



Making Business Sense

O₂ Individual Productivity Index

How ICT technology drives the UK office economy

A report for O₂ Business

22nd October 2013

Executive summary

- The purpose of this study is to understand how productivity at the employee level in office-based sectors (OBS) has changed due to ICT technology. The research illustrates how the rapid adoption of ICT since the 1970s (Information & Communication Technology) has transformed the office workplace.
- The importance of office-based sectors in the economy has increased dramatically since the 1970s. Office-based sectors now represent 43% of UK GVA equating to annual GVA of £595bn in 2012 – up from 24% in 1972. Approximately 30% of the UK workforce works in office-based sectors.
- Gross Value Added (GVA) per worker is one of the best ways of representing labour productivity in the economy. Office-based sectors have seen 84% growth in labour productivity since 1970. By isolating the share of GVA associated with ICT, we can estimate the amount of labour productivity that is attributed to adoption of ICT in the office-based sectors.
- The analysis finds that ICT's share of labour productivity has increased dramatically – from 3% in the 1970s to 9.8% in the 2000s and an estimated 11.6% in 2012. ICT labour productivity in the office-based sectors now amounts to an average of £5,700 per employee each year, up from £1,000 in 1972 when measured in today's money.
- ICT contributes £2.97 in labour productivity for every hour worked representing 11.6% of the total – a significant increase from just 3.7% in 1972.
- An individual productivity index was produced to present labour productivity per hour worked in the office sector associated with ICT. The index shows a growth of 480% in ICT-related labour productivity between 1972 and 2012 compared to growth of just 84% for overall labour productivity. This means ICT has had a massive impact on labour productivity growth in office-based sectors over the period.
- IPI is forecast to grow a further 22% or 2.5% per annum between 2012 and 2020. By the end of this period, GVA associated with ICT will equate to £3.87 for every hour worked in today's money or 12.4% of total productivity per hour.

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Introduction

- This study examines how technology in office-based sectors has contributed to advancing individual productivity over the past 40 years.
- The research illustrates how the rapid adoption of ICT (Information & Communication Technology) since the 1970s has transformed the office workplace.
- The purpose of this study is to understand how productivity of individual employees in office-based sectors has changed due to the increasing use of ICT in the office.
- We show how increasing use of technology has allowed office workers to be more productive.
- The study concludes with forecasts of how productivity driven by ICT technology will evolve up to 2020.

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Office-based sectors explained

- In order to understand how technology adoption has affected the productivity of office workers over time, we have focussed on sectors with a majority of office-based employees.
- These include:
 - Publishing, audio-visual and broadcasting services
 - Telecommunications
 - IT and information services
 - Financial and insurance activities
 - Professional, scientific, technical, administrative and support service activities
 - Public administration and defence
- Office-based sectors are part of the wider services industry. This industry is defined by the lack of production of physical products – much of the work involves the production of ideas or information and the provision of customer services.
- Examples of office-based services include accounting, legal advice, marketing, financial services, IT support and administration.
- The real estate sector which is defined as an office-based sector has been excluded from the analysis due to the unreliability of data which restricts estimates of labour productivity.

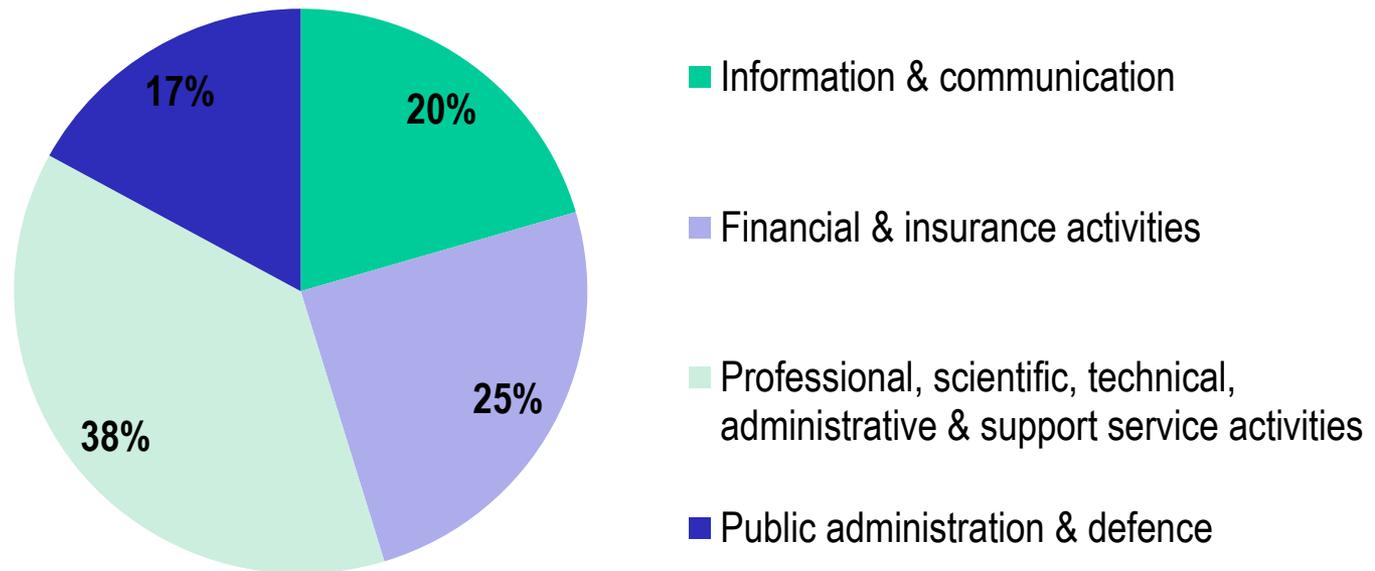
Office-based sectors make up 43% of UK GVA

- GVA is calculated by measuring an industries' output and subtracting intermediate consumption. This leaves a measure of value added generated in the economy.
- Therefore, in this analysis, we use GVA as the primary measure of production in each office sector.
- The GVA measure is commonly used with data on hours and employment to provide a measure of value added per worker and value added per hour worked.
- Total GVA from office-based sectors in 2012 was £595bn represented 43% of the UK economy.
- All data series used within the analysis are reported at constant 2010 prices i.e. inflation has been accounted for allowing direct comparability over time.

Professional, scientific, technical, administrative & support services is the largest sector followed by financial & insurance services

- Professional, scientific, technical, administrative & support services is the largest sector representing 38% of total office-based sector GVA in 2012.
- Financial & insurance services is the next largest with 25% of total.
- Public administration has seen the largest decline in its share of GVA out of all office sectors, falling from 43% in 1970 to 17% in 2012.

