IV. LINKS BETWEEN POLICY AND GROWTH: CROSS-COUNTRY EVIDENCE

Summary and conclusions

This chapter follows up on the review of growth patterns in the OECD countries

This chapter discusses some of the main factors shaping the growth process in the OECD countries. It draws on empirical evidence from a sample of OECD countries over the past three decades. The chapter follows on from one in the previous issue of the *OECD Economic Outlook* (No. 67, July 2000) which showed widening disparities in growth rates of output per capita in the 1990s, resulting from a continued slow-down in many OECD countries, but also a significant acceleration in a few, most notably the United States.

The first section of the chapter focuses on the basic factors driving the growth process, namely the accumulation of various kinds of capital: physical, human and knowledge. The role of the public sector as a provider, or funder, of infrastructure, education and research, and implications for growth, are also discussed here. The second section extends the analysis to a number of other policy and institutional factors that could influence output growth via their impact on the accumulation of physical capital or via their impact on economic efficiency and allocation of resources. The third section explores the implications of the empirical evidence for the interpretation of the observed cross-country differences in output per capita, as well as the evolution of growth rates over time in each country. The section also sheds some light on the current debate on the "new economy" by looking at two aspects that may be of particular importance in the current period of rapid technological change: financial market conditions and product-market regulations.

The main conclusions of this analysis are the following:

Investment in all forms of capital is important…

– The accumulation of physical capital and human capital is important for growth, and differences across countries in this respect contribute significantly to explain the observed differences in growth patterns. In particular, the evidence suggests that investment in education may be characterised by positive externalities that make social returns to schooling greater than private returns, although improvements to education systems may take time to make significant impacts on average skills in the workforce, especially in ageing populations.

… and can be encouraged by appropriate macroeconomic policies

– Macroeconomic policy geared towards stable, low inflation and sound public finances contributes to better growth performance, for example by encouraging private accumulation of physical capital and a shift in investment towards higher returns projects.

Both public expenditure, and the taxes needed to finance it, need to be carefully designed so that their net impact on growth is positive

– Public expenditure on health, education and research clearly sustains living standards in the long term, and social transfers help to meet social goals, but all have to be financed. The corresponding taxation could negatively affect incentives to save and invest, with however the effect on the economy depending on the efficiency of taxation and expenditure.

Research and development (R&D) spending appears to have a significant positive impact on growth

– Research and development (R&D) appears to be important to the growth process. In the past decade, R&D intensity has risen in a number of countries. Moreover, increases in business-performed R&D have in some cases more than compensated for falls in defence-related government outlays, the former having a potentially more direct effect on productivity and output growth. Interpretation of the large cross-country differences in R&D intensity and in the role that governments play in supporting directly and indirectly private R&D is, however, complicated by the increasingly interconnected and global nature of R&D networks.

Increased investment in equipment using new technologies spurs productivity growth, and is helped by continuing falls in their price...

– While the current debate on growth is dominated by "new economy" arguments, the evidence here suggests that "old economy" forces are still crucial to understanding the growth process. A key example is the United States, where the recent exceptional performance can be seen as the result of a fairly traditional process of strong capital deepening, in this instance due to ICT-driven investment resulting from rapid falls in the price of ICT capital equipment. Of course, "new economy" elements are involved: rapid capital deepening is related to the technological advance and falling prices of IC technologies -- a process widely expected to continue for some time. Over the longer term, reorganisation of working methods and network externalities associated with increasing ICT use could lead to an acceleration in multifactor productivity.

… as well as an appropriate financial and regulatory environment

– Against a backdrop of the need for governments to ensure a broad economic environment conducive to sustained growth, there are specific areas of policy that could support the spread of new technologies. One area that has attracted widespread attention is that small, innovative businesses have played a key role alongside more established firms in making advances in technology and developing downstream products and services. The evidence presented in this chapter underscores the role that appropriate conditions in financial markets and product-market regulations have in fostering innovation and productivity enhancement.

Basic determinants of growth

There are wide disparities in growth rates across the OECD countries…

As discussed in the previous *Outlook*, OECD countries have shown wide disparities in growth performances over the recent decades. The 1990s, in particular, saw some relatively affluent countries (notably the United States) pulling further ahead, while most other countries continued to slow down. Persistent differences in the accumulation of different forms of capital (physical, human, knowledge), market conditions and technological progress – all of which could themselves be influenced by policy and institutions – are potentially important sources of these differences in growth paths across countries.

… and policy and institutions are likely to play a key role

Although there is agreement on the importance of policy and institutions for growth, the precise mechanisms linking policy to capital accumulation, economic efficiency, technical progress and, ultimately, output growth are still the subject of an intense debate (see Box IV.1). In particular, policy and institutions may influence

Box IV.1. Policy influences on output growth

Renewed interest in the determinants of growth, in part encouraged by the availability of databases covering a large number of developing as well as OECD countries, has generated a vast literature.* There is, however, no agreement on the mechanisms linking policy settings to growth. A number of studies suggest that policy and institutions mainly affect the *level* of economic efficiency with which resources are allocated in the economy. This would imply that any policy change will affect output growth only in a short to medium-term perspective by shifting the growth path, although the underlying rate of growth remains determined by exogenous (but potentially different across countries) population growth and technological progress. Other studies assume that technological progress itself could be influenced by policy, leading to a more persistent effect of policy on output growth.

The distinction between these two views largely depends on how one sees the process of accumulation of various types of capital being affected by policies and on how capital accumulation then feeds back into output growth. Policies can influence savings and the formation of physical capital, human capital (*e.g.* education), knowledge capital (*e.g.* R&D) and infrastructure. Some of these forms of capital are likely to influence the process of innovation and technological progress: for example human capital and R&D are important ingredients in the formation of new ideas and their translation into new production processes; and technological progress itself may be embodied in new capital equipment, thus creating a link between physical capital accumulation and long-term growth rates.

Only empirical evidence can determine which view of the link between policy and the growth process is most relevant. Aggregate analyses, such as that presented in this chapter, can only shed some light, while microeconomic evidence is needed to better assess the link between capital accumulation and technological progress. In particular, the results presented in this chapter lend some support to the notion that countries converge to a country-specific steady state output per capita growth path and are interpreted under the assumption that policy largely affects growth via its impact on the level (as opposed to the growth) of economic efficiency. On this basis, the observed growth in output in any given period can be seen as the combination of three different forces: *i)* technological progress – which is assumed to be exogenous; *ii)* a convergence process towards the steady-state path of output per capita; and *iii)* shifts in the level of the steady state that can arise from changes in policy and institutions as well as investment rates and population changes.

The speed with which countries converge to their specific steady state paths of output per capita gives an idea of the relative importance of the different components shaping the growth process. Most studies that focus on a large sample of countries, including many non-OECD countries, find convergence to be slow. In this case, any policy change will have a long-lasting effect on growth but be of limited intensity in any one year. By contrast, with a rapid convergence, a policy change will have a significant but shorter-lived impact on growth, and its potential effect on living standards will be quickly felt. Estimates reported in the table below suggest that this second scenario is more likely for OECD countries: following a change in a growth-related variable, it takes about four years to go half way to the new steady state output per capita.** Hence, observed changes in factor inputs as well as in policies over past decades are likely to have significantly affected growth patterns and are of importance in the assessment of cross-country differences.

The estimated speed of convergence

	Range of estimated values	
Speed of conditional convergence towards the steady-state growth path (per year)[a]	15%	17%
Half way to convergence	4.3 years	3.9 years

a) The values reflect the coefficient on the lagged output per capita in a growth regression. The range reflects the values obtained in different specifications on the growth equation.

* For a review of the empirical literature see Ahn and Hemmings (2000).

