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Lessons for Canada from International Productivity Experience

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Abstract

The objective of this report is to develop a more comprehensive understanding, from a policy perspective, of key drivers of labour productivity in selected OECD countries and their impact on enhanced productivity performance. It is hoped that the project will inform and strengthen future policy development in the productivity area, particularly as to related to ensuring appropriate and effective investments to support the skills development of Canadians.

The report is divided into three major parts. The first part will provide a general review of international labour productivity and income growth rates and levels in OECD countries. The second section presents some general lessons from the productivity performance of OECD countries and international evidence of productivity drivers based on the OECD growth project and productivity studies by the McKinsey Global Institute. The third part discusses the productivity experience of six OECD countries considered of particular interest to Canada – the United States, Australia, Ireland, the United Kingdom, Finland, and Sweden – and comments on possible lessons for Canada from these experiences.

Lessons for Canada from International Productivity Experience

Executive Summary

Canada's productivity performance potentially could be improved if policy makers can assimilate relevant lessons from other countries in a timely and efficient manner. This report is intended to identify key drivers of labour productivity performance in selected OECD countries and suggest lessons that are relevant to Canada. It is hoped that this project will inform and strengthen future policy development in the productivity area in Canada, particularly in the area of skills development.

Productivity Performance in OECD Countries

Canada experienced very strong total economy labour productivity growth between 1947 and 1973 at an average of 3.74 per cent per year. After 1973 this growth slowed to just 1.21 per cent per year on average between 1973 and 1996. Canada experienced a labour productivity growth acceleration after 1996 to an average annual rate of 2.34 per cent between 1996 and 2000. Between 2000 and 2004 labour productivity growth again slowed, to an average annual rate of 0.99 per cent. Over the entire 1947-2004 period, labour productivity growth in Canada averaged 2.42 per cent per year.

Productivity and income trends in the United States provide the natural benchmarks against which Canadians tend to measure their own country's performance. The long-run tendency is for Canada to follow the United States, with long-run growth rates of labour productivity being nearly identical in the two countries. Canada's productivity growth between 1947 and 1973 exceeded that of the United States, and Canada's level of productivity relative to the United States peaked at 91.4 per cent in 1984. Since then Canada has steadily fallen further behind the United States, especially in the post-2000 period. In 2004 Canada's level of labour productivity relative to that of the United States was 73.7 per cent, a level not observed since the 1950s.

Since productivity trends are ultimately determined by the production decisions of firms, policies which seek to increase productivity must fundamentally affect the incentives facing private decision makers.

On the basis of output per hour at purchasing power parity, the productivity performance of OECD countries is quite diverse. In 2004 six European countries exhibited higher levels of labour productivity than the United States. Canada ranked 17th out of 23 OECD countries in terms of labour productivity. This is a significant decline from Canada's fifth-place ranking in 1973. This development reflects differing productivity growth rates across OECD countries. In this report, the productivity experiences of six OECD countries (Australia, Finland, Ireland, Sweden, the United

Kingdom, and the United States) are examined in more detail. All six of these countries had higher levels of labour productivity than Canada in 2004.

In terms of productivity growth rates, the period from 1950 to 1973 saw a very strong performance across OECD countries. All 23 OECD countries suffered a slowdown in productivity growth in the 1973-1995 period relative to the 1950-1973 period. All six countries studied experienced more rapid growth than Canada between 1995 and 2000. Between the 1995-2000 and 2000-2004 periods, 14 of the 23 OECD countries experienced a productivity growth slowdown. Only the United States experienced a significant acceleration in productivity growth.

General Lessons from OECD Productivity Experience

General findings about differences in the productivity experiences of OECD countries are drawn from the OECD growth project and various studies of the McKinsey Global Institute (MGI). At the macro level, the OECD identified education, innovation, deregulation, and investment as the basic determinants of productivity growth. It has also identified inflation, fiscal policy, international trade, and the financial system as policy and institutional determinants of growth. At the industry and firm level, the OECD identified market conditions, competition, and innovation and research and development as key policy drivers.