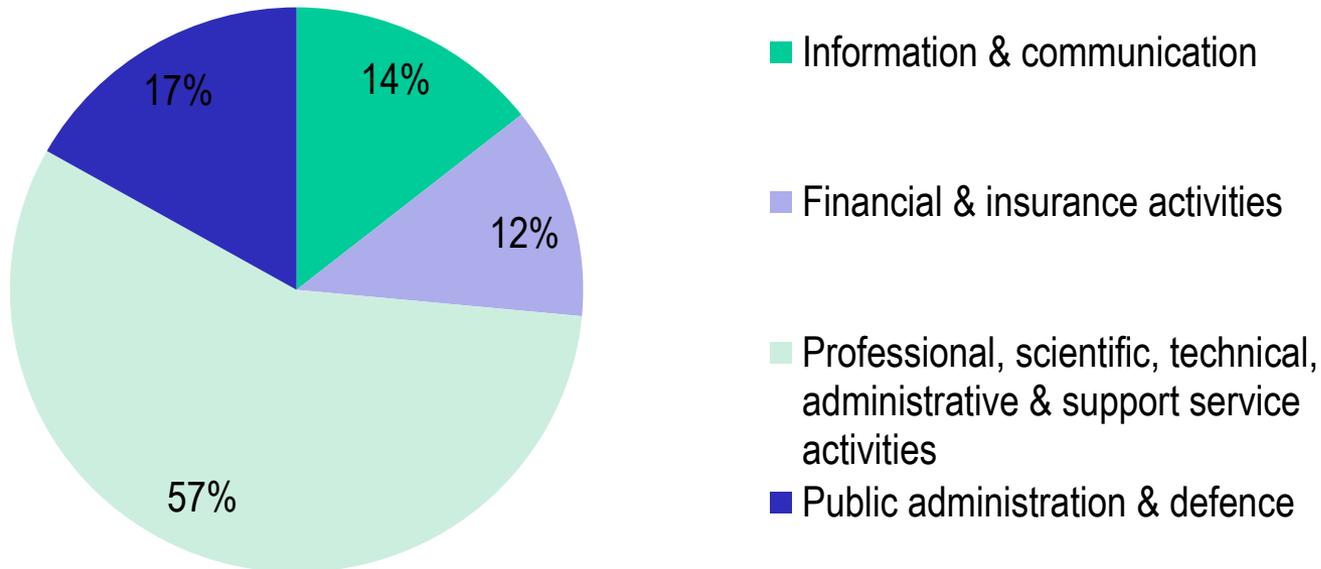
Share of office-based GVA, 2012, current basic prices



Office-based sectors employ 9.8m people or 30% of the UK workforce

- In 2013, approximately 9.8m of the UK's 32.5m workforce work in office-based sectors.
- The professional, scientific, technical, administrative and support services sector represents 57% of office-based sector employment or 5.3m people.
- These sectors have seen a large increase in share of the UK workforce, growing from 7.5% in 1978 to 16.2% in 2013.
- Public administration & defence has seen the largest relative decline in its share of UK employment, falling from 7.6% in 1978 to just 4.8% in 2013.

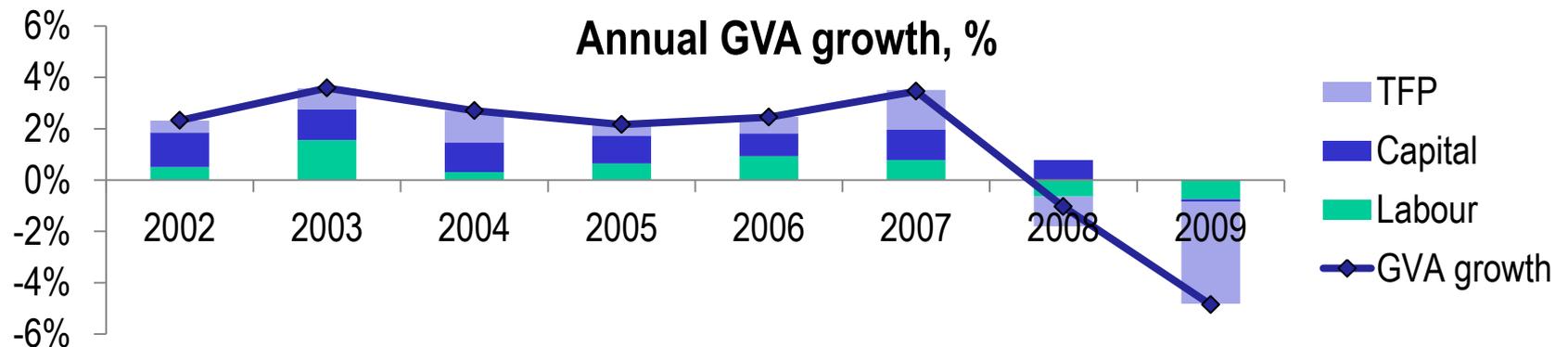
Share of office-based employment, 2013



Source: ONS Workforce Jobs, September 2013

GVA growth has 3 main components – capital being the largest representing on average 70% of GVA growth since 2002

- GVA has three main components which together are responsible for driving growth in value added in the economy.
- Labour – the total number of persons employed in the economy. Labour produces value added through its role in the production of goods and services.
- Capital – This refers to all financial and physical assets that can be employed in the production of goods and services. GVA associated with capital represents the flow of value added that can be attributed to the stock of installed equipment, machinery, buildings and financial assets such as cash and bonds.
- Total Factor Productivity (TFP) – This represents the share of GVA that cannot be directly attributed to labour or capital. TFP growth can be thought of as improvements in the quality of each unit of capital and labour. In the case of capital, this means improvements in the technology of equipment or machinery. For labour, this means improvement in the level of human capital.



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Office-based sectors and the UK economy

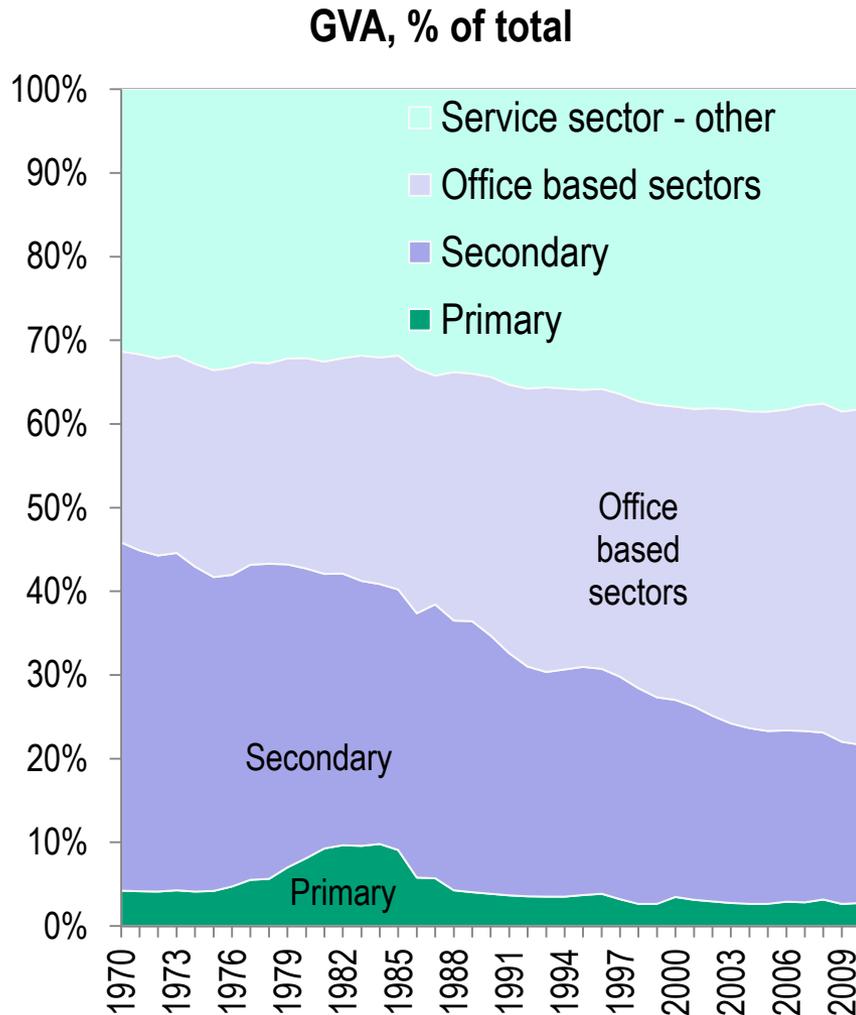
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Office-based sectors have grown from 24% to 43% of UK GVA in 40 years

