

# Ireland's Productivity Performance, 1980-2011

April 2012



## Introduction to the National Competitiveness Council

The National Competitiveness Council was established by Government in 1997. It reports to the Taoiseach on key competitiveness issues facing the Irish economy and offers recommendations on policy actions required to enhance Ireland's competitive position.

Each year the NCC publishes two annual reports.

- **Ireland's Competitiveness Scorecard** is a collection of statistical indicators of Ireland's competitiveness performance in relation to 18 other economies and the OECD or EU average.
- **Ireland's Competitiveness Challenge** uses this information along with the latest research to outline the main challenges to Ireland's competitiveness and the policy responses required to meet them.

As part of its work, the NCC also publishes other papers on specific competitiveness issues.

The work of the National Competitiveness Council is underpinned by research and analysis undertaken by Forfás - Ireland's policy advisory board for enterprise, trade, science, technology and innovation.

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# Table of Contents

<b>Executive Summary</b>	<b>6</b>
<b>1. Introduction</b>	<b>12</b>
1.1 Productivity, Economic Growth and Competitiveness	12
1.2 Overview of International and Regional Productivity Levels	13
1.3 Methodology and Scope	14
1.4 Report Structure	17
<b>2. Overview of Ireland's Labour Productivity Performance Since 1980</b>	<b>18</b>
2.1 Overview	18
2.2 Changes to Ireland's Long-run Labour Productivity Performance	18
2.3 Productivity and the Economic Cycle	20
<b>3. Ireland's Labour Productivity Performance by Sector</b>	<b>23</b>
<b>4. Labour Productivity in the Agri-Food Sector</b>	<b>27</b>
4.1 Agriculture	27
4.2 Food-processing	27
4.3 Developments in Agriculture since 2007	28
<b>5. Labour Productivity in the Construction Sector</b>	<b>29</b>
5.1 Physical Measures of Productivity	29
5.2 Developments in Construction Productivity since 2007	30
<b>6. Labour Productivity in the Manufacturing Sector</b>	<b>31</b>
6.1 Traditional Manufacturing	33
6.2 Modern Manufacturing	34
6.3 Developments in Industry Productivity since 2007	36
<b>7. Labour Productivity in the Tradable Market Services Sector</b>	<b>37</b>
7.1 Adjusted Productivity in Tradable Services	37
7.2 Tourism	39
7.3 Communications	39
7.4 Finance	39
7.5 Computers and R&D	40
<b>8. Labour Productivity in the Non-tradable Market Services Sector</b>	<b>41</b>
8.1 Wholesale and Retail	42
8.2 General and Professional Services	42
8.3 Transport Services	42
8.4 Utilities	43
8.5 Real estate	43
8.6 Developments in Services Productivity since 2007	43
<b>9. Gross Value Added Per Hour Worked in the Public Service</b>	<b>44</b>
9.1 Developments in Gross Value Added Per Hour Worked in the Public Services since 2007	45

<b>10. Overview of Ireland’s Capital Productivity Performance since 1980</b>	<b>46</b>
10.1 Overview	46
10.2 Changes to Ireland’s Long Run Capital Productivity Performance	47
<b>11. Conclusions</b>	<b>49</b>
11.1 Alternative Estimates of Irish Productivity	49
11.2 Which Factors Contributed Most to Growth?	49
11.3 Sectoral Sources of Labour Productivity Growth	51
11.4 Base of Ireland’s Productivity Growth	52
<b>Annex 1- Detailed Sectoral Breakdown</b>	<b>54</b>



# Ireland's Productivity Performance 1980-2011<sup>1</sup>

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<sup>1</sup> This report is based on work by Ronan Lyons commissioned by Forfás on behalf of the National Competitiveness Council. Any findings or conclusions contained in the report reflect the views of the National Competitiveness Council. The Council would like to thank Ronan for his valued work.

## Executive Summary

The National Competitiveness Council has recently undertaken significant examination of Ireland's international cost competitiveness<sup>2</sup>. Costs, however, are just one component of competitiveness. Productivity is the primary long term driver of competitiveness. Given the changes that have occurred in the Irish economy in recent years, it is an appropriate time to revisit this key element of competitiveness in more detail.

Productivity growth is important to improving living standards, particularly as it allows for sustainable pay increases without eroding cost competitiveness. As set out in *Ireland's Competitiveness Challenge* report 2011, enhancing productivity requires a long-term focus across a range of policy areas including:


- Improving our formal education system by reforming primary and secondary education, enhancing teacher training and development, and adequately funding third level education.
- Up-skilling and re-skilling by adapting labour market programmes to reflect the needs of the economy and to provide the unemployed with the skills required to gain employment.
- Prioritising State spending on R&D to support competitiveness.
- Facilitating labour market adjustment.
- Enhancing infrastructure by leveraging private sector investment and prioritising investment in next generation networks and intelligent infrastructure.

### The Importance of Productivity for Competitiveness and Growth

Productivity is a key driver of living standards and competitiveness. Productivity growth allows firms to compete successfully in international markets by enabling output to be produced in a more efficient and cost effective manner. In the decade or so prior to the current recession, Irish economic growth was driven equally by gains in productivity and an expansion in hours worked. With the onset of recession, despite Irish productivity performance remaining relatively strong, productivity gains have been more than offset by the fall in hours worked, leading to a sharp contraction in the size of the economy. Sustainable employment growth cannot resume without additional demand for Irish goods and services. Demand is influenced by numerous factors, one of which is price and in that sense Irish goods and services must be produced in a competitive manner. Higher productivity, therefore, is a prerequisite for a return to growth and employment creation.

### Ireland's Labour Productivity Performance

The primary measure of productivity performance considered in this report relates to labour productivity. Ireland's productivity performance has been comparatively strong over the 1980-2011 period. Labour productivity levels have increased from less than €14 an hour in 1980 to just under €39 an hour in 2011- an almost three-fold increase in three decades. Having started from a low base, Irish productivity levels now exceed those of many of our peers and key competitors. By 2011, Ireland's productivity levels were above the figures for the OECD and Euro area averages, the UK



and Denmark. In addition, the productivity gap between Ireland and the US has narrowed substantially.

Notwithstanding recent improvements, it is apparent that Irish labour productivity growth rates have slowed since the 1990s. Up to 2003, productivity grew by between 4 percent and 8 percent a year. Since 2003, annual productivity growth slowed to between 2 percent and 4 percent. This slowdown mirrors trends elsewhere in the developed world.

While Ireland's labour productivity growth rates are weakening, they remain relatively strong in an international context. Irish productivity growth rates have averaged 2 percent per annum between 2007 and 2011 (with particularly strong growth recorded in 2009 and 2010). This compares with 1.3 percent in the US, 1 percent in the OECD and 0.4 percent in the Euro area. Above average productivity growth combined with lower than average cost increases has resulted in improved Irish competitiveness.

Some of these gains, however, have arisen as a result of the impact of the recession on the labour market. Given the fact that below-average productivity workers (e.g. in the labour intensive construction sector) have been removed from the calculation of national productivity, aggregate productivity levels in Ireland have increased. Up to a third of Ireland's labour productivity growth since 2007 has arisen as a result of a reduction in hours worked in the economy. Changes to productivity growth rates arising from the impact of the recession on the labour market are unlikely to be repeated in the immediate future - nor is it desirable that they are repeated. As the number of total hours worked has stabilised, it appears that national productivity growth rates have returned to pre-recession trend. From a policy perspective, therefore, the focus must now be on embedding sustainable productivity enhancements through implementing structural reforms.

### **Where has Labour Productivity Growth come from?**

Looking at the sectoral contributions to Ireland's productivity growth, the contribution of modern manufacturing and tradable services (i.e. exporting sectors) to Irish productivity growth is large in comparison with international norms. Non-tradable services (which includes wholesale/retail trade, transport, utilities, real estate, and other professional services such as legal and advertising services) typically constitute the bulk of productivity gains for the Eurozone, the USA and the UK. In Ireland, however, modern manufacturing and tradable services (which account for about one fifth of hours worked) constituted approximately half of the productivity growth in the period 1990 to 2007.

High productivity levels in certain internationally trading sectors may include the returns from R&D, marketing and management practices undertaken by multinationals in other countries. To account for any potential distortion arising from the large MNC presence in Ireland (and thus providing a more accurate picture of underlying productivity levels), an exercise to control for MNC presence was undertaken: productivity levels for MNC dominated sectors have been adjusted downwards to match US sectoral levels (the source of most FDI investment). These hourly adjusted national productivity estimates still suggest that productivity levels in Ireland are high relative to competitor countries.

While Ireland's productivity growth from 1990-2000 had been concentrated in a narrow base around modern manufacturing sectors and tradable services, there is evidence that the base of productivity growth widened in the period 2000-2007. Some larger sectors in terms of employment experienced higher productivity growth than in the 1990s. In particular, the non-tradable services sector



increased its percentage contribution to aggregate productivity growth significantly from the 1990-2000 to 2000-2007 period.

## Ireland's Capital Productivity Performance

As well as examining the productivity of labour, it is also useful to assess the productivity of capital (both ICT and non-ICT capital) in the production process. The stock of capital investment has grown significantly in Ireland. The average annual growth rate in the stock of ICT capital in Ireland was in excess of 14 percent during the 1990 to 2011 period, while the corresponding rate for non-ICT capital was 4 percent. The increase in the stock of labour in comparison was much lower at less than 2 percent per annum. Therefore, the stock of capital per hour worked has increased significantly, supporting economic growth.

In terms of the productivity of capital, the available figures suggest that growth rates in capital productivity declined more in Ireland than in comparator countries over the 1995 to 2005 period. Since then, however, they have also rebounded more strongly in Ireland. This increase was driven by big increases in the productivity of capital in manufacturing, both traditional and modern. Evidence also suggests that increases in the stock of capital between 1995 and 2005 were responsible for the capital's positive contribution to output, rather than increases in the productivity of that capital. Since 2005, as capital productivity growth has rebounded, capital productivity levels have contributed positively to output, as well as continued increases to the stock of capital.

## Factors Driving Economic Growth

National output can be driven by a range of productive sources: namely labour, capital (both ICT and non-ICT) and a residual, which is commonly defined as total factor productivity (TFP) growth. Total factor productivity (TFP) growth is often attributed to technological change in a broad sense, i.e. improvements in the efficiency of an economy, possibly due to changes in regulation (e.g., competition policy, standardisation of policies relating to quality and requirements for health and safety), monetary policy or economic institutions<sup>3</sup>. High levels of TFP can be indications of high levels of innovation and technological progress. During the period 1995-1999, nearly half of Ireland's national output growth was attributable to changes in TFP. Economic growth averaged 1.39 percent between 2005 and 2011. The relative contribution to this growth can be broken down as follows: non-ICT capital accounted for 1.67 percent of this, ICT capital for 0.72 percent, and labour accounted for 0.18 percent. TFP, however, had a negative impact on economic growth over the 2005-2011 period, contributing -1.18 percent to growth. The data suggests, therefore, that more tangible factors (growth in the quality and productivity of non-ICT capital, followed by ICT capital and labour) have had the greatest impact on economic growth in recent years. Further up-skilling of the labour force, investment in capital and improvements in the environment to support innovation and technological progress will enable this trend to continue and improve prospects for economic growth.

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<sup>3</sup> However, TFP could also be a result of measurement errors (i.e. the inability of statisticians and economists to measure precisely the contribution of all other inputs).

## Policy Implications


Both enterprise<sup>4</sup> and government have a role to play in maximising productivity. Given that productivity gains arising as a result of the severity of the recession have passed, there must be a renewed emphasis on improving Ireland's long term productive capacity, which has declined in recent years. From a government perspective, a wide range of policies impact upon productivity growth. Government policies must be conducive to improving education, competition, innovation, technology and enterprise, which will all serve to drive improved productivity in the economy. The Council outlined a range of actions to improve Ireland's productivity in *Ireland's Competitiveness Challenge 2011*. Productivity will continue to be the focus of attention in future Competitiveness Challenge reports. From a policy perspective, a number of implications arise from this analysis.

- i. **Despite fiscal challenges, Ireland must continue to invest in productivity enhancing programmes and infrastructure.** The current fiscal environment and the need to reduce budgetary deficits provide a significant challenge to policymakers seeking to boost Irish productivity. The Government should avoid cutting expenditure on productivity enhancing programmes (e.g. education and training) and critical economic infrastructure to the greatest extent possible. Prioritisation based on robust cost-benefit analysis is essential. The money that is being spent must also be spent in as efficient a manner as possible. The Competitiveness Challenge 2011 report sets out NCC priorities and actions to improve delivery.
- ii. **Maximise competition in the non-tradable sector.** Actions to boost performance in low productivity sectors can have a significant impact on overall national productivity performance. Such actions also support the competitiveness of internationally trading sectors. Locally trading sectors have made a greater contribution to Ireland's national productivity performance in recent years. Building on these advances, it will be important to continue to broaden the productivity base through sector specific measures that enhance competition and reduce barriers to entrepreneurship.
- iii. **Access to finance is essential for firms to improve productivity.** Investment in capital has been a primary driver of productivity growth in Ireland over recent decades. The process of capital investment must be continuous if Irish enterprises are to increase their competitiveness. For firms to continue to invest in capital, availability of funding must be forthcoming. The Competitiveness Challenge 2011 report sets out a range of recommendations to improve the funding environment.
- iv. **Access to high quality broadband is also essential for firms to increase productivity.** Investment in ICT related capital have accounted for a significant share of Ireland's productivity growth. Access to high quality broadband offers further potential to improve economic growth as evidenced by the recent Forfás report *Ireland's Advanced Broadband Performance and Policy Priorities*<sup>5</sup> which found that widespread availability of advanced broadband was essential to realising future growth potential in existing and emerging sectors. The report also outlined the importance of advanced broadband in supporting the growth of small business, capturing opportunities for productivity and innovation, supporting regional development, enabling greater public sector efficiency and marketing Ireland as a location for ICT-intensive FDI and R&D projects.

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<sup>4</sup> While the focus of this paper is on national and sectoral productivity levels and the implications of these findings, Box 1 considers the actions that can be taken by companies themselves to maximise their own productivity.

<sup>5</sup> Forfás, Ireland's Advanced Broadband Performance and Policy Priorities, 2011

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- v. **Increasing productivity of the public sector.** Increasing labour productivity in the public sector is an essential element in improving aggregate productivity levels. As resource inputs to the public sector continue to be reduced, reform-driven productivity growth offers the only avenue to maintain and enhance service levels. The Council have identified three broad pillars of reform: firstly, government organisations need to be more output and outcome focused; second, greater autonomy should be granted to individual government entities to manage and allocate their resources in the most efficient manner; and thirdly, structures are required that link budget allocations and performance. The Council's Competitiveness Challenge 2011 set out a number of actions in this regard.

### Box 1- Enhancing Firm Level Productivity

A focus on productivity enhancement should be a core element of each organisation's (public and private) strategy. Simple steps that improve performance, reduce costs, or lead to more efficient processes can have significant impact on the productivity, and ultimately on the success of firms. Examples of such actions are summarised below.

- **Investment in ICT** (information and communications technologies) can allow a firm to introduce new business models, develop new applications, improve and re-invent business processes and increase efficiencies.
- **Investment in more efficient equipment** and in technologies that facilitate automation can also have a significant impact on productivity.
- Increasing **energy efficiency** can result in lower utility bills.
- **Training** can achieve significant productivity growth by investing in skilled and educated workers and providing job-related training. In particular, targeted training designed to address a particular issue can generate significant returns.
- Investment in **management development** is associated with large increases in both productivity and output - McKinsey & Co. have found that management performance is closely correlated with a range of corporate performance metrics, including labour productivity, sales growth and return on capital employed\*.
- Research has shown that **process innovation** is an increasingly important determinant of innovativeness and competitiveness of individual companies\*\*.
- By adopting innovative **HR management** policies and practices, companies can make real gains in productivity and performance (e.g. through the use of greater levels of information sharing and consultation with employees; through enhanced performance management and employee retention policies; flexible work arrangements etc.).
- Having an **international dimension** to your business can influence its productivity. Firms that are active in foreign direct investment are more productive than either firms that outsource overseas or are purely domestic. Likewise, exporting firms tend to be more productive than non-exporting companies.
- Using **benchmarking** and '**world class business**' tools can dramatically drive productivity within a business. Benchmarking provides a 'diagnosis', allowing companies to identify and prioritise productivity-related problems, while world class business tools provide the 'curative' action. For instance, Enterprise Ireland offers a service to client companies wishing to benchmark their company's competitiveness against international standards. This process makes detailed comparisons with like companies and suggests actions to improve performance.

\*Management Development Council, Management Development in Ireland, Forfás, 2010

\*\* Hirsch-Kreinsen, H. and D. Jacobson (eds.), Innovation in Low-Tech Firms and Industries, Edward Elgar, Cheltenham, 2008

# 1. Introduction

*Productivity isn't everything, but in the long run it is almost everything. A country's ability to improve its standard of living over time depends almost entirely on its ability to raise its output per worker.*

Paul Krugman, *The Age of Diminishing Expectations* (1994)

## 1.1 Productivity, Economic Growth and Competitiveness

Productivity growth is a key driver of economic growth and competitiveness<sup>6</sup>. Productivity also has a strong relationship with sustainability. If an economy is to grow, it can do so by either increasing labour utilisation ('working more, i.e. more people working or people working longer hours) and/or labour productivity ('working smarter'). Figure 1 illustrates the breakdown of Irish economic growth since 1980 into both components. Ireland's economic growth between 1990 and 2007 was high in an international context, and this was driven by strong increases in both the number of people working and productivity growth. For the OECD as a whole, productivity growth between 1980 and 2007 accounted for the bulk of economic growth.

Productivity growth since 2007 has been larger in Ireland compared to most of the economies shown in Figure 1. However, this growth in productivity was not enough to offset the sharp fall in the numbers at work and as a result output declined overall. Looking at the experience of other countries, Northern Ireland and the UK experienced negative productivity growth in the period 2007-2011. In the USA and the OECD (as average of all developed countries) productivity gains just about surpassed the fall in hours worked over the period 2007-2011 to record positive output growth.

Productivity is also a central to competitiveness. It is an indicator of competitiveness, because in market economies, goods will only be produced - and hence labour will only be productive - when there is demand for the goods to be produced. More importantly, productivity is also a driver of competitiveness, because for Irish firms to be competitive in international markets, they need to be cost effective. Increasing productivity enables firms to increase output with the same given levels of resources. At an aggregate level, this allows Ireland to maintain and improve competitiveness in the international economy while at the same time continuing to raise the standard of living here. The typical Irish industrial worker earned an annual salary of about €31,000 in 2010, compared to €22,000 a decade previously<sup>7</sup>. If this increase does not reflect underlying improvements in the value of what a worker produces with their year's work, it will not be possible for such increases to continue as economies will price themselves out of the market. Put another way, a lack of productivity growth will amplify the effects of weak cost competitiveness. This is of particular

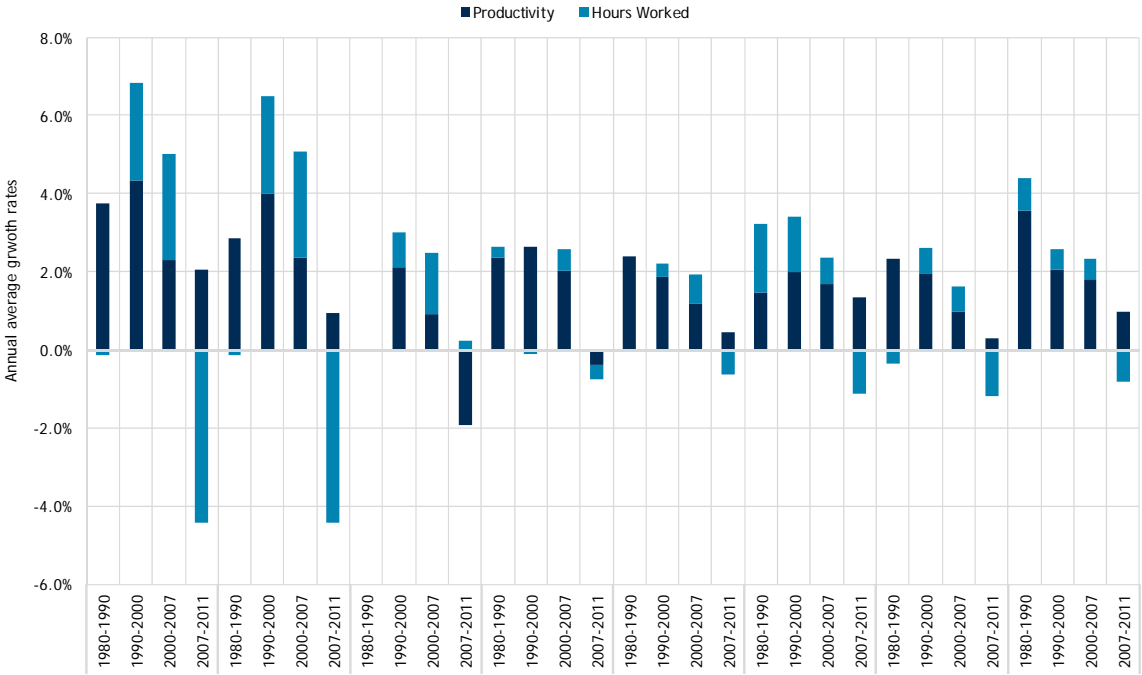
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<sup>6</sup> In 2006, the National Competitiveness Council published a report on Ireland's Productivity Performance over the period 1980-2005. Six years on, the Council believe it is important to revisit and update this publication given the changes that have occurred in the economy and the importance of productivity as a source of economic growth and competitiveness. This report contains a number of changes compared to the 2006 report. Specifically, the times series has been extended to capture the changes in economy-wide productivity up to 2011 (sectoral productivity up to 2010), and secondly recognising that the all output cannot be attributed to labour alone, this report contains a brief discussion on the changes in capital productivity.

<sup>7</sup> Department of Finance, Average Weekly Earnings of Industrial Workers (2011), Budgetary and Economic Statistics, table 48 Average Weekly Earnings of Industrial Workers

relevance for an economy like Ireland, where despite improvements, the cost base relative to key trading partners remains elevated<sup>8</sup>.

Figure 1: Growth and productivity performance in selected economies, 1980-2011 (average annual growth rates)



Source: Conference Board, Total Economy Database, January 2012

Productivity also has a strong relationship with sustainability. While the focus here is on the productivity with which labour is used, the concept can be employed to any input in the economy. There are concerns that ever-increasing GDP and ever-increasing population are incompatible in circumstances of finite resources. However, resources can be used more productively, thus rendering possible ongoing increases in output.

### 1.2 Overview of International and Regional Productivity Levels

Figure 2 charts per capita output levels in all 50 US states and all major EU regions<sup>9</sup>. US States are shown in green; EU-15 regions are in red; and regions from the newly established EU member states in blue. Selected Irish figures and regional averages are in black.