The primary factor identified by the MGI to explain cross-country productivity differences was competitive intensity. Specifically, potential factors directly conducive to competition were found to be a higher concentration of production in fewer larger firms, low international trade barriers, and fewer regulations. More indirect factors increasing productivity were identified as higher minimum wages, fewer collective agreements, and less restrictive zoning laws. The MGI also made some observations related to managerial innovation: managers need to be aware of best practice; human capital of managers, the qualifications of managers can have a significant effect on productivity; marketing, means greater output for a given investment in fixed capital; information and communications technologies (ICT) need to be applied appropriate by users, but also the presence of a strong ICT manufacturing industry can positively affect overall manufacturing productivity growth. Finally, increase the amount of capital per worker is a necessary, but not sufficient condition for productivity improvement since productivity improvement is also dependent on managerial and competitive factors. Demand factors like the desire of consumers for better products also can affect the productivity of a firm.

Although no MGI study of Canada has yet been produced, several implications for Canada can be drawn from other MGI studies. Managers in the Canadian retail industry appear not to have adopted new processes as rapidly as their US counterparts, although evidence of this has not been found. Canadian service-sector firms may be less exposed to competition than such firms in the United States. The OECD found the Canadian product market to be less competitive than that of the United States and that Canada's anti-trust regime may not be optimally effective.

Lessons from Country-Specific Productivity Experience

The United States economy possesses just about all of the virtues that are typically associated with improving productivity growth. Factor specifically identified include both the productivity gains associated with producing ICT goods, and the productivity gains associated with using ICT. Also important is the US university system and its world-leading research and knowledge-commercialization capacity. Other factors identified as important are strong intellectual property rights, flexible labour markets, a large and relatively barrier-free market, and well-developed and flexible financial markets. Above all, intense product market competition is identified as being very important in promoting the diffusion of ICT.

There is certainly much to learn from the U.S. experience, although several questions remain, first how these factors came precisely together to create the phenomenal productivity success since the mid 1990s, and second as to whether these factors could produce such productivity success if transplanted to other countries.

While much research still remains on these questions of coordination, it is tempting to suggest that the intense competition and strong market forces present in the United States have been responsible for or have at least played a facilitating role in the development of the many factors that have proven crucial for the U.S. productivity growth resurgence. Such competition attracts the brightest talent to the country, gives a strong incentive to commercialize the knowledge produced by that talent, and ensures a large market for such successful innovations as firms adopt them as part of their comprehensive and ongoing efficiency improvement efforts. However, while competition may have been the integral ingredient bringing all of these positive factors together in the United States, it is unclear whether such an ingredient exists that would ensure success in Canada and other countries.

The Irish economic boom provides other countries with many lessons. With most of its economic growth taking place in the last twelve years, the economic miracle has two dimensions: one is a continuing rapid long-term increase in productivity; and another is a short-term employment improvement. The causes of this productivity growth have important policy implications for other countries pursuing productivity improvement.

Irish commercial, industrial, tax and education policies have been very supportive of rapid long-term productivity growth. This strong and consistent support is not recent, but began to develop in the 1950s and matured in the 1970s. The goals of these policies included promoting greater openness to foreign trade and investment, developing a business-friendly environment, and providing a highly skilled labour force. The right policies eventually paid off. More specifically, the continuing Irish productivity growth implies three main lessons related to economic policies, namely that such policies should be directed towards: increasing openness to international markets and promoting free trade and monetary integration; maintaining macroeconomic stability and fostering a culture supportive of enterprises; and promoting and supporting formal education and encouraging lifelong learning within the workforce.

Australia experienced a resurgence of productivity growth in the 1990s. The fact that most other OECD countries did not share this experience suggests that domestic factors must have played an important role in this resurgence (Parham, 2004). According to the studies reviewed in this report, policy reforms that were introduced in the mid-1980s have been major drivers and enablers of Australia's impressive productivity performance.

Policy reforms in Australia have enhanced competitive pressures; opened the economy to trade, investment and technology; raised investment in R&D; and encouraged firms to become more flexible in terms of adjusting all aspects of production, distribution and marketing. On top of these foundations, the widespread use of ICT, increased labour market flexibility and strengthened national innovative capacity have been specific factors driving the remarkable productivity growth.

The United Kingdom economy has lagged behind its international competitors in terms of real GDP per capita since 1979. Lower labour productivity has been responsible for this gap. In response to this productivity differential, successive UK governments have adopted policies designed to move the economy back to "premier league" status. These policies have included reductions in trade union power, privatization of publicly-owned industries and introduction of share compensation plans. Together, these reforms have increased the employment rate and helped narrow the productivity gap.