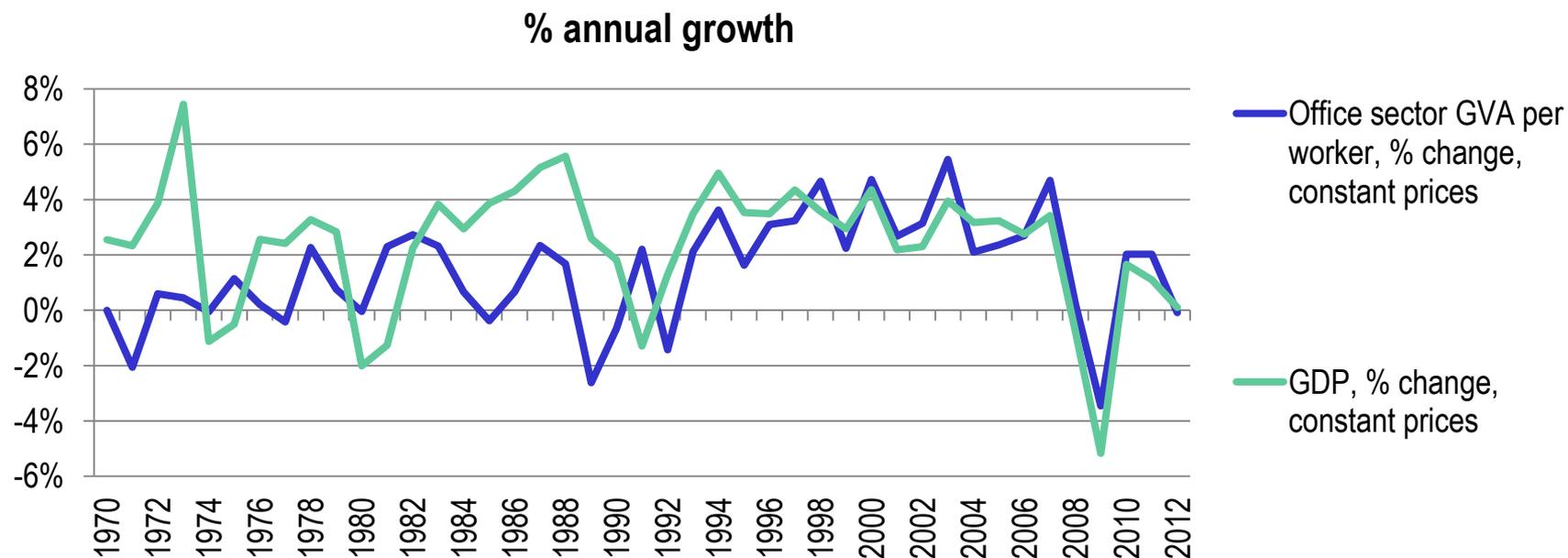


Source: EU KLEMS database 2012, Cebr analysis

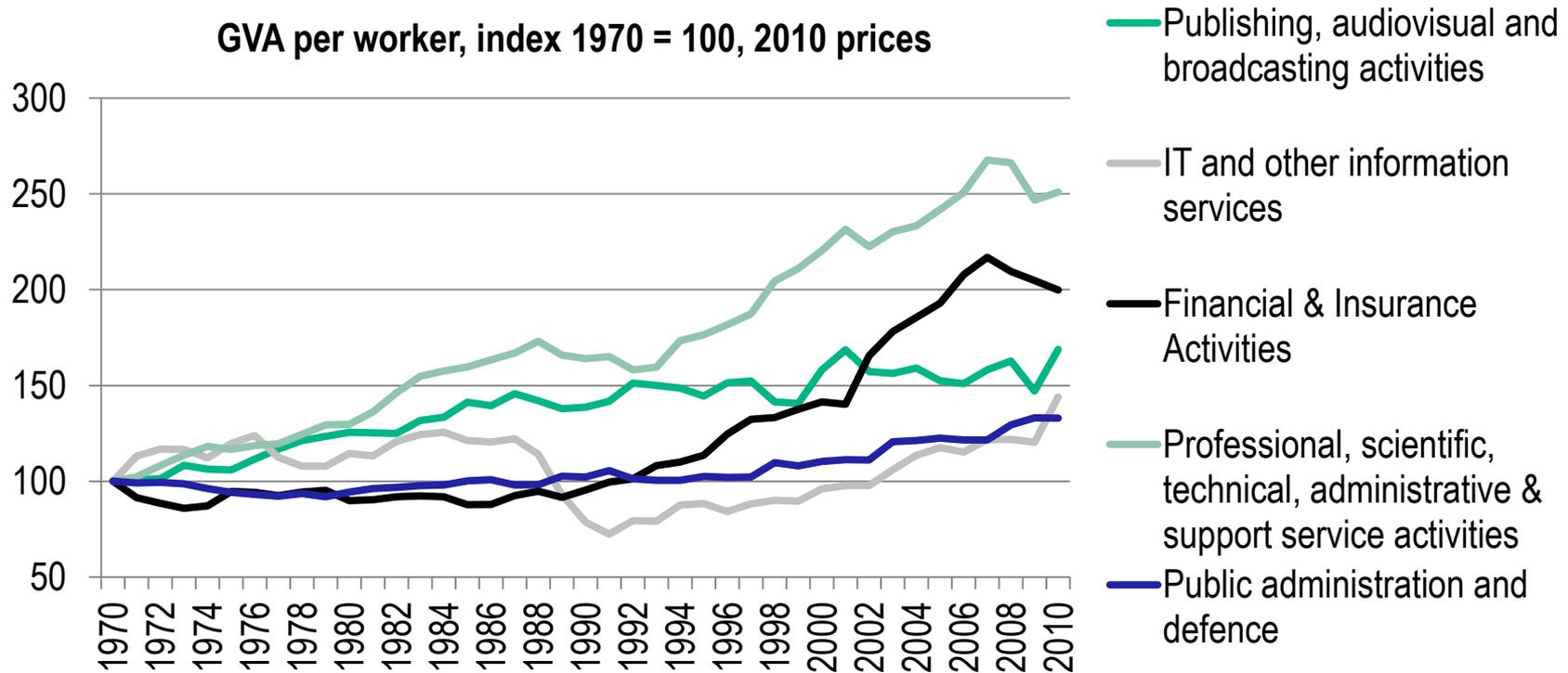
- Since the 1970s, the UK has shifted from a manufacturing to a service sector economy
- Office-based sectors in 2012 represented approximately 43% of UK national GVA – up from 24% in 1972.
- Approximately 30% of the UK workforce now work in office based sectors – up from 22% in 1978.
- This contrasts with the manufacturing sectors' share of employment which has collapsed from 25% of the workforce to just 8% over the same period.

