TECHNICAL PAPER

3/RT/02 JUNE 2002

IS THERE A "NEW ECONOMY" IN IRELAND?

BY

GERALDINE SLEVIN

CENTRAL BANK OF IRELAND

The views expressed in this paper are the personal responsibility of the author and are not necessarily held either by the Central Bank of Ireland or by the ESCB. The author would like to thank John Frain, Mark Cassidy and Karl Whelan for helpful comments on earlier drafts. All remaining errors and omissions are the author's. Comments and criticisms are welcome.

Economic Analysis, Research and Publications Department, Central Bank of Ireland, P.O. Box 559, Dame Street, Dublin 2. Tel: +353-1-4344466.
Email: geraldine.slevin@centralbank.ie

ABSTRACT

This paper examines the performance of the Irish economy using a growth-accounting framework. The aim of this analysis is to determine whether a "new economy" has developed in Ireland. At the aggregate level, productivity growth increased substantially in recent years. The impressive productivity performance of the overall economy was primarily driven by the industrial sectors of the economy. A sub-sectoral analysis revealed that strong productivity growth in the aggregate manufacturing sector was largely accounted for by the high-tech sector, particularly the chemicals sector. However, a large part of the success of the high-tech sector can be attributed to US multinationals investing in Ireland. Transfer pricing by these companies and high returns to research and development results in high net output figures in this sector. This implies that any conclusions regarding a "new economy" in Ireland is rather limited, as productivity growth rates in the high-tech sector are distorted in the data.

INTRODUCTION:

The performance of the Irish economy since the mid 1990s has been extraordinary, and this has led many commentators to believe that a "new economy" has developed in Ireland (Raven, 2001, Daveri, 2001). Between 1995 and 2000, Ireland's economic growth, as measured by percentage changes in real GDP (Gross Domestic Product), averaged approximately 10 per cent per annum. This compares with growth of approximately 4 per cent per annum between 1990 and 1994. Employment growth has also expanded rapidly in recent years, particularly in the building and construction, high-tech and services sectors. Employment growth averaged 5 per cent per annum between 1995 and 2000, compared with 2 per cent growth between 1990 and 1994. The increase in the country's capital stock amounted to 2 per cent per annum between 1990 and 1994 and accelerated to approximately 5 per cent per annum between 1995 and 2000, as a result of increased investment in the high-tech and services sectors of the economy. The aim of this paper is analyse the sources of economic growth and thus assess whether there is a "new economy" in Ireland.

The "new economy" is reflected in higher productivity growth as a result of technical progress in the Information and Communications Technology (ICT) sector. The characteristics of the "new economy" include a higher potential output growth rate, lower unemployment, higher productivity growth and improved living standards. The "new economy" encompasses ICT producing as well as ICT using sectors. Some US studies (Jorgenson, 2000, Gordon, 2000) found that the driving force in growth in the US economy in recent years was due to productivity growth in the ICT producing sectors. This paper will examine a sub-sectoral analysis of the ICT producing sectors.

At the aggregate level, it was found that productivity growth has increased substantially in recent years and averaged 4.0 per cent per annum between 1996 and 2000. This increase in productivity growth would suggest a "new economy" in Ireland. A sub-sectoral analysis showed that indeed the high-tech sector has contributed significantly to growth in recent years, particularly the chemicals sector. However, the large values of net output per worker in the high-tech sector may be the result of transfer pricing as well as high returns to research and development. Therefore evidence of a "new economy" is rather limited and it may represent a

sectoral shift of resources from more traditional sectors, rather than a "new economy" effect.

The structure of this paper is as follows. Section 2 outlines a review of the literature. Section 3 examines the ICT sector in Ireland using data from EITO (European Information Technology Observatory) 2001. In Section 4, the sources of economic growth are assessed using a growth-accounting approach for the period 1962-2000. Section 5 carries out a similar exercise for the period 1971-1999 where individual sectors are broken up into more detail. Section 6 examines the sources of output growth in the high-tech and traditional sectors for the period 1997-2001. In Section 7, the high-tech sector is further broken down into sub-sectors and the sources of output growth in each sector are examined. Section 8 concludes.

2. REVIEW OF THE LITERATURE:

Jorgenson et al. (2000) attribute the changing structure of the US economy since the mid-1990s to the "new economy". Comparing the periods 1990-1995 with 1995-1998, they find that output growth accelerated by almost 2 percentage points per annum due to a 1 percentage point increase in hours worked and a 1 percentage point increase in ALP growth. Capital deepening added 0.49 percentage points to ALP growth and faster total factor productivity (TFP) growth added 0.63 percentage points, with the latter mainly reflecting technical change in the production of computers.

Their results imply that the driving force in growth in the US economy was due to productivity growth in the information technology producing sectors but there has been no corresponding acceleration in productivity growth in the information technology using sectors. However they make the point that data for many of the goods and services sectors using high-tech capital may incorporate measurement errors, which could account for the low productivity growth in those sectors.

Gordon (2000) also examines the "new economy" in the US but reaches a somewhat different conclusion than Jorgenson et al. (2000). He compares the "new economy" era with the Great Inventions that originated in the period 1860-1990, which included

the electric light, the electric motor, the automobile, motor transport, air transport, the modern chemical industry, the telephone, the motion picture, radio, television, and the indoor toilet. He attributes the entire trend acceleration to faster productivity growth in the durable manufacturing sector. However, he finds no revival of productivity growth in 88 per cent of the private economy lying outside of durables and when the contribution of the massive investment in computers in the non-durable economy is subtracted out, productivity growth outside of durables has actually declined.

Oulton (2001) examines the presence of a "new economy" in the UK, using a similar methodology to that of Jorgenson et al. (2000). He finds that the UK performance resembled somewhat that of the US in the second half of the 1990s in that both countries experienced an acceleration in the growth of output and an increase in the contribution of ICT capital deepening. However, in the UK, the growth of labour productivity declined after 1994, due to a fall in the contribution of non-ICT capital and a decline in total factor productivity (TFP) growth. In contrast, the acceleration in labour productivity growth in the US was accompanied by an increase in TFP growth. The contribution of ICT capital rose in both countries, but the UK contribution is only about 67 per cent of the US one. Until the period 1994–1995, TFP and labour productivity growth had been higher in the UK than in the US. Oulton (2001) concludes therefore that there has been no sudden emergence of a "new economy" in the UK. However, since he finds that the ICT share in GDP is rising, the contribution of ICT capital to economic growth may continue to increase in the UK.

Comparing the macroeconomic performance of the US and EU economies in the 1990s, the European Commission (2000) conclude that the macroeconomic features of the "new economy" are not yet detectable in the aggregate figures for the EU. However, they note that the forces driving productivity growth in the US are also at work in the EU. They find that technical progress in the ICT sector and the accumulation of ICT capital in the EU contributed 0.5 to 0.7 percentage points per annum to output growth in the second half of the 1990s. This value is close to the estimates for the US in the first half of the 1990s and is consistent with the gap in ICT expenditure per capita between the US and EU. They suggest therefore that the EU is

lagging behind the US in the contribution of ICT to GDP growth by around half a decade.

Roeger (2001) also examines the European experience. He finds that, as in the US, the ICT contribution to growth in the EU rose between 1995 and 1999 and that the growth contribution of ICT for the Irish economy by far exceeds that in the US. The contribution of ICT sectors to aggregate TFP growth in Ireland also exceeds that in the US in the 1990s.

He suggests that the US has benefited both from ICT production and from investment, while Europe has only benefited from investment. He notes that the best explanation for the differences in growth between the US and the EU appears to be differences in the rate of technical progress in ICT production and therefore the US might have a comparative advantage in the production of high-tech goods.

Raven (2001) finds no evidence of a "new economy" in Europe as TFP growth has slowed in the late 1990s. In the US, however, the ICT sector contributed significantly to TFP growth. He finds that in Ireland, average TFP growth has accelerated from 2.75 per cent between 1991 and 1995 to 4.5 per cent between 1995 and 1999. He examines Ireland as a case study for possible "new economy" effects. GDP growth in Ireland averaged 9 per cent per annum between 1995 and 1999, compared to 5 per cent growth between 1991 and 1995. This rate of growth was far higher than in any other country in Europe. His results are reported in Table 1 in Appendix 2.

Between 1991 and 1995, his results implied that TFP growth contributed 2.75 percentage points per annum to output growth in Ireland. TFP growth in the ICT sector averaged 1 per cent per annum during this time period and increased to 1.75 per cent per annum between 1995 and 1999. From Table 1, it is clear that the main factor driving growth has been the increase in employment. The contribution of labour to output growth of 3.75 percentage points per annum, between 1995 and 1999, exceeded the contribution of the ICT sector. However, the increase in TFP growth in the ICT sector to 1.75 per cent per annum, compared to 0.25 per cent per annum growth in the EU, suggests a new era in the Irish economy.

Murphy (2000) gives a very detailed description of Ireland's economic history. This analysis helps to highlight Ireland's performance before and after joining the European Monetary Union. His results suggest that a large part of Ireland's success story can be attributed to US multinational companies investing in Ireland. The US multinationals needed a European base from which to sell their commodities and were attracted to Ireland because of the very low corporation tax rates on the profits of manufactured products and the transfer pricing possibilities raised by such low tax rates. Ireland was also English speaking, had an increasingly computer literate labour force and was fully committed to the European Union.