However, there still remain barriers to the improving United Kingdom's productivity performance. These factors include: low investment in education and training; low rates of ICT diffusion; and the continued presence of government regulation in specific goods markets and land use. To lower these barriers the UK will have to undertake more investment in formal education and skills training, research and development; encourage the development of the ICT industry and the diffusion of ICT; and continue efforts to deregulate domestic markets. Such measures are necessary to reward the entrepreneurship and encourage the technological innovation that underpin economic growth.

At least three major lessons can be learned from the Finnish productivity experience. First, a vibrant high-productivity-growth ICT-producing sector does not necessarily diffuse robust productivity gains to non-ICT producing sectors, especially in a small open economy. Second, an above average performance on innovation indicators such as R&D does not necessarily translate into above average living standards. GDP per capita in Finland is still only close to the OECD country median despite its innovative economy. Third, robust productivity growth across all sectors requires adaptable labour market institutions, innovative financial markets, and a workforce well trained in science and technology. The availability and diffusion of best-practice technologies is a necessary, but by no means sufficient condition for productivity advance.

While Sweden's productivity performance in the 1980s and 1990s is interesting in its own right, the lessons to be drawn for other countries are not immediately obvious,

given the relatively unique characteristics of Sweden. Such characteristics include a single dominant industry, a high degree of income redistribution and employment protection even by European standards, and the polarization of the Swedish economy into some highly competitive sectors and other heavily protected sectors. Nonetheless, some general points can be made: First, a comprehensive approach to promoting competition – encompassing deregulation and product market competition, the free movement of labour and capital, openness to trade, among other factors – is necessary for maximizing the potential for productivity gains.

The second observation is that the reliance on a single industry or even firm for aggregate productivity increases can subject a country to the greater possibility of suffering a prolonged stagnation in labour productivity and hence living standards. Third, as in Finland, the productivity-enhancing ICT revolution in Sweden is linked almost exclusively to ICT production rather than ICT use, and is dependent on a single firm. It is therefore not yet possible to state that Sweden has entered a "new economy" phase of development, defined as an acceleration in labour productivity growth that is broadly based across industries. This may in turn imply that the new economy-style productivity growth at the aggregate level experienced by Sweden in the 1990s may not be sustainable. Finally, in a small open economy such as Sweden or Finland, most technological spill-overs occur across international boundaries, and there appears to be very limited scope for other industries and firms to benefit from the R&D and productivity performance of the national leaders. This underlines the importance of openness for innovation and productivity growth.

Conclusion

Four key potential lessons for Canada emerge from the report.

- Competition and productivity are closely intertwined. Sectors that have been opened up to market forces, both domestic and international, have generally registered significant productivity gains, as seen most strikingly in the United Kingdom. The existence of a competitive environment is an essential condition for productivity advance. One of the most important steps, if not the most important step, that governments can take to promote productivity growth is to ensure that markets, whether it be product markets, labour markets, or capital markets, are as competitive as possible.

- Human capital is the foundation of productivity advance, driving innovation. Countries that have focused on human capital investment, particularly in the higher education area, have seen a major payoff in productivity growth. The basis of the U.S. productivity resurgence is that country's world class system of research universities, which have created the knowledge that led to the emergence of productivity-enhancing ICT. Ireland's productivity success is also closely linked to the massive expansion of opportunities for higher education in that country. Thus support of the higher education sector, including both research and

teaching, likely represents the most effective means by which government resources can be used to promote productivity growth.

- R&D intensity (R&D/GDP) is crucial for innovation and productivity growth, but it is not the complete story. Since Canada through its R&D efforts accounts for a very small proportion of the world supply of innovations, the wide diffusion of best practice techniques in this country depends critically on the ability of Canadian firms to keep themselves abreast of world technological developments and to assimilate those developments. As the Swedish and Finnish cases illustrate so well, R&D intensity in itself may be necessary for rapid productivity growth, but it is certainly not sufficient. Sweden and Finland have the two highest R&D intensities, yet have labour productivity levels below the United States and at least eight other European countries.