During the 1990s and 2000s, the UK office sector saw high levels of labour productivity growth – driven by increased use of ICT

- Labour productivity is a measure of the output per person employed.
- Labour productivity is highly correlated with GDP growth. Further investment in ICT capital as well as improvements in the quality of this capital – also known as technological development – help drive productivity improvements in the long-run. This will help support further GDP growth.
- The rapid productivity growth witnessed between 1990 and 2007 has been partially attributed to the effect of deployment of rapidly improving ICT technology in the economy.



Professional, scientific, administrative & support sector saw the highest growth in labour productivity

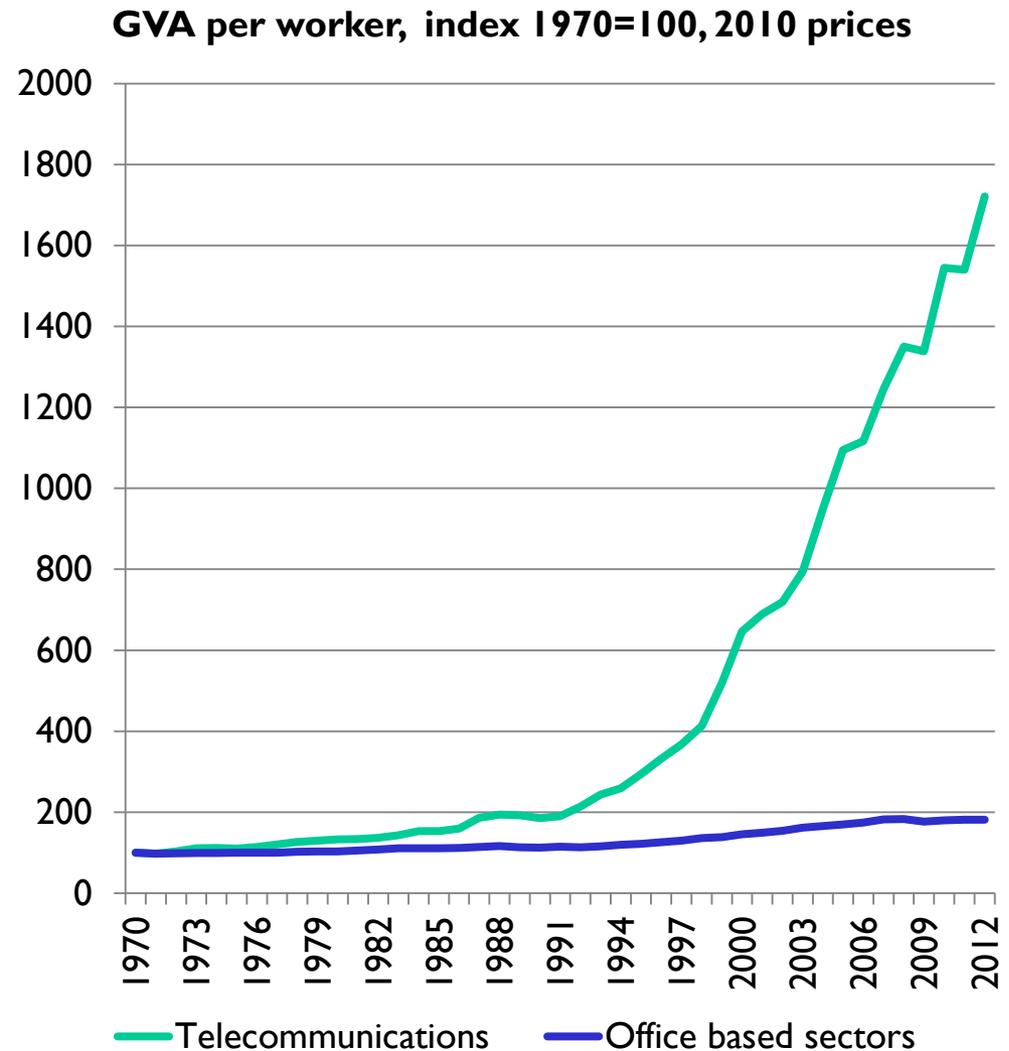


Source: EU KLEMS database 2012, Cebr analysis

- Since 1970, the professional, scientific, technical, administrative & support sector has seen 150% growth in labour productivity.
- The finance & insurance sector also experienced high productivity growth with a rise of 100% over the period.

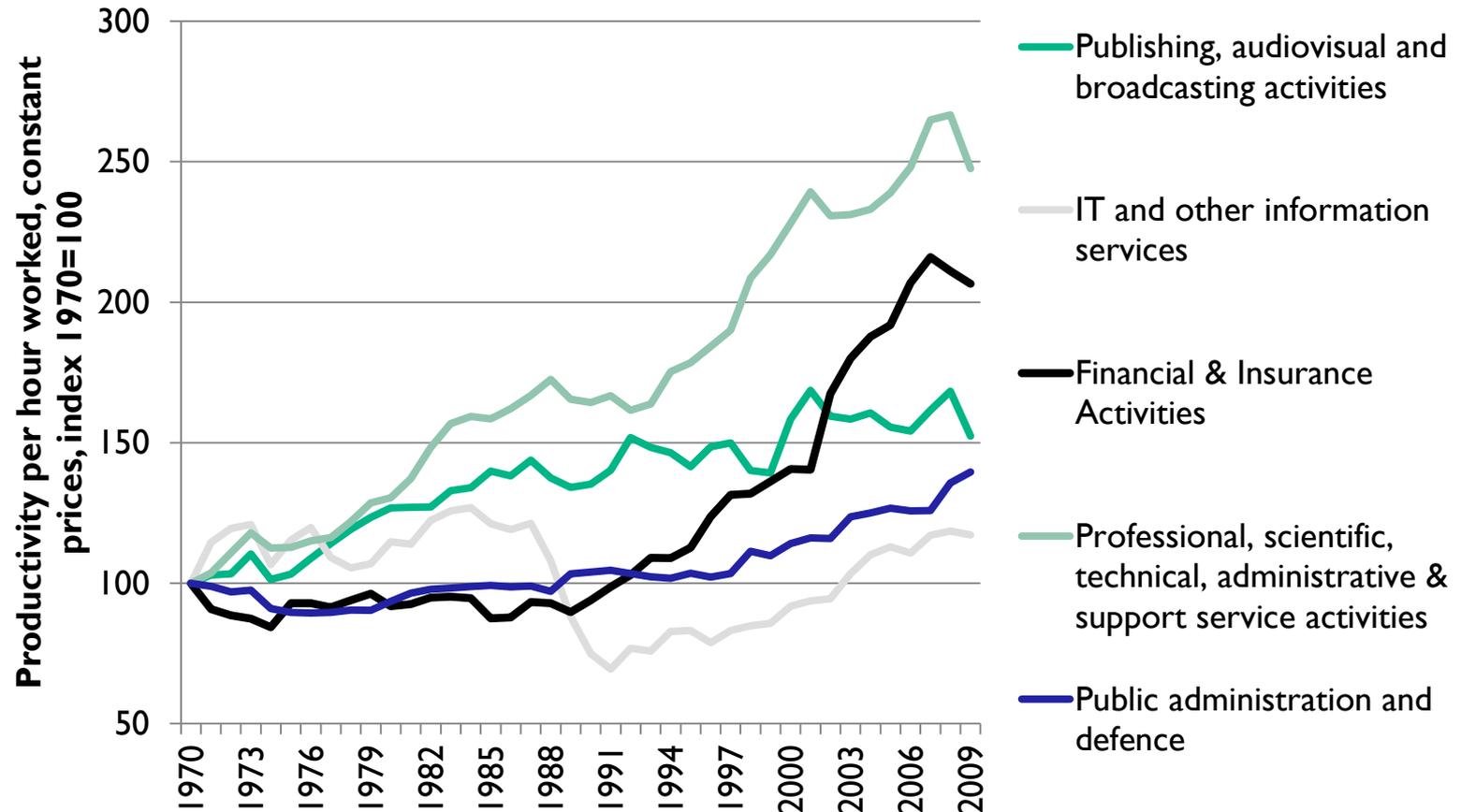
Telecoms sector received a productivity dividend in the 1990s with rollout of 2G mobile networks