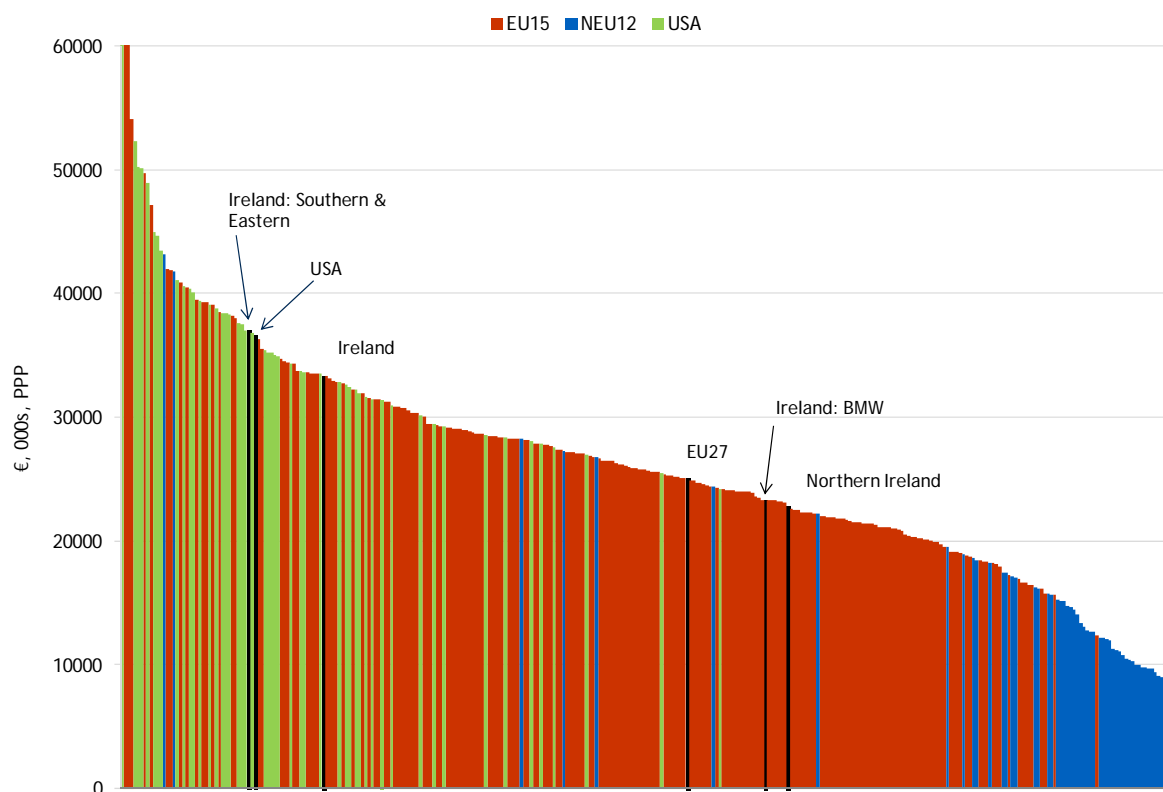
Latest available figures, for 2008, indicate that the average output per person in the EU-27 is €25,000, compared to €37,000 in the USA. Ireland has above EU-27 average output per capita at €33,000. However there is a large gap between the South and East of the country, where output is €37,000 (40th highest of the 325 regions analysed), and the rest of the island. Both the Border,

<sup>8</sup> National Competitiveness Council, Costs of Doing Business in Ireland 2011, Forfás, 2011

<sup>9</sup> NUTS2 level

Midlands & West region of the Republic and Northern Ireland have average output per capita close to €23,000 a year, below the EU-27 average.

Figure 2: Output per person, US States and EU Regions, 2008 (€, 000s PPP)



Source: Eurostat Regional Indicators and US BEA databases

Irish regional output figures have fallen down the rankings since 2008. Figure 2 highlights that there is significant potential to increase output levels further. The remaining chapters identify the factors driving Ireland’s productivity performance, and in doing so, suggest areas for action to improve Ireland’s productivity.

### 1.3 Methodology and Scope

Productivity refers to the amount of output generated by an input. Two measures of output are used in this report - Gross Value Added and Gross Domestic Product. These two output measures are conceptually the same<sup>10</sup>. Gross Value Added reflects the total value of the goods and services produced in the country without accounting for depreciation<sup>11</sup>.

<sup>10</sup> Gross Value Added (GVA) is conceptually the same aggregate as Gross Domestic Product. They both measure the added value generated in an economy in the production of goods and services. The difference between the two concepts is that GDP is measured after including product taxes (e.g. excise duties, non-deductible VAT, etc.) and deducting product subsidies, while GVA is measured prior to adding product taxes but includes product subsidies. CSO, National Accounts Output and Value Added by Activity, May 2010.

<sup>11</sup> GVA at basic prices, therefore, includes other (i.e. non-product) taxes on production minus other (i.e. non-product) subsidies on production. CSO, National Income and Expenditure 2010, August 2011 and Conference Board, Total Economy Database January 2012



The typical unit reported throughout this paper is per-hour labour productivity. All figures presented, unless otherwise stated, are based on measuring productivity through the Value Added (VA) divided by total hours worked

This approach can best be outlined using a simple example: consider a “firm” that is a sole-trader involved in producing certain products. If that single worker can turn raw materials worth €50 into a final product worth €250 using four hours of their time, their Value Added is €200 and their per-hour productivity is €50 (€200 divided by four hours). In effect, the same concept can be applied to the economy as a whole or to any given sector in that economy.

Recognising that productivity can be derived from sources other than labour (e.g. capital), a brief discussion on non-labour measures of productivity is also included.

While the measures of labour productivity used in this report are the best statistics available and are for the most part consistent across time and countries, there are a number of methodological issues and caveats that arise with this approach:

- Productivity should measure the quantity of output that an hour’s work gives, at a given level of quality. However, there is no ‘given level of quality’ - changes in quality occur all the time and the statistics rely on the accuracy of sector-specific price deflators. Often, particularly in sectors where the product’s quality is improving rapidly, it is far from straightforward to calculate how much prices have changed. One example might be computers, where there was no price for a dual core processor in the 1980s or 1990s. It would be of limited use to estimate the price of computers available in the 1980s. Instead, statisticians have to use a measure such as the price of a set amount of processing power or memory. This can happen with more traditional goods too, where “extras” become standard features over time or where the default inputs or ingredients change, such as cars (central locking), houses (energy efficiency) or food (organic ingredients).
- As outlined above, this approach is dependent on having accurate price deflators that distinguish increased output from inflation. Price deflators are more accurate for sectors that are internationally traded, where the price of goods is not influenced by domestic supply conditions.
- In sectors with countable outputs and relatively constant quality, the computation of physical measures of productivity can also be very useful. In the cases of residential construction and of road freight, physical measures of productivity are presented, based on the work of Aylward & O’Toole (2007), “Perspectives on Irish Productivity.”
- There are limitations to comparisons of productivity across sectors, as the scale and mix of factors (in particular the level and type of capital used) differ across industries. This underlines the importance of international comparisons of sectors.

#### Notes on the calculations:

- The figures (except for Northern Ireland) are sourced from the Conference Board’s Total Economy Database<sup>12</sup> (January 2012 revision) and the EU KLEMS project’s 72-Industry database (March 2011 revision). The 2011 release of the EU KLEMS industry data only covers data for the period up to 2007. This relates to labour productivity by sector analysis covered in Chapters 3-9.

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<sup>12</sup> The Conference Board is a global, independent business membership and research association.



- The sectors presented in the analysis are based on the EU's NACE 1.1 classification, which was superseded in 2008 by NACE Revision 2, which is in line with the UN's International Standard Industrial Classification of All Economic Activities (ISIC) Revision 4. The EU KLEMS project maps where possible from the US classification (NAICS) to NACE 1.1 but in certain sectors this constrains international comparability.
- EU KLEMS figures are given in national currencies for all countries, whereas Conference Board data are given in a standardised US\$ of 2011 value. GDP figures in the Conference Board are in 2011 US\$ (converted to 2011 price level with updated 2005 EKS<sup>13</sup> PPPs). For conversion of Conference Board data into euro figures, the OECD average exchange rate for 2011 (\$1=€0.719) was used. For conversion of EU KLEMS figures for non-euro countries, such as the UK and Denmark, into figures comparable with the 2007 euro, an average exchange rate for the period 2005-2010 was taken<sup>14</sup>.
- To compensate for the absence of more timely internationally comparable sectoral data, Irish only National Account data from the CSO is used to examine average annual growth in labour productivity for a range of sectors up to 2010.
- Capital productivity figures were taken from the OECD Structural Analysis (STAN) database and from the Conference Board Total Economy Database.
- The data presented are per-hour figures, as an important consideration in accurately capturing changes in productivity is the extent to which people are working shorter working weeks (and the extent to which people in Europe work fewer and shorter weeks than in the USA). However, the figures collected are averages - often across broad sectors - and actual hours worked in specific industries may differ from the average figures used while actual hours worked may differ from regulatory limits.
- Finally, as with the 2006 report, this paper presents alternative estimates of productivity in some sectors by adjusting the productivity performance of foreign-dominated sectors of the Irish economy. High Irish productivity levels in modern manufacturing and certain tradable services may reflect the returns from R&D, marketing and management practices undertaken by multinationals in other countries, rather than in Ireland. Given that US firms are the primary source of FDI into Ireland, US levels of productivity are used for the following sectors: chemicals, electronics, printing/publishing, computer services and finance<sup>15</sup> due to the large multinational presence. The purpose of this adjustment is to present alternative figures for productivity levels in foreign-dominated sectors in Ireland, as standard measures may potentially inflate Ireland's national productivity figures. It could be argued, that since Ireland has attracted many of the leading American firms in these sectors, their productivity levels, and thus of the sectors in Ireland, could be above the US average.

In providing an overview of productivity performance the comparator economies chosen are:

<sup>13</sup> Values are quoted in US\$ using EKS purchasing power parities. EKS (Éltető-Köves-Szulc) is a method for calculating a multilateral per capita quantity index from disaggregated price and quantity data.

<sup>14</sup> The period 2005-2010 was chosen as a period long enough to reflect the sustained trading value of a currency, not so long as to give excessive weight to pre-Financial Crisis values if different (as in the case of the UK). The average exchange rate is based on IMF data.

<sup>15</sup> The Annual Business Survey of Economic Impact 2009 estimated that 84 percent of all value-added in "client companies" [supported by Enterprise Ireland, IDA Ireland, Údarás na Gaeltachta and Shannon Development] came from foreign-owned companies. This proportion was highest in chemicals (99 percent), computer services (97 percent) and electronics (94 percent) The proportion was significantly lower for finance and for printing/publishing, but these have been included based on observed levels of productivity. It should be noted that ABSEI is a sample of the population of firms in Ireland and the classification of activity in it might differ to the national accounts.

- Ireland, both GDP and GNP based figures where possible. GNP figures are widely used in Irish policymaking due to the gap between GNP and GDP. Productivity using GNP figures should be interpreted with caution as GNP measures income not output.
- Northern Ireland, where possible.
- The UK, as a key trading partner and competitor for foreign direct investment.
- The euro-area 14 countries, as relative costs and productivities within a currency zone are of particular importance.
- The USA, as the source of inward direct investment and an important trading partner.
- Denmark, as a small open economy in the EU but outside the Eurozone.
- The OECD (where possible), as reflective of Ireland's economic peer group. Not all information is available for all current OECD members from 1980; therefore, a subset of 24 countries (broadly speaking, Western Europe plus US, Canada, Japan, Korea, Australia and New Zealand) is reported.

## 1.4 Report Structure

The remainder of this report is structured as follows. Chapter 2 provides an overview of Ireland's labour productivity performance at an aggregate level for the period 1980-2011, relative to that of a number of comparator countries, including the US, the UK, Northern Ireland, Denmark and the Eurozone. This time period and these comparators are used throughout the report where possible. Chapters 3 to 9 outline Ireland's labour productivity performance for a range of broad sectors, including Agri-Food, Construction, Traditional Manufacturing, Modern Manufacturing, Tradable Services, Non-Tradable Market Services and Public Services. Where appropriate, additional series are presented that allow for adjustments to Ireland's productivity performance to reflect the presence of multinational corporations (MNCs) in the economy. Chapter 10 provides an overview of the changes in capital productivity over the time period. Finally, Chapter 11 concludes by reassessing Ireland's aggregate productivity performance in light of these alternative estimates, outlining which factors have driven Ireland's output growth and finally which sectors have driven Ireland's productivity growth in recent years.

# 2. Overview of Ireland’s Labour Productivity Performance Since 1980

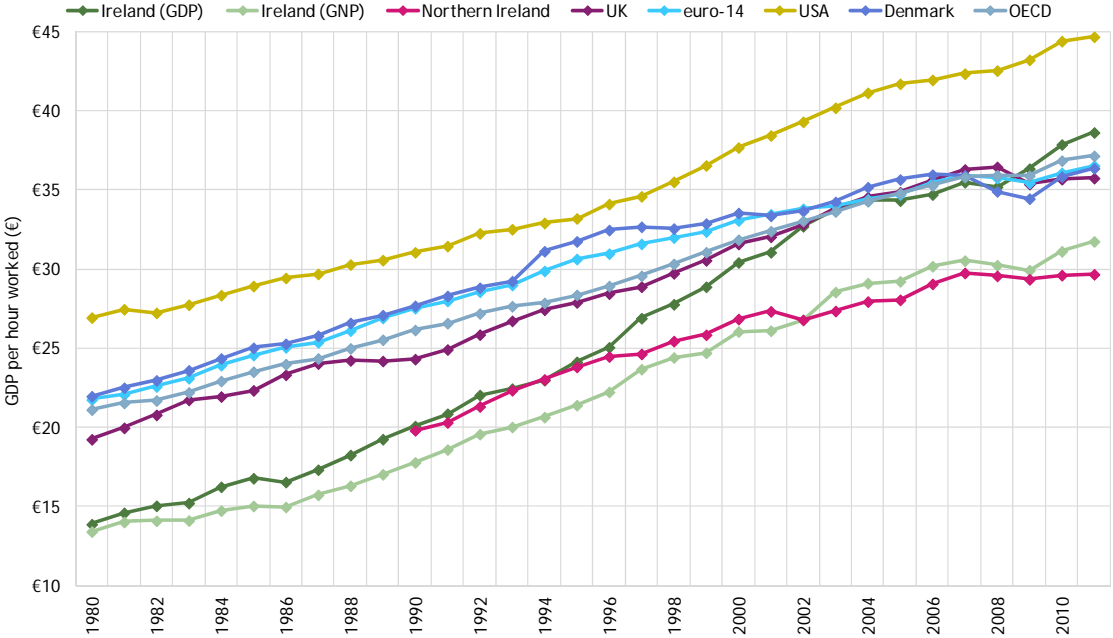
## 2.1 Overview

This chapter outlines Ireland’s national labour productivity levels and growth rates from 1980 until 2011. The growth rates relate to average annual growth rates for four time periods: 1980-1990, 1990-2000, 2000-2007, and 2007-2011 (the first years following the Global Financial Crisis and the collapse of the Irish property bubble).

## 2.2 Changes to Ireland’s Long-run Labour Productivity Performance

Figure 3 outlines the national per-hour productivity level, as measured by GDP per hour, for a range of economies. Ireland’s hourly productivity levels have increased from below €14 an hour in 1980 to almost €39 an hour by 2011, an increase of 178 percent in three decades. At the start of the period, productivity in Ireland was significantly below levels in the UK, the Eurozone and the USA. The differential began to narrow then and during the period 1996-2009 Ireland’s average productivity went from below that of Denmark, the UK and the Eurozone average to above. By 2011, the productivity gap between Ireland and the US<sup>16</sup> had narrowed and Ireland’s productivity level was above that of the remaining economies covered.

Figure 3: Output per hour worked in selected economies, 1980-2011

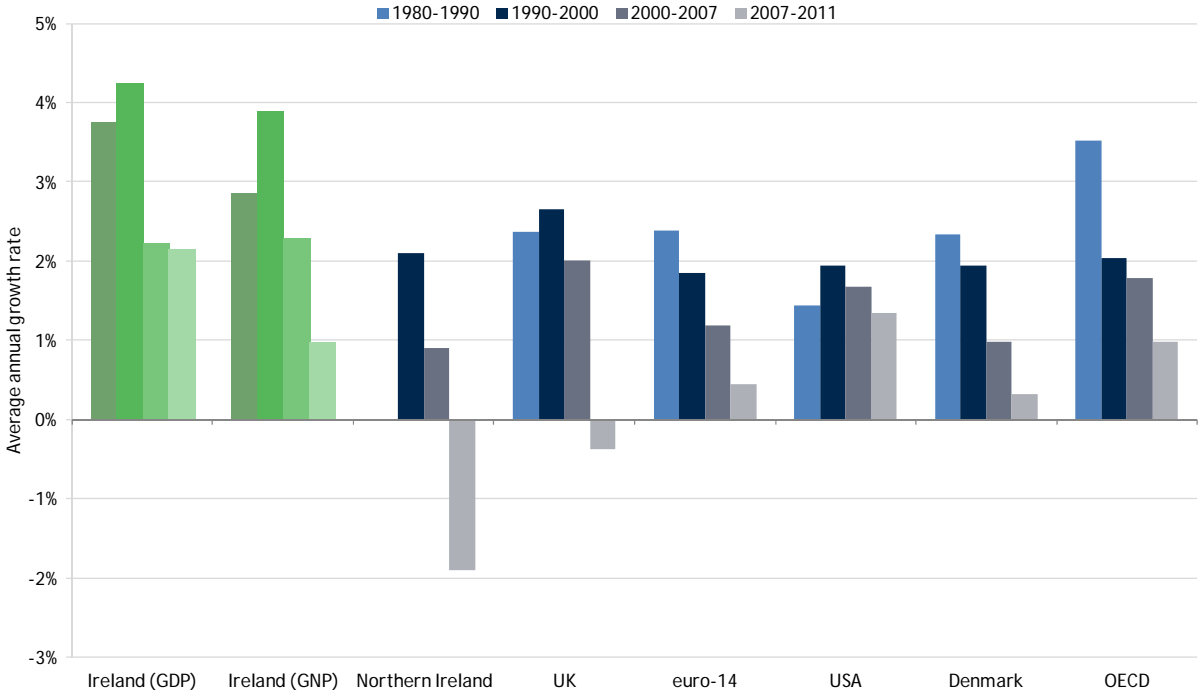


Source: Conference Board Total Economy Database, January 2012 and CSO National Income & Expenditure Accounts, July 2011

<sup>16</sup> The gap would have narrowed further, except for unfavourable Euro-US \$ exchange rate movements in 2011.

A different story emerges from using Irish GNP figures, where in 2011 the process of catch-up with the Eurozone or OECD averages was still very much ongoing. However while GNP is useful for income comparisons, it is not particularly instructive for output comparisons. Therefore, to account for the effect of MNC presence in Ireland a series of adjusted figures are provided for certain sectors (Chapter 6 and 7) and then economy-wide adjusted figures are presented in Chapter 11.

Figure 4: Growth in output per hour worked in selected economies, 1980-2011 (average annual growth rates)



Source: Conference Board Total Economy Database, January 2012

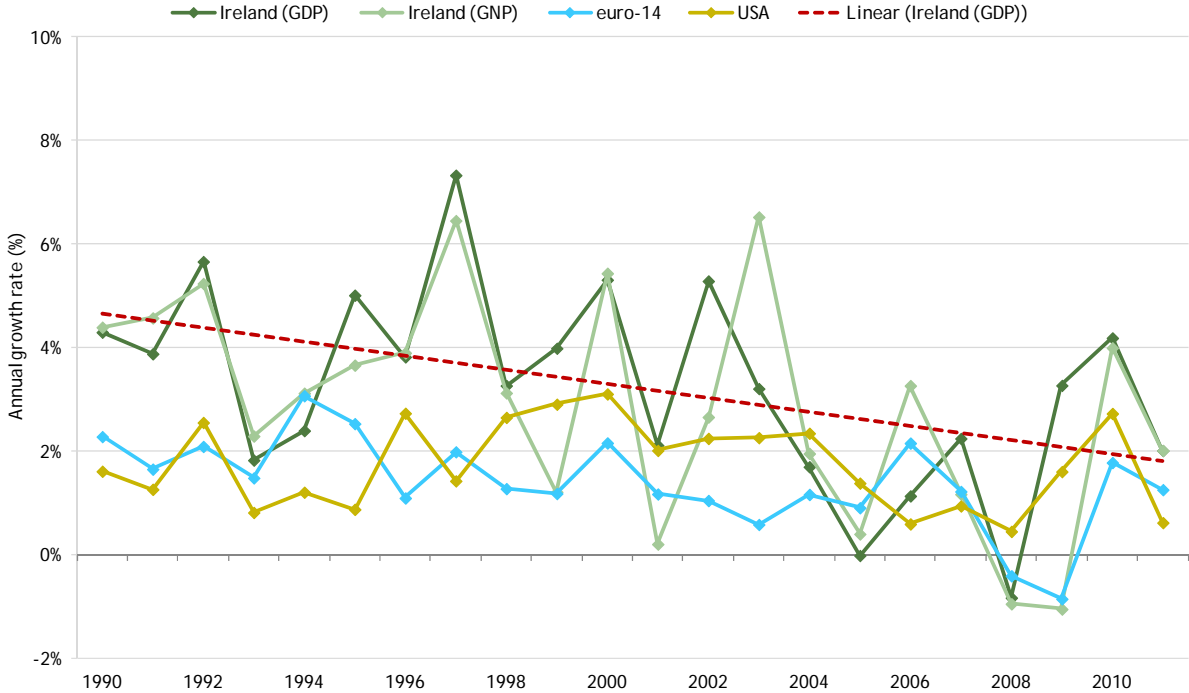
Figure 4 outlines the average annual growth rate (AGR) in productivity for four selected periods since 1980: the decade to 1990, the decade to 2000, the final stage of the Celtic Tiger (2000-2007), and the period of the recession/global financial crisis (2007-2011). This chart confirms three principal points about Ireland’s productivity performance over the last three decades.

- Ireland’s productivity growth rate over the 1980-2011 period has been strong relative to other countries, even if one chooses to measure productivity growth rates by GNP.
- Productivity growth has slowed considerably since the 1990s, particularly in the period since 2000.
- Despite this slowdown, Ireland’s productivity growth rate in the 2007-2011 period remains above that of key trading partners and comparative groups.

Given this slowdown in productivity growth rates, it is worth exploring the annual change in productivity in more detail. Figure 5 outlines the annual change in productivity for Ireland (GDP and GNP), the USA and the Eurozone. There has been a downward shift in Irish productivity growth rates since 2000, with 2008 experiencing negative growth. However, Irish productivity growth rates recovered over the period 2009-2011, rising above the Euro-14 and USA productivity growth rates.

Amongst the major advanced regions productivity growth remained around 1 percent for 2011; this compares to Irish productivity growth of 2 percent in 2011<sup>17</sup>.

Figure 5: Growth in output per hour worked in Ireland, the Eurozone and the USA, 1990-2011



Source: Conference Board Total Economy Database, January 2011

The Conference Board highlight one potential explanation for this pattern of slowing productivity growth in advanced economies. Their research suggests this slowdown could be due to an output gap between actual and potential output. Potential output, which measures the level of output an economy can produce assuming stable inflation and given its available resources and state of technology, has remained well ahead of actual output for several years. In the US, the output gap is estimate at about 6 percent, and in the EU it is about 3 percent. This implies that resources are not being used at full capacity, which has a negative impact on productivity.

### 2.3 Productivity and the Economic Cycle

The downturn in the economic cycle has affected Ireland’s productivity trends in a number of guises<sup>18</sup>.

