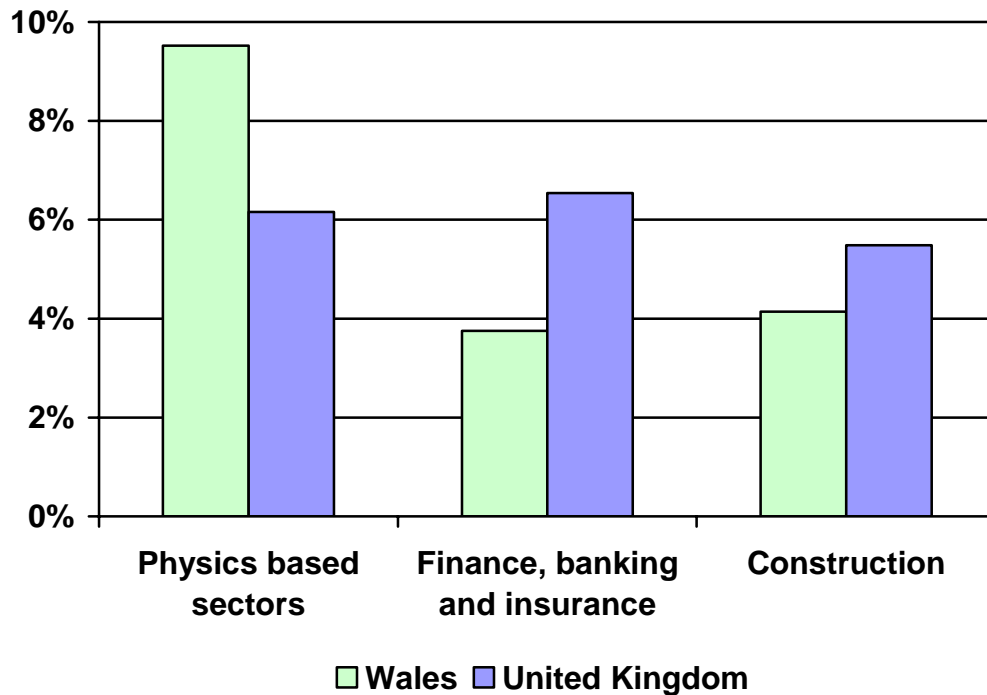
Figure 6: Gross value added in physics based sectors, £ billions



Source: The Office for National Statistics, *Annual Business Inquiry 2005* and cebr analysis

Figure 7 shows that between 2000 and 2005, physics based sectors in Wales accounted for 9.9 per cent of total gross value added on average. This share is notably higher than the construction sector and finance, banking and insurance which accounted for 4.3 per cent and 3.9 per cent of total gross value added respectively. The contribution of physics based sectors is higher in Wales compared to the United Kingdom, where they make up just 6.4 per cent of national gross value added.