- The telecoms sector is a special case exhibiting enormous productivity gains since the beginning of the 1990s.
- The mobile phone transformed the telecoms sector from one dominated by a national fixed-line monopoly to a technology sector with multiple operators and a rapidly growing consumer market.
- Between 1970 and 1990 it took 20 years for labour productivity to double in the sector.
- Coinciding with the launch of GSM networks in the UK, labour productivity took only another 8 years to double. Labour productivity in the telecoms sector is now around 16 times its 1970 level.



Source: EU KLEMS database 2012, Cebr analysis

On an hourly basis, employees in professional, scientific, technical, administrative & support services companies have seen the largest growth in productivity over the past 40 years



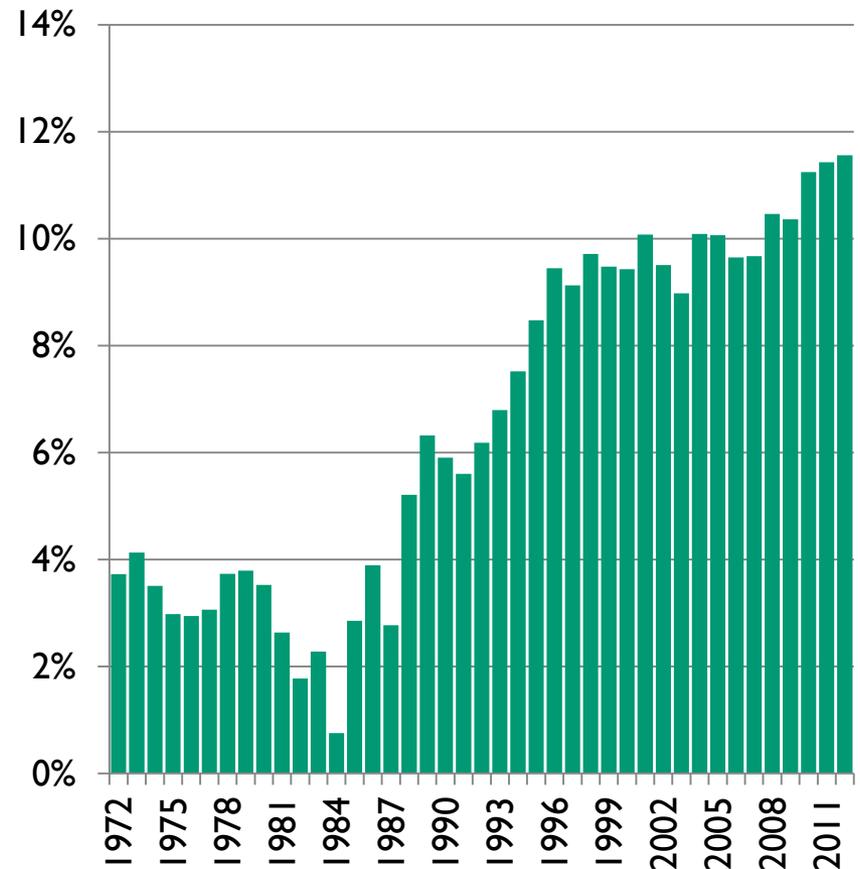
Source: EU KLEMS database 2012, Cebr analysis

- On an hourly basis and controlling for inflation, employees in professional, scientific, technical, administrative & support services companies have seen 150% productivity growth followed by employees in the financial & insurance sector who saw around 100% growth.

ICT's share of labour productivity has increased from 3% in the 1970s and 1980s to 11.6% in 2012

- The labour productivity from ICT measure represents the proportion of GVA per worker that can be attributed to ICT capital. This can also be interpreted as the intensity of ICT capital deployment per unit labour in the office-based sectors.
- During the 1970s and 1980s, ICT's contribution to labour productivity remained low at an average of only 3%.
- From 1990 onwards, ICT's share of office sector labour productivity increased dramatically to reach an average of 11.3% in 2012.