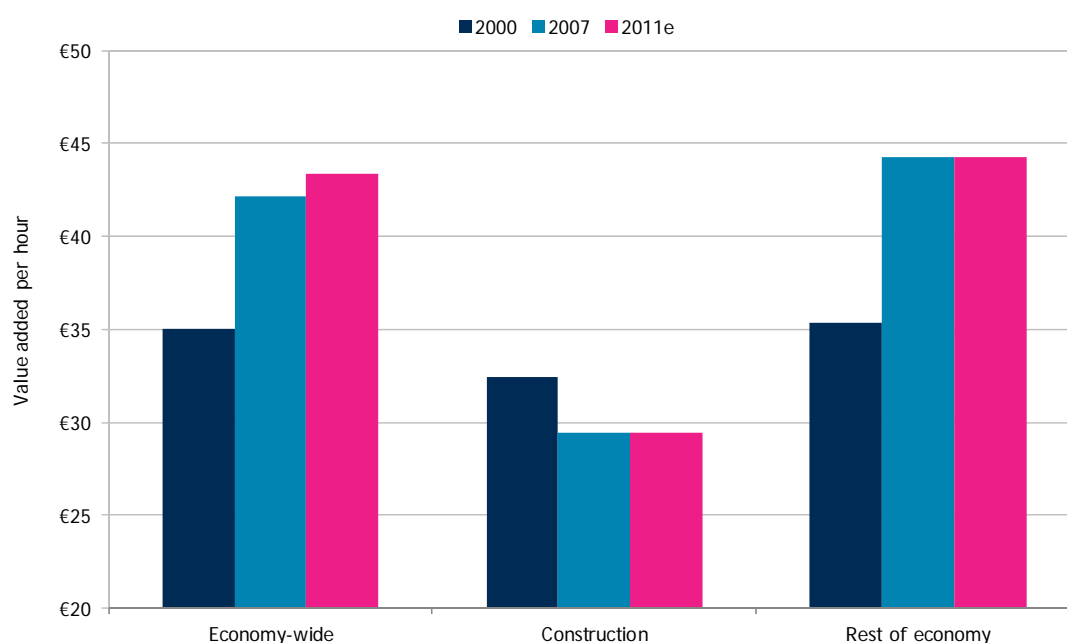
- Firstly, structural changes in the labour force - or the economic cycle more generally - can have a huge effect on measured productivity levels. This is particularly relevant for understanding

<sup>17</sup> The Conference Board, Total Economy Database, “The Outlook for 2012 suggests further decline in global productivity rates”  
<sup>18</sup> A number of international studies provide empirical evidence on the effects of the economic cycle on productivity. See: Bartelsman, E.J., & Doms, M., Understanding Productivity - Lessons from Longitudinal Microdata, Journal of Economic Literature, 2000; Baily, M.N., Bartelsman, E.J. & Haltiwanger, J., Labor Productivity - Structural Change and Cyclical Dynamics, The Review of Economics & Statistics 2001.

the apparent improvement in Ireland's productivity since 2008 seen in Figure 5 above. From 2007 to 2011 the total hours worked in the Irish economy fell by nearly 17 percent, while output declined by 9 percent. If the total hours worked in an economy declines by more than output, the economy realises a productivity gain.

- At a sectoral level, the fall in employment (and thus hours worked) in the labour intensive and relatively low productivity construction sector will have affected the aggregate productivity figures, particularly over the 2008-2010 period when significant hours worked in construction were shed. Previously the sector accounted 16 percent of total hours worked in the economy; this has fallen to about 6 percent by 2011.

Figure 6: Effect of decline in Employment on National Productivity, 2007-2011



Source: CSO Quarterly National Household Survey and EU KLEMS 72-Industry Database, March 2011

Figure 6 shows the stylised effect of the fall in employment on the national productivity figures. It assumes that productivity levels in all sectors remain the same, but that total hours worked fell in line with the fall in employment, including for construction. The reduction in numbers working on construction in this scenario boosts the national productivity per hour worked by 3 percent over the 2007-2011 period. The annual equivalent effect is 0.7 percent, and this must be compared to average productivity growth of almost 2 percent during that period, as outlined in Section 2.2. This means that approximately a third of labour productivity growth per annum in Ireland between 2007 and 2011 may be due solely to the shrinking of the employment (including construction, where value added per hour worked is below the national average).

- The third impact of the recession on productivity levels arises from the measurement of Value Added in the real estate sector<sup>19</sup>, which include imputed rent, which will be negatively affected by the recession.

In summary, while Ireland's productivity growth rates are weakening they remain relatively strong in an international context. Irish productivity growth rates have averaged 2 percent per annum between 2007 and 2011 (with particularly strong growth recorded in 2009 and 2010). This compares with 1.3 percent in the US, 1 percent in the OECD and 0.4 percent in the Euro area. Above average productivity growth combined with lower than average inflation has resulted in improved Irish competitiveness. Some of these gains, however, have arisen because of cyclical factors. Indeed up to a third of Ireland's productivity growth since 2007 can be explained by the reduction in hours worked (i.e. a sharper reduction in employment in sectors with lower than average productivity has increased average productivity). As the number of total hours worked has stabilised, national productivity growth rates have returned to pre-recession trend. Therefore, from a policy perspective the focus must now be on embedding structural productivity enhancements.

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<sup>19</sup> In the national accounts, the real estate sector includes the measurement of imputed rent to owner-occupiers, which depends on the prevailing level of prices in the housing market, as well as the value added by real estate professionals, which is also in part dependent on price levels. With property prices and rents down significantly from their peak in 2007, it is also to be expected that output per hour worked in real estate will be affected by the recession. There may be some impact also on output accruing to domestically trading financial services. The effects of the fall in house prices in Ireland should be mitigated if price deflators correct adequately for the fall in house prices in Ireland. However, as outlined in Chapter 1, this is reliant on the accuracy of sector-specific price deflators. Often, particularly in sectors where the product's quality is changing rapidly, it is far from straightforward to calculate how much prices have changed.



### 3. Ireland's Labour Productivity Performance by Sector<sup>20</sup>

Productivity varies across sectors, as well as across countries and over time. To see how productivity varies within the economy, and how different sectors have fared over time, seven broad sectors of economic activity are identified within each economy, each of which is analysed separately in the chapters that follow:

- **Agriculture and food processing** (including drinks and tobacco): The food and drinks industry is traditionally treated as part of manufacturing. However given the importance of this sector for indigenous exports, it is worthy of separate analysis.
- **Construction:** In employment and output terms this sector has experienced vast change over the past two decades. This is also one of the most labour intensive sectors in the economy.
- **Traditional manufacturing:** This sector includes textiles/clothing, wood/paper, minerals/materials, transport manufacturing and furniture.
- **Modern manufacturing:** Modern manufacturing includes those sectors in Ireland dominated by multinational firms: chemicals, electronics and printing/publishing (including reproduction of software).
- **Internationally tradable services:** Internationally traded services include communications, hotel/catering, finance and computers/R&D, some of which are dominated by MNCs.
- **Non-tradable market services:** This definition includes all other services that are market-based, i.e. wholesale/retail trade, transport, utilities, real estate, and other professional services (e.g. legal and advertising services).
- **Public Services:** The sector refers to the nature of the services, not necessarily their ownership. Thus significant proportions of the education and healthcare sectors may be privately owned in certain countries.

Figure 7 breaks down total value added across each of these seven areas of economic activity for 1990 and for the latest year available, 2007. It highlights the relative importance of these sectors to the overall economy across the range of selected countries. The contribution of an individual sector depends on two factors, (1) how many people are employed in a sector and (2) how productive those employed in that sector are.

As can be seen from Figure 7, what have been termed 'non-tradable' or domestically trading services form a large proportion of each country's total value added, typically 40 percent but slightly higher in the case of the UK. In the US and in Ireland, however, the contribution is closer to 30 percent. The decline in the proportion of the economy accounted for by non-tradable services in Ireland happened in spite of an increase in that sector's share of total hours worked (from 31 percent to 33 percent), a product of that sector's significantly slower productivity growth.

Ireland's public services also form a smaller proportion of the whole economy, in value added terms, than the other economies covered. About 18 percent of total hours worked in the Irish economy in 2007 were in the public services, similar to the UK and the Eurozone as whole, but

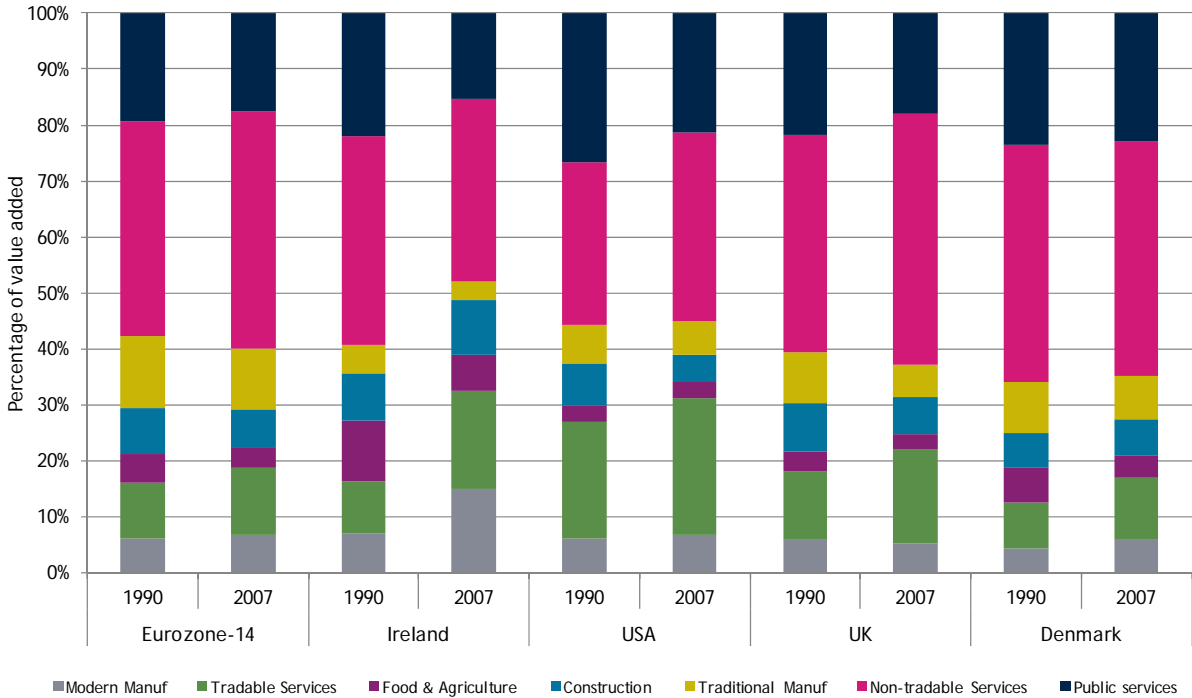
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<sup>20</sup> Data on sectoral labour productivity are sourced from the EU KLEMS database. Data on economy-wide labour productivity in the preceding chapters were sourced from the Conference Board Total Economy Database.



significantly smaller than the USA or Denmark, where these services accounted for 25-30 percent of all hours worked.

Figure 7: Proportion of gross value added attributed to broad sector, selected economies, 1990 and 2007 (percent)

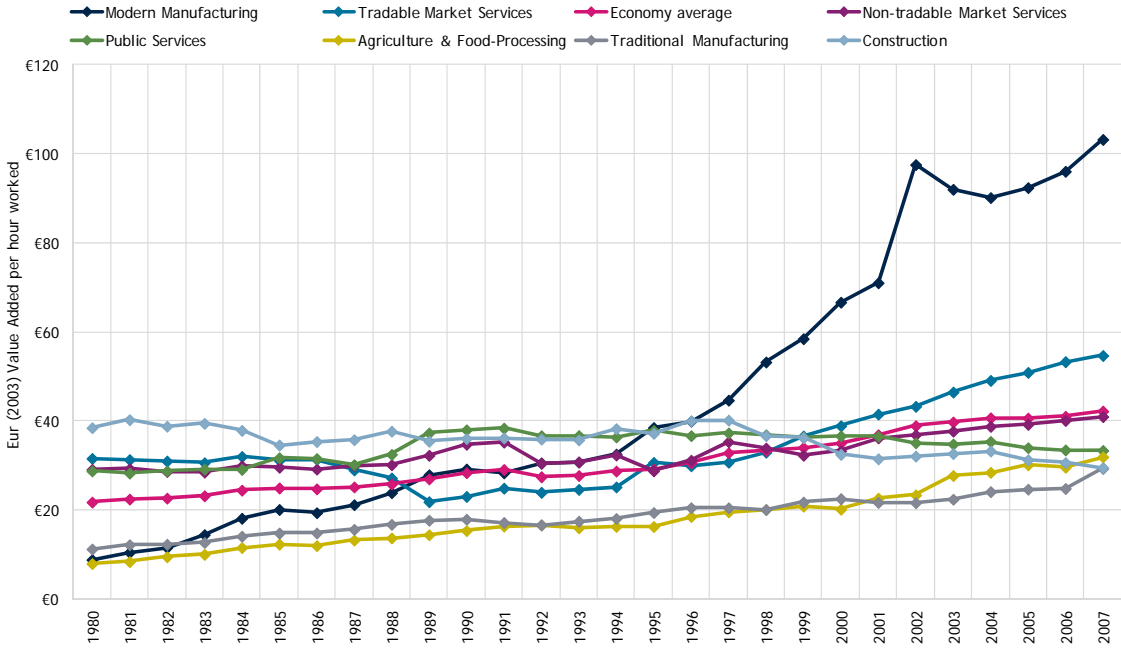


Source: EU KLEMS 72-Industry Database, March 2011

What is striking about the breakdown of the Irish economy in 2007 is the large contribution played by ‘modern’ manufacturing (the bottom sector in Figure 7), significantly larger than any other economy. Together with ‘tradable services’ (second from bottom), these relatively small sectors in terms of total hours worked (20 percent in Ireland in 2007, compared to 15 percent in the Eurozone and 28 percent in the USA) account for a disproportionate amount of economic activity in Ireland.

Figure 8 outlines Irish labour productivity levels in each of the seven broad sectors outlined above, as well as for the economy-wide average (pink line), which was over €42 in 2007. Only modern manufacturing and tradable market services lie above the average. The most obvious feature of Figure 8 is the detachment in recent years of the modern manufacturing series from all other sectors. At over €100 in 2007, hourly productivity appears to be three times that of all other sectors in the economy apart from tradable and non-tradable market services. If MNC presence in Ireland is skewing the figure, alternative estimates of productivity - such as those using US levels (as outlined in Chapter 1) - are needed.

Figure 8: Output per hour worked, across broad sectors of the Irish economy, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011


Chapters 4- 9 assess the productivity performance of each of the seven sectors in greater detail. Each sector is discussed in terms of labour productivity levels, its importance in the Irish economy, and recent trends nationally and internationally. Adjusted estimates of productivity are presented where appropriate. Chapter 11 provides some concluding thoughts, while specific figures for each industry are charted in the Appendix. Table 1 illustrates the sectoral composition for value added and hours worked in 2007.

Table 1- Percentage of Hours Worked and Value Added in the Irish Economy, 2007

Sector	Hours Worked	Value Added
Food & Agriculture	9 percent	7 percent
Construction	14 percent	10 percent
Tradable Services	14 percent	18 percent
Public services	19 percent	15 percent
Non-tradable Services	34 percent	33 percent
Traditional Manufacturing	5 percent	3 percent
Modern Manufacturing	6 percent	15 percent
Total	100 percent	100 percent

Source: EU KLEMS 72-Industry Database, March 2011, Conference Board Total Economy Database, January 2012

While internationally comparable sectoral data is only available up to 2007, a lot has changed in both the domestic and international economy since then. It is useful, therefore, to examine alternative, national sources of productivity data to determine how sectoral productivity has



changed in Ireland over the course of the recession. Where possible, national data based on CSO figures, are examined to provide estimates of changes in labour productivity since 2007 for a range of aggregated sectors - namely agriculture, industry, services, and the public services<sup>21</sup>. These national data are summarised in Figure 26 in the annex.

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<sup>21</sup> Sectoral productivity figures for Ireland post-2007 are calculated using CSO National Accounts and Quarterly National Household Survey data, as well as the Conference Board, Total Economy Database. Due to methodological and classification differences, the calculated labour productivity levels for these sectors will differ slightly from those calculated using the EU KLEMS 72-Industry Database (1980-2007). Therefore the annual average growth rates in labour productivity (2007-2010) are presented to give an indication of estimated changes since 2007.

## 4. Labour Productivity in the Agri-Food Sector

The agri-food industry comprised nearly 9 percent of all hours worked in the economy in 2007, down from 24 percent in 1980 and 12 percent in 2000. Figure 9 outlines the aggregate productivity performance of the agri-food sectors of Ireland and other economies over the period 1980-2007. Figure 27 and 28 in the appendix outline the figures for agriculture and food-processing separately. The overall performance of the sector in Ireland is impressive, rising from slightly above the Eurozone average in 1980 (€8) to a level comparable with Denmark and the USA by 2007 (€32). As outlined in sections 4.1 and 4.2 below, however, there is a big difference in productivity levels across primary agriculture and food-processing.

### 4.1 Agriculture

Productivity levels in primary agriculture are low relative to other sectors in Ireland, at less than €18 per hour in 2007 compared to an economy-wide average of just over €42. While below productivity levels seen in the US, the sector performs reasonably well compared to its counterpart in other economies shown. Due to the high level of subsidies given to agriculture in developed countries, these measures may be sensitive to small changes in methodology.

Matthews et al have examined agricultural productivity in Ireland using an alternative approach to compensate for the effect of direct payments and suggest that Ireland's agricultural productivity performance between 1984 and 2004 was weak relative to key competitors. This is explained as primarily a result of weak technical performance (i.e. related to research and innovation, employment of best practice techniques etc.)<sup>22</sup>.

Farm size may also be an issue - the Department of Agriculture, Fisheries and Food has highlighted this issue in their recent strategy for the sector which identifies the need for restructuring at farm level to increase scale and improve productivity<sup>23</sup>.

### 4.2 Food-processing

The food-processing sector, which includes beverages and tobacco, is one of the strongest indigenous trading sectors. Productivity levels in food-processing in Ireland have increased steadily over the period 1980-2007, especially since 2000. Productivity levels have gone from below the EU average in the early 1980s to more than twice the EU average in 2007. Since 2002 productivity in the Irish food-processing sector has also exceeded its high-productivity Danish counterpart.

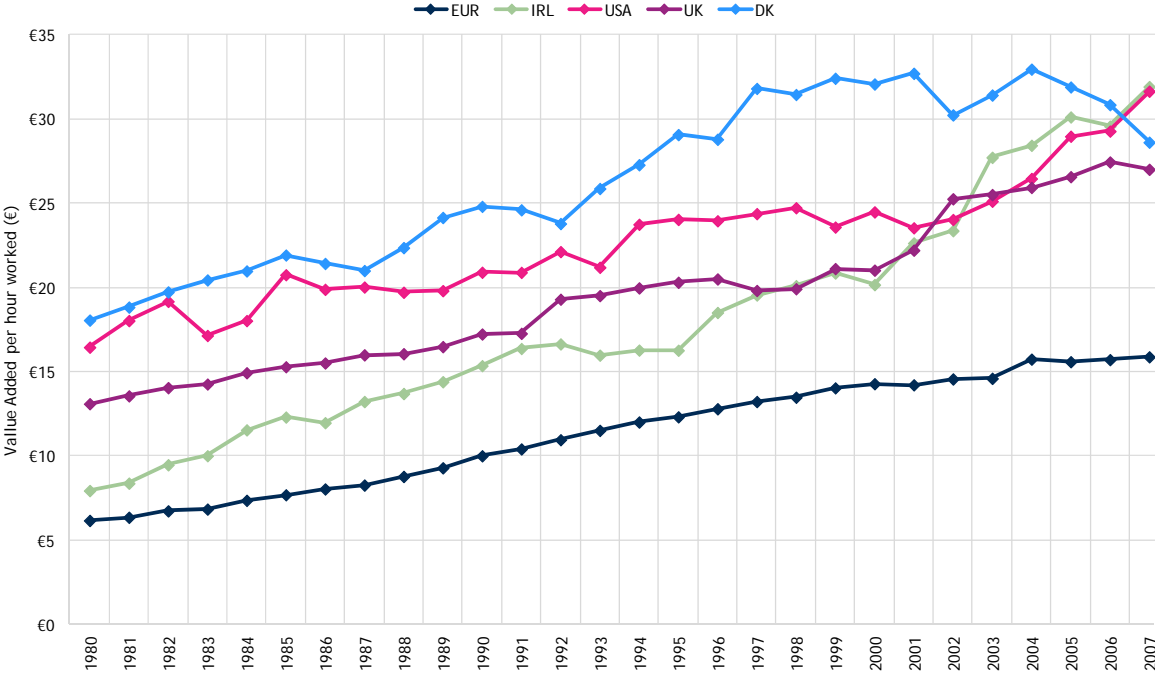
In part this is a result of the wide-ranging expertise built up by Irish companies over recent decades, particularly in key dairy and beef sectors. As a result of investment and innovation, Ireland's traditional sectors have been augmented by world-leading expertise in ingredients, infant formula and other functional and prepared consumer foods. The continued development of the value-added food sector (beyond primary processing) has boosted Irish productivity performance.

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<sup>22</sup> Matthews, A., Newman, C., and Thorne, F., Chapter 6 Productivity in Irish Agriculture, from Perspectives on Irish Productivity, Forfás, 2007

<sup>23</sup> Department of Agriculture, Fisheries and Food, Food Harvest 2020,

Figure 9: Output per hour worked in the agri-food sector, selected economies, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011

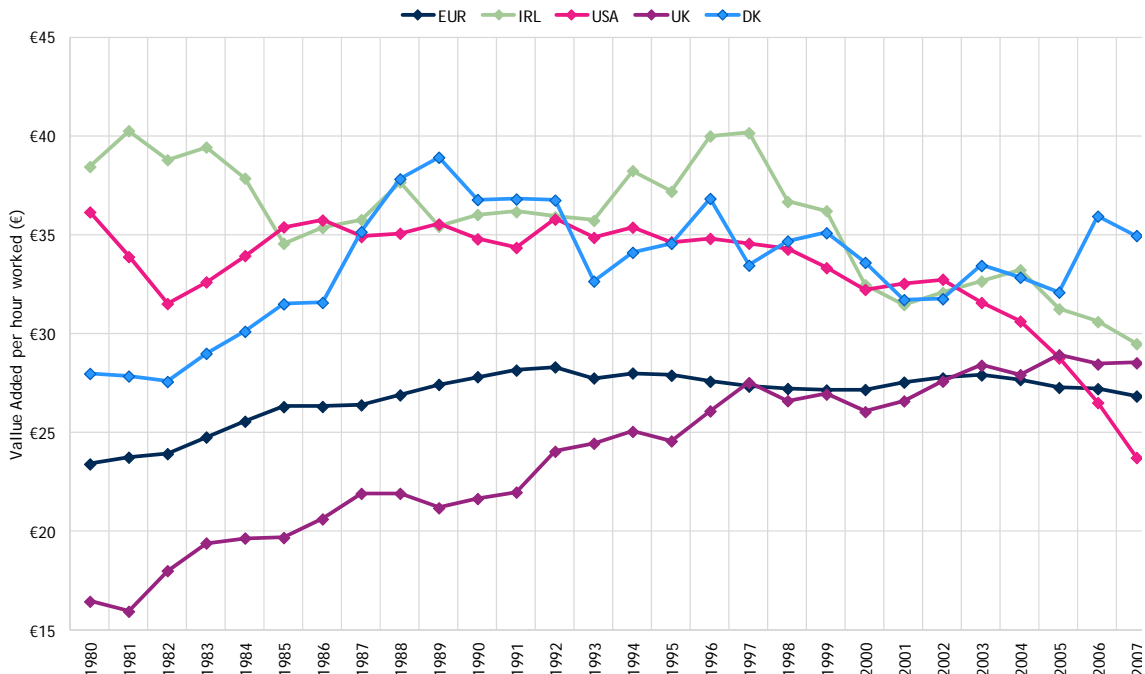
### 4.3 Developments in Agriculture since 2007

Looking at the post-2007 period, national data indicates that labour productivity in the agriculture sector continued on an upward trajectory after 2007, with productivity in the sector growing by an estimated 7 percent per annum between 2007 and 2010 (Figure 26 in the annex).

# 5. Labour Productivity in the Construction Sector

In 2007, the construction sector accounted for 14 percent of total hours worked in the economy, up from 8 percent in 1980 and 11 percent in 2000. Its productivity performance over time is shown compared to economies in Figure 10 below. As is the case with the Real Estate sector, due to the need to correct for changing house prices, the measurement of value added in construction is sensitive to the price deflators employed. The EU KLEMS project has attempted to account for price changes in houses and finds that productivity in construction in Ireland has not risen over the period 1980-2007, and indeed may have fallen in the decade to 2007. This would mirror the sector’s performance in the USA.