** As discussed above, an interpretation of more persistent policy influences on growth could be made, either by assuming a constant-returns-to-capital production process, or by assuming that policy affects technological progress. While there is no firm evidence on the first hypothesis, most of the policy and institutional factors considered in this chapter do not seem likely to affect technological progress, with the likely exception of R&D activity. See Bassanini, Scarpetta and Hemmings (2000) for a more detailed discussion.

private decisions on savings and investment and the formation of human capital. They can also contribute to the overall efficiency with which resources are allocated in the economy, over and above their effects on the accumulation of physical and human capital.

In order to shed light on the role of policy and institutions on output growth in OECD countries, an empirical analysis based on growth regressions has been undertaken. The analysis focuses on a sample of 21 OECD countries over the period 1971-1998 and it considers separately the effects of policy and institutions on physical capital accumulation and economic efficiency.[1] Conclusions are also drawn concerning the overall impact on output per capita.

The accumulation of physical and human capital

Business investment is a key factor for growth, and varies significantly across countries

The accumulation of physical capital (typically proxied by the share of investment in GDP) is a key factor in the growth process, although its effects could be more or less permanent depending on the extent to which technological innovation is embodied in new capital (see Box IV.1). Whatever the transition mechanism from capital accumulation to growth, the significant differences in the investment rate point to it as a possible source of differences in output per capita in different countries and over time. In particular, long-run averages of business-sector investment rates range from around 10 per cent to over 20 per cent of GDP. Furthermore, major shifts in investment rates within countries are common, a notable example being the rapid rise in the US investment rate in recent years (see below).

The empirical analysis confirms the importance of physical capital accumulation for output per capita, although there is no strong evidence that an increase in the rate of physical investment will have permanent effects on underlying growth rates as opposed to a permanent effect on the level of output.[2] More specifically, the analysis suggests that a 1 percentage point increase in the business sector investment rate could increase the annual rate of growth by as much as 0.2-0.3 per cent during the transition process, with a long-term impact on the level of output per capita of about 1.3-1.5 per cent (Table IV.1).

Some types of public investment also boost output

The government also is a direct investor in certain activities and, although the volume of its investment is small compared to that of the private sector, such investment may have a distinct bearing on growth, depending on its composition. For example, public investment in transport, communication and other infrastructure is likely to influence growth by contributing to an environment conducive to private-

1. The country sample includes neither the new members of the OECD nor Iceland, Luxembourg and Turkey. Moreover, some regressions (*e.g.* those including R&D indicators or indicators of financial developments) are based on smaller samples due to data availability. See Bassanini, Scarpetta and Hemmings (2000) for details. The same source provides an overview of recent studies applying growth regressions to data for OECD countries and their main results. Moreover, the analysis benefited from a workshop on growth organised by the OECD Economics Department held in July 2000; papers can be found in *www.oecd.org/subject/growth* (*OECD Economics Department Working Papers* Nos. 260-268).
2. For the former to be the case, one should have observed a significantly higher partial elasticity of output with respect to capital than the capital share in value added. Indeed, in a competitive market with a constant returns to scale production function, the estimated partial elasticity of output with respect to capital should be equal to the capital share in total value added. The estimated value of the partial elasticity is around 0.25, that is consistent with the range found for the capital share in National Accounts data, albeit somewhat on the low side.

Table IV.1. **The estimated role of capital accumulation for growth**

	Range of the estimated long-run impact on output per working-age person (per cent)
Business sector investment rate[a] (increase of 1% point)	1.3 to 1.5
Human capital[a] (1 additional year of average schooling in the working-age population)[b]	3.8 to 6.8

a) The values reported in this table are the estimated long-run effects on output per working-age person of a given change in the variable. The range reported reflects the values obtained in different specifications of the growth equation.
b) One additional year of average education is about a 10 per cent increase in the cross-country average.
Source: OECD.

sector activity. The varied nature of public-sector investment and its possibly complex role in the growth process is reflected in somewhat mixed conclusions from the empirical research. The empirical analysis conducted for this chapter suggests that the effect of government investment on output per capita, controlling for the required financing, has been positive, though not always statistically significant.

Human capital is of great importance for growth…

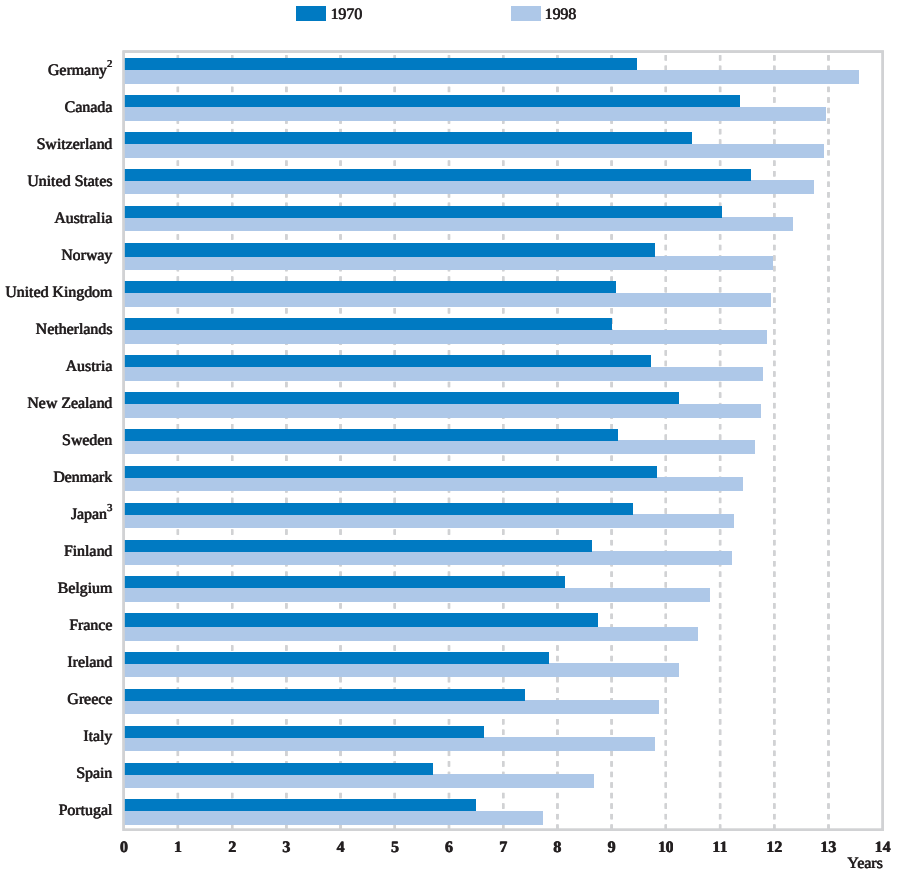
Studies on growth typically assume that formal skills and experience embodied in the labour force represent a form of (human) capital. It could be argued that human capital, like physical capital, is subject to some kind of diminishing returns, so that a more highly-trained and skilled workforce would enjoy higher levels of income in the long term, but not necessarily permanently higher growth rates of income. Alternatively, investment in human capital (*e.g.* expenditures on education and training) could have a more permanent impact on the growth process if high skills and training go hand-in-hand with more intensive research and development and a faster rate of technological progress or if a highly-skilled workforce eases the adoption of new technologies.[3]

… and its proxy based on formal education attainment shows variation across countries and over time…

Available indicators of human capital typically focus only on levels of formal education. They are admittedly crude and somewhat narrow proxies, taking little account of quality aspects of formal education or other important dimensions of human capital. Nonetheless, estimates of the average years of schooling amongst the working-age population suggest that, despite some convergence over the past decades, there remain significant differences across the OECD countries.[4] In terms of the evolution over time, Figure IV.1 indicates that the increases in average education were in the range from less than half a year per decade (*e.g.* the United States, from relatively high initial levels) to more than one year per decade (*e.g.* Germany and Italy, the latter from a relatively low level).