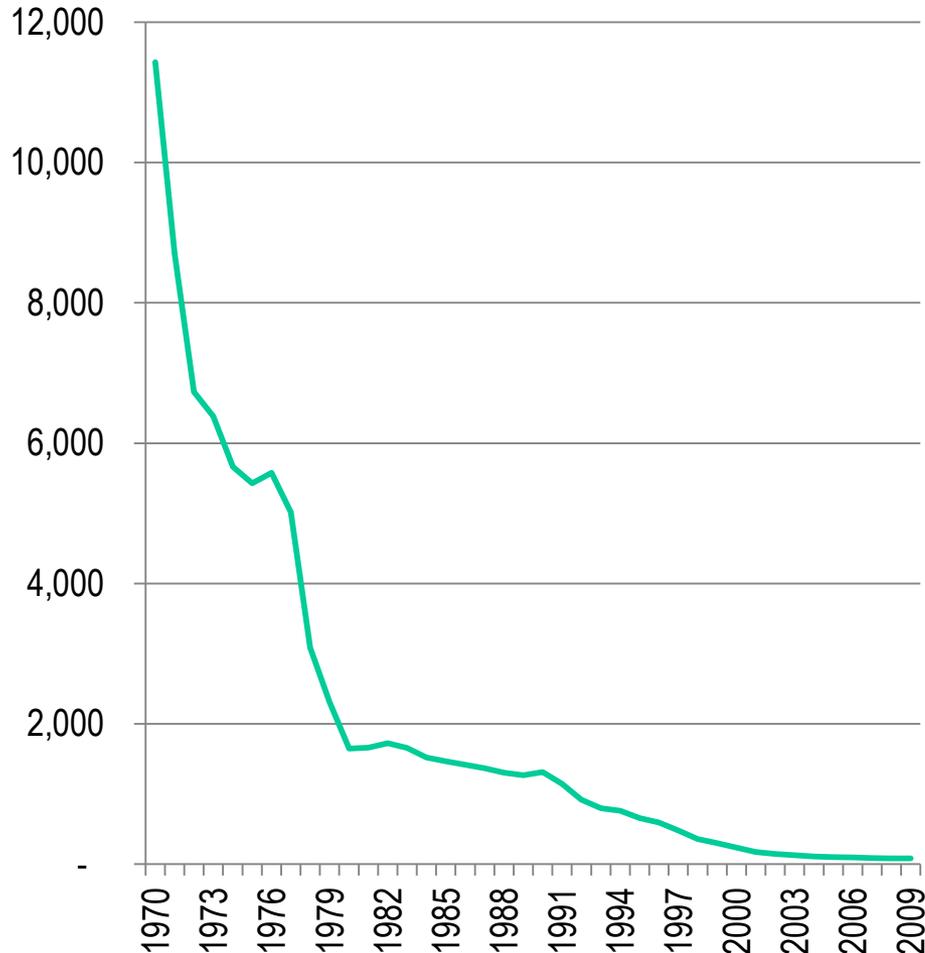
GVA per worker from ICT, % share



Source: EU KLEMS database 2012, Cebr analysis

The cost of computing has fallen dramatically releasing a wave of productivity gains

Gross fixed capital formation, computing equipment, price index 2005=100



Source: EU KLEMS database 2012, Cebr analysis

- The rapid advances in technology associated with ICT mean that what was once prohibitively expensive is now virtually costless and requires far less effort.
- For example, the unit cost of storage capacity has decreased dramatically. In 1980, a gigabyte of hard disk space cost £120,000 in today's money. The current cost of a gigabyte is approximately 5p, 2.4 million times less than in 1980.
- In 1980, one megabyte of RAM cost £9,600 in today's money. In 2013, the same costs just 0.3p. This means that the price of one megabyte of RAM is 3.2 million times less than in 1980.
- Widespread investment and adoption of technologies such as the internet, email and personal computers has facilitated a release of workers to more productive tasks. For example, secretaries were once needed to assist in the production of documents for junior executives up to CEOs, these staff are now available to carry out higher-value activities.

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Office-based sectors and the UK economy

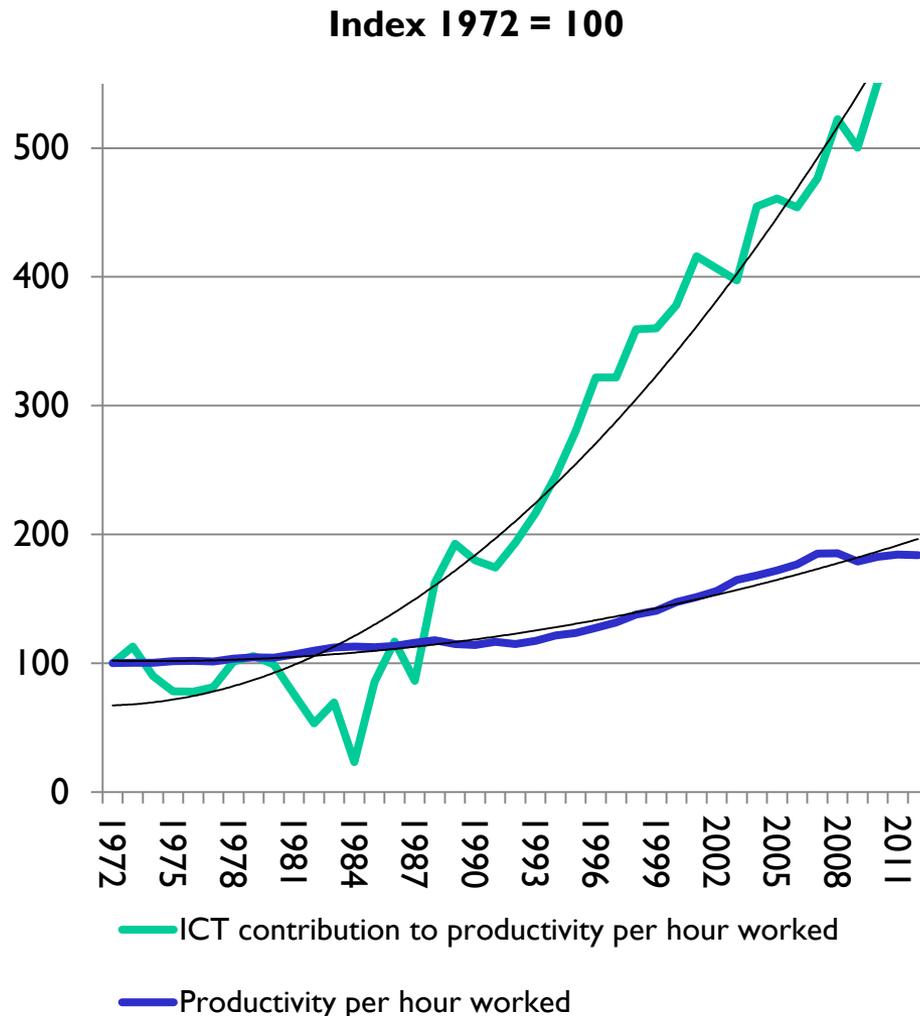
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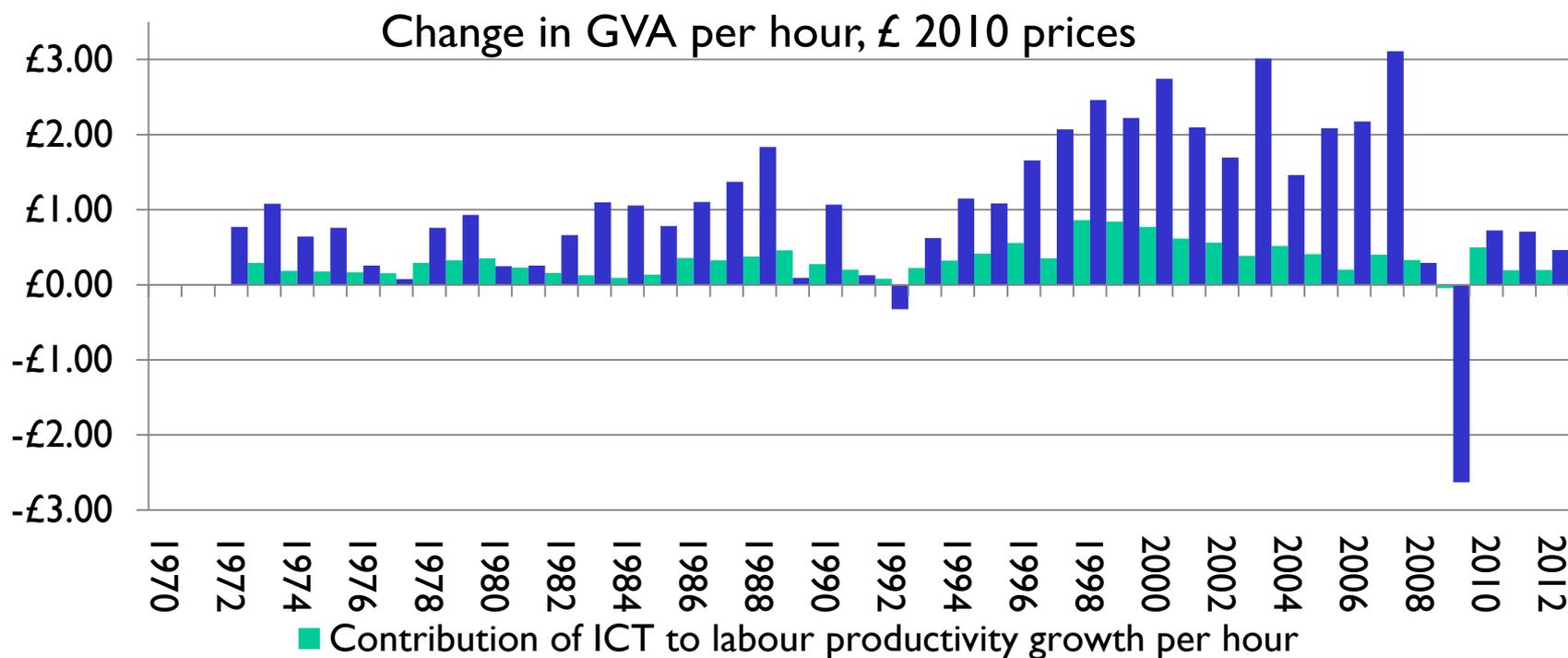
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Individual Productivity Index (IPI) – output per hour worked associated with ICT in office-based sectors