Examining net output per person employed in the manufacturing sector, he finds large discrepancies between US high-tech companies and those recorded by Irish companies. He finds that labour productivity growth is much higher in foreign owned high-tech companies than in similar Irish owned companies. He notes that the reason for the differences in labour productivity growth is not due to more productive workers in the high-tech multinationals; rather it is because globalisation allows these companies to transfer productivity gains from high tax to low tax environments. He notes that because of Ireland's low corporation tax on manufactured goods and financial services, it is in the interests of the multinationals to attribute very high levels of output to their Irish based plants. Transfer pricing can be achieved by pricing inputs at a lower price and/or valuing outputs at more than the market price. The effect of this is to raise the net output and productivity figures in the manufacturing sector.

Honohan et al. (1998) finds that the following foreign-owned multinational corporations (MNCs) sub-sectors: chemicals, software reproduction, computers and production of cola concentrate, accounted for over a third of gross manufacturing output in Ireland in 1995 and 22000 jobs. They found that the labour share in net output in these sectors was very low. In 1995, the average labour share of net output in Irish industry was 21 per cent. The corresponding labour share in the software reproduction sector was only 5 per cent and in the chemicals sector it was 10 per cent in 1995.

The four sectors mentioned above were also found to have very high excess returns on capital and used exceptionally high volumes of non-industrial services. This suggests that in addition to using physical materials, these sectors are also using invisible resources to generate output. These immaterial resources include technological and market knowledge brands. This research and development is usually undertaken in the parent company outside of Ireland. This research yields high returns in the form of royalties, licence fees and dividends for the parent company. They note that because the scale of this invisible entrepôt activity has been growing, it is not only the level of GDP that is affected by it but also its growth rate.

Their results show that excluding multinational profits from GDP altogether would reduce the average growth rate of GDP by 1.6 percentage points during 1993-1997. They conclude that taking out the contribution of this entrepôt activity would substantially reduce recent growth rates, but it would not alter the existence of the economic boom.

3. THE ICT SECTOR IN IRELAND:

The data used in the empirical analysis below have been collected by EITO (European Information Technology Observatory 2001). The sample consists of the United States, Norway, Switzerland and the EU Member States excluding Luxembourg. It covers the time period 1997 – 2000.[1] The ICT aggregate comprises computer hardware (server systems, workstations, PCs, and PC/Workstation add-ons), end user communications equipment (telephone sets, mobile phone sets and other terminal equipment), office equipment (copiers and other office equipment), datacom and network equipment (LAN hardware, PBX and key systems, packet switching and routing equipment, circuit switching equipment, cellular mobile radio infrastructure, transmission, other data communications, other network equipment), software products (system and application software), IT services (consulting, implementation, operations management and support services), Carrier services (Telephone services, which includes internet and online services, mobile telephone services, switched data

[1] The EITO 2000 edition has been combined with the EITO 2001 edition to provide data for 1997.

and leased line services, CaTV services). The focus in the EITO data is on spending figures, which give an indication of the demand for ICT products.

The total ICT market value in Ireland increased from 3,292 million euro in 1997 to 4,850 million euro in 2000[2]. Carrier services accounted for 53 per cent of the ICT market value in 2000. The annual growth rate in carrier services was 14.7 per cent in 2000, compared with 11 per cent in 1999. The most significant growth in the carrier services category occurred in mobile telephone services and CaTV services. The annual growth rate in mobile telephone services averaged 57 per cent in 2000, compared to 26 per cent in 1999. The annual growth rate in CaTV services averaged 35 per cent in 2000, compared with 24 per cent in 1999. In 2000, computer hardware accounted for 16 per cent of the total ICT market value, and increased by 12.3 per cent per annum.

Computer hardware and carrier services were also the main determinants of the total ICT market value in Europe. Computer hardware accounted for 16 per cent of the total ICT market value in 2000, and increased by 9.3 per cent per annum. The annual growth rate in server systems averaged 9 per cent in 2000. Carrier services accounted for 41 per cent of the total ICT market value in Europe in 2000 and increased by 12.6 per cent per annum. The annual average growth rate in mobile telephone services was 38 per cent in 2000, compared to 32 per cent in 1999. The annual average growth rate in CaTV services in Europe increased from 12.8 per cent in 1999 to 15.1 per cent in 2000.

Table 2 shows the overall ICT sectors in the EU and US for the period 1995–1999 (European Commission, 2000). It is evident that ICT production has expanded dramatically in Ireland. Output in overall ICT sectors in Ireland was 7.6 per cent of GDP in 1999, compared to 4.2 per cent in the EU and 6.8 per cent in the US. Technical progress in the ICT sector has led to drastic price declines and higher performance, which in turn have fuelled ICT expenditure (European Commission, 2000). Figures 1 and 2 in Appendix 1 show the annual average growth rate in information processing equipment and recorded media prices in Ireland. Between

1996 and 2001, the annual average growth rate in information processing and recorded media prices was approximately –13.6 per cent and 1.4 per cent respectively. Given this dramatic decline in ICT prices and the large share of ICT production in Ireland, we would expect to see a corresponding increase in ICT expenditure. However, Irish ICT expenditure has declined from 5.6 per cent of GDP in 1997 to 5.4 per cent in 2000. Apart from Norway, this represents the lowest expenditure as a percentage of GDP.

The most important indicators of ICT penetration relate to the use of computers, access to the Internet and mobile phones. The Nordic countries demonstrate tremendous ICT penetration on all accounts. The UK, Germany, France and Belgium demonstrate intermediate diffusion of ICT. Ireland is an interesting case, as in terms of use or access to PC and www, it has a low take up rate and in terms of mobile phone penetration it demonstrates intermediate diffusion. The ratio of business PCs to workers in Ireland is quite high and is equal to that in the US. PCs per population however are quite low in Ireland.

ICT per capita expenditure in Ireland is slightly less than in the EU, but it is only half that in the US. Irish ICT penetration rates are in most cases higher than the EU average, but are lower than those experienced by the Nordic countries and the US. Thus it appears as though Ireland is lagging slightly behind the US in terms of ICT expenditure and penetration, but it is ahead of the EU in this regard. However, even though Ireland may be lagging behind the US in terms of ICT diffusion, this has not been an impediment to growth in Ireland. Therefore, ICT production appears to be a more significant contributor to growth in Ireland than ICT investment.[3]

4. SOURCES OF ECONOMIC GROWTH: 1962-2000:

The methodology used in this analysis is based on the production possibility frontier adopted by Jorgenson et al. (2000) and Oulton (2001). The method is less detailed than for the United States, due to the absence of detailed data. The results are also not

[2] Tables are available on the printed version only, due to copyright restrictions. The printed publication is available from the author upon request.
[3] This is consistent with the results found by Raven (2001).

directly comparable to those for the United States, as US price indices for ICT products are hedonic.[4] In the case of computers, quality changes are made up of changes in speed, memory, size of hard-disk, speed of CD-ROM, and presence of software (Roeger, 2001). No hedonic price index is available for Europe as a whole. European statistical offices use more traditional methods of dealing with quality change, namely the "option price method" or the "overlapping method" (Roeger, 2001). Roeger (2001) finds that France, which uses hedonic methods, had a computer price decline of 80 per cent in the 1990s, while Germany, which uses the overlapping method, only had price declines of 20 per cent. Using traditional price indices would tend to understate the relevance of the "new economy". It has become common practice to take the US ICT price index and adjust it for the dollar-euro exchange rate (Schreyer, 2000, Daveri, 2000, Oulton, 2001). This assumes a full pass-through of US ICT price variations into EU price variations, once allowance is made for differences in investment good inflation (Daveri, 2000). This approach is not adopted here as results are reported for Ireland only, but these points should be borne in mind when making comparisons with other studies.

4.1 DECOMPOSITION OF OUTPUT GROWTH:

Aggregate output Y_t is measured as Gross Domestic Product (GDP) at constant (1995) market prices. Y_t is broken up into agriculture (Y_{At}), industry (Y_{It}), and services (Y_{St}) for the period 1962-2000. The data are taken from the ESRI Databank, which is based on the CSO National Income and Expenditure Accounts 2000. The first set of results, which broadly examines Agriculture, Industry and Services update the ESRI data using the latest National Accounts data. These outputs are produced from aggregate inputs, which consists of capital services K_t and labour employed L_t. Capital and labour are broken up into the same categories as output. Productivity is represented as a "Hicks-neutral" augmentation A_t of aggregate input:

$$Y_t(Y_{At}, Y_{It}, Y_{St}) = A_t.\ f[(K_t(K_{At}, K_{It}, K_{St}), L_t(L_{At}, L_{It}, L_{St}))] \qquad (1)$$

[4] Hedonic approaches use regression techniques whereby the price of an item is regressed on its quality characteristics and dummy variables for the time period to which the observations relate. The coefficients on these time dummies are estimates for the change in price over the period concerned, controlling for changes in the quality mix of what was bought.

Under the assumption of perfect competition and constant returns to scale, market prices measure marginal costs and wages measure the value of marginal products, growth accounting gives the share-weighted growth of outputs as the sum of the share-weighted growth of inputs and growth in *total factor productivity* (TFP):

$$\Delta \ln Y_t = \beta \Delta K_t + (1 - \beta)\Delta L_t + \Delta A_t \qquad (2)$$

where β is capital's average share of nominal income and can be interpreted as the elasticity of output with respect to capital.