3. Indeed, new-growth models that incorporate a knowledge-producing sector can be interpreted as incorporating the role that, for example, research universities may play in growth. An early example of this type of model was by Uzawa (1965), later examples by Lucas (1988), Romer (1990), Grossman and Helpman (1991) and Aghion and Howitt (1998).
4. This indicator of human capital is based on education attainment amongst the population of working age and average years of schooling at each level of education. It is derived from OECD data (OECD *Education at a Glance*, various issues) combined with data from de la Fuente and Doménech (2000).

Figure IV.1. **Average years of education[1] of the working-age population in OECD countries, 1970 and 1998**



1. Average number of years of education in the population aged 15-64 years, based on data on level of education attained and assumptions about the number of years of education implied by different levels of education attainment.
2. Western Germany in 1970.
3. 1990 instead of 1998 for Japan.

Source: OECD.

… with an estimated strong effect on observed growth trends

Analysis conducted for this chapter indicates that the long-run effect on the level of output per capita of an additional year of education has ranged between 4 and 7 per cent (Table IV.1).[5] However, although average levels of human capital have typically been rising – thus continually feeding through into higher growth – the relatively slow rates of increase (half to one year per decade) need to be borne in mind in evaluating this result.

The magnitude of the impact on growth found in this analysis suggests that the economy-wide returns to investment in education may be larger than those experi-

5. These results are in contrast with a number of previous studies that failed to find a robust association between human capital and output per capita. For example, Benhabib and Spiegel (1994) and Barro and Sala-i-Martin (1995) found no, or very limited, effects of human capital on growth. The more significant results found in the present study may be due to the use of better quality data on human capital. Indeed, using a similar indicator of human capital, de la Fuente and Doménech (2000) also found a statistically significant role for human capital in growth.

enced by individuals. This possibly reflects spillover effects, such as links between education levels and advances in technology, and implies that incentives for individuals to engage in education may be usefully enhanced by policy to reap maximum benefits for society as a whole. However, there are some caveats to this interpretation of the results. First, the impacts found in the analysis may be over-estimated because the indicator of human capital may be partially acting as a proxy for other variables, an issue also raised in some microeconomic studies. In addition, the empirical analysis suggests that the impact is determined with some lack of precision. In any case, the average level of formal education is bound to react only slowly to changes in education policy, as the latter typically affect only young cohorts entering the workforce. Finally, extending the period of formal education may not be the most efficient way of providing workplace skills, and this aspect of education must also be balanced against other (sometimes-competing) goals of education systems. Thus, for those countries at the forefront of educational provision, the growth dividend from further increases in formal education may be less marked than that implied in the empirical analysis.

Innovation, R&D and growth

Innovation is a key driver of growth, and is influenced by R&D activity

Expenditure on R&D can be considered as an investment in knowledge that can translate into new technologies and more efficient ways of using existing resources of physical and human capital. Insofar as it is successful in these respects, it is plausible that higher R&D expenditure would, *ceteris paribus*, be associated with permanently higher growth rates. The potential benefits from new ideas may not accrue fully to the innovators themselves due to spillover effects, implying that without policy intervention the private sector would likely engage in less R&D than is socially optimal. This can justify some government involvement in R&D, both through direct provision and funding and through indirect measures such as tax incentives and protection of intellectual property rights to encourage private-sector R&D.

Expenditures on R&D have increased from the 1980s to the 1990s, especially in the business sector…

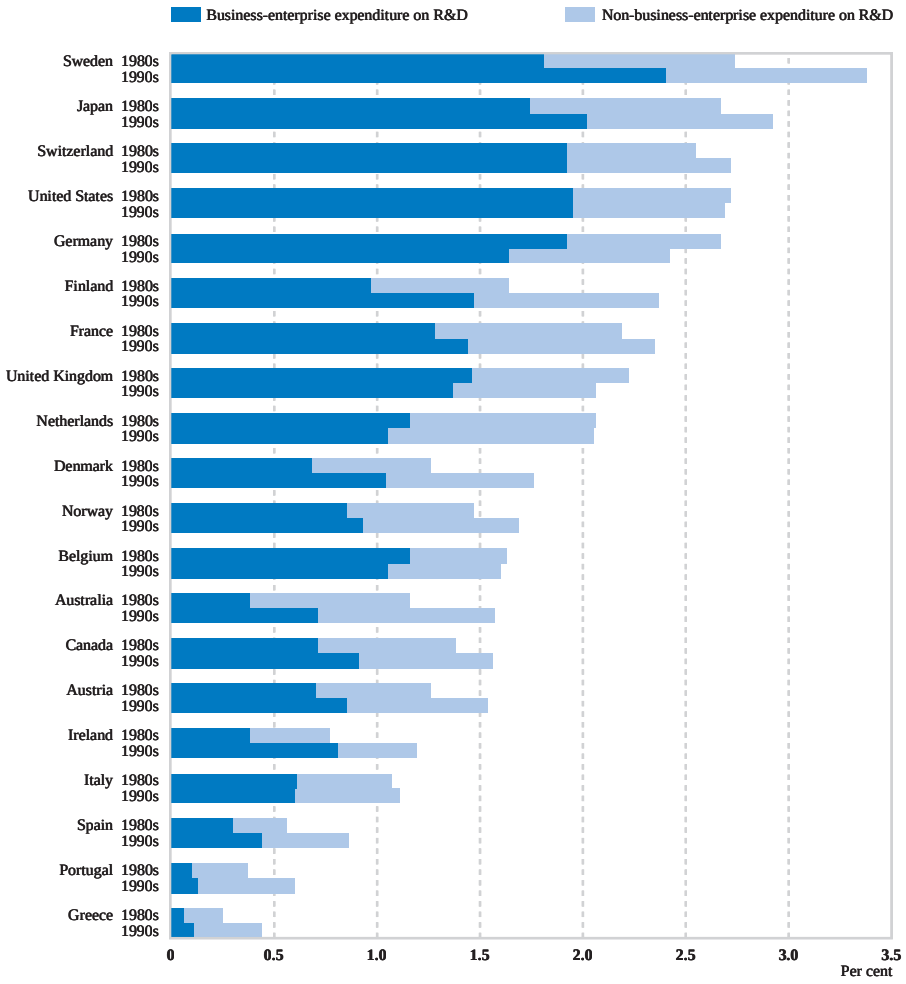
Overall expenditure on R&D as a share of GDP has risen somewhat since the 1980s in most countries (Figure IV.2), mainly reflecting increases in business-performed R&D that accounts for the majority of expenditure in most OECD countries.[6] The increase in business-sector R&D intensity in the 1990s as compared with the 1980s has been driven by larger resources made available by private firms, rather than by governments: indeed the share of publicly financed business-sector R&D has declined over the past decade.

… and this is estimated to have had a significant positive effect on output per capita

The empirical analysis suggests that business-performed R&D has had a substantial impact on output and growth.[7] Confirming some previous studies, R&D activities seem to have high social returns: the 10 per cent increase in R&D intensity (about 0.1 per cent of GDP) recorded from the 1980s to the 1990s could have boosted output growth in the latter period by some 0.3-0.4 per cent. This could imply a long-run effect of about 1.2 per cent higher output per capita under the "conservative" view that changes in R&D do not permanently affect output growth. The

6. OECD (2000) provides more details on recent trends in R&D intensity. In particular, the decline in government spending on R&D has been affected by the reduction in military R&D budgets following the end of the cold war and, more generally, efforts to reduce fiscal imbalances.
7. These empirical findings are not fully comparable with those discussed above, insofar as the analysis from which they are drawn only includes 16 countries over the 1981-98 period.