- This chart presents an index representing office sector GVA per hour worked associated with ICT.
- The index shows that over time, labour productivity per hour associated with ICT has grown dramatically, up by 480% since 1972.
- In comparison, overall productivity per hour worked grew only 84% over the same period.
- This means that ICT has had a massive impact on labour productivity growth in office-based sectors over the period.

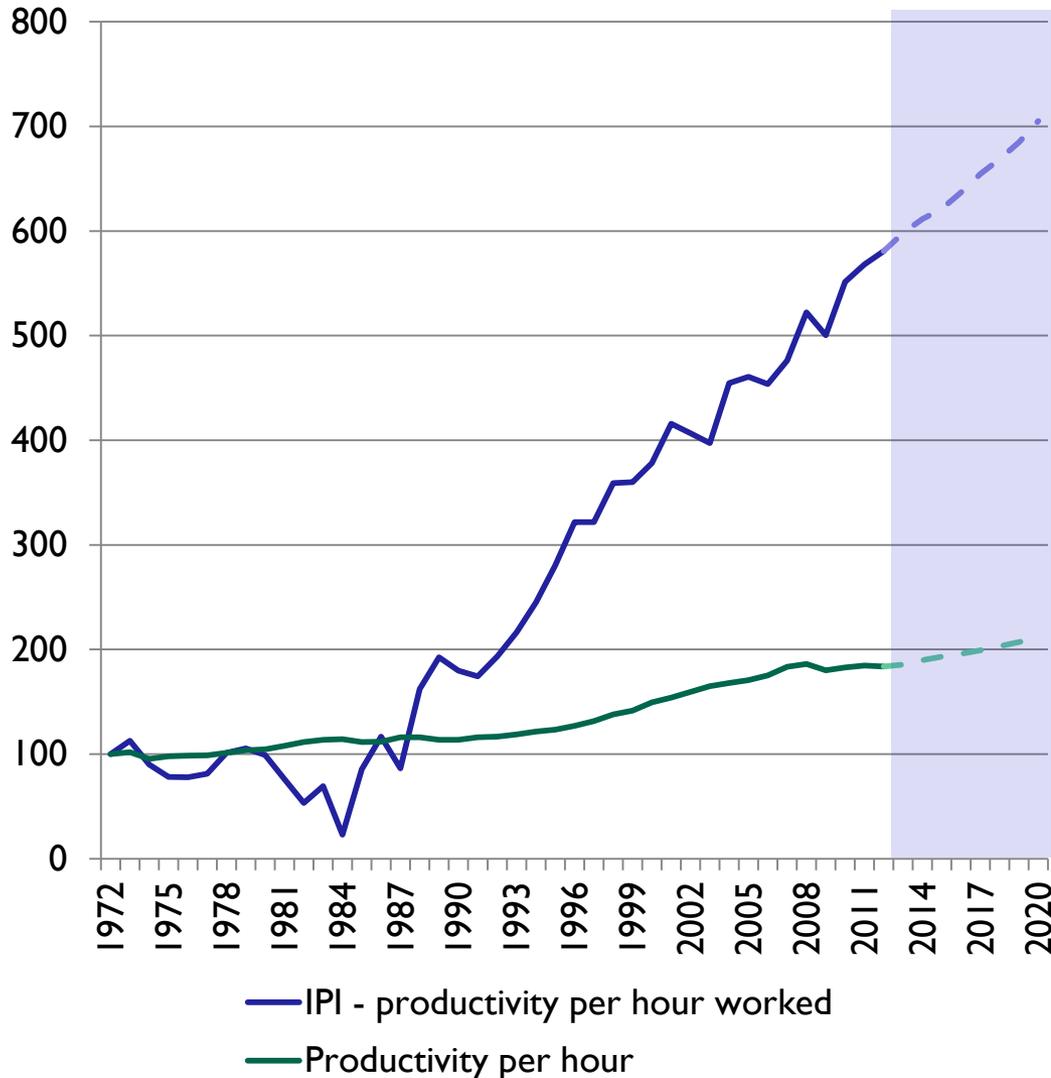
ICT contributed on average 41p or 26% of growth in productivity per hour during the 2000s – equivalent to £750 per year



Source: EU KLEMS database 2012, Cebr analysis

- This chart demonstrates the impact of ICT on growth in labour productivity per hour in office-based sectors. GVA per hour worked grew by an average of £1.60 in office-based sectors during the 2000s. Of this, 26% or 41p was associated with ICT.
- During the 1990s, ICT had an even larger impact responsible for 34% of labour productivity per hour growth.

Individual Productivity Index (IPI) – forecast to 2020



- This chart presents forecasts for office sector GVA per hour worked associated with ICT out to 2020.
- The pace of growth in IPI is forecast to exceed productivity per hour between 2012 and 2020 as ICT's contribution to GVA continues to expand.
- IPI is forecast to grow a further 22% or 2.5% per annum between 2012 and 2020. This compares to growth in overall productivity per hour of 15% or 1.7% per annum.
- The primary reason for the differing growth rates is the forecast continued growth in ICT's contribution to GVA which is expected to outpace overall GVA during the period.