Figure 10: Output per hour worked in the construction sector, selected economies, 1980-2007




Source: EU KLEMS 72-Industry Database, March 2011

## 5.1 Physical Measures of Productivity

Given the sensitivity of productivity estimates to assumptions about price and quality changes, a physical measure of productivity can give a more reliable indicator of productivity in a sector such as construction. Aylward and O’Toole<sup>24</sup> produce an alternative estimate of productivity in construction based on physical output, dividing the number of residential units completed in a particular year by the number of hours worked in the sector. They also make an adjustment for

<sup>24</sup> Aylward, C. and O’Toole, R., Productivity in the Irish Residential Construction Industry, in Perspective on Irish Productivity, Forfás 2007



changes in the size and quality of new homes. Their measure of productivity increases if more or larger homes were built with the same amount of labour. They estimate that productivity levels in the Irish residential construction sector grew by 32 per cent from 1993 to 2003: it took 26 workers a year to complete ten homes in 2003, compared to 33 workers a decade before. Aylward and O'Toole attribute this change to increased skills in the industry, increased mechanisation, the use of more modern site management techniques and increases in the average scheme size.

## **5.2 Developments in Construction Productivity since 2007**

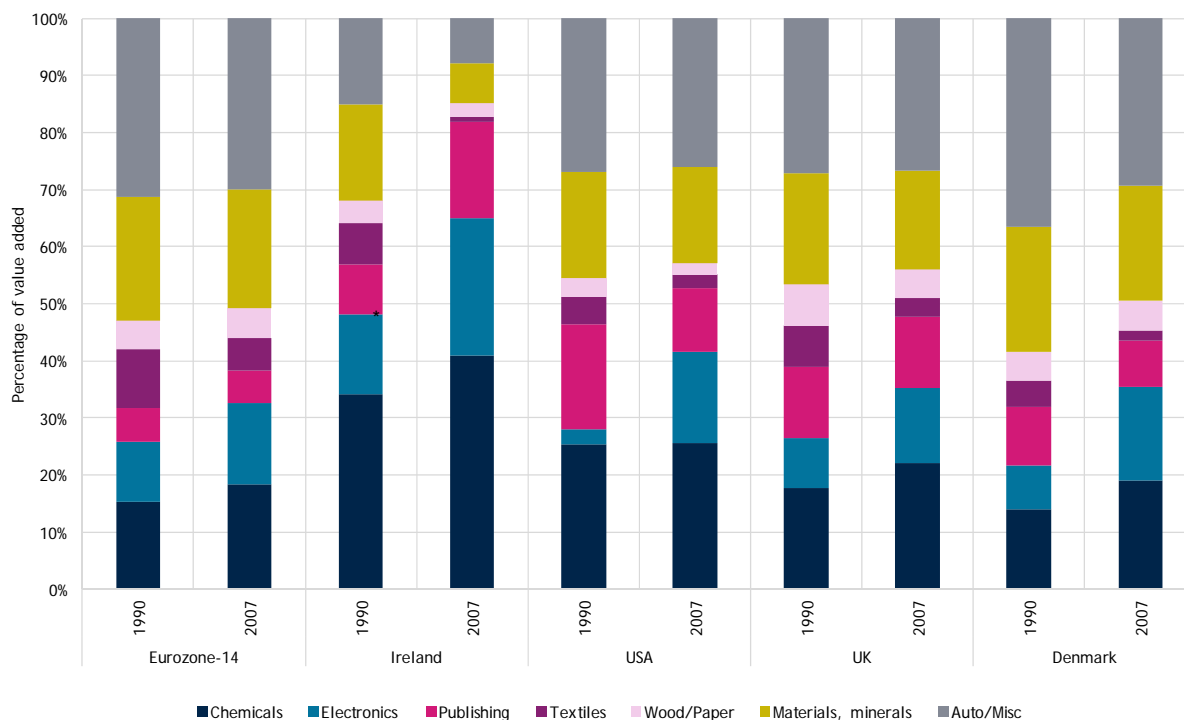
There are indications that labour productivity in the construction sector improved since 2007. The sector experienced an estimated annual average growth in labour productivity of 2 percent between 2007 and 2010 (Figure 26). The improvement in labour productivity since 2007 has in part been driven by the fact that the total hours worked in the sector decreased by more than output over the period.

## 6. Labour Productivity in the Manufacturing Sector

There is large variance in productivity within the manufacturing sector. It is therefore important to examine traditional manufacturing and modern manufacturing separately. Firstly however it is useful to examine the scale of this variance as is illustrated in Figure 11 and 12. Figure 11 outlines the proportion of all value added in manufacturing attributed to the different industries: it is clear that three of the seven sectors (chemicals, electronics and publishing) account for the bulk of value added (over 80 percent in 2007).

This concentration of value added takes place despite the fact that the modern manufacturing sectors, which comprise largely foreign-owned companies, do not dwarf other manufacturing sectors in terms of the numbers of hours worked: 240 million hours worked in 2007, compared to 190 million in traditional manufacturing sectors.

Figure 11: Proportion of value added in manufacturing attributed to sub-sector, in selected economies, 1990 and 2007

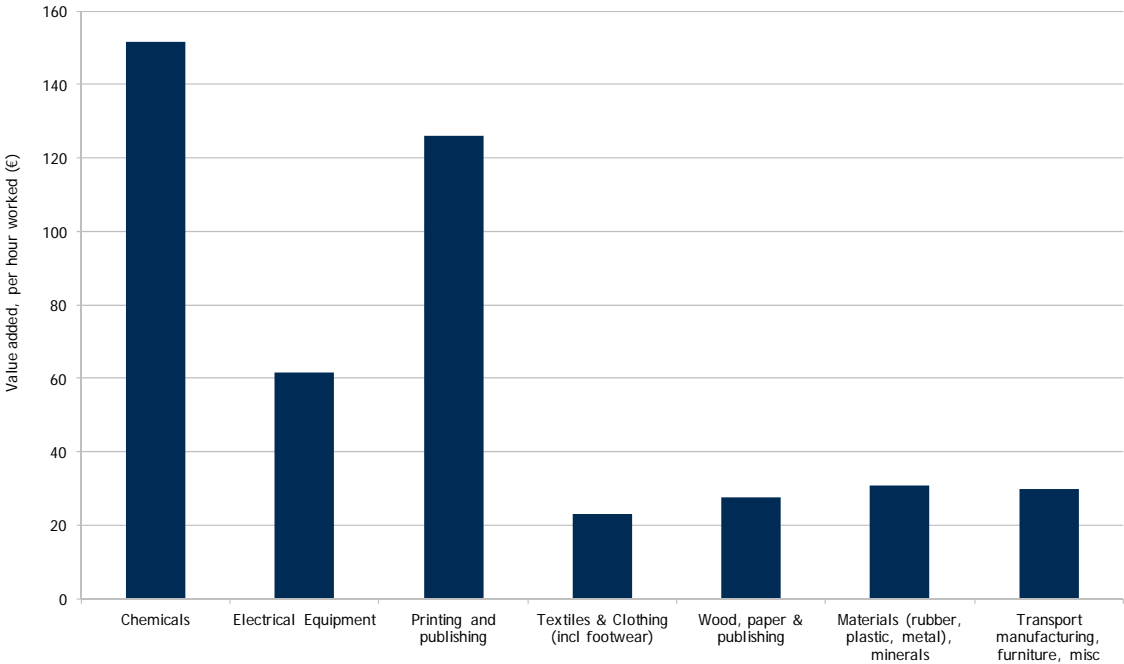


Source: EU KLEMS 72-Industry Database, March 2011

Figure 12 outlines productivity levels across the various manufacturing industries in 2007. It is clear that a separate treatment of the three sectors to the left and the four to the right is of use. In particular, by splitting the sectors in such a way, it will be possible to construct alternative estimates of the productivity of modern manufacturing in Ireland and thus alternative estimates of overall productivity in the economy.

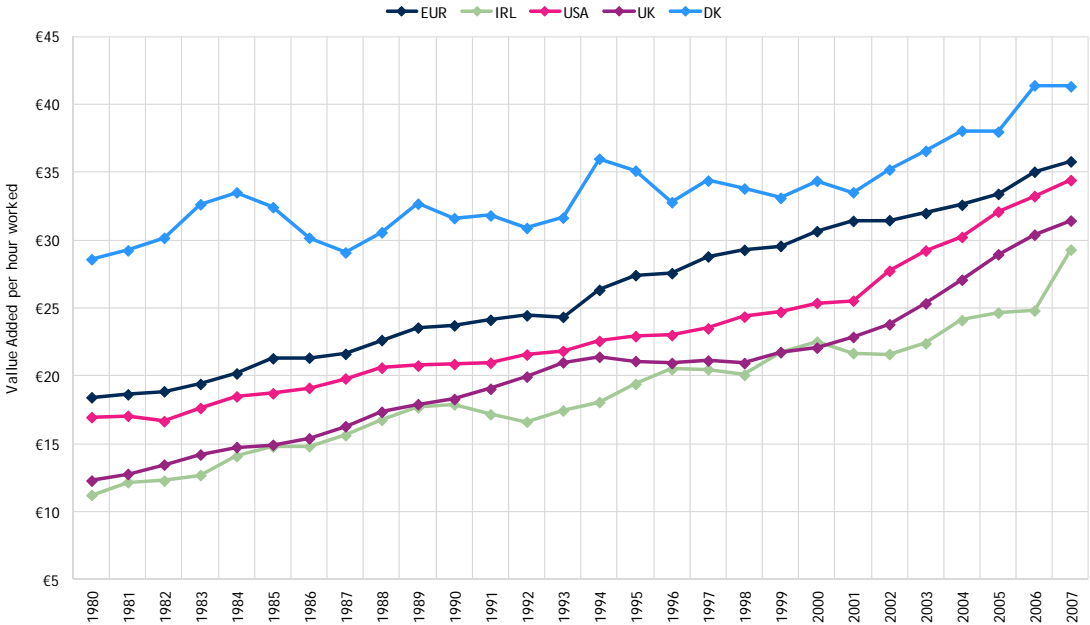


Figure 12: Per hour productivity in 2007, across manufacturing sub-sectors



Source: EU KLEMS 72-Industry Database, March 2011

Figure 13: Output per hour worked in the traditional manufacturing sector, selected economies, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011

## 6.1 Traditional Manufacturing

This section outlines productivity in traditional manufacturing industries. The sector comprises four relatively small industries in the Irish economy: textiles/clothing, wood/paper, materials/minerals and transport manufacturing/furniture. Productivity levels across traditional manufacturing rose from €12 in 1980 to just below €30 in 2007, leaving it below the EU average (€36) and significantly below Denmark (€41). The sector's overall productivity performance is shown in Figure 13, while detailed sectoral charts are in the appendix.

Traditional manufacturing accounted for 5 percent of total hours worked in the Irish economy in 2007, down from 9 percent in 1980 and 6 percent in 2000. Productivity levels in textiles have risen in recent years and are similar to averages in other economies but below most of sectors of the Irish economy. Productivity levels in wood/paper jumped in 2007 but had not improved significantly in the years prior to that. Productivity levels in materials and minerals doubled between 1980 and 2007 but remain below the Eurozone and US averages. Value added in furniture and transport goods also jumped in 2007 but did see steady increases in the preceding years.

### 6.1.1 Textiles & Clothing

Ireland's textiles & clothing industry accounted for just 0.3 percent of all hours worked in the economy in 2007, down from 2 percent in 1990. As the sector has declined, it appears only higher productivity firms have survived, and hourly productivity has increased from below €15 an hour in the 1990s to above €20 an hour in 2007. At these levels, productivity in the sector is equivalent to the averages of the Eurozone and the USA but is still significantly below the Irish economy-wide average and the second lowest of all the sectors covered in this report (after agriculture). The UK has recorded significant improvements in productivity in the sector since 1999.

### 6.1.2 Wood & Paper

In 2007, the wood and paper industry in Ireland accounted for just 0.7 percent of total hours worked, compared to 1.1 percent in 1980. Value added per hour worked in the sector appeared to jump in 2007, primarily due to an increase in value added in pulp and paper products. Until that jump, value added per hour worked had not increased significantly the previous decade (€17 in 1995, €19 in 2006). This performance is in sharp contrast to the fortunes of the sector in the Eurozone at large, where productivity levels increased steadily from €13 an hour in 1980 to over €30 an hour in 2007.

### 6.1.3 Materials & Minerals

The materials and minerals sector, which includes rubbers, plastics and metals, accounted for 1.8 percent of all hours worked in the Irish economy in 2007, compared to 2.7 percent in 1980. Productivity levels doubled between 1980 and 2007, although this was not enough to catch up with the Eurozone or US averages. At €30 an hour, the level of productivity in the sector was below the economy-wide average but ahead of other traditional manufacturing sectors.

### 6.1.4 Furniture & Transport

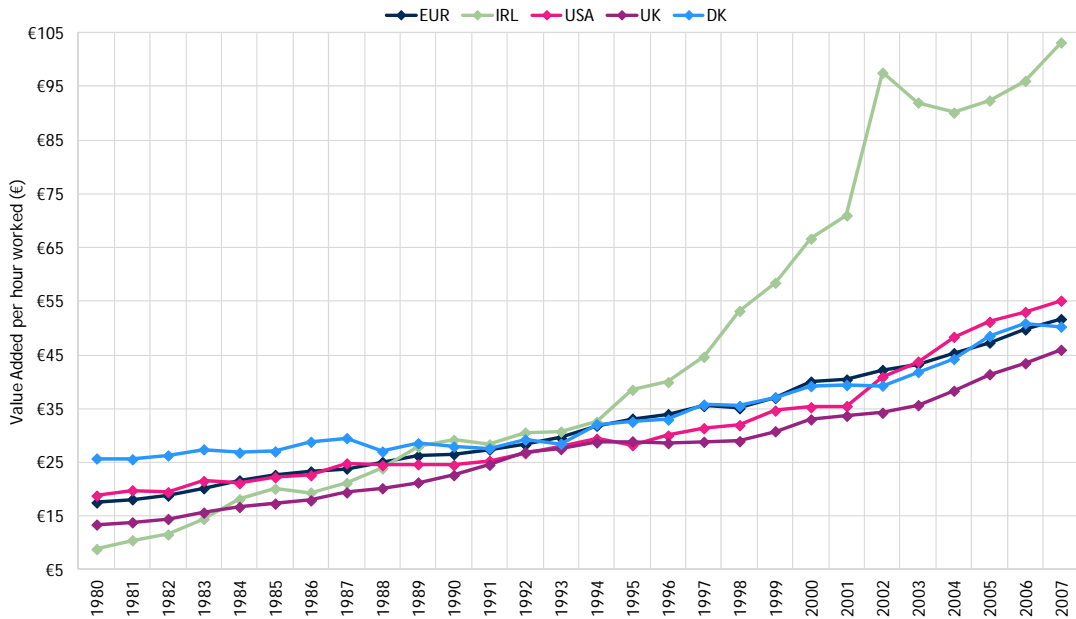
The furniture and transport machinery sector - which also includes all other manufacturing not classified elsewhere - accounted for 2.2 percent of total hours worked in the Irish economy in 2007, down from 3.2 percent in 1980. As with the materials and minerals industry, there were steady improvements in the hourly productivity of the furniture and transport sector between 1980 and 2007, with productivity rising from €10 an hour in 1980 to €30 in 2007. As was the case with wood &

paper, though, the 2007 figure marks a significant one-year jump and it remains to be seen whether this was a sustainable increase in productivity or a temporary jump.

### 6.2 Modern Manufacturing

In 2007, the modern manufacturing sector accounted for 6 percent of total hours worked in the Irish economy, a similar proportion to 1980 and to 2000. The sector comprises three sub-sectors: chemicals, electronics and printing/publishing. Estimated productivity in the sector rose from €10 an hour in the early 1980s to over €100 in 2007 (Figure 14). Productivity in chemicals - and in 2007 in printing/publishing also - is subject to volatile swings, which may reflect factors unrelated to worker productivity, such as the price of particular drugs. An alternative estimate of productivity, using US rates of value added per hour, is presented. This revises down the estimated per hour productivity in modern manufacturing from €103 an hour in 2007 to €57, which has the effect of reducing average productivity in the entire manufacturing sector (modern and traditional) from €70 to €45 an hour in 2007 (Figure 15).

Figure 14: Output per hour worked in the modern manufacturing sector, selected economies, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011

#### 6.2.1 Chemicals

The chemicals and pharmaceuticals sector comprised 2.3 percent of total hours worked in the Irish economy in 2007, effectively the same proportion as in 1980 (2.5 percent) and 1990 (2.3 percent). Productivity levels in the sector rose dramatically from about €15 in 1980 to €70 in 1990 and over €200 in 2002. It has since fallen back to about €150 in 2007, but is still about twice the level seen in the USA and almost three times the levels seen in the UK and the Eurozone. Ireland is one of the world’s leading pharmaceuticals exporters and thus it is to be expected that productivity in the

sector is high, relative to other sectors of the Irish economy and to its counterparts in other countries. Nonetheless, the large swings in productivity levels in the decade to 2007 suggest that at least a proportion of the measured productivity is as a result of factors other than the effort of workers, such as the price of “blockbuster” drugs.

### 6.2.2 Electronics

The electronics and electrical equipment sector accounted for 3.3 percent of all hours worked in the Irish economy in 2007, down significantly from the 4.5 percent it comprised in 2000 but similar to the proportion it made up in both 1980 (3.5 percent) and 1990 (3.1 percent). While it has fallen in size, it remains the largest employing manufacturing industry of the seven analysed. Productivity levels in the sector have risen from less than €10 an hour in the early 1980s to €33 in 2000 and €61 in 2007. This is slightly greater than the increase seen in other economies analysed. It should be noted that the rapid rate of technological change in the sector means that tracking changes in prices is not straightforward. If countries measure technology improvements differently, thus affecting the price deflator, this will in turn affect the estimates of productivity.

### 6.2.3 Printing & Publishing

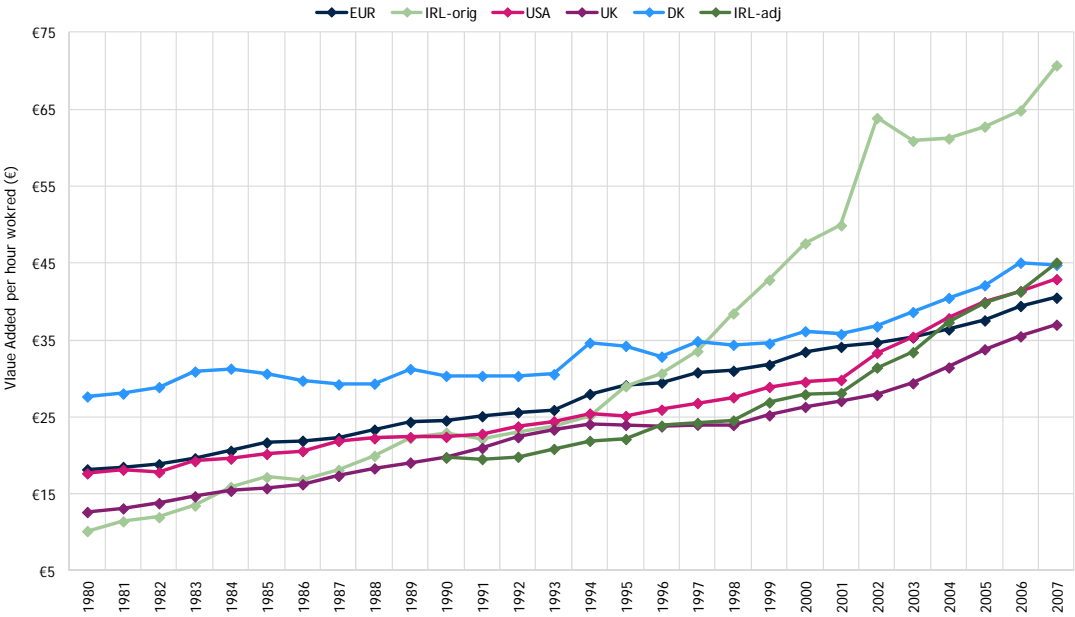
The printing and publishing sector, which includes software reproduction, accounted for 1.2 percent of hours worked in the Irish economy in 2007, similar to the proportion it comprised in 1980 and 1990. This makes it the smallest of the three modern manufacturing sectors. Productivity levels in the sector increased steadily but not dramatically from 1980 (€15 per hour) to 1996 (€29 per hour). Between 1996 and 2006, value added per hour worked jumped from €29 to €72, almost twice the level seen in other countries analysed. From 2006 to 2007, output per hour worked jumped from €72 to €126; suggesting that factors other than worker effort might affect value added statistics in this sector.

### 6.2.4 Adjusted Productivity in Modern Manufacturing

The potential for huge changes in the estimated productivity of modern manufacturing industries in Ireland from year to year highlights the importance of an alternative to the simple value added approach. GNP is often used for an alternative measure to GDP at the national level. This, however, measures income not output, and so is not appropriate for productivity related measurements. Instead, it is possible to use the rich detail contained in the EU KLEMS project’s 72-Industry database to build up the Irish economy sector by sector, replacing the observed productivity levels in the modern manufacturing sector with US productivity levels instead. This approach reflects the fact that the US is the single largest source of FDI into Ireland and these sectors are predominantly foreign-owned companies.

Undertaking this exercise for the three modern manufacturing industries yields revised productivity levels in modern manufacturing and in the manufacturing industry in Ireland as a whole. According to the revised estimates, productivity levels in modern manufacturing were €57 in 2007, rather than €103. This approach also leads to a reduced estimate of productivity levels for the overall manufacturing sector in Ireland; per hour productivity in 2007 is adjusted from above €70 per hour using the original approach to almost €45 per hour under the revised approach, and is more in line with the other economies covered (dark green line in Figure 15).

Figure 15: Output per hour worked in the manufacturing sector, with adjustments for Ireland, selected economies, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011

### 6.3 Developments in Industry Productivity since 2007

Returning again to the national data to consider productivity performance over the course of the recession, it is possible to examine changes in labour productivity in the industrial sector<sup>25</sup>. Per hour labour productivity in industry showed an estimated annual average growth rate of 5.6 percent between 2007 and 2010 (Figure 26).

<sup>25</sup> Note that the industrial sector in the national data differs from the definition of manufacturing used previously; industry includes manufacturing, electricity, gas and water supply, and mining and quarrying.

## 7. Labour Productivity in the Tradable Market Services Sector

Tradable market services accounted for 14 percent of all hours worked in the Irish economy in 2007, similar to their level in 2000 but up significantly from 8 percent in 1980. The sector comprises the tourism industry and the communications services industry, as well as two industries that are home to many MNCs - finance and computers/R&D. Figure 16 provides a breakdown of the value added within tradable services by the different sub-sectors.