— Figure IV.2. **Expenditure on R&D in the OECD countries, 1980s and 1990s** —
Per cent of GDP



Source: OECD.

results are not clear-cut for R&D activities performed by other institutions (mainly government and research laboratories). There are, however, potential interactions between the different sources of R&D activities that were not considered in the empirical analysis, *i.e.* certain forms of government R&D could stimulate business R&D.[8] Moreover, the nature of the two forms of R&D activity may be different. For example, while business R&D is likely to be more directly targeted towards innovation and implementation of innovative processes (leading to improvements in productivity), non-business oriented R&D (*e.g.* defence, fundamental science and health research) may generate basic knowledge with possible "technology spillovers" in the long run. The latter are difficult to identify in growth regressions, not least because of the long lags involved, and the possible interactions with human capital and associated institutions.

8. See Guellec and Van Pottelsberghe (2000).

Policy and institutional influences on growth

Macroeconomic policy setting and growth

Both the level and variability of inflation could be harmful for growth

In recent years, most OECD countries have succeeded in lowering inflation and improving public finances, and a number of studies have shown the beneficial effects of these moves for economic growth. The usual arguments for lower and more stable inflation rates include reduced uncertainty and enhanced efficiency of the price mechanism. Moreover, more stable inflation may be associated with more stable output growth, also reducing uncertainty and improving the environment for private-sector decisions. There could also be an additional effect on capital accumulation where inflation exacerbates tax distortions (*e.g.* nominally-denominated allowances). Nevertheless, a simple comparison of inflation rates and growth rates for OECD countries shows that the link may not be very strong, especially when inflation is low, as at present. By contrast, there is a somewhat stronger negative correlation between the change in variability of inflation and changes in average growth rates from the 1980s to the 1990s.[9]

More sophisticated empirical analysis lends stronger support to the notion that the level of inflation has a negative impact on output, mainly via its impact on the accumulation of physical capital in the private sector (Table IV.2). On this basis, the approximately 4 percentage point reduction in the average rate of inflation from the 1980s to the 1990s could be associated with about 1.6 per cent higher output per capita. Moreover, the average reduction in the *variability* of inflation observed from the 1980s to the 1990s could be associated with an increase in output per working age person of about 1.3 per cent, holding all other factors constant. These results are consistent with the view that uncertainty about price developments influences growth mainly via its impact on economic efficiency, for example by leading to a sub-optimal choice of potential investment projects, with lower average returns. At the same time, the results suggest that high levels of inflation discourage savings and investment and by this channel negatively affect growth. However, some care has to be taken in interpreting the evidence on the negative relationship between inflation (or its variation) and growth, given the current conditions observed in many OECD countries. At low levels of inflation, the link with growth is likely to be more uncertain.[10]

Government expenditures and taxation could also have a bearing on growth

Most types of government expenditures probably have some impact on economic growth, directly and indirectly, whether or not this is their main purpose. Analysing the impact of these expenditures on growth is not straightforward, in part because the mechanisms may be complex and slow to operate in some cases, but also because the causation could go the other way.[11]

9. The correlation between the change in the standard deviation of inflation from the 1980s to the 1990s and the change in the average growth rate is –0.42 (with a t-statistic of –2.23). If countries with relatively high variability of inflation are excluded (*e.g.* Mexico, Ireland, Turkey, Korea and Greece), the correlation is not statistically significant (–0.28, with a t-statistic of –1.23).
10. On the one hand, some argue (*e.g.* Feldstein, 1996) that further reductions in inflation, even towards zero inflation (or more stringently, price stability) would see continuation of the benefits of reduced inflation. On the other hand, others (*e.g.* Akerlof *et al.*, 1996) claim that negative effects on growth emerge at very low levels of inflation through nominal wage rigidities creating market inefficiencies.
11. For example, long-run data often show that government expenditure as a share of GDP tends to rise with standards of living (Wagner's law), reflecting income-elastic demand for key government services (health, education and law and order). Kolluri *et al.* (2000) find strong support for Wagner's law operating in OECD countries based on regressions linking total government expenditure with GDP.

Table IV.2. **Estimated impact of changes in institutional or policy factors on output per capita**[a]

Variable	Impact on output per working age person (per cent)[b]			Order of magnitude withrespect to OECD experience (1980s-90s)[c]
	Effect via economic efficiency	Effect via investment	Overall effect	
Inflation rate (fall of 1% point)		0.4 to 0.5	0.4 to 0.5	About 1/4 the observed fall
Variability of inflation (1% point fall in the standard deviation of inflation)	2.0		2.0	About 1.5 times the observed fall
Tax burden[d] (increase of 1% point)	–0.3	–0.3 to –0.4	–0.6 to –0.7	About 2/3 of the observed increase
Business R&D intensity[d] (increase of 0.1% point)	1.2		1.2	About the increase observed
Trade exposure[d] (increase of 10% points)	4.0		4.0	About the increase observed

a) The values reported in this table are the estimated long-run effects on output per working-age person of a given policy change. The range reported reflects the values obtained in different specifications of the growth equation.
b) The effect via economic efficiency refers to the impact on output per capita over and above any potential influence on the accumulation of physical capital. The effect via investment refers to the combined impact of the variable on the investment rate and by that channel, on output per capita.
c) Average change from the 1980 average to the 1990 average in the sample of 21 OECD countries, excluding new Members as well as Iceland, Luxembourg and Turkey.
d) In percentage of GDP.
Source: OECD.

In any case, expenditures have to be financed. Where public consumption or social transfers are financed by government deficits, a traditional argument for a more restrictive fiscal policy is to contain the crowding-out effects that reduce growth through cut-backs in private-sector investment. Where taxes are raised to support government spending, they may distort incentives, reduce the efficient allocation of resources and hence reduce the level or growth of output.

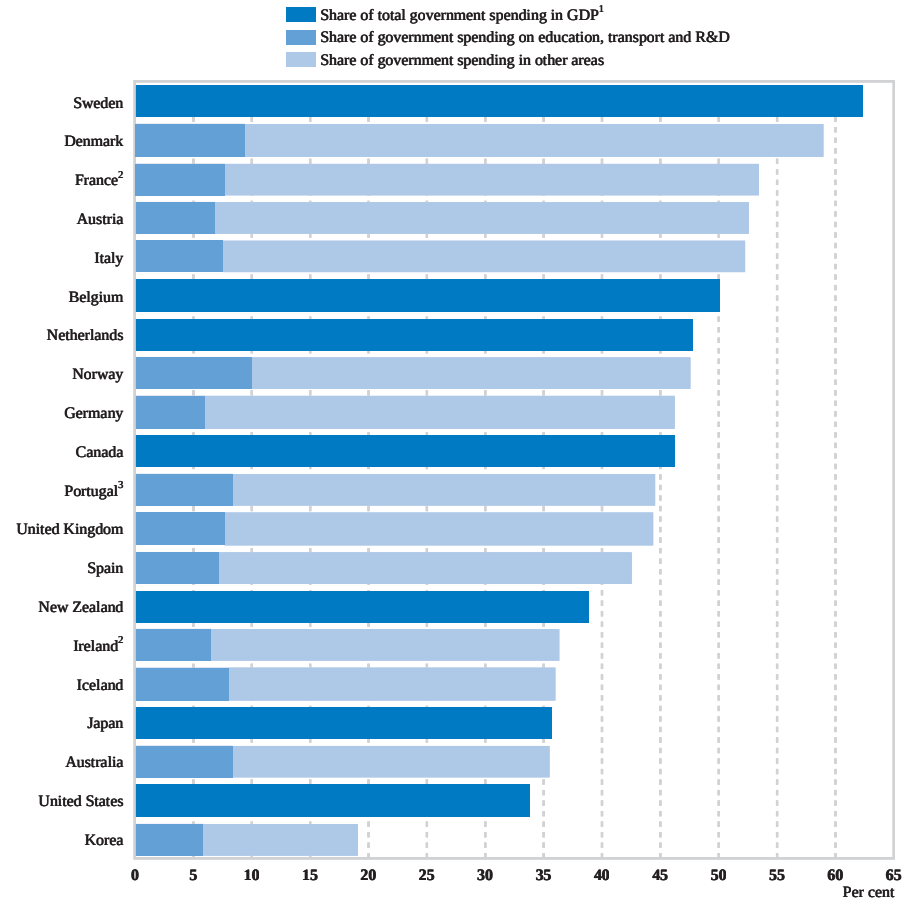
Over the past decade, tax pressure increased in many countries…

Over the past decade, the size of the public sector tended to increase in most OECD countries as did government gross liabilities, although the most recent years have seen some reversal of this trend. Notwithstanding these latest developments, the ratio of total government expenditure to nominal GDP was still in the range of 40-50 per cent in a number of OECD countries in 1999. Less than a fifth of expenditure is typically allocated to areas more directly related to growth (*e.g.* schooling, infrastructure and R&D) (Figure IV.3).