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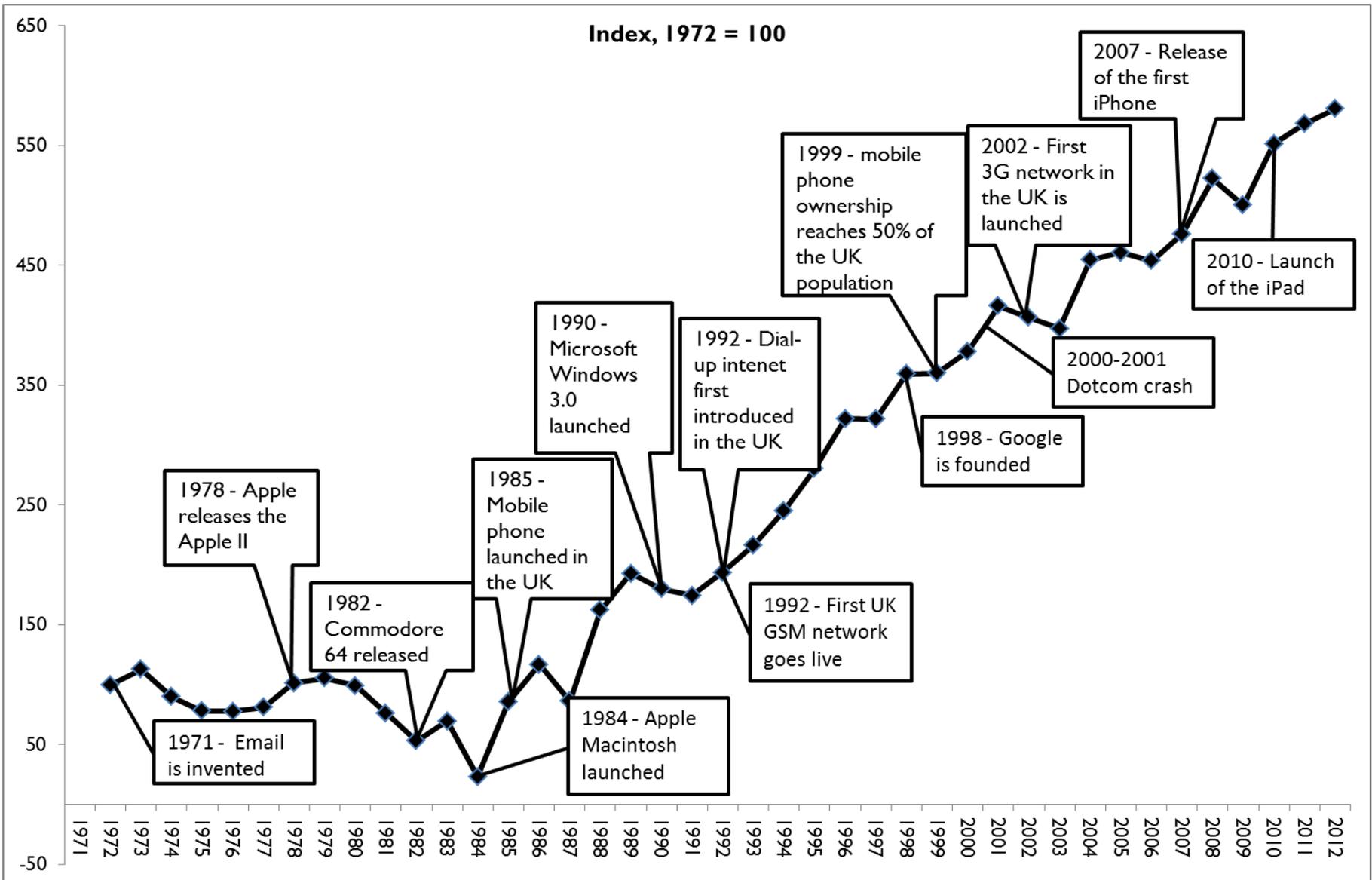
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IPI in context – Technology timeline



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Appendix: Data methodology

The creation of the Individual Productivity Index required analysis, adjustment and modelling of data series within the EU KLEMS dataset in order to calculate an index representing labour productivity growth in office-based sectors associated with ICT. The following steps were taken:

1. GVA data series for each sector were converted from current prices to constant 2010 prices using GVA price and volume indices within the dataset.
2. ICT Contribution to GVA growth series were converted to their monetary values at constant prices in order to arrive at measures for ICT's absolute contribution to GVA.
3. Composite "office-based sector" series were created using a summation of absolute values to arrive at GVA and ICT contribution to GVA data series for office-based sectors.
4. All data series were divided by number of workers for each sector to arrive at measures of GVA per worker at constant prices.
5. These data series were divided by hours worked per year in each sector to arrive at GVA and ICT contribution to GVA series for each sector.
6. These data series were converted to indices based to the first year where data were available. The ICT contribution to office-based sector GVA per hour worked index series represents the individual productivity index as described in slides 20 and 22.

Data points for 2011 and 2012 were estimated using a combination of employment and GVA data for office-based sectors and forecasted data for ICT contribution to GVA and hours worked. These data points should not therefore be considered as actual data points since forecasted data have been used in their estimation.

Appendix: Forecast methodology

- A forecast analysis was carried out to predict the evolution of the Individual Productivity Index (IPI) up to 2020.
- The analysis involved forecasting each of the following variables which are inputs in the calculation of the IPI.
 - Annual hours worked in the office sector
 - ICT contribution to GVA in the office sector
 - Employment in the office sector
 - Office sector GVA
- Linear regression models were fitted to data annual hours worked and ICT contribution to GVA in order to generate forecasted values for the period 2011 to 2020.
- Growth forecasts for employment in the office sector and office sector GVA were generated using Cebr's proprietary UK econometric models. Forecasted values were applied to the most recent data points to provide forecasted levels of these series for the period 2013 to 2020.
- These forecasted data series were in turn used to calculate the IPI for the period 2013 to 2020.

Appendix: Data

- The primary data source used for this analysis is the EU KLEMS dataset funded by the European Commission. EU KLEMS provides individual country data with industry level growth accounting tables covering indicators such as contributions to value added, labour input, labour productivity, employment and total factor productivity.
- Other data sources used for the analysis include:
 - ONS Green Book, 2013
 - ONS Workforce Jobs Dataset, September 2013
 - ONS Quarterly National Accounts, September 2013
 - Cebr UK macroeconomic model

Appendix: Definitions

- For the purposes of defining office-based sectors, certain sectors needed to be excluded from the analysis. These including all primary and secondary industry sectors such as construction and mining. While some of these sectors do have significant numbers of office based employees, the numbers are not sufficient to warrant designation as predominantly ‘office-based’.
- The intention is that the findings of this analysis can be used to understand how ICT has improved productivity growth in all sectors with office-based functions, not just ‘office-based’ sectors.
- Other tertiary industry sectors such as retail have been excluded because they predominantly relate to activities that do not take place in offices.
- Office-based sectors are defined as the following:
 - Publishing, audio-visual and broadcasting services
 - Telecommunications
 - IT and information services
 - Real estate services
 - Financial and insurance activities
 - Professional, scientific, technical, administrative and support service activities
 - Public administration and defence
- The real estate sector is defined as an office-based sector. However, this sector has been excluded from the analysis due to unreliability in the way output has been calculated which restricts estimation of labour productivity.



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