- As a general rule, institutional rigidities impede productivity advance while institutional flexibility supports it. Many examples of this general principle came to light in the six country studies. For example, both Sweden and Finland have recognized that certain of the characteristics of their labour market institutions – such as centralized collective bargaining and limited earnings differentials between high and low skilled workers – can have negative implications for productivity growth. Both countries have shown flexibility in adapting their institutions to make them conducive to, or at least not inimical to, productivity.

Based on the four key lessons for Canada we put forward a number of specific policies that could be usefully considered in the Canadian context.

In terms of the first lesson concerning the importance of market forces, some specific policies that could foster productivity growth in Canada are creating enhanced competitive environment through deregulation and gradual winding down of marketing boards which limit the supply of certain agricultural products such as milk.

In terms of the second lesson, the federal government has recognized the importance of the importance of human capital for productivity growth. Since 1997, the federal government has taken a number of measures to boost post-secondary education, including the establishment of the Canada Research Chair program and additional funding for the granting councils. One policy in the human capital area that could be pursued more vigorously are a reduction in the underemployment of the human capital of recent immigrants to Canada through programs that better and more quickly foster the integration of immigrants into the workforce. Another policy is putting a greater emphasis on the basic skills of the workforce. A characteristic of the workforce of a number of the countries studied in this report (e.g. Sweden, Finland, Ireland) was its high level of basic skills.

The third lesson concerns the importance of the adoption of new technologies, as opposed to the production of new technologies through R&D. This lesson was in particular identified with Ireland, a country with a relatively low R&D intensity, yet very

rapid productivity growth. Specific policies that could be considered in this area for Canada include the expansion of programs that foster the adoption of best practice technologies and management practices by small and medium-sized enterprises (SMEs) by providing these firms with information on the latest technological developments in their industry and with technical advice on how to best adopt the latest technology in their situation. Another area for improvement is information and communications technologies, which are a key driver of productivity growth. Yet Canada badly lags the United States in ICT investment per worker across almost all industries. Measures to increase ICT investment thus could boost productivity growth.

The fourth lesson concerns the role of institutional rigidities in impeding productivity growth and the identification of these rigidities and their removal. Specific rigidities in Canada include the Employment Insurance (EI) program, which provides income support for the unemployed in seasonal occupations, discourages to some degree mobility to regions where permanent employment prospects are more promising. Another likely source of productivity improvement is a reduction in interprovincial barriers to labour mobility in the professions and the trades to allow a greater role for market forces to influence the reallocation of workers from low productivity/low wage to high productivity/high wage jobs, a an important source of productivity growth.

It is always difficult to gauge the relative payoffs to different economic policies. Nevertheless, with regard to the four key productivity drivers (human capital, competition, R&D and institutional flexibility) discussed, a case can be made that the payoff from additional investment in the area of skills development would be greater than that of additional investment in R&D. This is in part because Canada already has one of the most generous fiscal regimes for R&D in the world. In contrast, our investment in skills development by both the public and private sectors is relatively weak by international standards. From this perspective, a skills development strategy should play a salient role Canada's overall productivity strategy.

Lessons For Canada from International Productivity Experience[1]

The main purpose of this report is to develop a more comprehensive understanding, from a policy perspective, of key drivers of labour productivity in selected OECD countries and their impact on enhanced productivity performance. It is hoped that the project will inform and strengthen future policy development in the productivity area, particularly as to related to ensuring appropriate and effective investments to support the skills development of Canadians.

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I. Productivity Performance in OECD Countries

Productivity performance has two dimensions: productivity growth rates and productivity levels. Both are important and both will be discussed in the report. Productivity levels are the ratio of output to an input such as labour or capital. Productivity growth rates refer to the per cent change in productivity levels over time.[2]

In discussion of international productivity performance, the issue of the comparability of data always arises. According to the OECD (Schreyer, 2001), differences in definitions of statistical categories and measurement techniques across countries do not result in significant differences in productivity level and growth estimates, at least at the aggregate or total economy level, the focus of this report. Thus little of the variation in productivity growth rates among countries can be attributed to differences in measurement techniques. Of course, there are a large number of measurement differences, many of them offsetting. Appendix 1, drawn from Cette (2005), outlines a number of these differences.

A. An Overview of Canadian Productivity Performance

[1] This report was written by Andrew Sharpe with assistance from Sharon Qiao, Peter Harrison, Jeremy Smith, Jean-Francois Arsenault, and Sean Rogers. The CSLS would like to thank officials in the Labour Policy Branch of Human Resources and Social Development Canada, particularly Christina Caron, for very useful comments on earlier versions of the report.