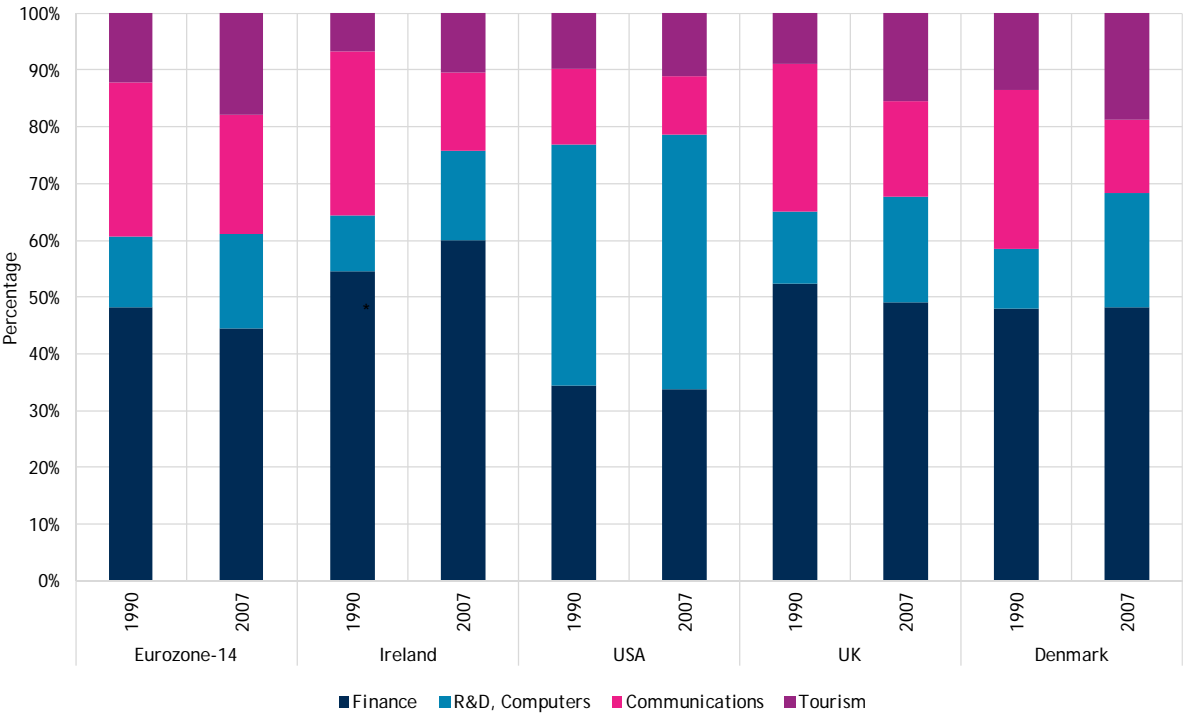
Productivity levels in the sector fell sharply in the 1980s but have risen significantly since then, from less than €25 an hour in 1990 to €55 in 2007 (Figure 17). Productivity levels in tourism are low but have increased steadily since 1993 and are in line with Eurozone and US averages. Productivity has also improved in the communications sector but remains below levels in other economies. For both finance and computers/R&D, estimated productivity (particularly in later years of the data) is well above those in other countries. Thus, an alternative estimate of overall productivity levels in tradable services is presented.

### 7.1 Adjusted Productivity in Tradable Services

Given the dominance of foreign firms in both the finance and computers/R&D industries, an adjustment similar to that made for modern manufacturing (where the Value Added of these sectors in Ireland is substituted for the US Value Added of these sectors) is applied to internationally tradable services. Figure 16 outlines the larger proportion of value added in tradable services coming from finance and R&D/computers in Ireland in 2007 (75 percent) compared to the Eurozone average (about 60 percent).

Figure 17 presents alternative estimates of per-hour productivity in internationally tradable services for Ireland (dark green line) from 1990 onwards. As a result of this approach, per hour productivity is adjusted downwards (from €55 to €40 per hour in 2007), but, still ahead of a number of economies analysed. Despite this downward adjustment, Ireland compares favourably with the Eurozone and the US averages of approximately €36 for the same year.

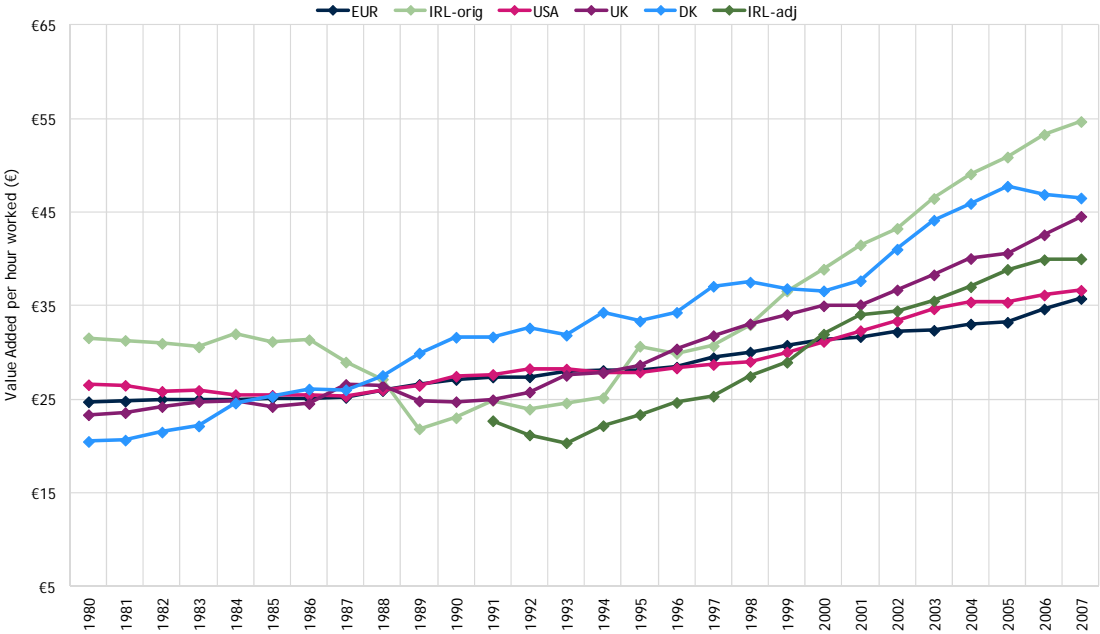
Figure 16: Proportion of value added in tradable services attributed to sub-sector, in selected economies, 1990 and 2007



Source: EU KLEMS 72-Industry Database, March 2011

There are a number of factors that may explain the upward productivity trajectory in the tradable services sector since the early 1990s. Tradable services are typically subject to greater intensity of competition relative to non-tradable sectors. Therefore firms operating in this sector have a strong motivation to make their production processes as efficient and cost effective as possible in order to protect and increase their market share in such a competitive operating environment. Furthermore, a number of market leading multinational firms in this sector are located in Ireland. The presence of market leaders will improve the sectors overall productivity levels - as market leaders are generally characterised by high productivity performance.

Figure 17: Output per hour worked in the tradable services sector, with adjustments for Ireland, selected economies, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011

### 7.2 Tourism

Tourism comprised 7 percent of total hours worked in the economy in 2007, up from 6 percent in 2000 and 3 percent in 1980. EU productivity levels in tourism fell in the early 1980s and have not changed significantly since then. The productivity performance of the sector between 1980 and 2007 can be split into two parts. Per hour productivity in the labour-intensive tourism sector halved between 1980 and 1993, from €20 an hour to €10. Between 1993 and 2007, productivity increased slowly but steadily from €10 to €17. This is in line with estimates for the Eurozone and US averages.


### 7.3 Communications

The communications services industry accounted for 1.9 percent of all hours worked in the Irish economy in 2007, similar to the proportion it contributed in both 1980 and 2000. Productivity levels in the communications services industry in many countries rose dramatically starting in the early 1990s, with the advent of mobile telecommunications. In Ireland, productivity rose from €10 in 1980 to €43 in 2000 and €46 in 2007. While it has improved considerably over the period, it has with the exception of 2000-2001 remained consistently below the Eurozone and US averages.

### 7.4 Finance

The financial services sector has grown in Ireland over the last thirty years. It accounted for 5 percent of total hours worked in the Irish economy in 2007, compared to 4 percent in 2000 and 2 percent in 1980. Productivity in the finance sector fluctuated between 1980 and 2000 but did not change significantly over that period (at €63 an hour in both years). Between 2000 and 2007, measured productivity increased to over €100 an hour. This is significantly ahead of the equivalent





measures of productivity in finance for other economies and may reflect both domestic factors, such as the huge growth in credit, and international factors, such as the growth of internationally trading financial services in Ireland, in particular Dublin's evolution into one of the major back office financial centres globally.

## 7.5 Computers and R&D

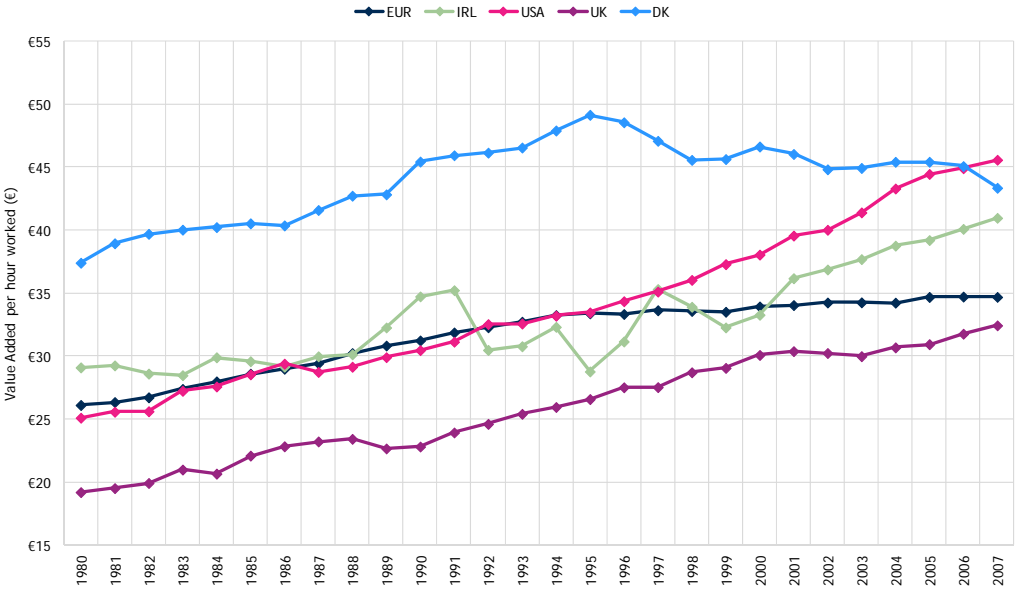
The computer services and R&D sector is a relatively small sector in employment terms but one that has grown substantially since 1980, when it accounted for just 0.3 percent of all hours worked. In 2007, it comprised 1.5 percent of all hours worked, making it bigger than three of the seven manufacturing industries covered in this analysis. Under the NACE classification used to 2007 and in this report, "computer and related activities" includes hardware and software consultancy, data processing and other data base activities, and machine maintenance, as well as other computer-related activities. Research and development can be classified as either 'natural sciences or engineering' or as 'social sciences and humanities'. It refers to value added through research facilities, rather than follow on commercial gains through for example corporate patents.

Estimated productivity in the sector declined substantially from €80 an hour in 1980 to €33 in 1995. After this, it recovered, reaching €86 an hour in 2007. At all stages apart from the 1995 figure, estimated productivity levels in Ireland are significantly above those of other countries analysed. EU and US productivity levels have remained relatively stagnant over the 1980-2007 period.

# 8. Labour Productivity in the Non-tradable Market Services Sector

Non-tradable market services comprised one third of all hours worked in the Irish economy in 2007, making it by far the largest of the seven broad sectors analysed in this report. Its size in the Irish economy has grown since 1980, when it accounted for 28 percent of total hours worked. The statistics provided below on productivity in non-tradable market services should be treated with caution, and as indicative rather than definitive. This is because the measurement of productivity in non-tradable market services is difficult, as there is no physical output to measure (as there is with merchandise), nor is there any pressure for prices to converge across countries, as the service is not internationally traded. Instead, prices in domestically traded services are subject to a force known as the Balassa-Samuelson effect. In an economy with one widget-maker and one child-minder, if the productivity of widget-making increases, generating greater earnings for that worker, this can cause inflation in the price of child-minding, as those excess earnings feed their way across the economy into non-traded sectors.

Figure 18: Output per hour worked in the non-tradable services sector, selected economies, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011

Overall productivity levels in non-tradable market services increased from €30 pre-1995 to just over €40 by 2007 (Figure 18). Measured productivity increased steadily in wholesale and retail trade, and dramatically in utilities, although in the latter it remains significantly below Eurozone and US averages. Value added per hour worked fell then rose in general & professional services and was

volatile in transport services. Physical measures of productivity for the road freight industry suggest an improvement of about 2.5 percent a year, two thirds of which is due to the use of larger vehicles<sup>26</sup>. Value added per hour worked in real estate fell over the period<sup>27</sup>.

## 8.1 Wholesale and Retail

The wholesale and retail trade is one of three large service sectors, along with public services and general services. It has maintained a steady proportion of the total hours worked in the Irish economy, 14 percent in 2007 being the same proportion as 1980. Productivity levels in the industry have increased steadily over the period 1980-2007, rising from €16 in 1980 to €30 in 1997 and €36 in 2007. Productivity performance of the wholesale and retail sector in Ireland in 2007 was above that of the US (€28) and EU average (€21).

The use of ICT in both wholesale and retail sectors has been a key driver of productivity in the sector - indeed, use of ICT has been an important contributor to the US productivity acceleration of the late 1990s<sup>28</sup>. In Ireland, the entry of new players into the retail market may also have contributed positively to productivity growth over recent years. Improvements in logistics, bar-coding etc. are also likely to have improved productivity performance.

While the wholesale and retail sector does not have a high-skill public image, the reality is that much of the employment in this sector in Ireland is quite highly skilled. While the educational attainment profile of the sector is below that for the economy as a whole, it has improved rapidly. The share of employees with higher education in the sector rose from 12 percent in 1999 to 21 percent in 2009<sup>29</sup>. This too could have had an impact upon productivity.

## 8.2 General and Professional Services

General services, including legal, professional and personal services, comprise a growing proportion of the economy. In 2007, they accounted for 17 percent of all hours worked, approximately twice the level of 1980 (8.8 percent). Estimated hourly productivity in general services fell from above €30 an hour in the 1980s to €18 an hour in 1999. After this, it rose steadily to €26 by 2007. Many professional services require sector specific qualifications, often third level or professional qualifications. As such, the average educational attainment of employees in this sector is above the national average, and may in part explain recent productivity growth. In addition, increasing exposure to competition for many previously sheltered sectors may also be driving productivity.

## 8.3 Transport Services

Transport services accounted for 4.4 percent of total hours worked in the Irish economy in 2007. This marks an increase over 1990, when the industry comprised just 3.2 percent of all hours worked. Productivity in the transport services sector has been volatile in Ireland. It rose between 1980 and 1990, reaching €45, before falling to €27 in 2001. By 2007, it had recovered to €35 an hour.

The volatility is a cause for concern. As was the case with construction (outlined in Section 4.2.1 above), it is possible to build measures of productivity that use industry-specific data. In the case of

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<sup>26</sup> Aylward, C., and O'Toole, R., Chapter 8 Productivity in the Irish Road Freight Industry, from Perspectives on Irish Productivity, Forfás, 2007

<sup>27</sup> This is subject to caveats about methodology.

<sup>28</sup> van Ark, B., Inklaar, R. and McGuckin, R.H., Changing Gear' Productivity, ICT and Service Industries: Europe and the United States, Research Memorandum GD-60 Groningen Growth and Development Centre, 2002

<sup>29</sup> EGFSN, Future Skills Needs of the Wholesale and Retail Sector, April 2010

construction it was homes built. Aylward & O'Toole also produced estimates of productivity in the Irish road freight industry. They concluded that the productivity gains which occurred within the Irish transport sector between the mid 1990's and 2003 arose as a result of (i) increases in 'carrying capacity' - the average size and capacity of goods vehicles, and (ii) improvements in 'capital efficiency' - the intensity with which vehicles are used<sup>30</sup>.

#### 8.4 Utilities

The small, capital-intensive utilities industry, which includes electricity and gas, accounted for just 0.8 percent of all hours worked in the Irish economy in 2007. This represents a contraction for the sector, which accounted for 1.2 percent of total hours worked in Ireland in 1990. Most of this adjustment happened between 1990 and 2000.

The capital-intensive nature of the utilities industry results in very high hourly rates of labour productivity. In current euro terms, productivity in the Irish utilities sector in 2007 was estimated to be €81 per hour, up from below €25 in the 1980s. Nonetheless, while the levels are high relative to other sectors of the Irish economy, they are significantly below the Eurozone average (€130) or the US average (€170). This may reflect the small size of the domestic economy - utilities typically enjoy increasing returns to scale - or other factors such as the level of investment into the sector or limited demand.

#### 8.5 Real estate

The real estate sector accounted for 1.1 percent of total hours worked in 2007, up significantly from 0.3 percent in 1980. Value added in real estate, however, includes "imputed rent" from people occupying properties they own. This has a significant effect on the estimate of hourly productivity in the sector, as it creates a false link between hours worked by those employed in the sector with value added by the large proportion of households that are owner-occupied.

Unfortunately, it is not possible to separate these two metrics. Mirroring international trends, value added in real estate in Ireland fell from above €500 per hour throughout the 1980s to an average of €350 an hour during the decade to 2007.

#### 8.6 Developments in Services Productivity since 2007

Looking at recent developments in Ireland, labour productivity in the services sector (both tradable and non-tradable) grew on average by 0.3 percent per annum between 2007 and 2010 (Figure 26). While this indicates that labour productivity levels in the services sector have remained relatively static since 2007, growth rates within the different services sub-sectors are likely to have varied significantly if previous trends have been repeated.

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<sup>30</sup> Aylward and O'Toole calculated that productivity in the industry, measured as tonne-kilometres per employee, increased by 22 percent between 1995 and 2003, or an average of 2.5 percent per year. Increases in the average size and capacity of goods vehicles accounted for 14 percent of that increase, with improvements in capital efficiency accounting for the remaining eight per cent. See Aylward, C., and O'Toole, R., Chapter 8 Productivity in the Irish Road Freight Industry, from Perspectives on Irish Productivity, Forfás, 2007

## 9. Gross Value Added Per Hour Worked in the Public Service

The figures relating to the public service in this analysis refer to the nature of the services, not necessarily their ownership. Thus significant proportions of the education and healthcare sectors may be privately owned in certain countries. In addition, the measure of value added in public services is a measure of the payments in cash and kind to employees of public services<sup>31</sup> rather than a measure of output. The results, therefore, should be interpreted with caution.

Measuring public services activity is not a straight forward exercise because the services provided are generally non-market activities and thus do not command a price. As a result, monetary output measures are difficult to develop. Ideally, productivity in this sector should be calculated by associating output by the total hours worked. The NCC's 2006 report on productivity related data on physical outputs and outcomes of various public services, to the amount of resources used<sup>32</sup>. Using that measure of productivity, the 2006 report found that the public sector performed well in an international context.

The 2006 analysis of public sector productivity was based on an international study undertaken by the Netherlands Institute for Social Research using OECD data from 2004. An update of this report is expected later in the year, and this will shed further light on this issue. The reductions in public sector staffing which have occurred since 2008 can be expected to have impacted positively on productivity growth (provided that the output of the public sector has not fallen by proportionately more).

In 2007, public services accounted for 19 percent of hours worked in the Irish economy, up from 16 percent in 2000 and 1980. Value added per hour worked, in the Irish public service was €33 in 2007; this was above the productivity levels of the EU (€30) and the US (€28) (Figure 19). A notable trend in this data is the downward shift since 1995, following a period of rapid productivity growth 1987-1991. The OECD Economic Review of Ireland 2011 made a number of suggestions to improve public sector efficiency. Implementation of these recommendations would improve the productivity performance of the public sector<sup>33</sup>.

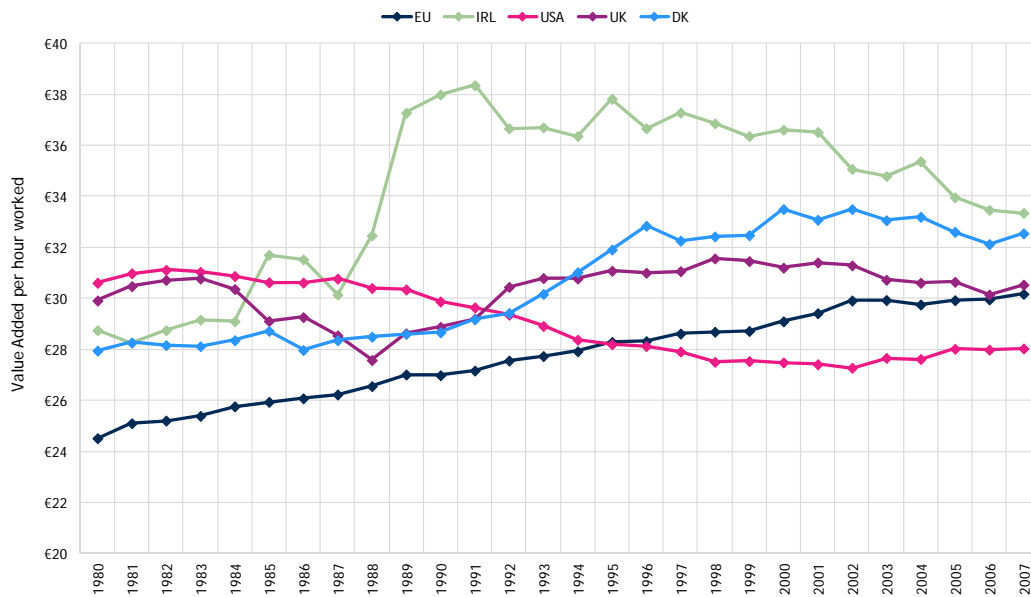
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<sup>31</sup> The Value Added for this sector includes payments in cash and kind to employees of the central government and local government who are engaged in administrative or regulatory activities, including those in the administrative departments and offices of government, the army and Gardai and diplomatic and consular officials abroad. CSO, National Income and Expenditure 2010

<sup>32</sup> National Competitiveness Council, Overview of Ireland's Productivity Performance 1980-2005, Forfás, 2006

<sup>33</sup> OECD, Economic Review of Ireland, 2011

Figure 19: Gross Value added per hour worked in public services, selected economies, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011

‘Value added’ in the public service reflects payment to factor services by the government, rather than a market price capturing benefits to final users. In addition, public services provided are often non-market activities and thus do not command a price, so monetary output measures are difficult to develop. Productivity levels for the public services should, therefore, be interpreted with caution.

### 9.1 Developments in Gross Value Added Per Hour Worked in the Public Services since 2007

Using CSO Irish-only data, gross value added per hour worked in the public services declined by an estimated average of -0.5 percent per annum between 2007 and 2010. However as stated, this must be interpreted with caution. In addition, the decline in hours worked resulting from incentivised retirements in 2011 and 2012 are not captured in this data.

## 10. Overview of Ireland's Capital Productivity Performance since 1980

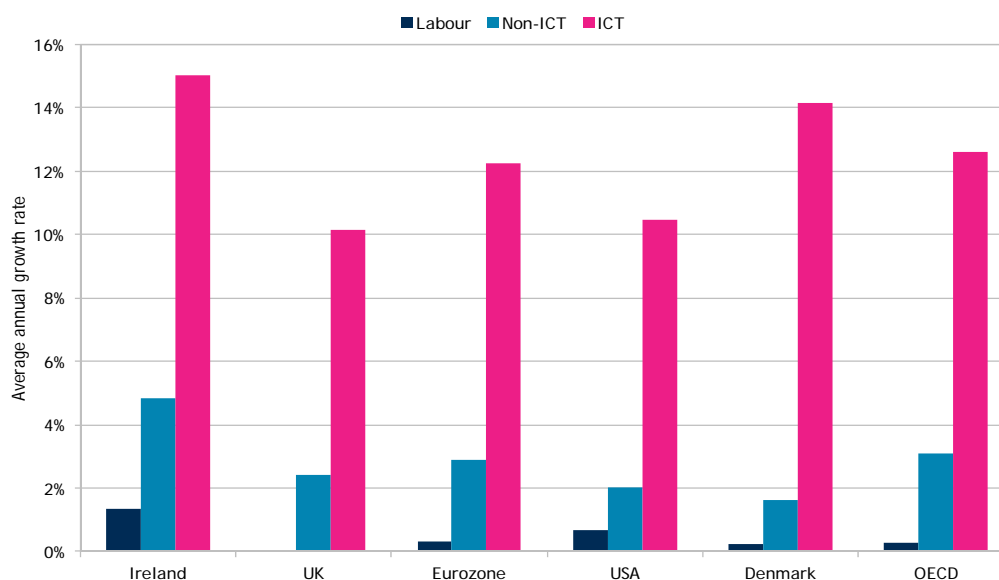
### 10.1 Overview

Productivity measures output per unit of input. There are a number of inputs to the production process aside from labour, such as ICT capital, and non-ICT capital. Therefore it is worth examining other drivers of national output.