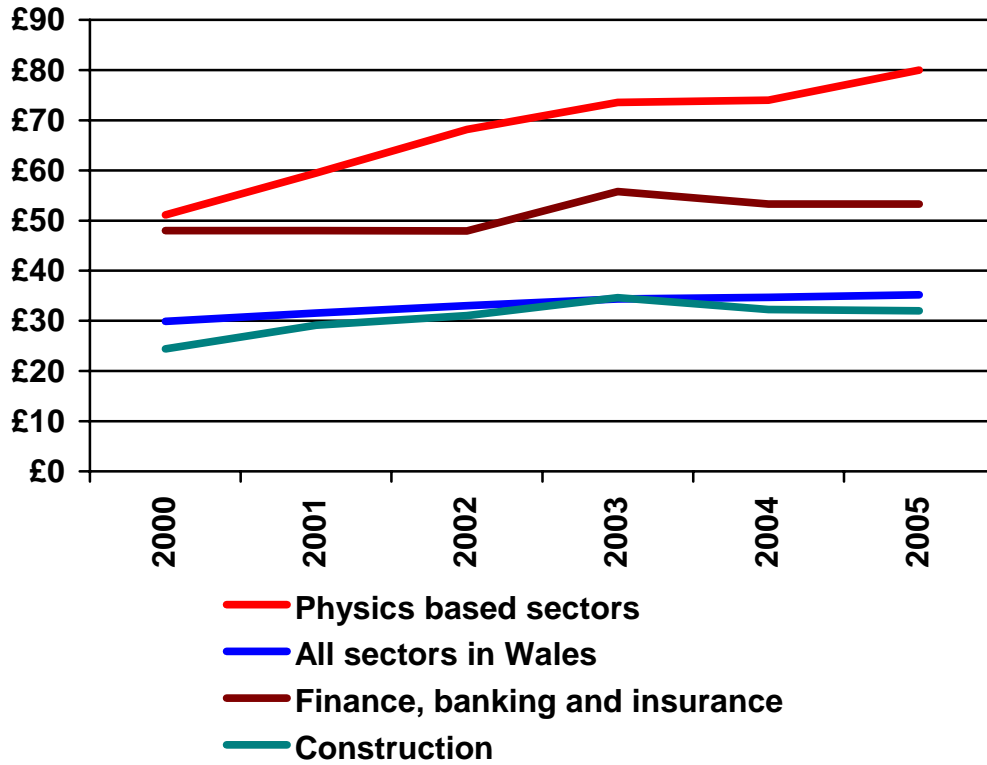
Figure 7: Share of total gross value added in the United Kingdom, average between 2000 and 2005



Source: The Office for National Statistics, *Annual Business Inquiry 2005* and cebr analysis

Figure 8 shows productivity in physics based sectors compared to other sectors. In 2005, productivity levels in physics based sectors were more than double that of the average of all sectors in Wales. This, in part, reflects that many physics based sectors are manufacturing based. As manufacturing is more capital-intensive than many other sectors in the economy, the level of gross value added generated per employee is higher.

Figure 8: Productivity (gross value added per head) in physics based sectors, £ thousands



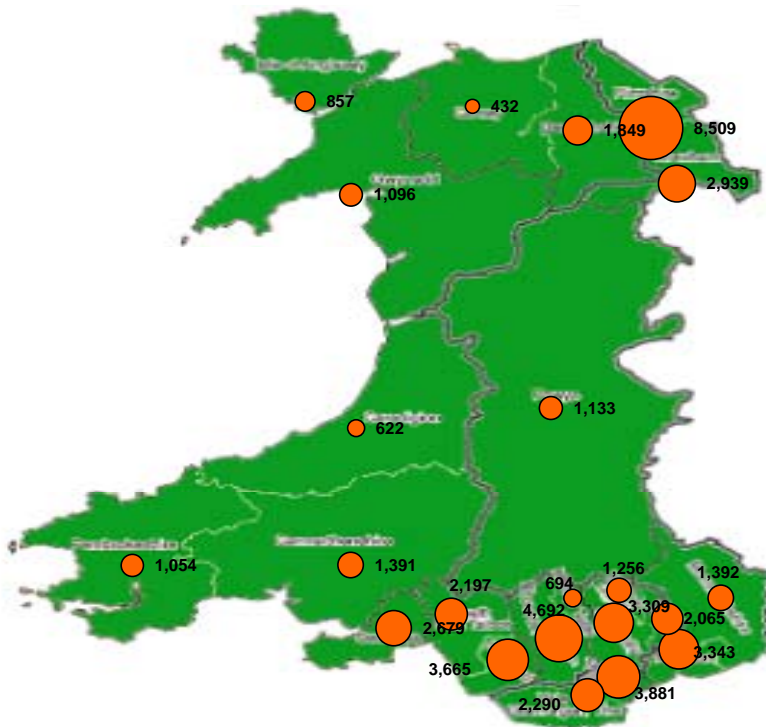
Source: The Office for National Statistics, *Annual Business Inquiry 2005* and cebr analysis

2 REGIONAL DISTRIBUTION

In this chapter we analyse the relative importance of the physics based sectors across districts in Wales. We assess where concentrations of employment in physics based sectors exist in Wales. We analyse the ratio of employment in physics based sectors in each of the districts to total employment in each district.