The aggregate growth rate of output is calculated as[5]:

$$\Delta \ln Y_t = \sum v_{it} \Delta \ln Y_{it} \qquad (3)$$

v_{it} is the share of the ith type of final output Y_{it}, and is calculated as follows:

$$v_{it} = \tfrac{1}{2}\{p_{it}Y_{it}/\sum p_{it}Y_{it} + p_{it-1}Y_{it-1}/\sum p_{it-1}Y_{it-1}\} \qquad (4)$$

where p_{it} is the deflator for the ith type of final output.

The capital stock is calculated using the perpetual inventory method for each individual sector:

$$S_{it} = S_{it-1}(1-\delta_i) + I_{it} \qquad (5)$$

where δ_i is the depreciation rate in sector i, which is assumed constant over time, I_{it} is real investment in sector i, and S_{it} is the capital stock in sector i at time t.

The quantity index of the capital stock is given by:

$$\Delta \ln S_t = \sum s_{ik} \Delta \ln S_{it} \qquad (6)$$

[5] Official growth rates for GDP, capital and labour will differ from those reported here. The growth rates used here are weighted by the relevant value shares.

where the weights are now the value shares of the aggregate capital stock:

$$s_{ik} = \tfrac{1}{2}\{ITD_{it}S_{it}/\sum ITD_{it}S_{it} + ITD_{it-1}S_{it-1}/\sum ITD_{it-1}S_{it-1}\} \quad (7)$$

where ITD_{it} is the investment goods deflator for the ith type of investment.

Capital stock estimates fail to take account of substitution towards assets with high marginal products (for example, computers), and it has become common practice to use capital services as the capital component for growth accounting analysis (Jorgenson, 2000, Oulton, 2001, Roeger, 2001).

Capital services are assumed to be proportional to the flow of capital services from that stock over a given period:

$$K_{it} = (S_{it} + S_{it-1})/2 \quad (8)$$

The growth rate of aggregate capital services is defined as a share-weighted average of the growth rate of the individual components:

$$\Delta \ln K_t = \sum w_{ik} \Delta \ln K_{it} \quad (9)$$

where w_{ik} is the value share of capital income and is calculated as follows:

$$w_{ik} = \tfrac{1}{2}\{c_{it}K_{it}/\sum c_{it}K_{it} + c_{it-1}K_{it-1}/\sum c_{it-1}K_{it-1}\} \quad (10)$$

c_{it} is the user cost of capital. The user cost of capital is calculated as follows:

$$c_{it} = ITD_{it}\,(r_{it} + \delta_i - (ITD_{it} - ITD_{it-1})/ITD_{it-1}) \quad (11)$$

where r_{it} is the nominal cost of borrowing funds and δ_i is the depreciation rate for sector i. As in Slevin (2001), negative real interest rates will not correctly reflect the marginal cost of financing and therefore the shadow cost of capital was estimated.

The growth rate of aggregate capital services and the capital stock have different weights. The index of aggregate capital services uses rental prices as weights, while the index of aggregate capital stock uses asset prices. Assets with falling prices will have large rental prices. Capital services are calculated as a two-period average of the capital stock, so the timing of capital services growth and capital stock growth will differ for individual assets (Jorgenson et al., 2000).

Finally, the growth rate of employment is defined as:

$$\Delta \ln L_t = \sum w_{il} \Delta \ln L_{it} \qquad (12)$$

where w_{il} is the proportion of the aggregate wage bill accounted for by the ith type of employment, and is calculated as follows:

$$w_{il} = \tfrac{1}{2}\{w_{it}L_{it}/\sum w_{it}L_{it} + w_{it-1}L_{it-1}/\sum w_{it-1}L_{it-1}\} \qquad (13)$$

where w_{it} is defined as compensation of employees divided by employment in sector i. L_{it} is persons employed in sector i.

The capital share in sector i, β_{it}, is calculated as capital's average share of national income:

$$\beta_{it} = c_{it}K_{it}/p_tY_t \qquad (14)$$

Recall that c_{it} is the user cost of capital in sector i, K_{it} is capital services in sector i. Y_t is defined in equation (1) as the sum of GDP at constant (1995) market prices in Agriculture, Industry and Services and p_t is the corresponding GDP deflator. The total capital share is therefore:

$$\beta_t = \Sigma \beta_{it} \qquad (15)$$

The total contribution of capital services is thus:

$$\sum \beta_{it} \Delta \ln K_{it} \quad (16)$$

It has been shown by Domar (1961) that aggregate TFP growth can be represented as a weighted average of sectoral TFP, where the weights are represented by the production share of individual sectors in total GDP (Roeger, 2001):

$$TFP = \Sigma s_i TFP_i \quad (17)$$

where s_i is the production value of sector i in total nominal GDP. The contribution of labour for each sector is then calculated as the difference between the contribution of capital services and TFP growth.

4.2 SOURCES OF OUTPUT GROWTH: 1962-2000:

In Table 1 in Appendix 4, the results of the growth accounting decomposition based on equation (2) for the period 1962-2000 and various sub-periods are shown. Figure 1 in Appendix 3 shows the contributions of sector outputs to economic growth.[6] It is clear from the graph that the contribution of agricultural output is very small. The contribution of industry output to economic growth was relatively stable until 1995 but increased significantly between 1996 and 2000, as it accounted for 54 per cent of total output growth. The contribution of services output also increased significantly in the final sub-period and accounted for 45 per cent of total output growth.

Figure 2 shows the contributions of factor inputs to economic growth. Between 1962 and 2000, aggregate TFP growth made the largest growth contribution of 3.0 percentage points per annum (see Table 1). Labour employed contributed 0.9 percentage points per annum and capital services contributed only 0.6 percentage points per annum. Therefore, input growth accounted for approximately 33 per cent of growth, with the remaining 67 per cent accounted for by TFP growth. Between 1981 and 1990, TFP growth accounted for 97 per cent of the growth in output. Comparing 1990–1995 with the period 1996–2000, the contribution of employment

[6] An output contribution is calculated as the average share-weighted annual average growth rate.

increased by 2.3 percentage points per annum, while the contribution of TFP growth increased by 1.5 percentage points per annum[7].

Figure 3 shows the breakdown of the contribution of labour by sectors. As can be seen from the graph, the contribution of agricultural employment was practically zero in all sub-periods. Between 1962 and 1970, employment in industry accounted for 11 per cent of output growth, while services employment accounted for 8.5 per cent. Between 1990 and 1995, industrial employment accounted for 14 per cent of output growth, while services employment accounted for 31 per cent of output growth. Between 1996 and 2000 employment in both industry and services combined accounted for approximately half of economic growth. Services employment growth accounted for 58 per cent of the total labour contribution during this time period.

The breakdown of TFP growth by sector for each of the sub-periods is shown in Figure 4. Industrial TFP growth has increased significantly in the final sub-period, as can be seen in Figure 4. Between 1996 and 2000 it accounted for 68 per cent of aggregate TFP growth. Analysing a breakdown of industrial TFP growth into manufacturing sectors would allow us to assess the contribution of the high-tech sector to growth. This will be examined in a later section. Aggregate TFP growth increased to 4.0 percentage points between 1996 and 2000. This was a significant increase in productivity growth and accounted for 44 per cent of economic growth during this time period.

The next section will examine in more detail the contribution of various sectors to economic growth. This will enable us to analyse the source of the significant rise in industrial TFP growth in recent years and determine its association with the "new economy".

5. SOURCES OF OUTPUT GROWTH: 1971-1999

In this section the industrial and services sectors are further sub-divided. The industrial sector incorporates building and construction, manufacturing and fuel and

[7] Results based on a production function estimate of the capital share for each sector, as in Slevin

power products. The manufacturing sector consists of high-tech and traditional manufacturing. The high-tech manufacturing sector combines the chemical, metal and engineering sectors. Traditional manufacturing incorporates textiles, clothing and footwear, wood and furniture, paper and printing, glass and ceramics, other manufacturing, drink and tobacco and mining and quarrying. Output in the manufacturing sector is measured as net output at constant (1995) market prices, as defined in the *Census of Industrial Production*, for the latter period[8]. The services sector consists of market services, which incorporates distribution, transport & communications, finance and insurance and professional excluding financial services. Output in the market services sector is measured as value added at constant (1995) market prices[9].

Table 2 in Appendix 4 shows the contributions to output growth broken down by sector for the period 1971-1999. The results are not directly comparable with the previous results, as non-market services are excluded, due to the difficulty in determining productivity in government services, and food manufacturing is also deleted. Between 1971 and 1999, industry output accounted for 66 per cent of total output growth (see Table 2). High-tech manufacturing output growth accounted for 74 per cent of this industry output growth. Market services accounted for 30 per cent of output growth over this time period. The main determinant of market services growth was professional services.

Between 1971 and 1975, market services accounted for the majority of output growth. However, between 1975 and 1980, the industrial sector was the main determinant of output growth. The contribution of traditional manufacturing increased to 1.3 percentage points per annum between 1975 and 1980, and thus the industrial sector accounted for 59 per cent of output growth during this time period. Between 1980 and 1985, the contribution of the high-tech sector increased, while the contribution of the traditional sector declined. Between 1985 and 1990, high-tech manufacturing

(2001), were broadly similar. Results are available upon request.