Before examining changes to Ireland's capital productivity since 1980, it is important to firstly consider the growth in the stock of all inputs to the economy (Figure 20). In addition to growth in labour stock (as measured by the growth in total hours worked, as per Chapter 2), the growth of two additional inputs are considered; non-ICT related capital and ICT capital.

- Non-ICT capital services refer to three broad categories of assets: transport equipment; plant and machinery; and buildings and other structures.
- ICT capital refers to three types of assets; computer hardware and equipment; telecommunication equipment; and computer software and services.

Figure 20: Average annual growth rates of stocks<sup>34</sup> of inputs, selected economies, 1990-2011



Source: Conference Board Total Economy Database, January 2012

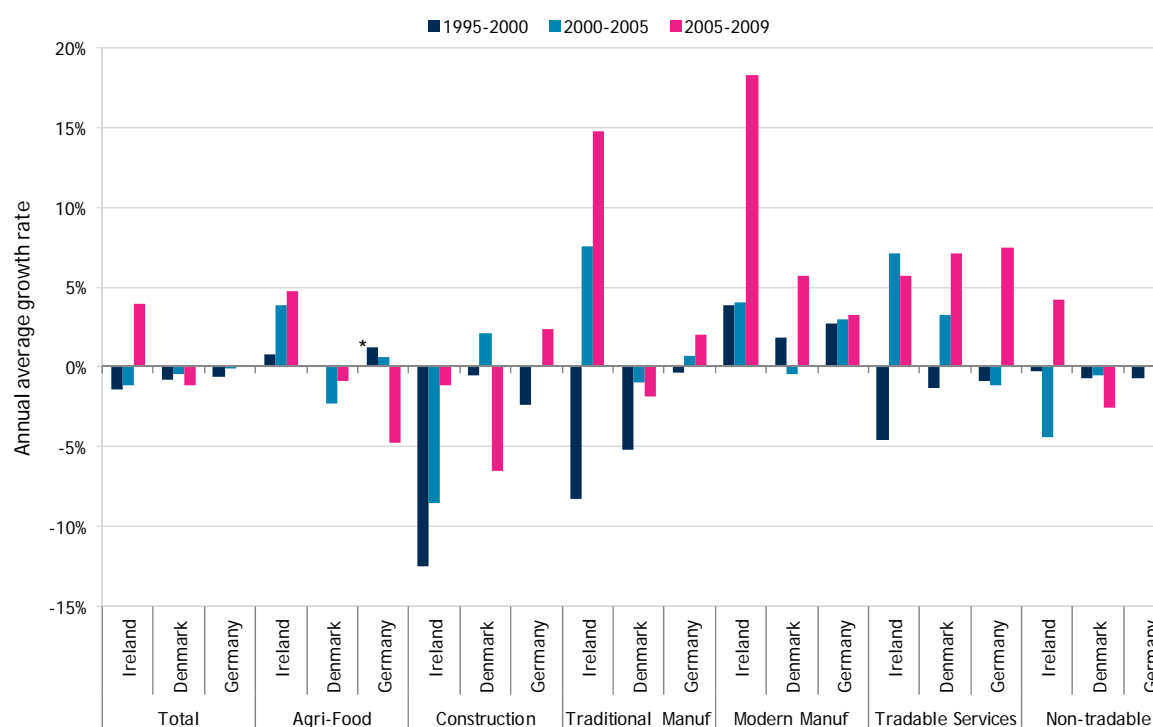
Figure 21 highlighted that the stock of capital, in particular ICT capital, has grown significantly faster than stock of labour since the 1990s. This trend is mirrored across the other countries examined. The scale of the growth rates particularly from ICT capital indicate that during the 1990-2011 period, the production process incorporated a significant amount of capital.

<sup>34</sup> The stock of labour refers to the total hours worked in the economy. In terms of non-ICT and ICT capital, the growth in the stock refer to the total amount in value terms of capital at work in an economy, the best estimate available of the total capital at work in an economy. The numbers shown are the best available counterpart to "total hours worked" for labour.

## 10.2 Changes to Ireland's Long Run Capital Productivity Performance

The direct measurement of the productivity of capital is not a straightforward exercise. In addition to the issues outlined in Chapter 1, there is the additional complication that while workers are easily countable, capital is more difficult<sup>35</sup>. Nonetheless, there are useful OECD statistics available on the real consumption of fixed capital<sup>36</sup>; these are broken down by sector and by year. This provides an estimate of the total stock of capital in each sector. By relating real value added (VA) to the real consumption of fixed capital (CFC), it is possible to estimate the change in productivity of capital by sector (i.e. the VA-to-CFC ratio).

Figure 21: Average annual growth rates in capital productivity, selected economies, 1995-2009



Source: OECD STAN Database, 2011

Figure 21 presents the annual average growth rates in capital productivity (the VA-to-CFC ratio) for Ireland, Denmark and Germany (as a proxy for the Eurozone), for the economy as a whole and for six broad sectors of the economy. Between 1995 and 2005, capital productivity levels fluctuated in Ireland (from €9.60 in 1995, €8.90 in 2000, €8.40 in 2005 and €9.80 in 2009). Therefore examining

<sup>35</sup> While there are estimates of the worth of capital assets, these are not always comparable across sectors, countries or time, with for example different treatments of depreciation and even some countries treating certain services as capital assets while other treat them as consumption goods.

<sup>36</sup> The consumption of fixed capital (CFC) becomes available in the calculation of the stock of fixed assets in *net* and *gross* terms. CFC reflects the decline in the value of the fixed assets of enterprises, governments and owners of dwellings in the household sector within an accounting period. Consumption of fixed capital assigns a current value to fixed assets used up in production within the accounting period. Unlike "depreciation" in business accounting, CFC in national accounts is not a method for allocating the costs of past expenditures on fixed assets over subsequent accounting periods. Rather, it is the decline in the future benefits of the assets due to their use in the production process. United Nations, National Accounts: A Practical Introduction, Series F, No.85; CSO, Estimates of the Capital Stock of Fixed Assets 2008, 2010. Data is sourced from the OECD, Structural Analysis Database



the growth rates in capital productivity over a time series provides additional detail of Ireland's capital productivity performance.

A number of trends emerge from this exercise:

- In the earlier period (1995-2000), capital productivity fell across the countries benchmarked. The fall was sharper in Ireland (-1.4 percent) than in Denmark (-0.8 percent) and Germany (-0.7 percent).
- Between 2000-2005, while national capital productivity growth in Ireland was still negative, a number of sectors made strong progress:
  - Capital productivity in traditional manufacturing and tradable services recovered strongly. Productivity in the agri-food sector continued to grow. However, this was offset by significant fall in productivity in the large non-traded services sector. Capital productivity in the growing construction sector continued to fall but at a lower rate. Construction - perhaps due to its capital intensive nature - is associated in many instances with rapidly declining capital productivity.
- In the latest period (2005-2009), Ireland recorded a strong increase in capital productivity (3.9 percent), while it remained static in Germany (0.1 percent) and declined in Denmark (-1.1 percent).
  - This was driven by significant increases in capital productivity in traditional and modern manufacturing. This is particularly noteworthy, given the experiences of Germany and Denmark over the same period, where capital productivity in these sectors experienced much lower or negative growth rates.
  - In terms of traditional manufacturing, these trends suggest that while the sector has shrunk relative to the economy as a whole, the remaining firms use their capital more efficiently.
  - In contrast to earlier periods, non-tradable services recorded a strong increase in capital productivity.

After examining growth in capital productivity, it is necessary to determine whether increases in the stock of capital or increases in capital productivity contributed to output. Over the 1995-2005 period, national capital productivity growth declined. In the same period the stock of capital increased significantly. Therefore, the contribution of capital to economic growth was driven more by increases in the quantity of capital in Ireland than increases in the productivity of that capital. Significant sectoral differences of capital productivity exist, however, and they indicate that high stocks of ICT capital (in modern manufacturing and in tradable services) were associated with significant gains in capital productivity.

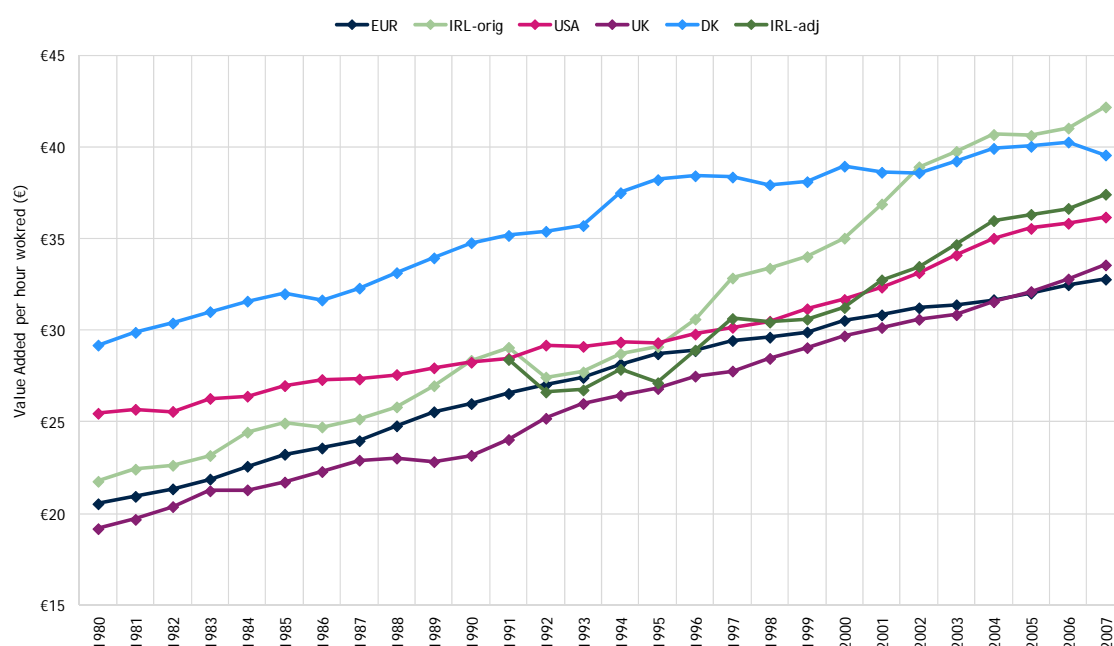
Over the 2005-2009 period economy-wide capital productivity in Ireland rebounded and experienced strong growth. Therefore evidence suggests that since 2005 capital productivity levels have contributed positively to output, in addition to a continued positive contribution from the growth the stock of capital.

## 11. Conclusions

### 11.1 Alternative Estimates of Irish Productivity

As outlined in preceding chapters, certain sectors of the Irish economy are dominated by overseas owned multinationals and have very high levels of value added per hour worked. Alternative estimates of hourly productivity in the overall manufacturing sector and in tradable services - using US rates - were presented in those sections. These can be combined with existing estimates of value added per hour worked in the remaining sectors to build up an adjusted economy-wide estimate of hourly productivity in Ireland, from 1990 to 2007. This is presented in Figure 22.

Figure 22: Hourly labour productivity, with adjustments for Ireland, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011

Adjusted Irish productivity levels are presented from 1990 onwards. By 2000, the differential between adjusted and unadjusted productivity levels had stabilised between €3- €4 per hour worked. Whereas the original figures suggest that per-hour productivity in Ireland was €35 in 2000 and €43.50 in 2007, the adjusted figures suggest productivity was closer to €31.25 in 2000 and €37.40 in 2007. The hourly adjusted productivity estimates still suggest that Ireland has made significant progress since 1980.

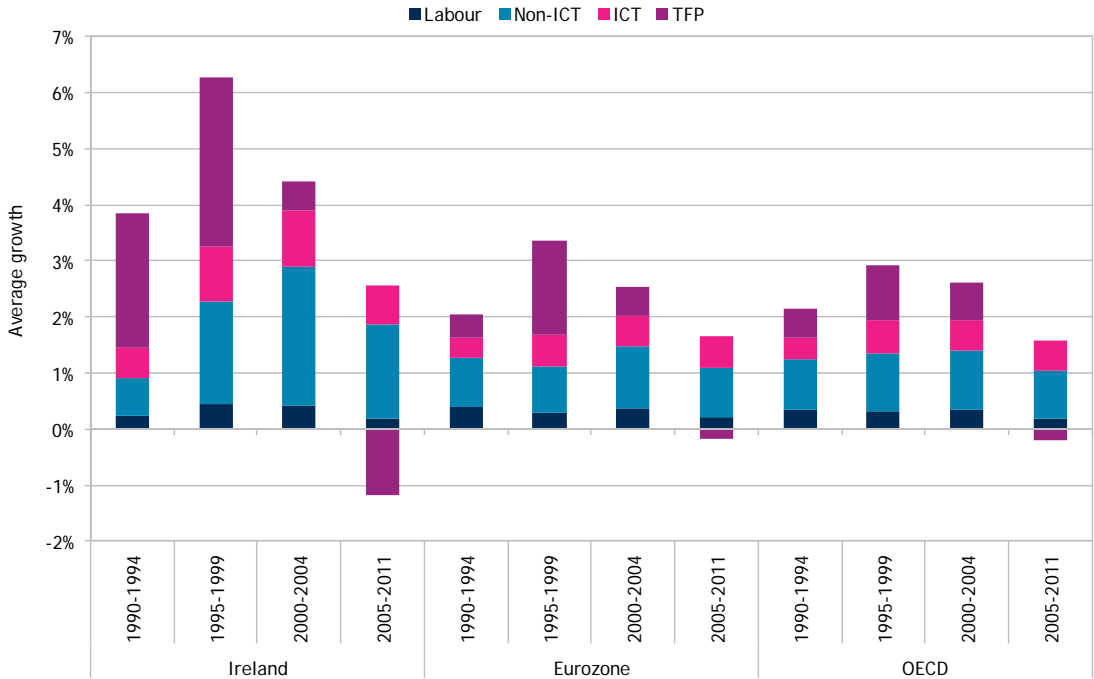
### 11.2 Which Factors Contributed Most to Growth?

Having examined labour and capital productivity separately, it is necessary to bring this analysis together to identify the factors which have driven economic growth in Ireland over recent decades.

The Conference Board calculate the relative contribution of different factors to GDP growth namely; labour composition (which measures hours worked adjusted for skills composition)<sup>37</sup>, non-ICT capital, and ICT capital<sup>38</sup>. In addition, estimates for total factor productivity are calculated. Total factor productivity (TFP) growth is often attributed to technological change in a broad sense, i.e. improvements in efficiency in an economy, possibly due to changes in regulation (e.g., competition policy), monetary policy or economic institutions<sup>39</sup>.

Figure 23 outlines the average economic growth rates in Ireland, the Eurozone and the OECD over the period 1990-2011, attributed to these four broad categories of inputs. The high growth rates enjoyed by Ireland during the period 1995-1999 cannot explicitly be attributed to any of the measurable inputs of the economy, labour, ICT capital or non-ICT capital. Instead, nearly half the growth in the 1995-1999 period is attributed to TFP. Between 2005 and 2011, non-ICT capital has had the greatest impact on growth (accounting for 1.67 percent of growth), followed by ICT capital (0.72%) and labour (0.18%). TFP had a negative impact on economic growth over the 2005-2011 period (-1.18%).

Figure 23: GDP growth by source input, Ireland, the Eurozone and OECD average, 1990-2011



Source: Conference Board Total Economy Database, January 2012

For capital to continue to contribute to economic growth, firms must continue to invest to remain competitive. Availability of funding will be paramount in this regard. In addition, given that a large

<sup>37</sup> Labour composition is calculated through adjusting employment for the quality of labour by applying a weighting for different skill-level groupings in the labour force as well as changing employment rates.  
<sup>38</sup> In relation to non-ICT and ICT capital assets, what is included in the Total Economy Database figures is the change in the flow of productive services provided by these assets.  
<sup>39</sup> Chen, V. et al., Recent Productivity Development in the World Economy: An Overview from The Conference Board Total Economy Database, 2010. TFP has is also understood as including a measurement error (i.e. the inability of statisticians and economists to measure precisely the contribution of all other inputs).

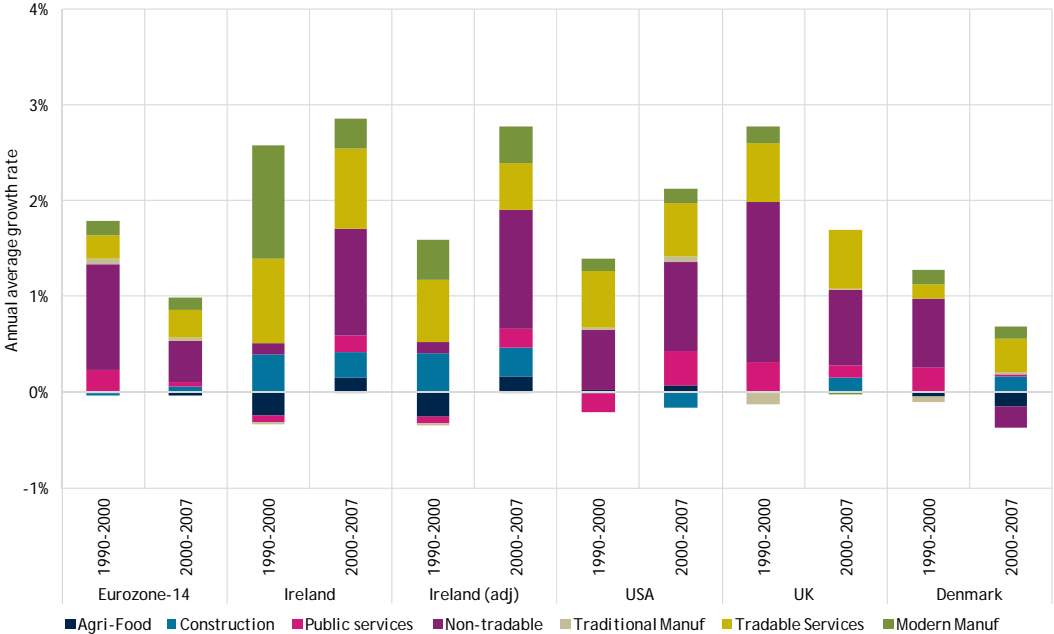
proportion of output is driven by ICT capital, access to high quality broadband offers further potential to improve economic growth.

Finally, TFP has negatively contributed to economic growth over the 2005-2011 period. In response, the efficiency of the operating environment for enterprise needs to improve. This includes improving the efficiency of the public sector (as the largest sector in the economy in employment terms). Firms themselves have a role to play also. It will be important for firms to continue to innovate and examine methods to improve the efficiency of their production processes.

### 11.3 Sectoral Sources of Labour Productivity Growth

Figure 24 outlines the contribution made by each of the seven broad sectors to the increase in hourly productivity in two periods, 1990-2000 and 2000-2007, for the five economies analysed. The figures for each economy represent the average annual growth rate in productivity over the period in question. There are two features worth noting in this chart.

Figure 24: Average annual growth rate in labour productivity, attributed to sectors, selected economies, 1990-2007



Source: EU KLEMS 72-Industry Database, March 2011

- The first is that due to their large and increasing size relative to the overall economy, non-tradable services typically constitute the bulk of productivity gains for the Eurozone, the USA and the UK.
- Secondly, in Ireland, over the 1990-2000 period, the bulk of productivity growth came from the modern manufacturing and tradable services sectors<sup>40</sup>. Since 2000, a larger number of sectors

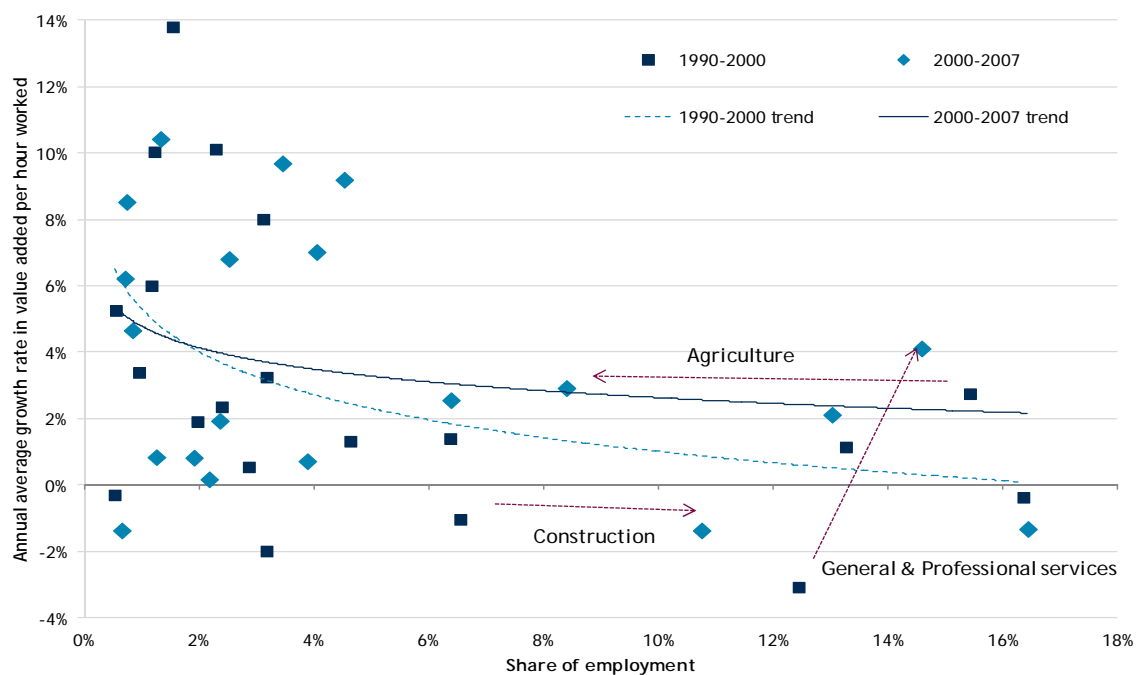
<sup>40</sup> These two sectors, which account for about one fifth of hours worked constituted 1.5-2 percent of the 2 -3.5 percent per-annum annual productivity growth in the period covered.

are contributing to productivity growth. This signifies that Ireland's productivity base is widening.

## 11.4 Base of Ireland's Productivity Growth

The Council's 2006 report highlighted that Ireland's high rates of productivity growth had a relatively narrow base: a number of smaller exporting sectors enjoyed higher growth than larger labour intensive domestic sectors. There is some evidence that the base of productivity growth widened in the period 2000-2007 compared to 1990-2000. Figure 24 alluded to this and Figure 25 below provides further evidence.

Figure 25: Productivity growth by size of sector, 1990-2007



Source: EU KLEMS 72-Industry Database, March 2011

Figure 25 maps the annual average growth in labour productivity for each sector by its share of total employment within the economy. This allows us to examine productivity growth by the size of the sector.

As can be seen (by the cluster of data points on the left of the chart), in both periods the largest average productivity growth was seen in some of the smallest sectors. This includes chemicals, publishing and communications. Meanwhile larger sectors, in employment terms, typically saw average productivity growth of less than 2 percent (the data points on the right hand side of the chart). However, the flatter trend line for the later period indicates that the base of Ireland's productivity growth was wider 2000-2007 than 1990-2000.