[2] See Sharpe (2002) for a discussion of basic concepts and definitions related to productivity.

This section provides a brief overview of the labour productivity performance of the Canadian economy in the postwar period – both over time and compared to the United States – and puts this performance in the context of income growth over this period. This section also briefly discusses the sources of labour productivity growth since 1981 and the possible influence of public policy on productivity. The remaining sections in this part of the report explore the same themes across various groups of OECD countries.

1) Labour Productivity and its Relationship with Income in Canada since 1947

Labour productivity growth is important because it is the key determinant of real income growth. Gross Domestic Product (GDP) per capita can be exactly decomposed into the product of labour productivity (defined as output per hour worked at the total economy level), the average number of hours each employed person works, and the proportion of the entire population that is employed. Likewise, the growth rate of real income as proxied by the GDP per capita growth rate can be approximately decomposed into the summation of the growth rates of these three variables.

Table 1 demonstrates this decomposition using Canadian data for the 1947-2004 period. Over this entire period, GDP per capita grew by 2.13 per cent per year on average.[3] This was driven entirely by productivity growth, at 2.42 per cent per year. The employment-population ratio grew modestly over this period on an annual per cent basis, making a small contribution to GDP per capita growth.[4] Average hours of work, on the other hand, declined from 51 hours per week in 1947 to less than 35 hours per week in 2004. This represented a drag on GDP per capita growth: if average hours had stayed at their 1947 level until 2004 holding all other things constant, GDP per capita would have been 48 per cent higher in 2004 relative to its actual 2004 level and GDP per capita growth over 1947-2004 would have been 2.84 per cent per year rather than 2.13 per cent per year. However, it is important to note that real income is only one aspect of well-being, and that to the extent that individuals have actively chosen to trade fewer hours of work for less rapid real income growth than would have otherwise been achieved, overall well-being has improved.

Table 1 also breaks down the 1947-2004 period into four important sub-periods, each representing a different era in Canada's productivity performance. The 1947-1973 period is often referred to as the golden days of capitalism, with labour productivity advancing at a remarkable 3.74 per cent per year. This period also saw the greatest progress in terms of reducing working time, with average hours per week falling by 13.6

[3] The tables and charts referred to in the text are found at the end of the report.

[4] The employment-population ratio can itself be decomposed into a number of variables. In Canada for the 1947-2004 period, the increased employment-population ratio reflected an increase in the labour force participation rate as well as in the ratio of the working age population (defined as those aged 15 years and above) to the total population. These two favourable effects were slightly offset by a higher unemployment rate in 2004 relative to that in 1947.

or by 1.19 per cent per year. Due to this offsetting effect of falling hours, GDP per capita growth, at 2.55 per cent per year, was below labour productivity growth.

After 1973, Canada entered a period of prolonged stagnation in terms of both productivity and income growth. After the blistering pace of the 1946-1973 period, labour productivity growth slowed to just 1.21 per cent per year in 1973-1996. Average hours of work continued to fall, but the employment-population ratio increased from 40.1 per cent to 45.3 per cent or by 0.53 per cent per year. The result is that GDP per capita growth was more rapid than productivity growth in this period, but at 1.49 per cent per year, was still much slower than in the previous period. The causes of this productivity growth slowdown, which was experienced across most developed countries, have been debated widely. Possible explanations range from measurement error to adjustment costs related to technological change to the massive supply shocks brought about by the oil price shocks, rapid inflation and monetary policy responses characterizing this period. Some of these explanations are addressed in Diewert and Fox (1999) and the references therein.

Table 1: The Relationship Between Real Income and Productivity in Canada, 1947-2004

	GDP per Capita	Labour Productivity (Output per Hour)	Average Hours Worked per Week	Employment-Population Ratio
levels*				
	A=B*(C*52) *(D/100)	B	C	D
1947	$10,586	$10.14	50.7	39.6
1973	20,387	26.31	37.1	40.1
1996	28,642	34.66	35.1	45.3
2000	33,294	38.02	35.0	48.2
2004	35,239	39.56	34.3	50.0
compound average annual growth rates				
	A˜ B+C+D	B	C	D
1947-2004	2.13	2.42	-0.68	0.41
1947-1973	2.55	3.74	-1.19	0.05
1973-1996	1.49	1.21	-0.25	0.53
1996-2000	3.83	2.34	-0.08	1.54
2000-2004	1.43	0.99	-0.50	0.94

* GDP per capita and labour productivity are expressed in 1997 chained dollars. Hours are expressed as hours per week. The employment-population ratio is expressed in per cent.