[8] Net output is defined as gross output minus material inputs. There was no GDP data available for sub-sectors in the manufacturing sector.

[9] Value added refers to GDP at constant (1995) market prices for each sector and is taken from Table 4 in the National Income and Expenditure Accounts 2000. Non-market services were excluded from the analysis for the period 1971-1999 due to the difficulty in measuring productivity growth in government related sectors.

accounted for 89 per cent of the total manufacturing contribution. The contribution of market services increased to 1.8 percentage points per annum, due mainly to an increase in the distribution sector's output growth. Between 1990 and 1995 the contribution of industrial output declined to 4.0 per cent per annum[10]. The contribution of market services increased to 2.1 percentage points per annum and this was mainly accounted for by professional services.

The final sub-period 1995-1999 is particularly interesting. Over this time period, the industrial sector accounted for 70 per cent of output growth. The contribution of high-tech manufacturing sector increased by 4.5 percentage points per annum and accounted for 59 per cent of aggregate output growth and 84 per cent of the contribution of industry output. The contribution of market services increased by 1.4 percentage points, largely as a result of increases in the contribution of distribution and professional services. Figure 5 highlights the results for the period 1995-1999. It is clear from the graph that the high-tech manufacturing sector has been the predominant determinant of output growth in this period. An analysis of how labour, capital and productivity growth has developed in each sector will now be examined.

Tables 3-5 show the contributions of labour, capital and productivity to economic growth for the period 1971–1999 by sector and for various sub-periods. Between 1971 and 1999, TFP growth was the main determinant of aggregate output growth, accounting for 77 per cent of growth (see Table 5)[11]. The high-tech manufacturing sector accounted for 51 per cent of aggregate TFP growth over this time period. The contribution of labour was 1.0 percentage point per annum and capital contributed 0.5 percentage points per annum between 1971 and 1999 (see Tables 3 and 4).

In Figure 6 the contributions of labour, capital and technological progress are shown for all sub-periods. It is clear from the graph that there has been a significant

[10]The reason for the fall in output growth in the industrial sector is the decline in the contribution of high-tech manufacturing output. Output for this sector is defined as net output, which is defined as gross output minus material inputs. Gross output for high-tech manufacturing sectors increased from 11.6 per cent between 1985 and 1990 to 12.6 per cent per annum between 1990 and 1995. However over the same time periods, the growth of material inputs for the high-tech sectors increased from 3.8 per cent to 11.8 per cent per annum and therefore net output declined between 1990 and 1995.

[11] The sum of the contributions of capital, labour and productivity growth in Tables 3-5 (row 1) equals GDP growth. GDP growth also equals the sum of the contributions of agriculture, industry and market services output growth in Table 2.

transformation of the Irish economy in recent years. Until the 1990s TFP growth was the predominant determinant of economic growth. However, between 1990 and 1995, the contribution of employment increased significantly and accounted for 34 per cent of output growth (see Table 4). This contribution increased further to 5 percentage points between 1995 and 1999, and accounted for 40 per cent of output growth.

Industry employment accounted for 46 per cent of the total labour contribution between 1995 and 1999 (see Table 4). The contribution of the Building and Construction sector increased to 0.7 percentage points per annum and accounted for 14 per cent of the aggregate labour contribution over this time period. Employment growth in this sector increased to 11.8 per cent per annum, as a result of the boom in the property market. High-tech employment accounted for 32 per cent of the total labour contribution during this time period. Between 1995 and 1999, employment growth in the high-tech sector increased to 6.3 per cent per annum, compared with 3.8 per cent growth between 1990 and 1995. The contribution of market services increased to 2.9 percentage points per annum and accounted for 58 per cent of the total labour contribution during this time period. Professional services employment accounted for the majority of the contribution of market services.

The final sub-period shows that TFP growth increased to 7.0 percentage points per annum (see Table 5). The high-tech manufacturing sector accounted for 81 per cent of aggregate TFP growth between 1995 and 1999 and 46 per cent of aggregate output growth. Therefore, the high-tech sector has been a significant contributor to economic growth, particularly in recent years. The combination of employment and TFP growth in the high-tech sector accounted for almost 60 per cent of output growth between 1995 and 1999. The next section examines the high-tech sector in more detail in order to assess whether the ICT sector was an important determinant of the economic boom.

6. Sources Of Economic Growth In The High-Tech And Traditional Sectors: 1997-2001:

This section examines the high-tech and traditional sectors using the most recent available data from the *Industrial Production Index*. The data relate to the period

1995 Q1 – 2001 Q4[12]. The output data refer to gross value added and thus the results are not directly comparable with the previous results where output in the manufacturing sectors was defined as net output[13]. The high-tech sector incorporates the following sectors: publishing, printing and reproduction of recorded media, chemicals, chemical products and man-made fibres, optical and electrical equipment. The traditional sector includes: textiles, leather, wood, pulp and paper, rubber and plastic and other non-metallic mineral products, mining and quarrying, beverages and tobacco.

Table 6 shows the sources of output growth in the high-tech and traditional sectors for the period 1997–2001. Average Labour Productivity (ALP) is defined as output divided by total hours, where total hours are defined as employment (heads) by hours worked per week. Figure 7 shows the sources of output growth in the high-tech sector. Between 1997 and 2001, ALP growth accounted for approximately 65 per cent of the total output growth in the high-tech sector. Figure 8 shows the sources of output growth in the traditional sector[14]. In Table 6, it can be seen that between 1997 and 2001 output growth averaged 1.5 per cent in the traditional sector. This compares with 17.6 per cent output growth in the high-tech sector over this period. Productivity growth accounted for all of this growth in the traditional sector during this time period. Comparing Figures 7 and 8, it is clear that the performance of the high-tech sector has been extraordinary in recent years and has been a significant source of the transformation of the Irish economy since the mid 1990s. The next section will examine the high-tech sector in more detail and allow us to assess the significance of the ICT sector to growth.

7. SOURCES OF OUTPUT GROWTH IN THE HIGH-TECH SECTOR: 1997-2001:

It was shown in the Spring 2002 Central Bank of Ireland Quarterly Bulletin that the chemicals sector has been a significant contributor to productivity growth in the industrial sector. In 1999, the high-tech sector accounted for 73 per cent of total net

[12] Data for 2001 Q4 are provisional.
[13] Gross value added refers to the production value less intermediate consumption, while net output is the difference between gross output and industrial input.
[14] These graphs are drawn to the same scale to facilitate comparison.

output in manufacturing. Within the high-tech sector, the chemicals sector accounted for almost 50 per cent of total net output in 1999[15], and 18 per cent was accounted for by the reproduction of recorded media.

Table 7 shows the sources of output growth in the high-tech sector for the period 1997-2001. Output and ALP growth was much stronger in the chemicals sector than in any other sector. Output growth in the publishing, printing and reproduction of recorded media sector actually declined in recent years. Although output growth is higher in the electrical and optical equipment sector in 2000, it only accounts for 22 per cent of total net output in manufacturing. In 2001, output growth in the chemicals sector increased to 18.7 per cent per annum, which is higher than in any other sector.

Thus the chemicals sector has been the main contributor to high output and ALP growth in the high-tech sector. As mentioned previously, high values of net output in foreign-owned high-tech companies may be the result of transfer pricing (Murphy, 2000). It may also include high returns to research and development and other marketing activities, which are undertaken in the parent company outside of Ireland (Honohan et al., 1998). Thus, the results concerning productivity growth in the high-tech sector should be treated with caution. Although the contribution of the ICT sector has been significant in recent years, this may represent a sectoral shift of resources from more traditional sectors, rather than a "new economy" effect.

8. CONCLUSION:

This paper examined the sources of economic growth in Ireland using a growth-accounting framework. At the aggregate level, there has been a significant increase in productivity growth since the mid 1990s. This step up in productivity growth would suggest a "new economy" in Ireland. Indeed a sub-sectoral analysis revealed that strong productivity growth in the aggregate manufacturing sector was largely accounted for by the high-tech sector, particularly the chemicals sector. However, a

[15] The chemicals sector has been expanding rapidly in recent years. Between 1960 and 1970, the chemicals sector accounted for approximately 6 per cent of total net output in industry. This increased to around 9 per cent between 1971 and 1980 and to 14 per cent between 1981 and 1990. Between 1991 and 1999, the chemicals sector accounted for approximately 26 per cent of total net output in industry.

large part of the success of the high-tech sector can be attributed to US multinationals investing in Ireland. Transfer pricing by these companies results in large net output figures and consequently high productivity levels. Therefore, evidence of a "new economy" is rather limited, as the results regarding the high-tech sector are distorted in the data by the presence of multinational companies in Ireland.

BIBLIOGRAPHY

Central Bank of Ireland Quarterly Bulletin Spring 2002, "Aggregate and Sectoral Productivity Trends 1988-2000".

Daveri F. (September 2000), "Is growth an information technology story in Europe too?", University of Parma and IGIER.

Daveri F. (May 2001), "Information Technology and Growth in Europe", University of Parma and IGIER.

FitzGerald J. & Jonathon Hore (2000), "ESRI Time Series Databank", ESRI 2000.