***… and this is estimated to have led to a lower output per capita,* ceteris paribus**

The empirical results reported in Table IV.2 provide some support for the idea that the tax pressure related to government spending could have an overall negative impact on output per capita, by influencing the efficiency of resource allocation across different investment projects, and by reducing the accumulation of physical capital. Bearing in mind the illustrative nature of this exercise, the observed average increase in tax pressure across the 21 OECD countries between the 1980s and the 1990s (about 1.5 per cent of GDP) could have led to a lower output per capita, *ceteris paribus*, of about 0.9 to 1.1 per cent. The composition of expenditure is also

Figure IV.3. **Share of total government spending in GDP in OECD countries, 1995**



1. Where disaggregated data are not available.
2. 1993.
3. 1992.

Source: OECD.

important: both government consumption and investment seem to have a positive impact on output per capita. In addition, it seems likely that the structure of taxes has some bearing on this result as an additional negative effect was found for tax structures with a heavy weight on direct taxes.

Trade and growth

Exposure to foreign trade has increased in all OECD countries over the past decade…

Empirical studies have often pointed to the importance of foreign trade for growth. Aside from the benefits of exploiting comparative advantages, gains from trade may arise through economies of scale, greater exposure to competition and the diffusion of knowledge. Past progress in reducing tariff barriers and dismantling non-tariff barriers has almost certainly opened up opportunities to gain from trade. The relatively open policy stance now in place across OECD countries would sug-

gest that the amount of trade conducted is by now more a reflection of patterns of growth (and to some extent geography, size and transport costs) rather than something that is tightly constrained by tariff and non-tariff barriers.

... with an estimated positive contribution to income per capita

Given this interpretation of the link between trade and growth in OECD countries, the results in Table IV.2 concerning trade exposure probably capture various competitive pressures, as much as factors directly related to trade policy. The results are based on a measure of trade exposure that attempts to control for the inherent higher exposure of small countries as compared to large countries (Table IV.2). The results point to a significant contribution to output per capita (about 4 per cent) from the observed average increases in trade exposure in the OECD countries over the 1980s-90s period.

Financial development and growth

Financial systems deliver a range of services that are likely to encourage growth…

Financial systems play a role in the growth process because they are key in the provision of funding for capital accumulation and for the diffusion of new technologies. A well-developed financial system: *i*) mobilises savings by channelling the small-denomination savings of individuals into profitable large-scale investments while offering savers a high degree of liquidity; *ii*) provides insurance to individual savers against idiosyncratic risk through diversification; *iii*) reduces the costs of acquiring and evaluating information on prospective projects, for example through specialised investment services; and *iv*) serves in the monitoring of investments to reduce the risk that resources are mismanaged. All these services are likely to contribute to economic growth, but there could, in theory, also be opposite effects. For example, lower risk and higher returns resulting from diversification may prompt households to save less.

… and recent OECD analysis finds supporting evidence for this within Member countries

Despite the theoretical complications, a number of empirical studies attempting to explain cross-country differences in growth across a broad range of countries have concluded that financial development plays a significant role.[12] In particular, financial market development appears to be significantly related to output per capita.[13] The results point to effects working through two channels. One is through increased efficiency, which may arise from the allocation of resources towards higher-return projects. The other is through the accumulation of physical capital. However, as is the case in previous studies, the possibility of reverse causality must be recognised in assessing these results insofar as economic growth may also prompt the development of financial systems.

12. See, for example Levine (1997), Levine *et al.* (2000), Temple (1999).
13. Specifically, an indicator of stock market capitalisation was found to be statistically significant in the regression analysis. Results using private credit of deposit money banks as a share of GDP were somewhat weaker. See Leahy *et al.* (2000) and Bassanini, Scarpetta and Hemmings (2000).

Determinants of growth in OECD countries over the past decades and the "New Economy"

Explaining past growth trends

Changes in policy settings within countries have generally gone in the direction of fostering growth…

The results discussed above can be used to shed some light on the possible impact of policy changes on the growth path of each country over the past decade (Figure IV.4).[14] The improvement in human capital seems to be a common factor behind the growth process of the past decades in all OECD countries, but especially so in Italy, Greece, Ireland and Spain where the increase in human capital accounted for more than half a percentage point acceleration in growth in the 1990s with respect to the previous decade. The contribution stemming from changes in the investment rate is more mixed. Some countries are estimated to have benefited from an increase in the business investment rate in the past decade (*e.g.* Canada, Austria, Belgium, New Zealand, Portugal and Spain), while others experienced a negative impact from lower investment rates (*e.g.* Finland, and to a lesser extent Norway and Sweden).

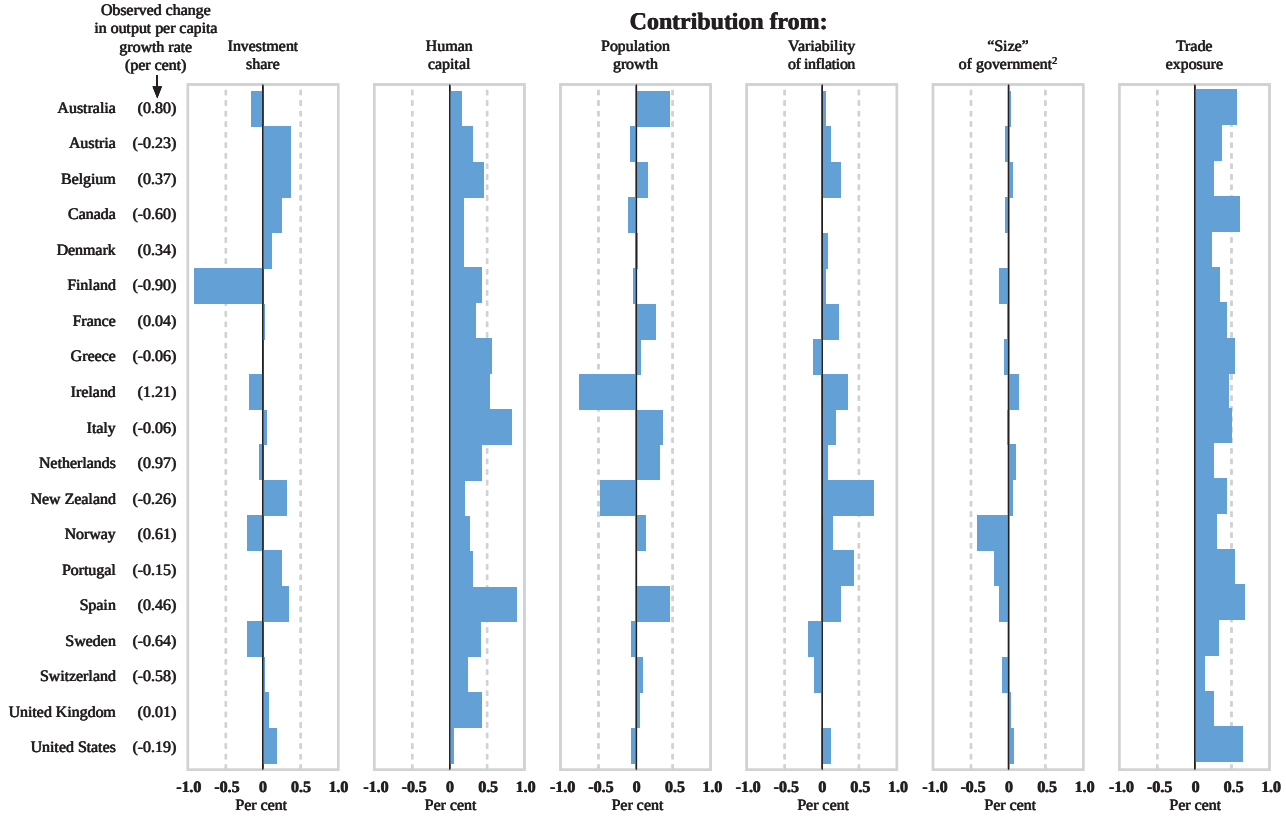
There have also been important changes in policy and institutional settings in each country that have contributed to growth, over and above the changes in inputs of physical and human capital. Most countries have benefited, especially in the 1990s, from a lower variability of inflation. The most noticeable examples include Portugal and New Zealand, where about half a percentage point higher annual output per capita growth rate is estimated to be due to this factor, *ceteris paribus*. By contrast, in spite of the greater fiscal discipline especially in the last decade, the rise in the size of government contributed to a marginal growth slow-down in many countries. Exceptions include Ireland and the Netherlands, where a reduction in taxes and expenditures as a share of GDP marginally boosted output per capita growth in the 1990s. Finally, the generalised process of trade liberalisation in which all OECD countries have been involved is estimated to have increased growth by up to two-thirds of a percentage point annually over the past decade.