In the later period, the fastest rates of productivity growth enjoyed were typically less than during the 1990s. There is evidence that non-tradable sectors enjoyed greater productivity growth. The

change in trend in general and professional and personal services from -2.5 percent to +4 percent is particularly striking<sup>41</sup>. It will be important that Ireland continues to widen its productivity base, particularly in low productivity sectors through up-skilling workers in those sectors, increasing innovation and competition.

#### **Box 2- Why is Denmark so Productive?**

Denmark consistently performs well across most measures of productivity (as well as across many other competitiveness metrics) - although a recent OECD study suggests productivity growth is slowing and highlights a range of policy responses required to boost growth. Not surprisingly and not dissimilarly from our own situation, the OECD has recommended moves to increase competition in a number of sheltered sectors (e.g. pharmacies, taxis and public transportation), to strengthen the fiscal framework and to improve the outcomes achieved through social expenditures. While policy measures are not always transferable across borders, it is worth considering in brief some of the factors that underpin such a strong performance, particularly as Denmark, like Ireland is a small open economy and a member of the EU.

In part, Denmark's productivity performance has been shaped by its geographic situation. The dearth of raw materials (prior to the discovery of oil and natural gas in the 1970s), meant that Denmark's industries developed as secondary production and processing concerns, usually specializing in traditional fields, often with a high-tech or design focus (i.e. high value added).

However, there is more at play than mere geographic happenstance. The Danish social model is a hybridised form of the Scandinavian social model incorporating social democratic and liberal elements. Denmark practices a decentralized form of corporatism which facilitates highly inclusive, consensus driven policy-making. Another element of this distinctive social model includes the flexicurity system, which helps the economy to adjust to shocks while limiting the social cost of unemployment and the risk that it becomes entrenched.

Similarly, a long standing commitment to education - universal compulsory schooling was introduced in the early 1800s - provides a stream of high skilled workers. Additionally involvement of unions and industry in the formation of curricula at second level has contributed to the development of a highly flexible and adaptable education system.

At third level, Denmark was an early mover, adopting a networked approach to building up R&D capabilities. Due to its traditionally large and varied SME sector, the centralised approach to innovation policy was unsuitable. In response, Denmark delegated autonomy to Universities in the 1990s to build research links with domestic industry. This was aligned with a geographic distribution of industries to incubate sectoral clusters, maximizing technological agglomeration effects.

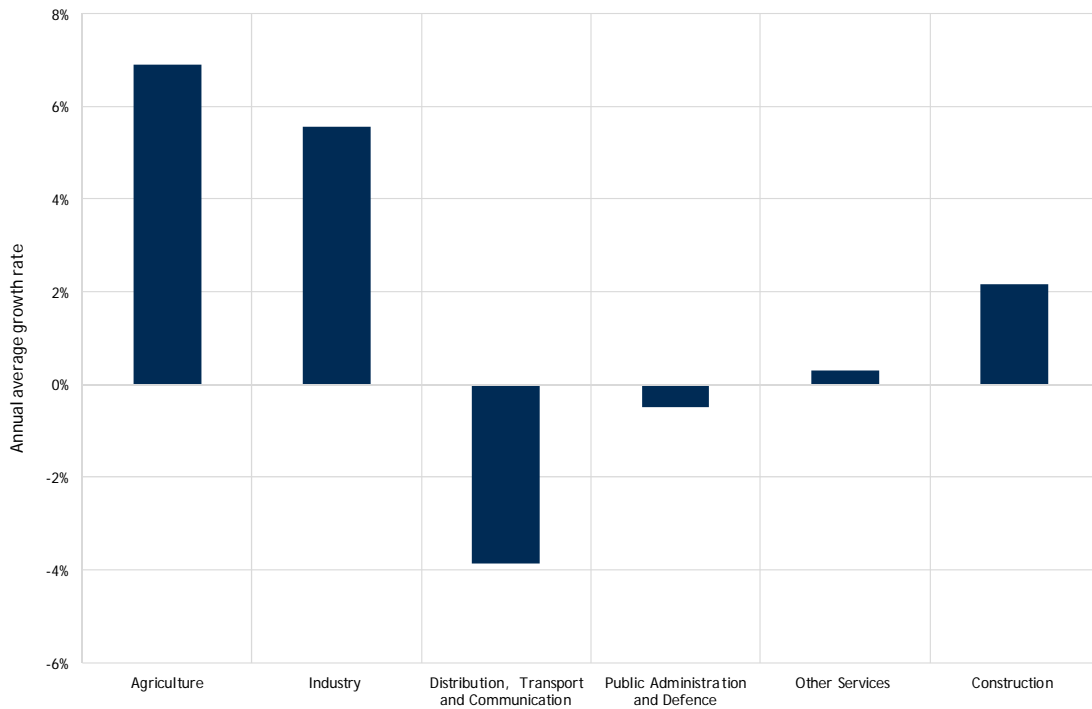
The economy features a high-tech agricultural sector - which in many instances is closely integrated with the industrial sector, state-of-the-art industry with world-leading firms in pharmaceuticals, maritime shipping and renewable energy. These sectors are supported by a decisively pro-enterprise regulatory regime and Denmark is considered extremely open to global trade and investment. Denmark also benefits from high degrees of business freedom, investment freedom, and financial freedom. The overall regulatory environment, transparent and efficient, encourages entrepreneurial activity.

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<sup>41</sup> Bearing in mind that value added does not always reflect or capture the full extent of changes in productivity in non-traded parts of the economy

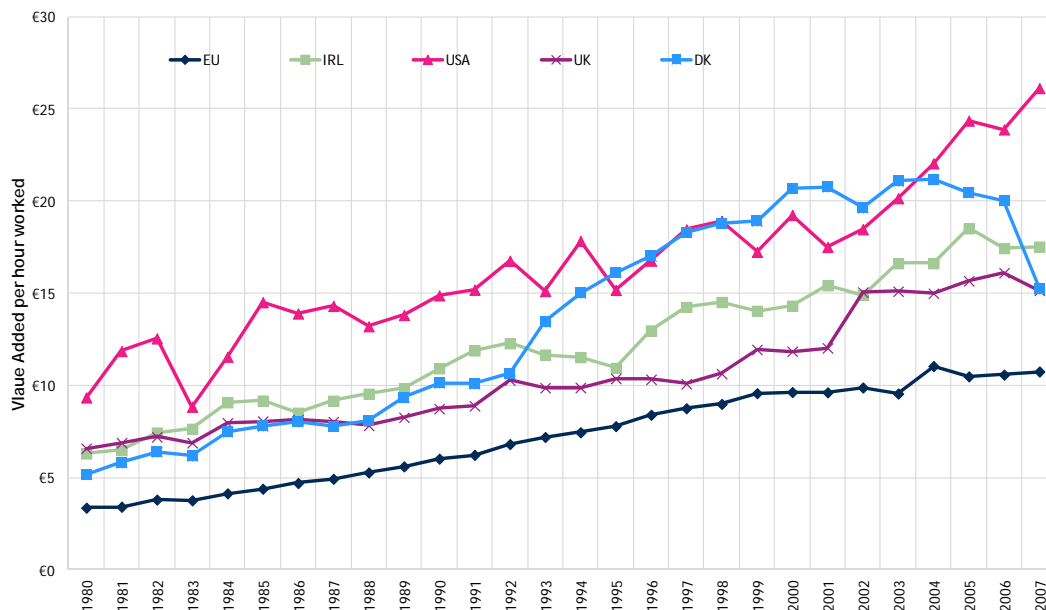
## Annex 1- Detailed Sectoral Breakdown

Figure 26: Annual average growth rates in per hour labour productivity across sectors, 2007-2010



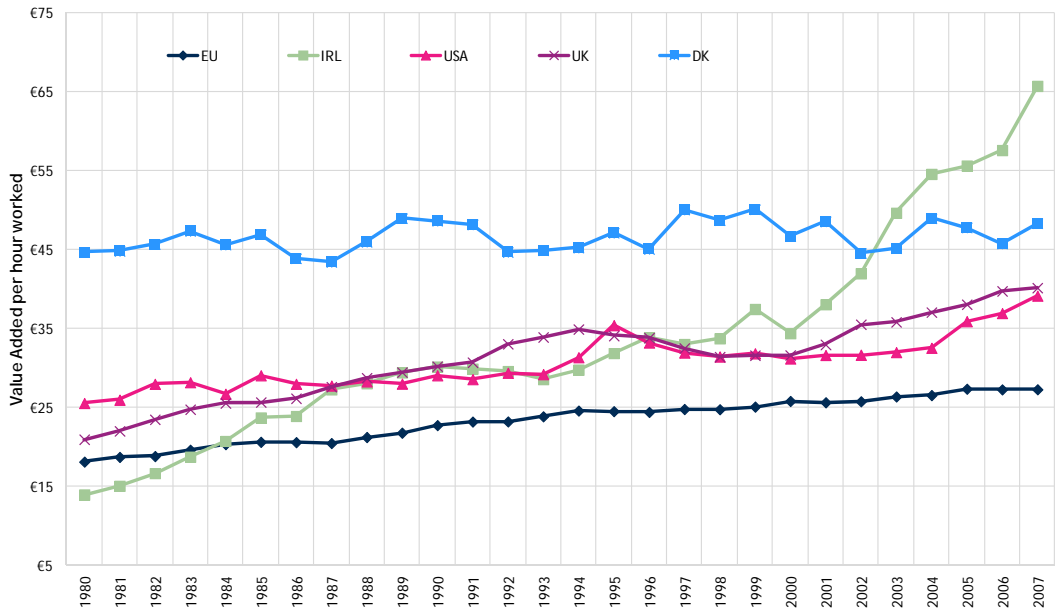
Source: CSO, National Accounts, Quarterly National Household Survey, EU KLEMS 72-Industry Database, March 2011

Figure 27: Value added per hour worked in agriculture, selected economies, 1980-2007



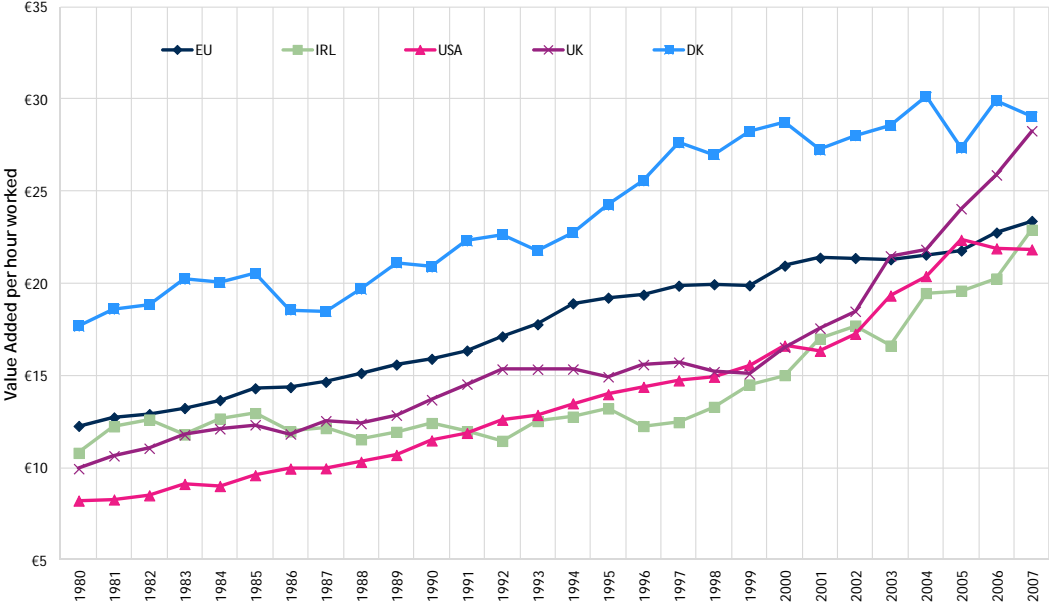
Source: EU KLEMS 72-Industry Database, March 2011

Figure 28: Value added per hour worked in food and drink processing (including tobacco), selected economies, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011

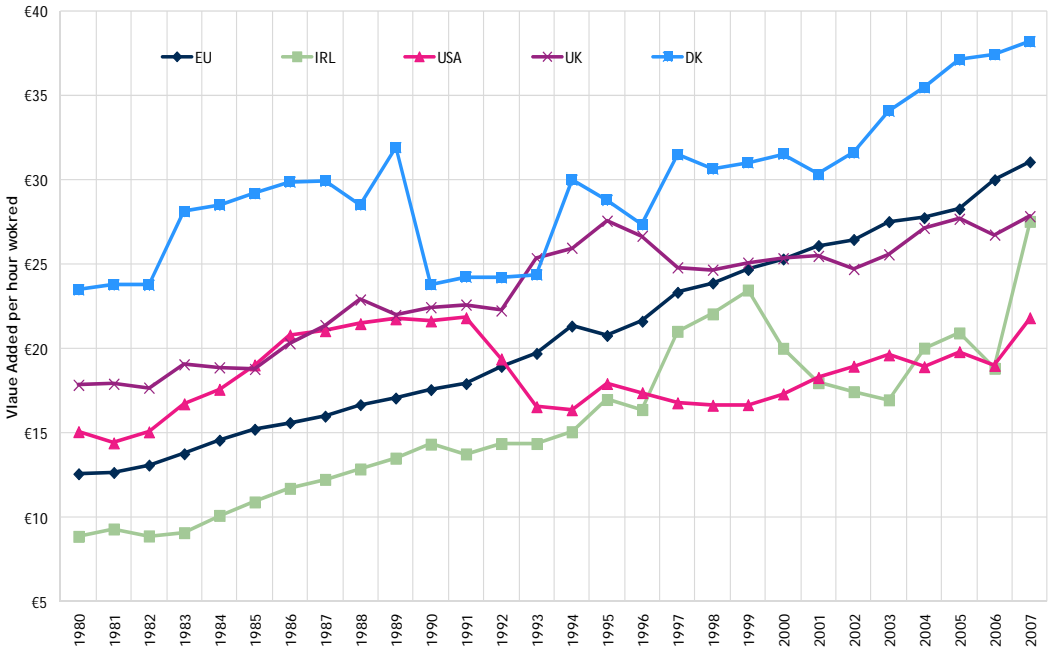
Figure 29: Value added per hour worked in textiles and clothing, selected economies, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011

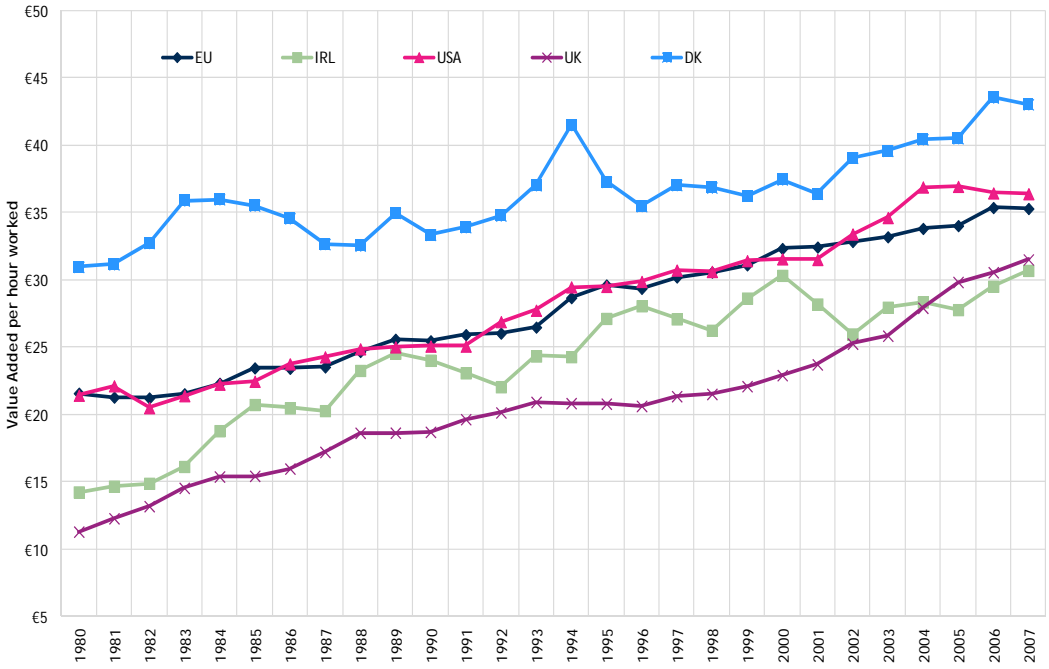


Figure 30: Value added per hour worked in wood and paper products, selected economies, 1980-2007



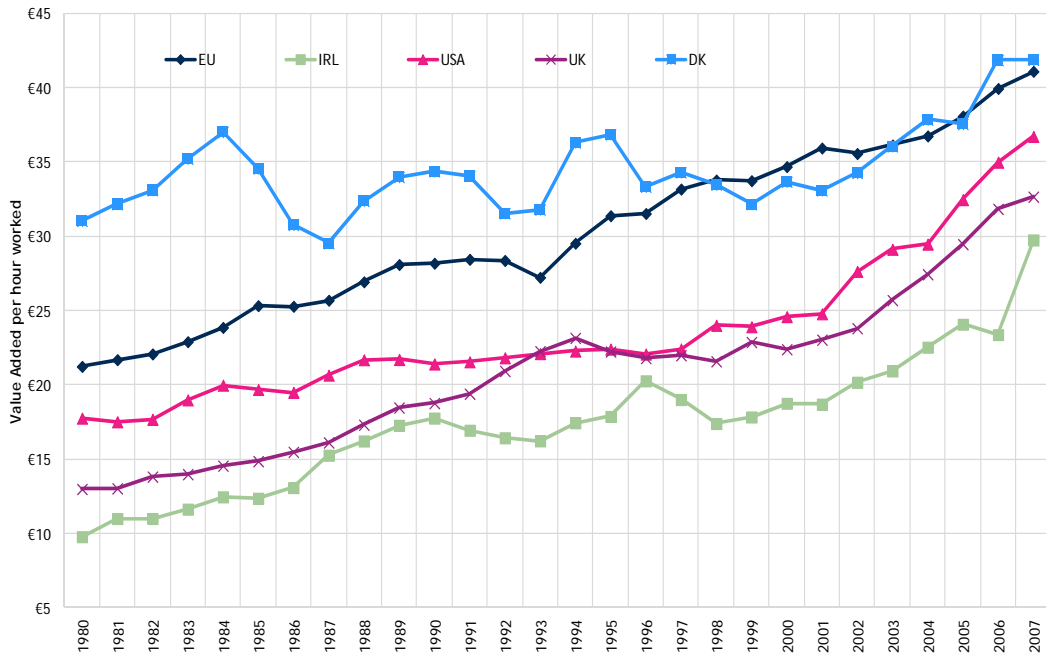
Source: EU KLEMS 72-Industry Database, March 2011

Figure 31: Value added per hour worked in materials and minerals manufacturing, selected economies, 1980-2007



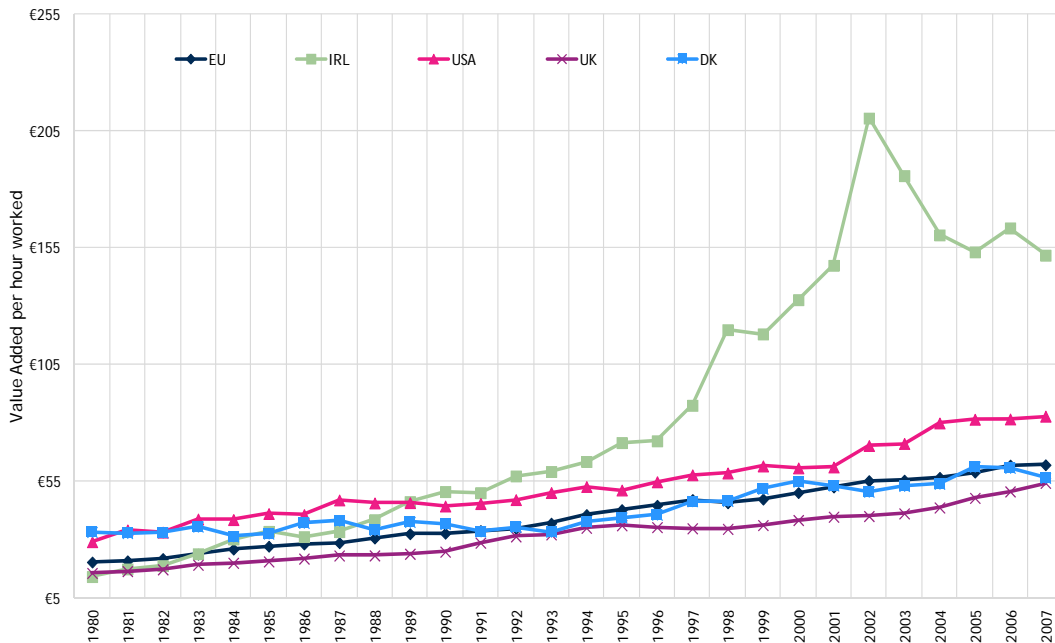
Source: EU KLEMS 72-Industry Database, March 2011

Figure 32: Value added per hour worked in transport, furniture and other merchandise, selected economies, 1980-2007



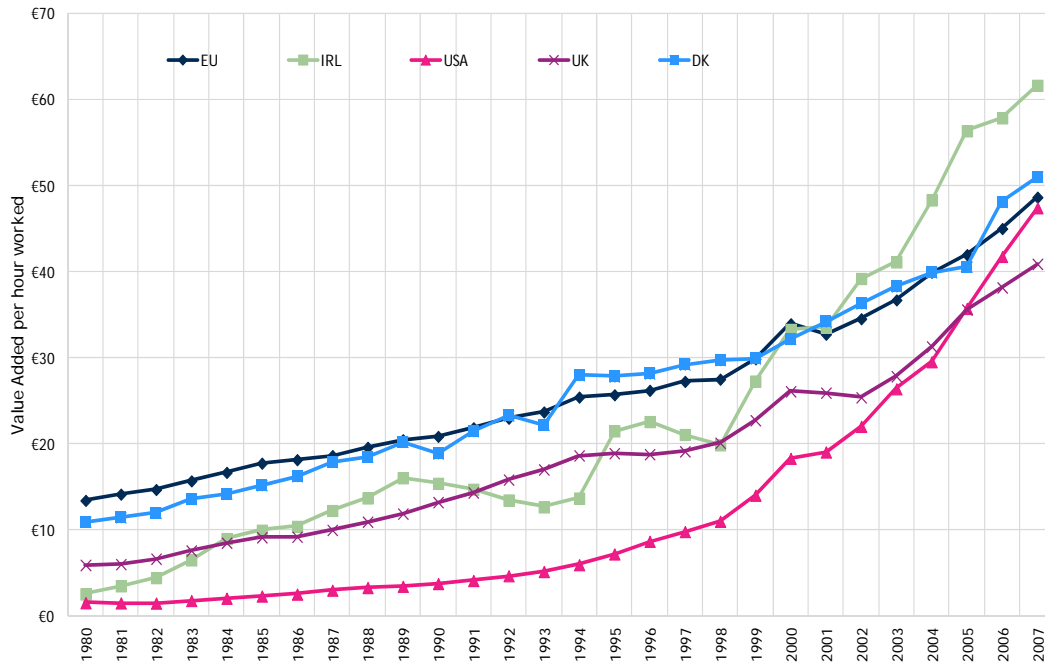
Source: EU KLEMS 72-Industry Database, March 2011

Figure 33: Value added per hour worked in chemicals including pharmaceuticals, selected economies, 1980-2007