European Commission (2000), "Economic Growth in the EU: Is a "New" Pattern emerging?", European Economy 2000 Review.

Fitzgerald J. and Jonathon Hore (April 2001), "Wage Determination in Economies in Transition: Ireland Spain and Portugal" Economic and Social Research Institute, Seminar Paper ESRI Dublin 2001.

Fitzgerald J. and Ide Kearney (October 2000) "Convergence in Living Standards in Ireland: The Role of the New Economy?", Economic and Social Research Institute Working Paper No. 134.

Frain J. (1990) "Borrow and Prosper? Notes on the User Cost of Capital", Central Bank of Ireland Technical Paper No. 3/RT/90.

Gordon (2000), "Does the "New Economy" measure up to the Great Inventions of the Past", National Bureau of Economic Research Working Paper No. 7833.

Honohan P. (1992), "The Irish Economy in the 1990s: Resolving Some Paradoxes", unpublished.

Honohan P., Bertrand Maître and Charles Conroy (1998), "Invisible Entrepôt Activity in Irish Manufacturing", Irish Banking Review Summer 1998.

Jorgenson D.W. and Kevin Stiroh (May 2000), "Raising the Speed Limit: US Economic Growth in the Information Age", Brookings Papers on Economic Activity, Vol. 1.

Kenny (Autumn 1996) "Economic Growth in Ireland: Sources, Potential and Inflation", Extract from Central Bank of Ireland, Autumn Bulletin 1996.

McMorrow K. and Werner Roeger (April 2001) "Potential Output: Measurement Methods, "New" Economy Influences and Scenarios for 2001-2010 – A Comparison of the EU15 and the US", Economic Papers European Commission Directorate-General for Economic and Financial Affairs Working Paper No. 150.

Murphy A. (2000), "The "Celtic Tiger", An Analysis of Ireland's Economic Growth Perfomance", EUI Working Paper No. 2000/16.

Nordhaus W. (January 2001), "Alternative Methods For Measuring Productivity Growth", National Bureau of Economic Research Working Paper No. 8095.

Nordhaus W. (January 2001), "Productivity Growth and the New Economy", National Bureau of Economic Research Working Paper No. 8096.

Oulton N. (July 2001) "ICT and productivity growth in the United Kingdom", Bank of England Working Paper No. 140.

Raven (2001) "A New Economy in Europe?", PricewaterhouseCoopers European Economic Outlook January 2001.

Roeger W. (January 2001), "The Contribution of Information and Communication Technologies to Growth in Europe and the US: A Macroeconomic Analysis", European Commission Working Paper No. 147.

Schreyer P. (2000), “The contribution of Information and Communication Technology to Output Growth: A study of the G7 countries”, OECD Directorate for Science, Technology and Industry, DSTI/DOC(2000)2.

Senhadji A. (2000) “Sources of Economic Growth: An Extensive Growth Accounting Exercise”, International Monetary Fund Staff Papers Vol. 47, No.1.

Slevin G. (September 2001), “Potential Output and the Output Gap in Ireland”, Central Bank of Ireland Technical Paper Series RT/5/2001.

Slevin G. (December 2001), “Potential Output and the Output Gap in Ireland”, Central Bank of Ireland Quarterly Bulletin Winter 2001.

Stiroh K. (January 2000), “Is there a New Economy?”, Federal Reserve Bank of New York.

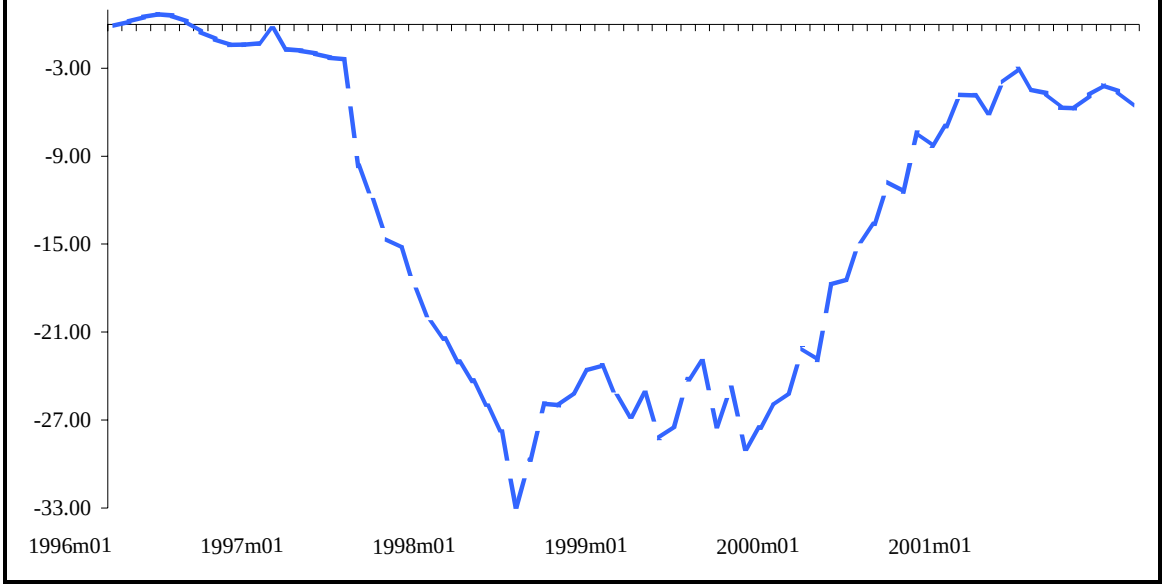
Stiroh K. (July 2001), “What Drives Productivity Growth?”, Federal Reserve Bank of New York.

Stiroh K. (June 2001), “Are ICT Spillovers Driving the New Economy?”, Federal Reserve Bank of New York.

Vives X. and Angel de la Fuente (December 1997) “ The Sources of Irish Growth”, Centre for Economic Policy Research Discussion Paper No. 1756.

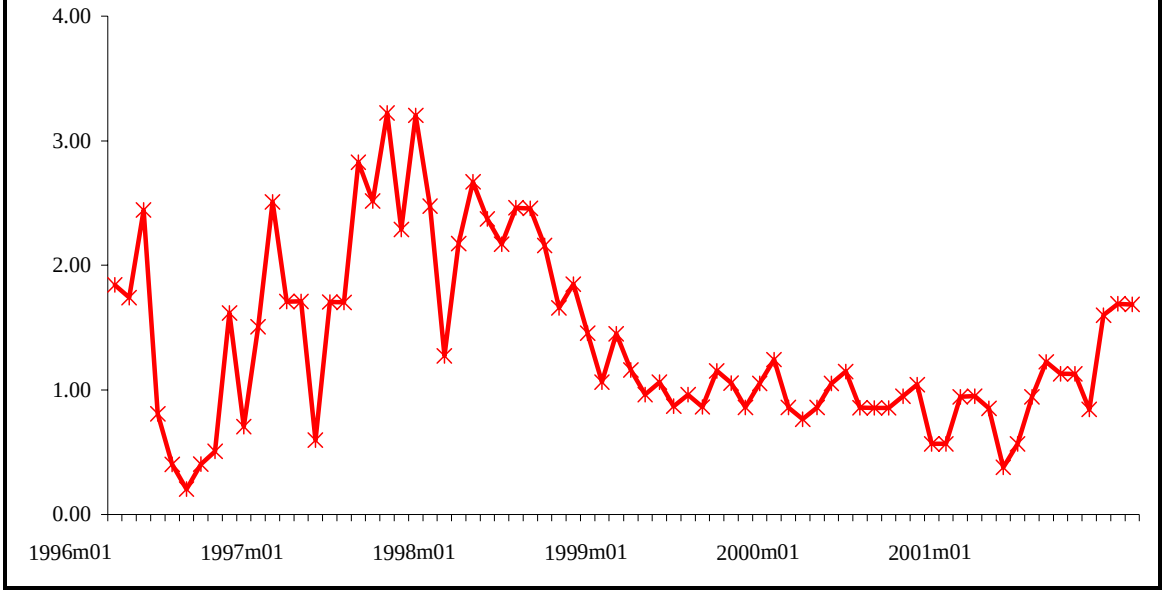
APPENDIX 1

Figure 1: Annual average growth rate in Information Processing Equipment prices: 1996-2001



Source: CSO.

Figure 2: Annual average growth rate in Recorded Media prices: 1996-2001



Source: CSO.

APPENDIX 2

Table 1: Contributions to GDP growth in Ireland and the European Union

Driver of Growth	Ireland		European Union	
	1991-95	1995-99	1991-95	1995-99
Labour Force Growth	1	1	0	0
Employment Rate	0.25	1.25	-0.25	0.25
Hours per employee	0.75	1.5	-0.75	0.5
(1) Total labour contribution	**2**	**3.75**	**-1**	**0.75**
Investment in ICT capital	0.25	0.5	0.25	0.25
TFP growth in ICT sector	1	1.75	0.25	0.25
(2) Total ICT contribution	**1.25**	**2.25**	**0.5**	**0.5**
Investment in other capital	0	0.25	1	0.25
TFP growth in other sectors	1.75	2.75	1	0.75
(3) Other contributions to growth	**1.75**	**3**	**2**	**1**
Overall GDP growth	**5**	**9**	**1.5**	**2.25**
Less: estimated cyclical element	0	2	-0.75	0
Estimated trend GDP growth	**5**	**7**	**2.25**	**2.25**

Source: PricewaterhouseCoopers European Economic Outlook.