… however, there remain large cross-country differences in the main determinants of growth

Despite developments in the past decade, there remain profound differences in the main determinants of economic growth across the OECD countries. As an illustration, Figure IV.5 presents the changes in output per capita that would occur in individual countries if these determinants converged to the OECD average (of the 1990s). The potential contributions are derived from the empirical results discussed above. Focussing on the basic determinants of growth, a relatively low investment rate tended to reduce output per capita in a number of countries (*e.g.* United States, United Kingdom, Ireland), *ceteris paribus*, whilst relatively low levels of human capital have had a negative impact on output per capita in some European countries,

14. Note that Figure IV.4 does not report the estimated effect on growth of different initial conditions (*i.e.* the convergence process) nor does it show the unexplained country-specific effect. The coefficients used to perform the decomposition are from a growth equation that includes the variability of inflation, trade exposure and government consumption (as a share of GDP) as a proxy for the potential effect of government "size" on growth. This last variable is highly correlated with the overall tax and non-tax receipts, for which however there is not full country coverage. For further details on the decomposition, see Bassanini, Scarpetta and Hemmings (2000).

Figure IV.4. **The estimated effect of changes in explanatory variables to changes in output per capita growth rates[1] over the period 1980s-1990s**



Note: The calculations are from decompositions of differences in growth rates based on the results of multivariate regressions. The sum of the contributions shown do not correspond to the observed change in output per capita growth rates because the estimated impact of initial levels of GDP per capita and the component unexplained by the regressions are not shown.

1. The changes in growth are based on differences in average growth in GDP per person of working age over each decade. The 1980s include the period 1981-89; the 1990s cover the period up to 1997.
2. Government consumption as a percentage of GDP is used as a proxy for the size of government due to data availability. This variable is highly correlated in most countries with the tax and non-tax receipts (as a share of GDP) for which, however country coverage is more limited.

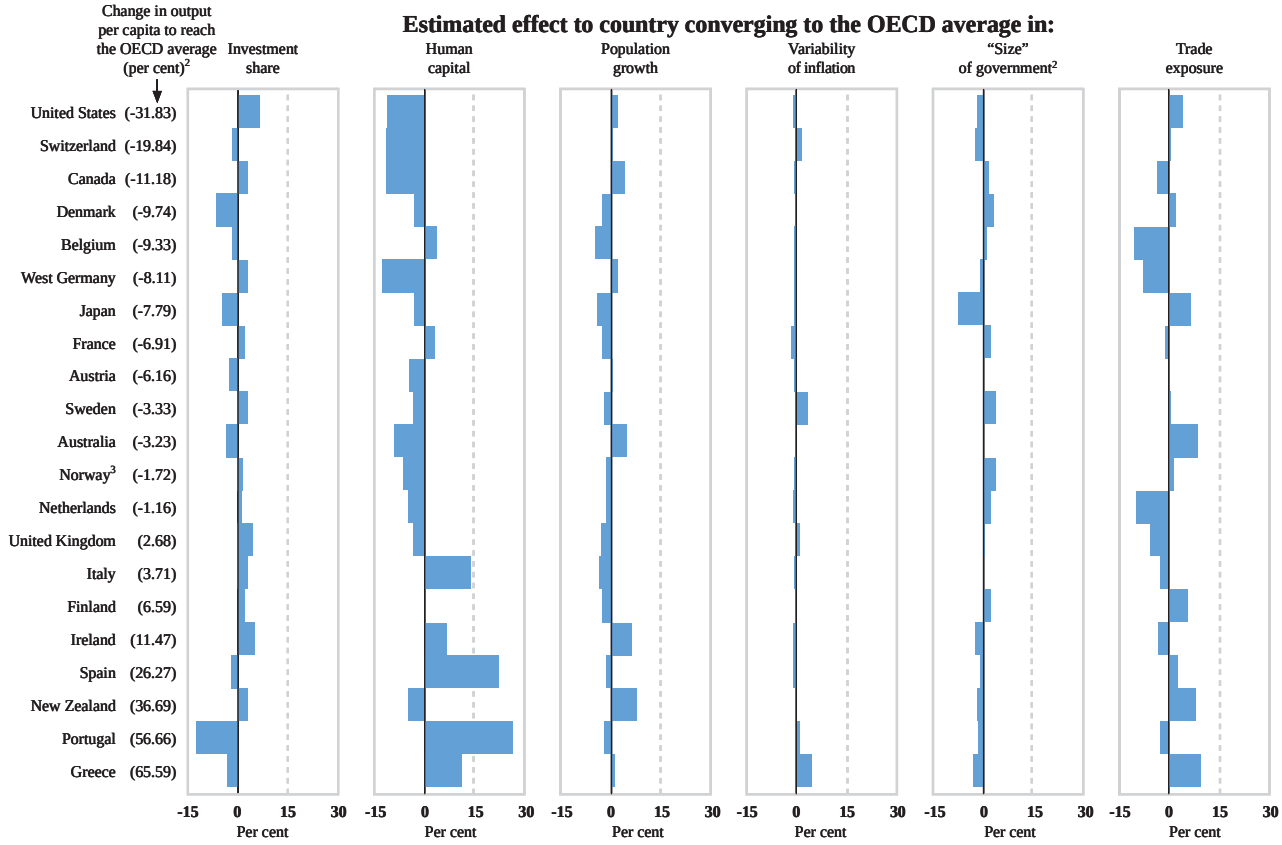
Source: OECD.

particularly in Portugal and Spain.[15] It should be stressed, however, that in the case of human capital, closing the gap with the OECD average could take a long time, given that formal education policy mainly affects new entrants in the working-age population.[16]

Differences in macroeconomic policy conditions in the 1990s had only a limited effect on output per capita. At the same time, the large "size" of government had a negative influence on output per capita in some countries, notably in Denmark and Sweden. Moreover, the relatively low exposure to foreign trade (after controlling for

15. It should also be noted that the calculations in Figure IV.5 are based on a regression in which the estimated effect of human capital on output per capita is on the high side of the range presented in Table IV.1.
16. In addition, some countries, including Australia, Canada, Ireland and New Zealand, had a somewhat lower output per capita as a result of a rapidly growing population.