The map below shows how employment in physics based sectors is distributed across the country. This analysis shows that Flintshire has the highest number of employment in physics based sectors, although this is likely to be strongly influenced by the manufacturing based employment from the Airbus factory in Broughton which is Wales' largest manufacturing facility.

Figure 9: Employment in physics based sectors by district



Source: The Office for National Statistics, *Annual Business Inquiry 2005* and cebr analysis

In Table 1 below we present the location quotients for each district in Wales. Location quotients show how concentrated a sector is in a specific area relative to other areas. Here, we use location quotients to compare the degree to which each district specialises in the use of physics compared to that of the country as a whole. A location quotient with a value greater than one indicates a higher concentration of physics based sectors in the district compare to the country average. Box 1 shows the method used to calculate the location quotients for each districts.

Box 1: Location quotients

The formula used to calculate the location quotients for each district is shown below. We have used data from the Annual Business Inquiry in our analysis.

Location quotient showing concentration of physics in district =

$$\frac{\text{Physics based employment in district}}{\text{Total employment in district}} \div \frac{\text{Physics based employment in country}}{\text{Total employment in country}}$$

Table 1: Location quotients for Welsh districts, 2005

District	Location quotient for districts compared to country, 2005
1. Flintshire	2.93
2. Caerphilly	1.56
3. Bridgend	1.53
4. Blaenau Gwent	1.45
5. Vale of Glamorgan	1.39
6. Torfaen	1.38
7. Rhondda, Cynon, Taff	1.37
8. Wrexham	1.31
9. Neath Port Talbot	1.17
10. Denbighshire	1.12
11. Newport	1.05
12. Anglesey	0.99
13. Monmouthshire	0.90
14. Merthyr Tydfil	0.73
15. Pembrokeshire	0.64
16. Powys	0.60
17. Swansea	0.57
18. Ceredigion	0.56
19. Gwynedd	0.53
20. Carmarthenshire	0.53
21. Cardiff	0.46
22. Conwy	0.26

Source: The Office for National Statistics, *Annual Business Inquiry 2005* and cebr analysis

Table 2 shows the number of jobs in physics-based sectors in the regions of Wales and what proportion of the total jobs in the region are in physics-based sectors.

Table 2: Employment in physics based sectors within the Welsh districts, 2005

District	Employment in physics based sectors, 2005	Employment in physics based sectors as a share of all employment in district, 2005
1. Anglesey	857	4.3%
2. Blaenau Gwent	1,256	6.3%
3. Bridgend	3,665	6.7%
4. Caerphilly	3,309	6.8%
5. Cardiff	3,881	2.0%
6. Carmarthenshire	1,391	2.3%
7. Ceredigion	622	2.4%
8. Conwy	432	1.1%
9. Denbighshire	1,849	4.9%
10. Flintshire	8,509	12.8%
11. Gwynedd	1,096	2.3%
12. Merthyr Tydfil	694	3.2%
13. Monmouthshire	1,392	3.9%
14. Neath Port Talbot	2,197	5.1%
15. Newport	3,343	4.6%
16. Pembrokeshire	1,054	2.8%
17. Powys	1,133	2.6%
18. Rhondda, Cynon, Taff	4,692	6.0%
19. Swansea	2,679	2.5%
20. Torfaen	2,065	6.0%
21. Vale of Glamorgan	2,290	6.1%
22. Wrexham	2,939	5.7%

Source: The Office for National Statistics, *Annual Business Inquiry 2005* and cebr analysis