Table 2: Overall ICT sectors in the EU and the US
(Share of value added in GDP)

	1995	1996	1997	1998	1999
Austria	4.7	4.4	4.2	4.4	4.8
Belgium	3.3	3.5	3.5	3.8	4.1
Germany	3.4	3.3	3.6	3.7	3.9
Finland	4.3	4.6	5.5	5.5	5.8
France	3.8	3.9	4.0	4.1	4.3
Ireland	6.5	6.7	7.5	7.3	7.6
Italy	3.3	3.3	3.3	3.5	3.7
Netherlands	4.3	4.4	4.5	4.7	5.0
Portugal	3.4	3.5	3.7	4.0	4.3
Spain	2.8	3.0	3.2	3.4	3.6
UK	5.2	5.2	5.2	5.4	5.6
EUR-11	3.6	3.7	3.8	4.0	4.2
US	5.3	5.5	6.1	6.4	6.8

Source: European Commission 2000.

APPENDIX 3

Figure 1: Sectoral Contributions to growth: 1962-2000

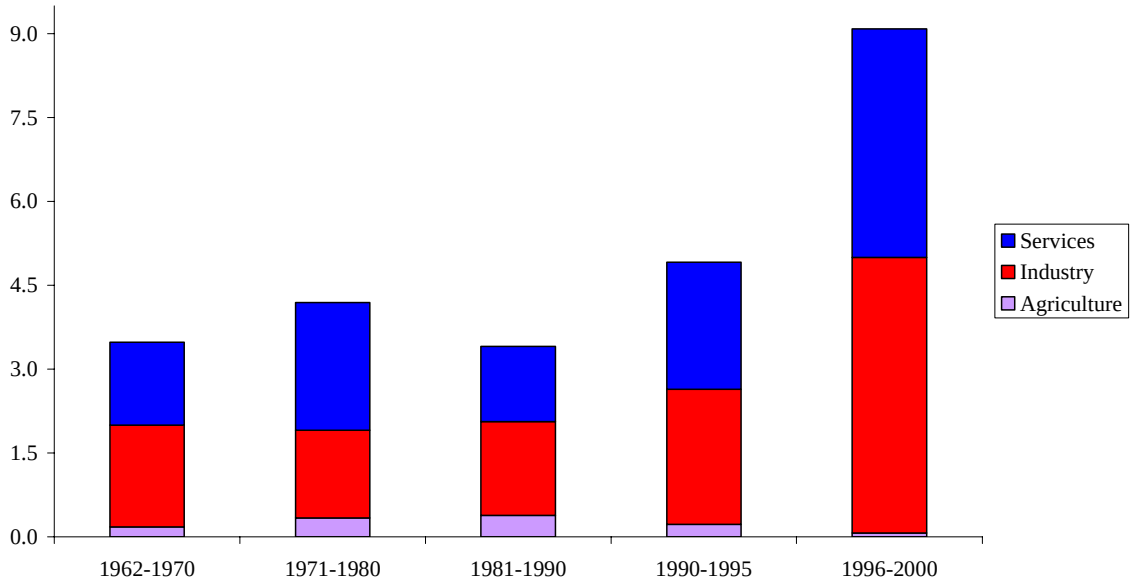


Figure 2: Sources of Economic Growth: 1962-2000:

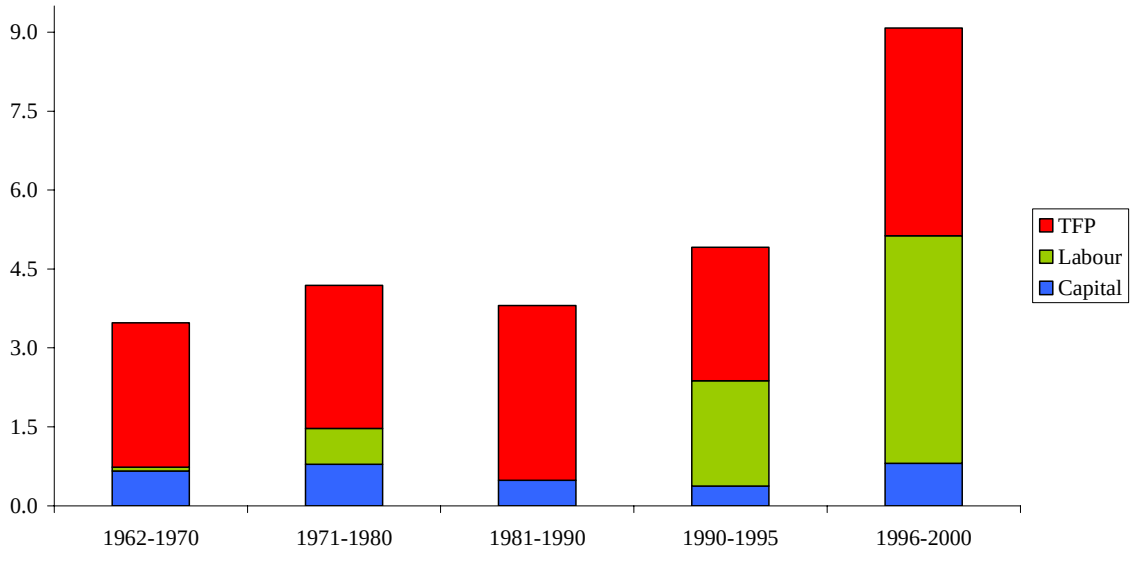


Figure 3: Contribution of Labour by sector: 1962-2000

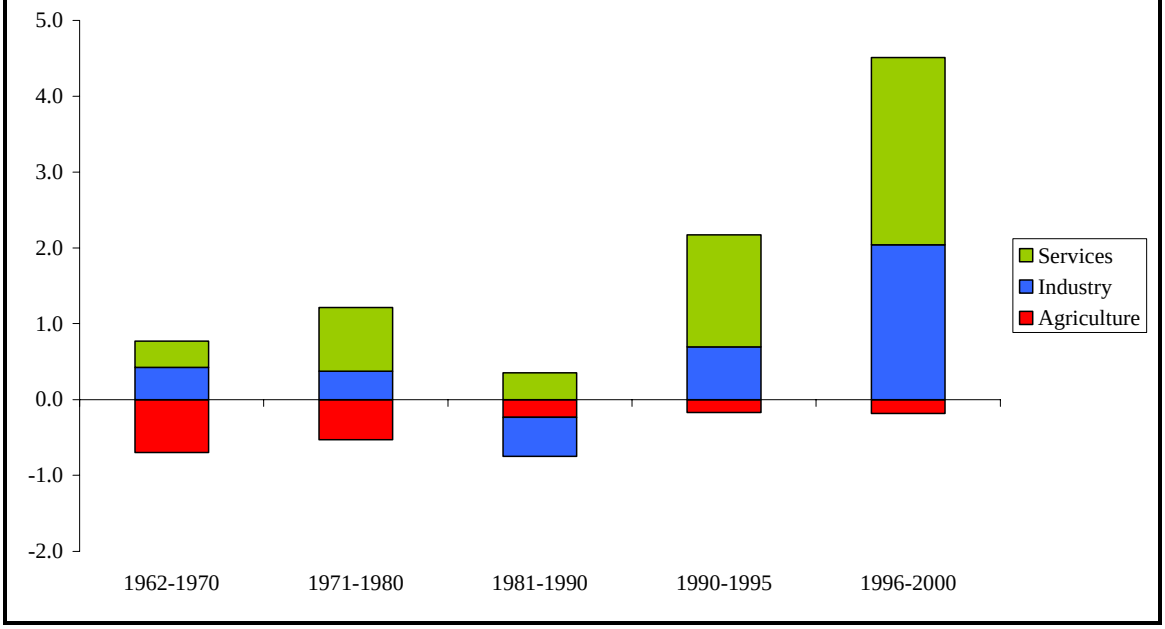


Figure 4: Contribution of TFP by sector: 1962-2000

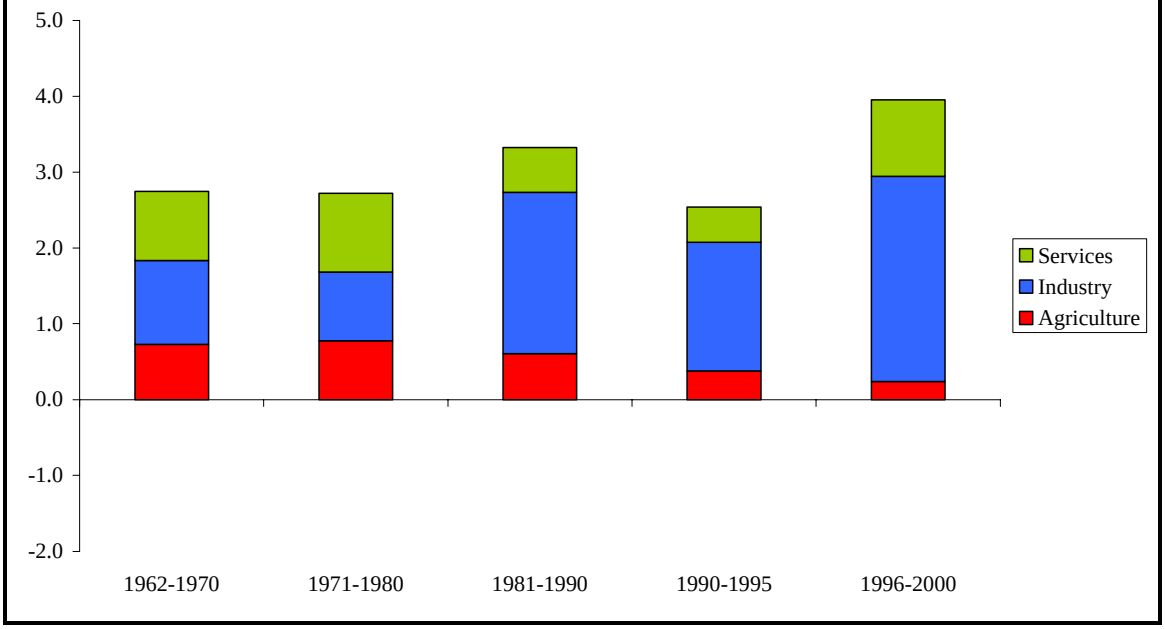


Figure 5: Output contributions by sector: 1995-1999

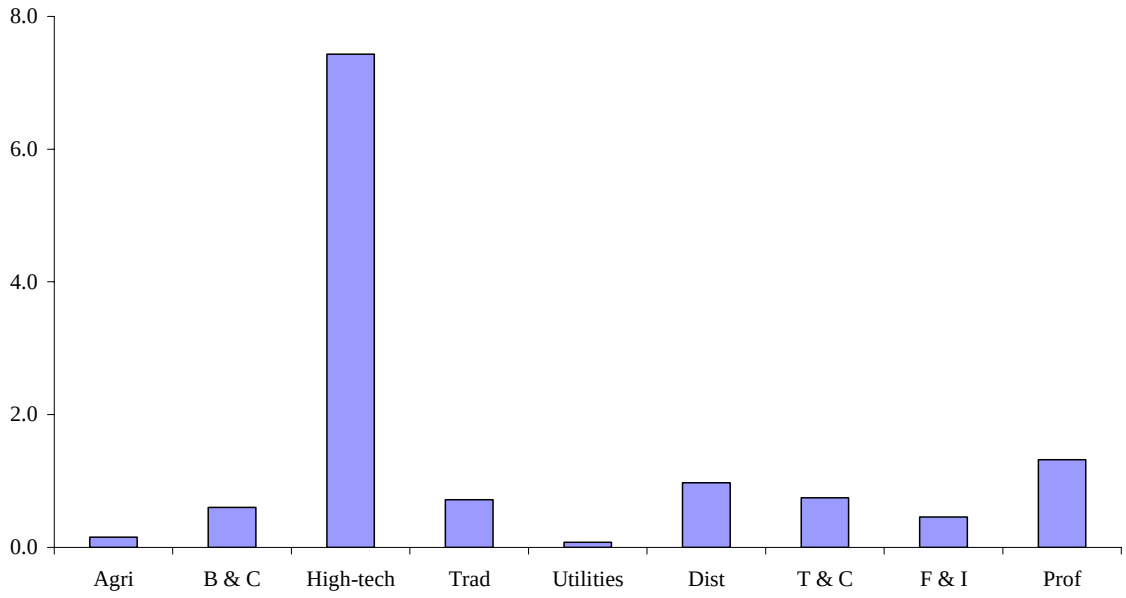


Figure 6: Sources of Economic Growth: 1971-1999

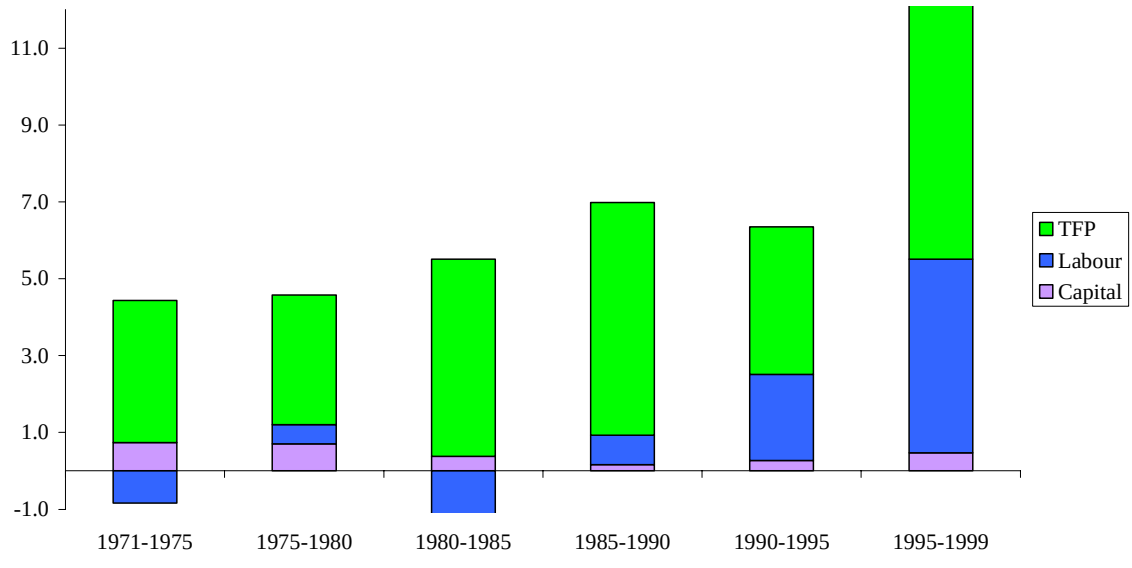


Figure 7: Sources of Output Growth in the High-Tech sector: 1997-2001

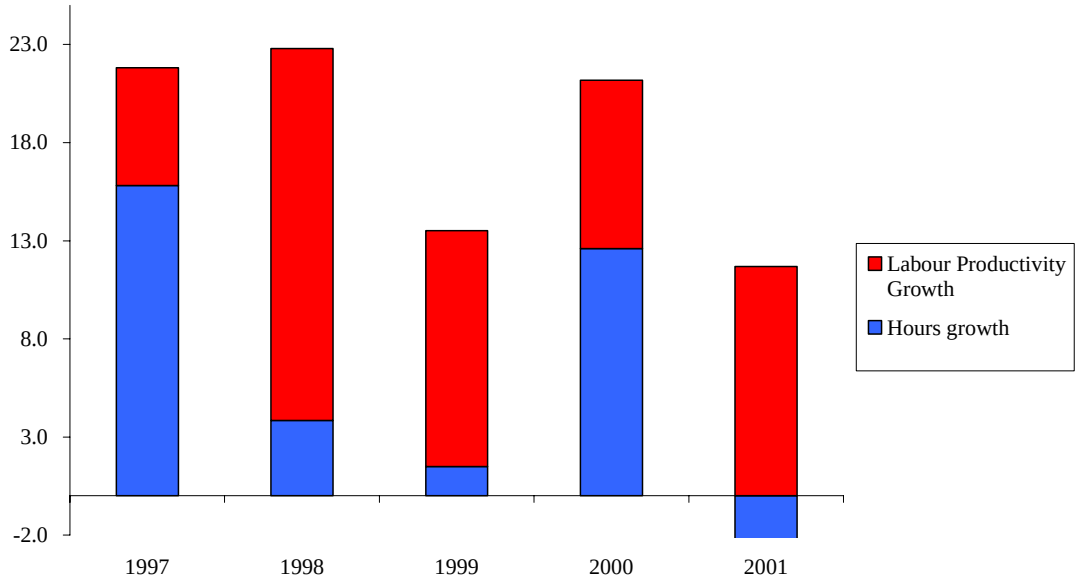
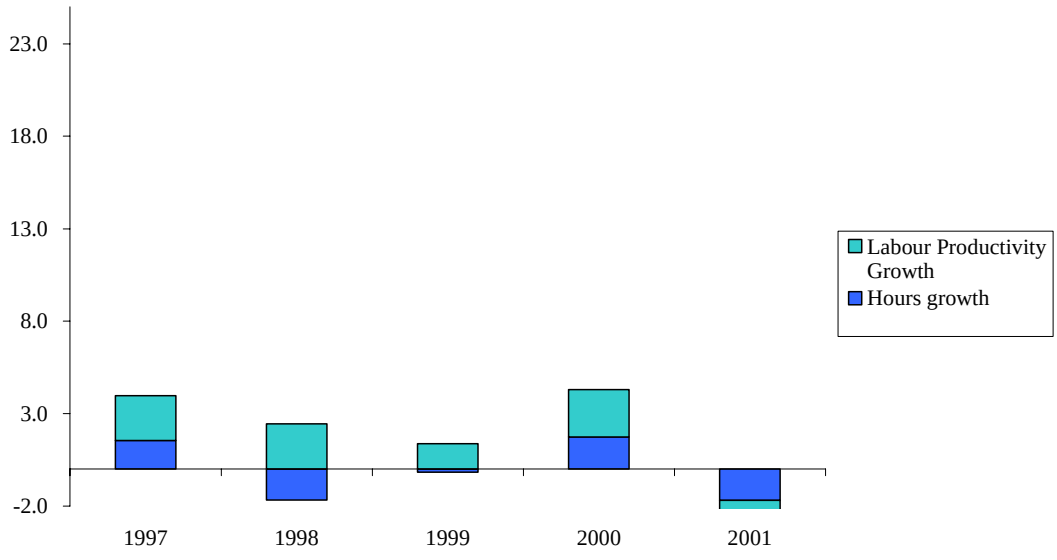