Source: Statistics Canada, CANSIM series v3860085, v504324, v15900411, v29509279, v716818, v719846, v2461119, v21052 and v1, July 28, 2005.

It is now generally accepted that Canada experienced a structural labour productivity growth acceleration after 1996, about one year following a similar acceleration in the United States. From the 1.21 per cent average annual rate recorded in 1973-1996, labour productivity growth rebounded to 2.34 per cent per year in 1996-2000. Canada's labour market also boomed in this period, with the employment-population ratio increasing from 45.3 per cent to 48.2 per cent, i.e. by nearly three per centage points over just five years or by 1.54 per cent per year. While average hours of work continued to decline slightly in this period, the labour productivity and employment-population ratio effects combined to push GDP per capita growth to an outstanding 3.83 per cent per year, more rapid even than in the golden days of the two decades immediately following World War II.

Like the post-1973 productivity growth slowdown, the post-1995/1996 acceleration, which appears to have been experienced only by Canada, the United States, Australia and a few other countries, has been widely examined. Most research has typically concluded that both the production and intensive use of information and communications technologies (ICT) played an important role in the structural break from the torpid productivity growth of the post-1973 period. The evidence for Canada is summarized by Wilson (2003), Macklem (2003) and Robidoux (2003).

The post-2000 period, although still in progress and consequently difficult to classify as a complete period, has raised a whole new set of questions for productivity researchers. After the impressive performance in the second half of the 1990s, labour productivity growth decelerated sharply to 0.99 per cent per year in 2000-2004, slower than the pace recorded in 1973-1996. Despite continued strength in the labour market, with the employment-population ratio increasing by 0.94 per cent per year, GDP per capita growth followed productivity growth, slowing to 1.43 per cent per year.

This situation has proven difficult for researchers to understand, especially given that the United States appears to have experienced a further post-2000 productivity growth acceleration in addition to its post-1995 acceleration. Rao, Sharpe and Smith (2005) provide a detailed examination of this issue, and while they suggest a number of possible explanations, are unable to fully solve the puzzle of Canada's poor productivity growth since 2000. Some tentative explanations are the following: poor productivity in the extractive industries due to the exploitation of marginal resources induced by high commodity prices; insufficient investment in the most recent technologies as embodied in new machinery and equipment; poor macroeconomic conditions in general, combined with adjustment costs to the rapidly appreciating Canadian dollar; and the collapse of the ICT-producing manufacturing sector early in the decade.

It is clear from the above discussion that productivity growth can vary widely from period to period from a diversity of effects, but also that the relationship between productivity growth and GDP per capita growth is variable over time as well. In 1947-1973, productivity growth accounted for more than 100 per cent of GDP per capita growth, which is explained by the offsetting effect of falling hours of work. However, in 1973-1996, productivity growth accounted for 81 per cent of income growth, with growth

in the employment-population ratio assuming a more important role than in the earlier period. By 1996-2000 and 2000-2004, growth in the employment-population ratio became even more important, with productivity growth's contribution to income growth falling to 61 per cent in the former period before rebounding slightly to 70 per cent in the latter period.

Even at 70 per cent, productivity growth is still obviously the most important component of income growth, but it should also be noted that most analysts expect that future contributions from the employment-population ratio will be limited, especially in the face of the demographic crunch that many feel is looming in Canada's and other developed countries' future. From this perspective, future growth in GDP per capita will continue to be intrinsically linked to improvements in productivity.

2) Productivity Trends in Canada Relative to the United States since 1947

For productivity and income trends as well as many other variables, the United States is the natural benchmark against which Canadians tend to measure their country's performance. Chart 1 shows business sector productivity growth rates for the 1947-2004 period and the four sub-periods discussed above in both Canada and the United States.[5] This chart demonstrates the long-run tendency for Canadian productivity trends to follow those in the United States, with productivity growth in the two countries nearly identical over the entire period.