Figure IV.5. **Differences in output per capita[1] and estimated contributions from differences in policy and institutional variables, 1990s**



Note: The contributions from policy and institutional variables are calculated on the basis of the observed differences in these variables in each counrty with respect to the OECD average and the estimated elasticities in the growth regressions.

1. Output per capita refers to GDP (in 1993 PPPs) per working age person.
2. Government consumption as a percentage of GDP is used as a proxy for the size of government due to data availability. This variable is highly correlated in most countries with the tax and non-tax receipts (as a share of GDP) for which, however country coverage is more limited.
3. Mainland only.

Source: OECD.

the size of individual economies) somewhat reduced potential output per capita in Australia and New Zealand, possibly reflecting geographical realities but also in Greece.

There are limits to the extent to which these results can shed light on very recent growth trends…

Results based on regression analysis clearly have limits in the extent to which they can confirm and quantify links between policy and institutional settings and economic growth. An obvious and inherent difficulty is that relatively recent growth issues, in particular the current debate about the possible shift to a "new economy" due to the development and diffusion of ICT, are difficult to examine using the regression approach. The most fruitful analyses on the effects of ICT to date have been based on growth accounting or case studies which attempt to isolate the impact on aggregate productivity of the ICT-producing sector, and the identification of wider effects on productivity in other sectors (see the previous *OECD Economic Outlook* for a review). These studies point out that rapid technological change in the ICT-producing

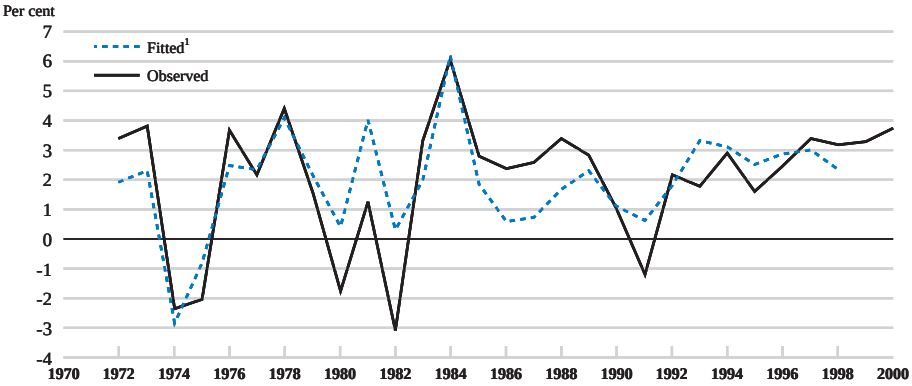
sectors and falling relative prices of ICT equipment induced rapid growth of investment in the United States, thereby boosting growth in ICT-using sectors.

… but a comparison of model-predicted and actual growth rates sheds some light on the strength of "new economy" factors

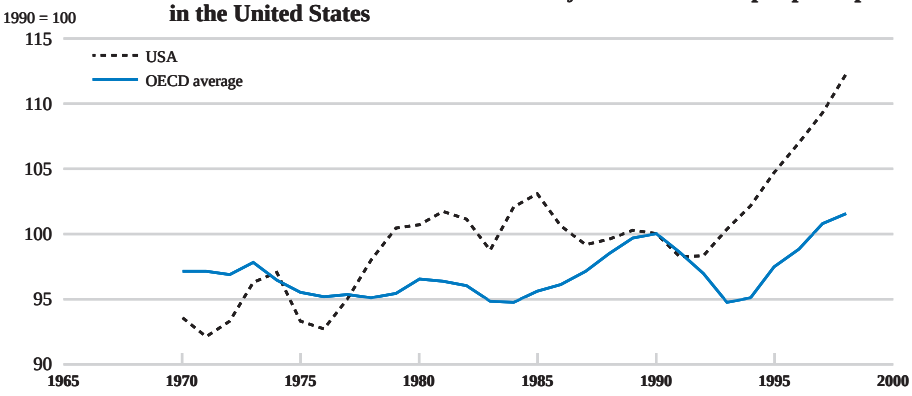
A tentative contribution from the regression analysis to the current debate can be made by comparing the growth rates estimated by the empirical model discussed in this chapter with the values actually observed in a country where there is some evidence of a "new economy", the United States. Panel A of Figure IV.6 plots predicted annual growth of output per capita in the United States with the actual values. From the figure, there is little evidence of a positive gap opening up between actual and predicted growth rates, that is to say factors included in the growth regression explain most of the observed growth paths up to 1998, and there is little need for additional explanatory factors. Consistent with most growth-accounting studies, this also suggests that there is still little evidence of a generalised pickup in productivity resulting from spillover, or network, effects in the use of IC technology, since these effects should have shown up in a divergence between estimated and observed growth rates.

Figure IV.6. **US growth performance and the role of investment in output per capita**

Panel A. Observed and fitted annual growth rates in the United States, 1972-1998



Panel B. Contribution of investment to the steady-state level of output per capita in the United States



1. The fitted series is based on a panel regression where the coefficients of some variables are allowed to vary across countries.

Source: OECD.

Rising investment in the US explains most of the acceleration in growth

This result suggests an interpretation of the "new economy" that emphasises an ICT-driven process of capital deepening. Indeed, the good fit of the growth regression is largely explicable by the business-sector investment variable. Panel B of Figure IV.6 plots the estimated contribution of the investment rate to output per capita. The figure shows that this contribution soared in the United States in the 1993-1998 period – accounting for a rise in the steady state output per capita of more than 10 per cent – while it had remained roughly constant in previous decades.[17] If the rise in the investment share in the United States is a more permanent phenomenon, its economy would converge over time to this higher steady-state level of output per capita. This may not seem implausible given that a significant part of the rise in investment in the United States has been due to a major fall in the relative prices of ICT equipment,[18] *i.e.* the rise in investment has not required a similar rise in savings. In any case, the figure also shows that no such boost from investment to output could be detected in the OECD-wide average over the same period.

Encouraging the "New Economy"

Encouraging the new economy requires both "old" and "new" policies

Although evidence of new forces shaping the growth process is still limited, it is undeniable that the recent years have witnessed an acceleration in growth in some countries and, at least in the United States, this has been driven by an ICT-related process of capital deepening. Setting the right broad economic environment for encouraging further diffusion of this technology is likely to involve a combination of both "old" and "new" policies. Thus, the general framework conditions discussed above, including macroeconomic conditions and the climate for investment in physical and human capital development and R&D, will remain important in a comprehensive growth strategy. At the same time, a number of more specific issues affects the ability of markets to adapt to the new technologies. This section focuses on two areas of concern. First, the role that the financial environment may play in fostering investment and innovation; and second, the role that product-market regulations may have on innovation and technological progress through their influence on competition, market entry and incentives for business start-ups. Finally, the new technologies raise a number of challenges to existing policies in various areas and these are briefly presented.

The financial environment and innovation

Financial environment conditions may play an important role in the development of ICT-related industries

As discussed above, financial systems have an important role to play in the growth process. In the context of the new economy, a specific contribution they could offer is that of allowing the emergence of new, innovative enterprises. In particular, the financial environment is likely to have played a role in the development of "venture capital" markets. Venture capital typically consists of equity, or equity-linked, investments in young, privately held companies and has often served as seed money in ICT businesses. In addition, share markets have also played a role in providing funding by the public. The fact that these forms of capital, and other forms of high-risk capital, have developed to differing degrees across countries suggests that differences in financial framework conditions may be influential in determining investment in innovative projects and ultimately the rate of innovation itself.

17. The empirical analysis does not, of course, "explain" in detail why investment in ICT has soared so much.
18. See the previous *OECD Economic Outlook* and Bassanini, Scarpetta and Visco (2000).

In theory the relationship between financial systems and innovation is complex…

The link between financial environment and innovation is not clear-cut. For example, a system of shareholder rights that results in ownership concentration may strengthen shareholders' incentives to monitor enterprises and investments, but may also inhibit the development of liquid equity markets, providing fewer opportunities for risk diversification and greater obstacles to funding risky projects. In terms of creditor rights, a harsher bankruptcy policy might elicit more efficient decision-making by enterprise managers but may also reduce incentives for managers to undertake risky projects that offer the potential for higher future returns, leading to less innovation and slower long-run growth.