Figure 8: Sources of Output Growth in the Traditional sector: 1997-2001



APPENDIX 4

Table 1: Sources of Economic Growth: 1962-2000

		1962-2000	1962-1970	1971-1980	1981-1990	1991-2000	1990-1995	1996-2000
GDP		**4.5**	**3.5**	**4.2**	**3.4**	**6.7**	**4.9**	**9.1**
	Agriculture	0.2	0.2	0.3	0.4	0.0	0.2	0.1
	Industry	2.2	1.8	1.6	1.7	3.7	2.4	4.9
	Services	2.0	1.5	2.3	1.3	3.0	2.3	4.1
Capital		**0.6**	**0.7**	**0.8**	**0.5**	**0.6**	**0.4**	**0.8**
	Agriculture	0.1	0.1	0.1	0.0	0.0	0.0	0.0
	Industry	0.2	0.3	0.3	0.1	0.1	0.0	0.2
	Services	0.4	0.2	0.4	0.4	0.5	0.3	0.6
Labour		**0.9**	**0.1**	**0.7**	**-0.4**	**3.0**	**2.0**	**4.3**
	Agriculture	-0.4	-0.7	-0.5	-0.2	-0.2	-0.2	-0.2
	Industry	0.4	0.4	0.4	-0.5	1.3	0.7	2.0
	Services	0.9	0.3	0.8	0.4	1.9	1.5	2.5
TFP		**3.0**	**2.7**	**2.7**	**3.3**	**3.1**	**2.5**	**4.0**
	Agriculture	0.6	0.7	0.8	0.6	0.3	0.4	0.2
	Industry	1.6	1.1	0.9	2.1	2.3	1.7	2.7
	Services	0.8	0.9	1.0	0.6	0.6	0.5	1.0

Note: Figures might not sum due to rounding.

Table 2: Growth in GDP by sector: 1971-1999

	1971-1999	1971-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-1999
Agriculture	*0.3*	*1.0*	*0.1*	*0.6*	*0.3*	*0.3*	*0.1*
Industry	*4.2*	*0.8*	*2.7*	*2.6*	*4.8*	*4.0*	*8.8*
Building and Construction	0.3	0.4	0.4	-0.2	0.1	0.3	0.6
Manufacturing	3.8	0.3	2.2	2.6	4.6	3.7	8.1
High-tech	3.1	0.4	0.9	2.3	4.1	2.9	7.4
Traditional	0.7	-0.1	1.3	0.3	0.5	0.8	0.7
Fuel and power products	0.1	0.1	0.1	0.2	0.1	0.0	0.1
Market Services	*1.9*	*1.7*	*1.8*	*1.0*	*1.8*	*2.1*	*3.5*
Distribution	0.5	0.4	0.5	0.0	0.9	0.4	1.0
Transport and Communications	0.4	0.3	0.3	0.2	0.4	0.4	0.7
Finance and Insurance	0.3	0.4	0.3	0.2	0.1	0.5	0.5
Professional excluding financial	0.7	0.6	0.7	0.6	0.4	0.8	1.3

Note: Industry growth rates are based on net output and thus do not correspond to those in Table 1, which uses value added.

Table 3: Contribution of Capital: 1971-1999

	1971-1999	1971-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-1999
Capital	**0.5**	**0.7**	**0.7**	**0.4**	**0.2**	**0.3**	**0.5**
Agriculture	*0.0*	*0.1*	*0.1*	*0.0*	*0.0*	*0.0*	*0.0*
Industry	*0.2*	*0.3*	*0.4*	*0.2*	*0.0*	*0.0*	*0.2*
Building and Construction	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Manufacturing	0.1	0.2	0.2	0.0	0.0	0.0	0.1
High-tech	0.1	0.2	0.1	0.0	0.0	0.0	0.1
Traditional	0.0	0.1	0.1	0.0	0.0	0.0	0.0
Fuel and power products	0.0	0.1	0.1	0.1	0.0	0.0	0.0
Market Services	*0.2*	*0.3*	*0.2*	*0.2*	*0.2*	*0.2*	*0.3*
Distribution	0.1	0.1	0.1	0.1	0.0	0.0	0.1
Transport and Communications	0.1	0.1	0.0	0.0	0.1	0.1	0.1
Finance and Insurance	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Professional excluding financial	0.1	0.0	0.0	0.1	0.0	0.1	0.1

Table 4: Contribution of Labour: 1971-1999

	1971-1999	1971-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-1999
Labour	**1.0**	**-0.8**	**0.5**	**-1.4**	**0.8**	**2.2**	**5.0**
Agriculture	*-0.4*	*-0.7*	*-0.5*	*-0.5*	*-0.1*	*-0.2*	*-0.2*
Industry	*0.4*	*-0.2*	*0.1*	*-1.3*	*0.4*	*1.0*	*2.3*
Building and Construction	0.1	0.2	0.1	-0.4	-0.1	0.2	0.7
Manufacturing	0.3	-0.4	0.1	-0.8	0.6	0.8	1.7
High-tech	0.5	-0.1	0.3	-0.2	0.7	0.8	1.6
Traditional	-0.2	-0.3	-0.2	-0.6	-0.1	0.0	0.1
Fuel and power products	0.0	0.0	0.0	-0.1	-0.1	0.0	-0.1
Market Services	*1.0*	*0.1*	*0.9*	*0.4*	*0.5*	*1.4*	*2.9*
Distribution	0.1	0.0	0.0	0.0	0.1	0.1	0.4
Transport and Communications	0.0	0.1	0.0	0.0	-0.1	0.0	0.2
Finance and Insurance	0.3	0.2	0.4	0.2	0.1	0.2	0.6
Professional excluding financial	0.6	-0.2	0.6	0.2	0.4	1.0	1.7

Table 5: Contribution of TFP: 1971-1999

	1971-1999	1971-1975	1975-1980	1980-1985	1985-1990	1990-1995	1995-1999
TFP	**4.9**	**3.7**	**3.4**	**5.1**	**6.0**	**3.8**	**7.0**
Agriculture	*0.7*	*1.7*	*0.5*	*1.1*	*0.4*	*0.4*	*0.3*
Industry	*3.6*	*0.7*	*2.2*	*3.7*	*4.5*	*3.0*	*6.3*
Building and Construction	0.2	0.1	0.2	0.2	0.2	0.1	-0.1
Manufacturing	3.3	0.5	1.9	3.3	4.0	2.8	6.3
High-tech	2.5	0.3	0.5	2.4	3.5	2.1	5.7
Traditional	0.8	0.2	1.4	0.9	0.5	0.7	0.6
Fuel and power products	0.1	0.0	0.1	0.1	0.2	0.0	0.1
Market Services	*0.7*	*1.4*	*0.6*	*0.4*	*1.1*	*0.5*	*0.3*
Distribution	0.3	0.3	0.4	-0.1	0.8	0.2	0.5
Transport and Communications	0.3	0.1	0.2	0.2	0.5	0.2	0.5
Finance and Insurance	0.0	0.2	-0.1	0.0	0.0	0.3	-0.1
Professional excluding financial	0.1	0.7	0.1	0.3	-0.1	-0.3	-0.5

Table 6: Sources of Output Growth in High-Tech and Traditional Sectors: 1997-2001

	1997-2001	1997	1998	1999	2000	2001
High-Tech						
Output Growth	**17.6**	**21.8**	**22.8**	**13.5**	**21.2**	**8.7**
Total Hours Growth	6.2	15.8	3.8	1.5	12.6	-3.0
ALP Growth	11.4	6.0	18.9	12.0	8.6	11.7
Traditional						
Output Growth	**1.5**	**4.0**	**0.8**	**1.2**	**4.3**	**-2.7**
Total Hours Growth	0.0	1.6	-1.7	-0.2	1.7	-1.7
ALP Growth	1.6	2.4	2.4	1.4	2.6	-1.0

Table 7: Sources of Output Growth in the High-Tech sector: 1997-2001

Chemicals	1997-2001	1997	1998	1999	2000	2001
Output Growth	**24.4**	**32.6**	**34.7**	**22.9**	**13.2**	**18.7**
Total Hours Growth	3.7	4.5	5.5	2.1	4.1	2.0
ALP Growth	20.8	28.0	29.2	20.8	9.1	16.7
Publishing, printing and reproduction of recorded media						
Output Growth	**10.0**	**21.6**	**24.9**	**10.4**	**-5.8**	**-1.2**
Total Hours Growth	4.2	11.2	0.1	7.4	1.5	1.0
ALP Growth	5.8	10.5	24.8	3.0	-7.2	-2.2
Electrical and Optical Equipment						
Output Growth	**16.4**	**17.7**	**14.0**	**14.6**	**31.1**	**4.3**
Total Hours Growth	6.6	16.7	3.9	0.6	17.2	-5.3
ALP Growth	9.7	1.0	10.1	14.0	13.8	9.6