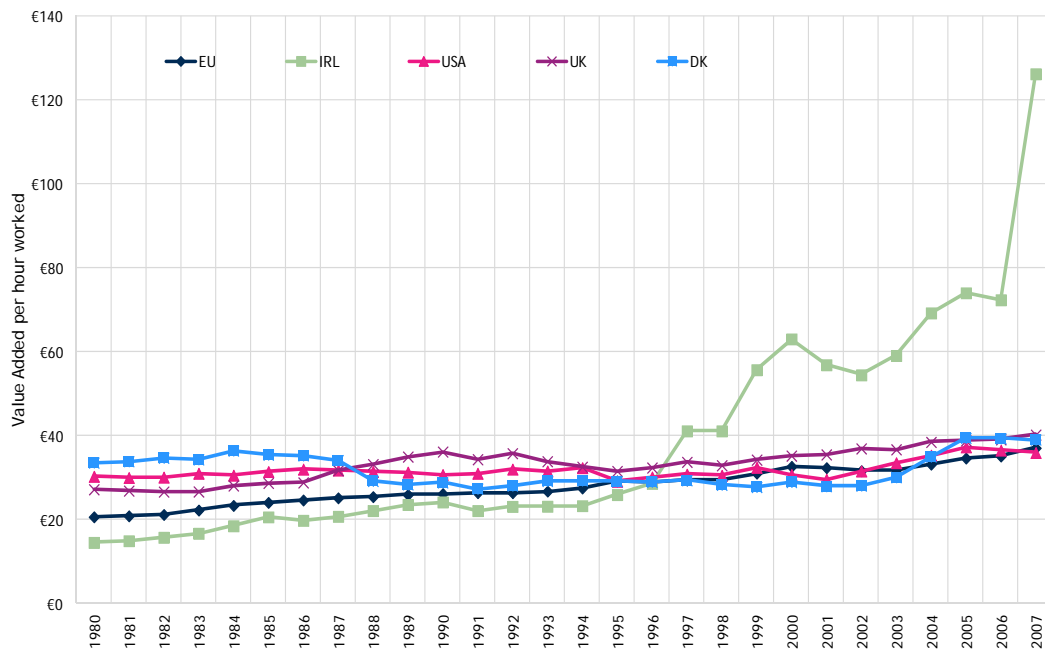
Source: EU KLEMS 72-Industry Database, March 2011

Figure 34: Value added per hour worked in electronics including ICT equipment, selected economies, 1980-2007



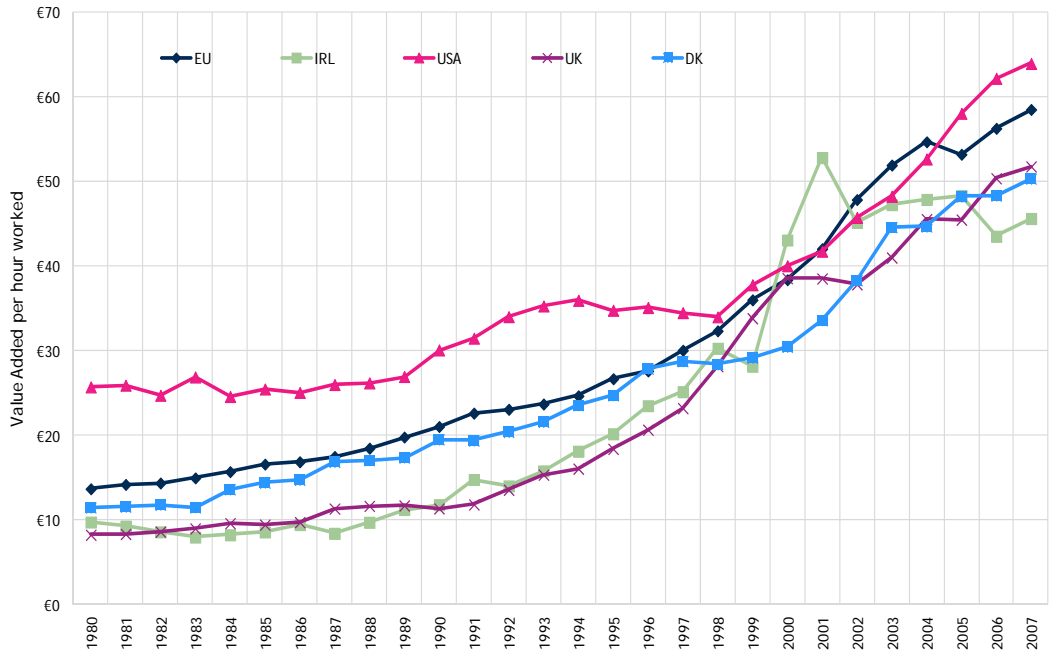
Source: EU KLEMS 72-Industry Database, March 2011

Figure 35: Value added per hour worked in printing and publishing (including software reproduction), selected economies, 1980-2007



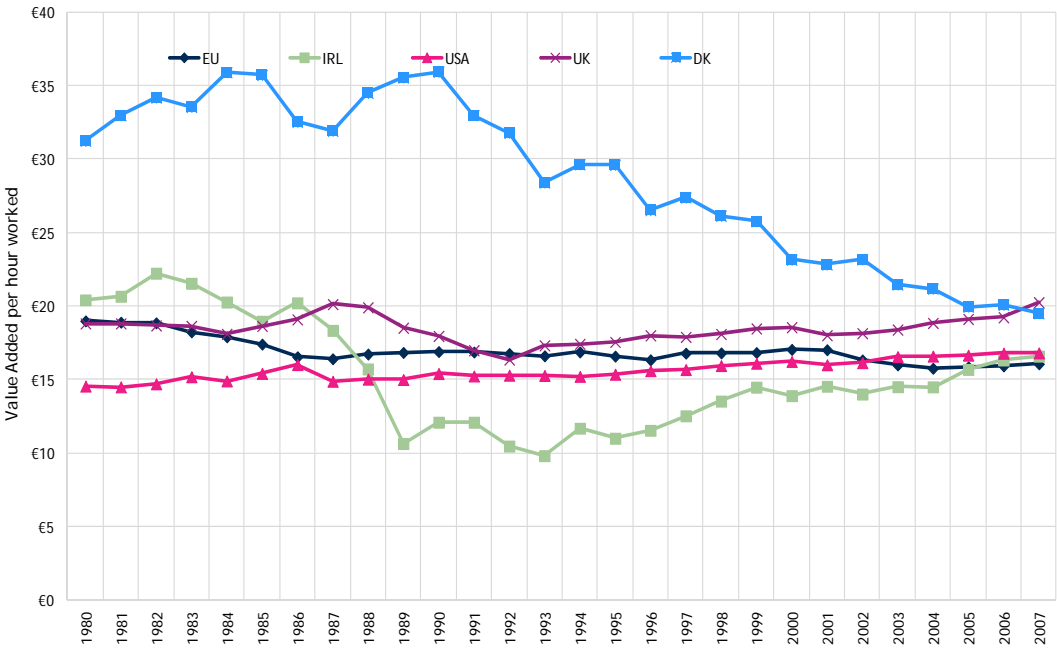
Source: EU KLEMS 72-Industry Database, March 2011

Figure 36: Value added per hour worked in communications services, selected economies, 1980-2007  
 Source: EU KLEMS 72-Industry Database, March 2011



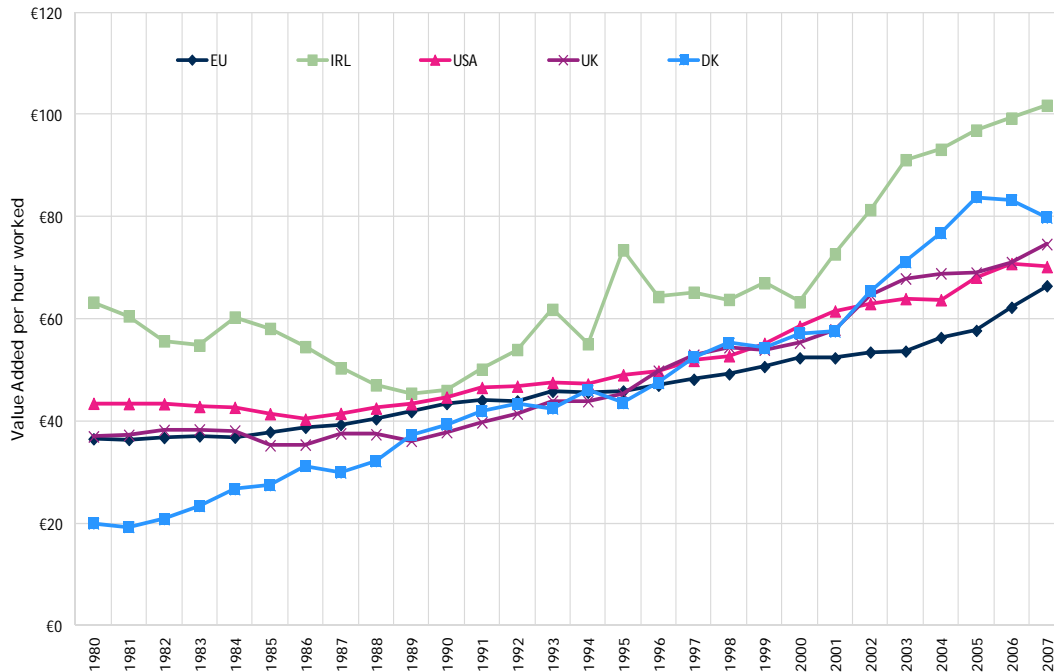
Source: EU KLEMS 72-Industry Database, March 2011

Figure 37: Value added per hour worked in hotels and catering services, selected economies, 1980-2007



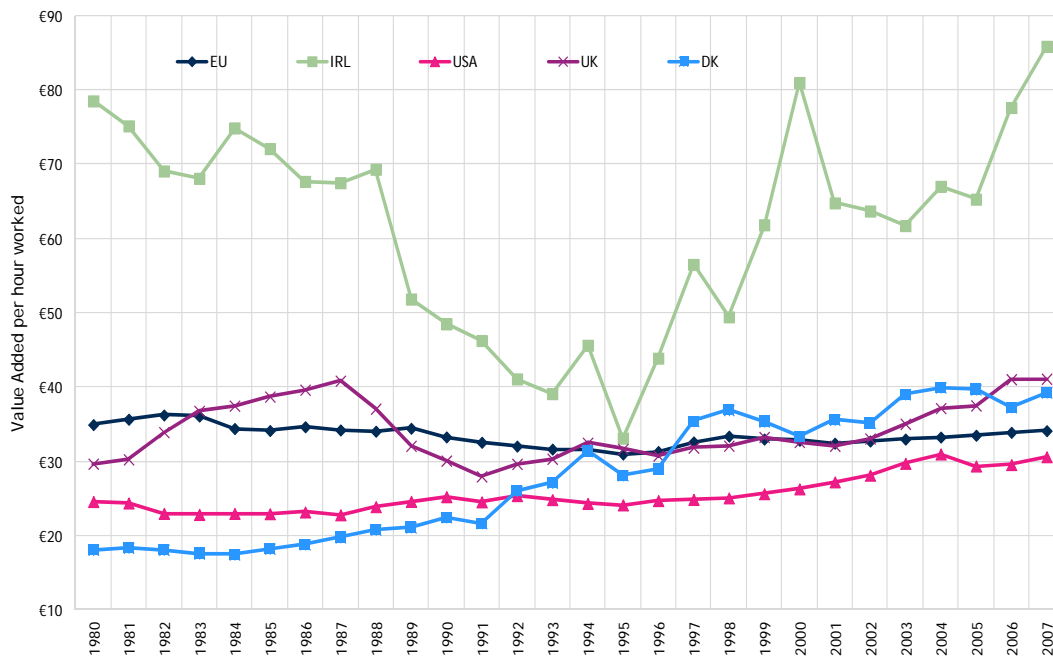
Source: EU KLEMS 72-Industry Database, March 2011

Figure 38: Value added per hour worked in financial services, selected economies, 1980-2007  
 Source: EU KLEMS 72-Industry Database, March 2011



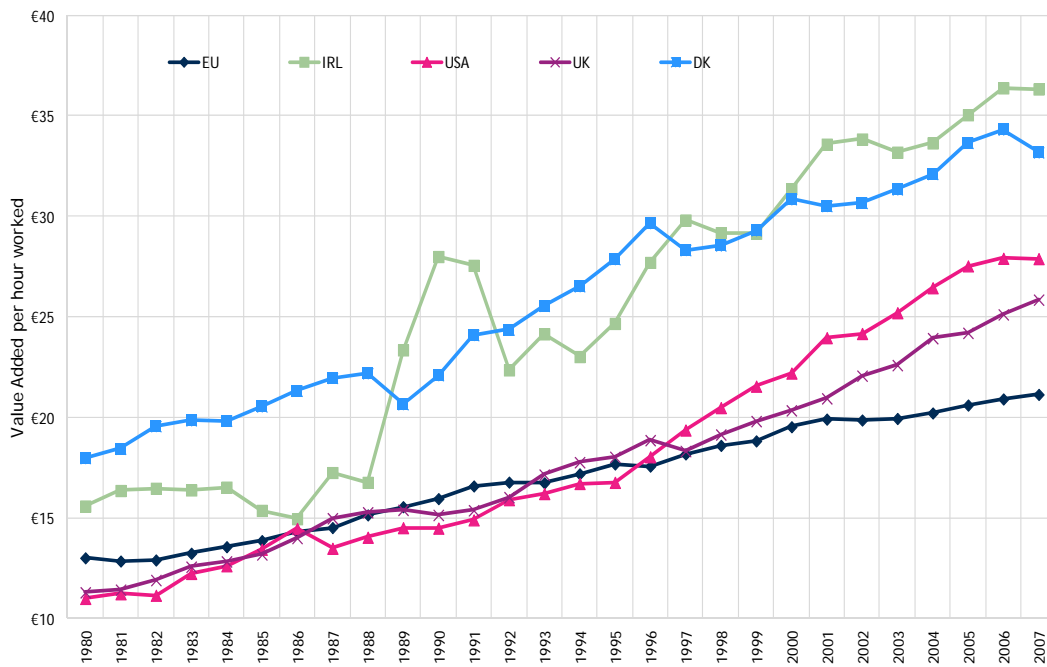
Source: EU KLEMS 72-Industry Database, March 2011

Figure 39: Value added per hour worked in computer services and R&D, selected economies, 1980-2007



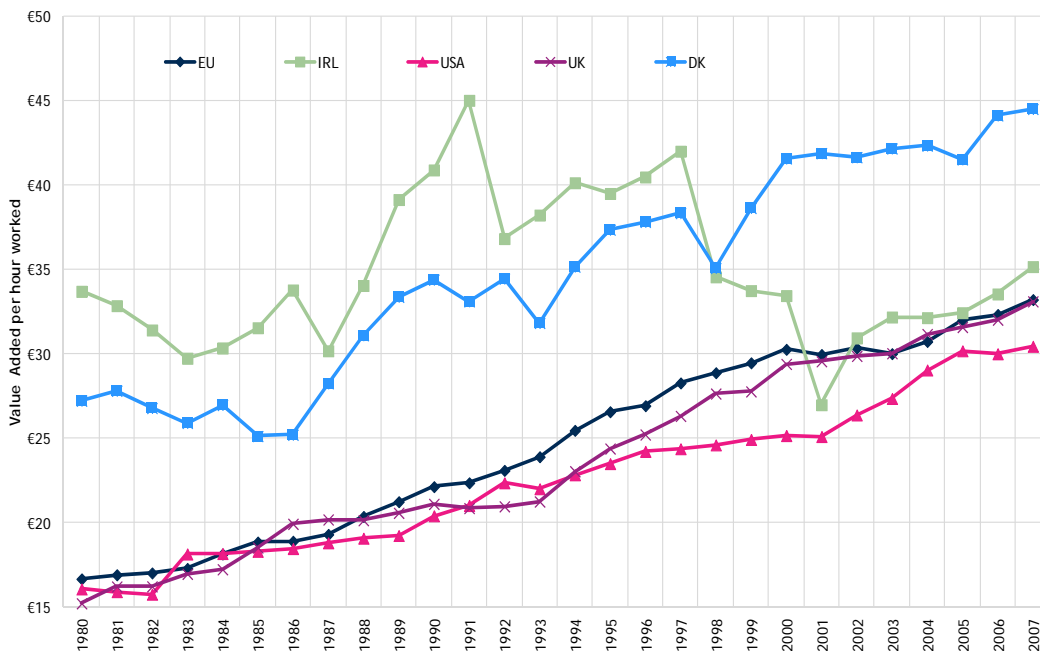
Source: EU KLEMS 72-Industry Database, March 2011

Figure 40: Value added per hour worked in wholesale and retail trade, selected economies, 1980-2007



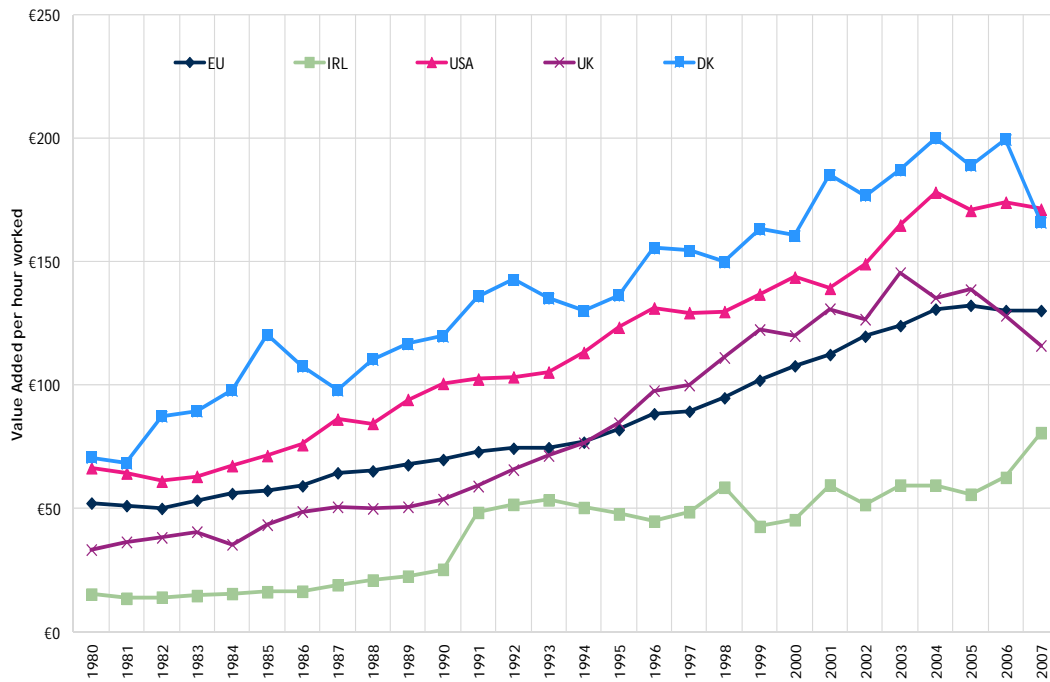
Source: EU KLEMS 72-Industry Database, March 2011

Figure 41: Value added per hour worked in transport services, selected economies, 1980-2007



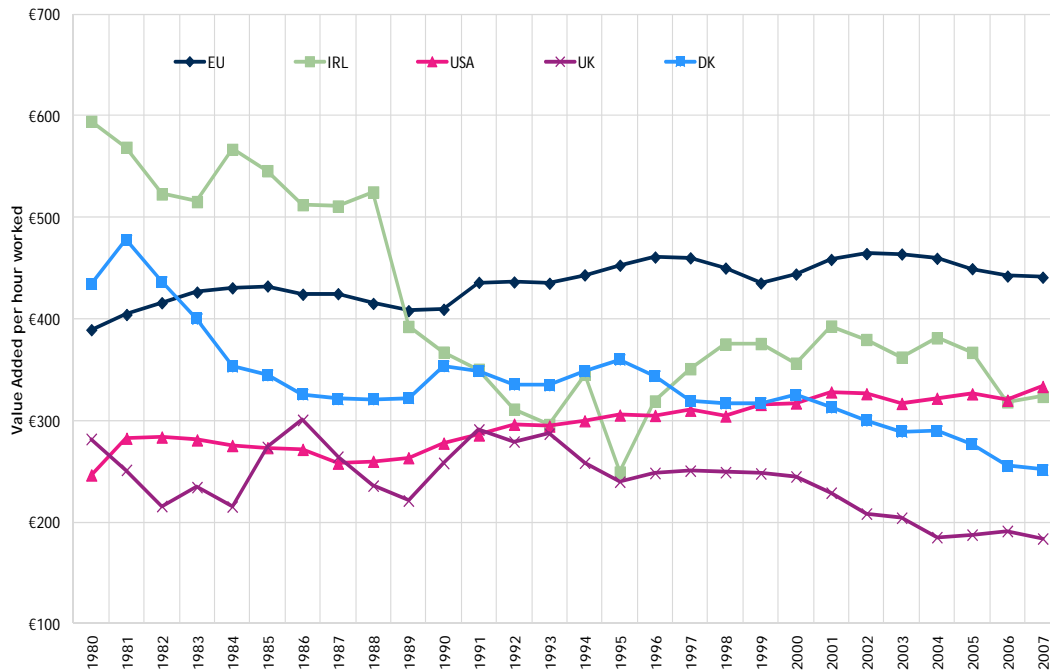
Source: EU KLEMS 72-Industry Database, March 2011

Figure 42: Value added per hour worked in utilities, selected economies, 1980-2007



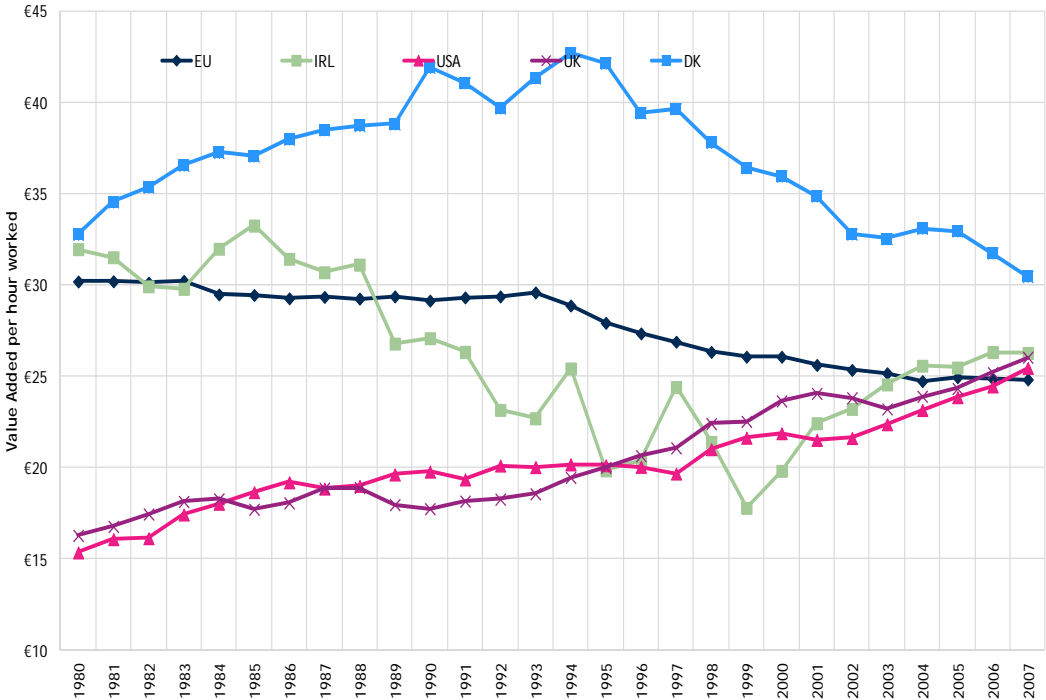
Source: EU KLEMS 72-Industry Database, March 2011

Figure 43: Value added per hour worked in real estate, selected economies, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011

Figure 44: Value added per hour worked in other services, selected economies, 1980-2007



Source: EU KLEMS 72-Industry Database, March 2011





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