… and measurement issues are prominent

Given the trade-offs involved, questions of how financial conditions affect innovation, investment and growth are essentially empirical. The approach taken in this chapter is to examine simple correlations between measures of framework conditions and innovation, investment and growth.[19] Such an approach is clearly tentative, at best, as it faces inevitable measurement difficulties and tends to skim over the complex nature of both evolving financial systems and their interactions with the growth process. Nonetheless, some significant relationships emerge.

However, there would appear to be some connection between framework conditions and various indicators of innovation…

The results (Table IV.3, left-most column) suggest that several specific indicators of innovative activity are positively correlated with a compound measure of investor protection, which includes measures of transparency and enforcement, as well as shareholder and creditor rights. R&D spending, R&D personnel and patent applications in OECD countries tend to rise with investor protection. Also, measures of IPOs and venture capital investment, which can be seen as proxies for investment in innovative new businesses, show significant and positive correlation with the compound measure of investor protection. Finally, supporting the view that stronger investor protection might help economies to adapt to and deploy changing technologies, results indicate that cross-country changes in multifactor productivity (MFP) growth from the 1980s to the 1990s are significantly correlated with the compound measure of investor protection.

… but the most important factors seem to be enforcement and transparency, rather than specific issues of shareholder and creditor rights

Examination of the role played by the separate components of the summary measure of investor protection indicates that the correlations in the left-hand column of Table IV.3 are driven largely by the indicator of enforcement and transparency, rather than statutory shareholder and creditor rights. It is possible that financial systems may adapt to whatever legal framework conditions are in place, with this adaptation helped by strong enforcement and transparency. Thus, the particular rights and mechanisms that apply may be less critical to the functioning of economic activity than their clear and consistent enforcement and execution.

Product-market regulation and MFP growth

Product-market regulation may be another factor influencing the degree of entrepreneurial activity and innovation in ICT industries…

Entrepreneurial behaviour is an important factor in the growth process at any time but especially so in periods of major technological change, when new technologies are often more efficiently harnessed through the creation of new enterprises and the redesign of existing ones. Product-market regulation is one of the influences on the entrepreneurial climate, alongside issues such as taxation, employment regulations and, as discussed above, finance. For example, excessive regulation in the registration of new businesses (as well as opacity in the procedures) adds further costs

19. See Leahy *et al.* (2000).

Table IV.3. **Correlation between financial framework conditions and indicators of innovative activity**[a]

Correlation coefficients

	Indicator of financial framework conditions				
	Enforcement, transparency, shareholder and creditor rights	**Enforcement, transparency**	**Shareholder and creditor rights**	**Shareholder rights**	**Creditor rights**
R&D expenditure as a per cent of GDP (average 1990-97)	0.56***	0.65***	0.00	0.08	–0.22
Total R&D personnel per 1 000 labour force (average 1990-97)	0.57***	0.68***	–0.06	0.00	–0.19
Resident patent applications per 10 000 population (average 1990-97)[b]	0.65***	0.69***	0.05	0.16	–0.04
Patents in the United States, per 100 000 population (average 1990-97)[c]	0.57**	0.62***	–0.24	–0.07	–0.20
IPOs per million of population, (1995:7-1996:6)	0.50**	0.45*	0.30	0.48**	–0.26
Venture capital investment, early stage and expansion, as a per cent of GDP (average 1995-98)[d]	0.47**	0.44*	0.05	0.19	–0.26
Change in MFP growth corrected for hours worked (average 1990s minus average 1980s)	0.48**	0.47**	0.15	0.26	–0.19

a) 21 countries are covered in the calculation. The indicators of financial framework conditions are based on factor analysis (see Leahy *et al*, 2000) .
*: significant at 10% level; ** at 5% level; *** at 1% level.
b) Excluding Japan.
c) Excluding Japan, Switzerland and the United States.
d) Data for Japan and Australia are for 1994 and 1997, respectively.
Sources: Indicators of financial framework conditions are from La Porta *et al.* (1998) and Kaufmann *et al*. (1999*a*, *b*). Other data are from OECD sources.

that can discourage entry. Furthermore, administrative procedures might require many steps and interaction with a multitude of different agencies, raising start-up costs and reducing incentives for developing new ventures.

… and negative correlation between indicators of product-market regulation and changes in MFP growth lends some support to this hypothesis

Tentative evidence of the correlation between stringent administrative regulations concerning start-ups (*e.g*. licences and permits, communication rules, administrative burdens on corporate and sole proprietor firms, legal barriers to entry) and productivity performance is shown in Table IV.4.[20] Indeed, strict regulations seem to be associated with poorer MFP growth from the 1980s to the 1990s. Administrative burdens are not the only dimension of product-market regulation that may matter for speeding up the adoption of new technologies and, more generally, the process of innovation. The indicator of the stringency of overall domestic product-market regulation is also negatively related to the evolution of MFP growth from the 1980s to the 1990s. More specifically, the indicator reflecting government involvement in business operations (*e.g.* price controls, use of command and control regulations) appears to be negatively and significantly associated with MFP growth. All in all, these results point to the potential negative implications for productivity growth of

20. The indicator of administrative regulation, as well as all other indicators of product-market regulation, increases with the strictness of regulations. The product-market regulation indicators are from Nicoletti *et al*. (2000).

Table IV.4. **Correlation between changes in average multifactor productivity growth between 1980s and 1990s and OECD indicators of product-market regulation**

	Correlation
Overall product-market regulation	–0.30
Inward orientated policies	–0.41*
State control	–0.25
Public ownership	–0.04
Involvement in business operations	–0.43*
Barriers to entrepreneurship	–0.52**
Administrative burdens	–0.63***
Regulatory and administrative opacity	–0.02
Barriers to competition	0.14

Notes: * significant at 10% level; ** at 5% level; *** at 1% level.
19 countries are covered in the calculation: Australia, Austria, Belgium, Canada, Denmark, Finland, France, Greece, Germany, Ireland, Italy, Japan, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden and United States. The MFP growth data are cyclically-adjusted figures from Scarpetta *et al.* (2000). MFP growth in Germany for 1991 is excluded from the calculations. The indicators of regulation are based on factor analysis of a range of variables. Note that "outward-orientated" indicators could not be used for correlations because EU countries were given the same value in most of the data. See Nicoletti *et al.* (2000) for more details. Note that Norway was a significant outlier in the correlations. With the exclusion of Norway, the correlation between overall product-market regulation and the acceleration of MFP becomes statistically significant (at 5% level) and all the others are higher and often statistically significant.
Source: OECD.

stringent regulations in the product market and suggest an area where, despite recent reforms, more remains to be done.[21]

Policy challenges created by the spread of IC technologies

However, there are a number of additional policy challenges directly related to the spread of ICT

The increased role of ICT in the OECD economies raises a number of additional policy issues that are not discussed in this chapter. Reaping the full benefits of ICT requires, for example, the removal of barriers to network access. Moreover, regulatory reforms are needed to foster competition in new ICT-related activities such as mobile telephony. At the same time, there are also features of the IC technology that pose new challenges to competition: certain products become more useful as more people use them (*e.g.* networks or software) and economies of scale in their production can be large, both factors making it more difficult for other enterprises to enter a market where an incumbent is already established. The spread of e-commerce has implications for tax revenues, privacy and consumer protection that are difficult to tackle given the borderless nature of the net and the many jurisdictions involved. Last but not least, social concerns are raised about the possible emergence of a "digital" divide in the access to the new technologies.

21. A number of other studies have also found a negative impact of more general regulatory indicators on growth (see Ahn and Hemmings, 2000, for a review of the evidence).

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