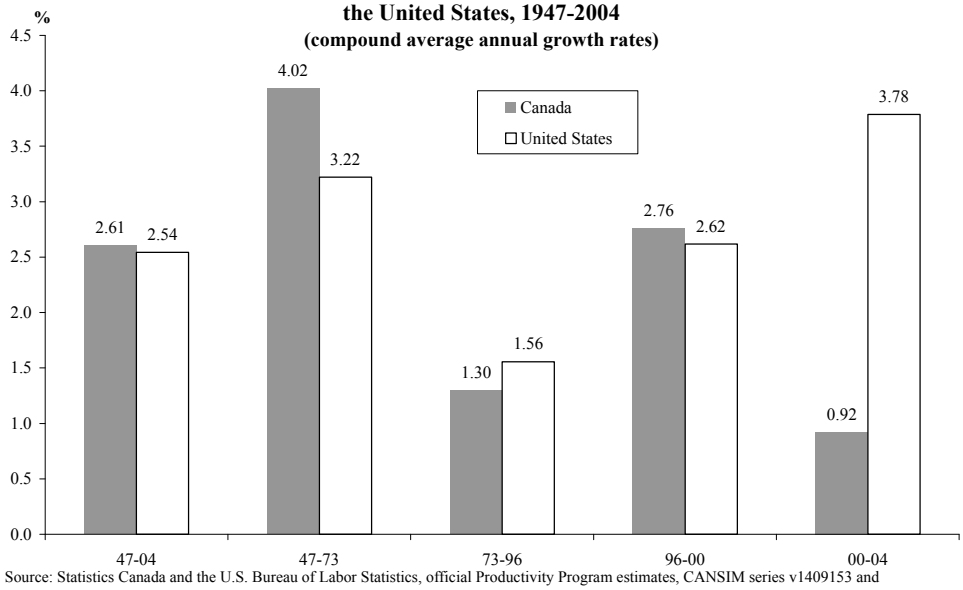
In the 1947-1973 period, Canada's productivity growth, at 4.02 per cent per year, substantially exceeded that in the United States, at 3.22 per cent per year. This can be explained by the mechanisms of catch-up and convergence that have been discovered by growth researchers, whereby countries or regions with below-average productivity levels experience rapid productivity growth as they adopt the technologies and practices that have already been developed by the world leaders and consequently converge towards the productivity levels of the leaders.

Both Canada and the United States saw significant productivity growth slowdowns after 1973, with Canada's more severe than that in the United States. However, the 1973-1996 growth rates mask a period of productivity improvement in

[5] The business sector differs from the total economy in that the activities of government and all other sectors whose output is not sold in a market environment are excluded. This decreases the extent of measurement error, but also decreases comparability across countries, as some activities are marketed in one country but are not in another (e.g. hospitals in the United States versus Canada). Statistical agencies typically produce official productivity measures for the business sector only, and these are the figures that are most commonly quoted by analysts and in the media. These are the figures that will be used to compare Canada and the United States here, and while they differ from the total economy productivity growth rates discussed above, it should be noted that business sector and total economy productivity typically evolve in a very similar way over long periods. Indeed, the business sector, accounting for around 75 per cent of the total economy, largely drives total economy trends. Business sector productivity trends were not used from the outset because the relationship between GDP per capita and business sector productivity is not as straightforward as that between GDP per capita and total economy productivity. For more information on the relative advantages and disadvantages of using the business sector for monitoring productivity trends, see Smith (2005).

Canada relative to the United States between 1973 and 1984, offset by a large deterioration in Canada's relative productivity position thereafter. Chart 2 shows Canada's level of labour productivity as a proportion of that in the United States over the entire 1947-2004 period. This chart shows that Canada's productivity level peaked relative to that in the United States in 1984 at 91.4 per cent, then fell sharply to 81.9 per cent in 1992. The level then rebounded to 84.8 per cent in 1995 and fell back to 82.0 per cent in 1996, well below the 86.9 per cent recorded in 1973.

Chart 1: Labour Productivity Growth in the Business Sector in Canada and the United States, 1947-2004
(compound average annual growth rates)



Source: Statistics Canada and the U.S. Bureau of Labor Statistics, official Productivity Program estimates, CANSIM series v1409153 and v720290, and BLS series PRS84006093.

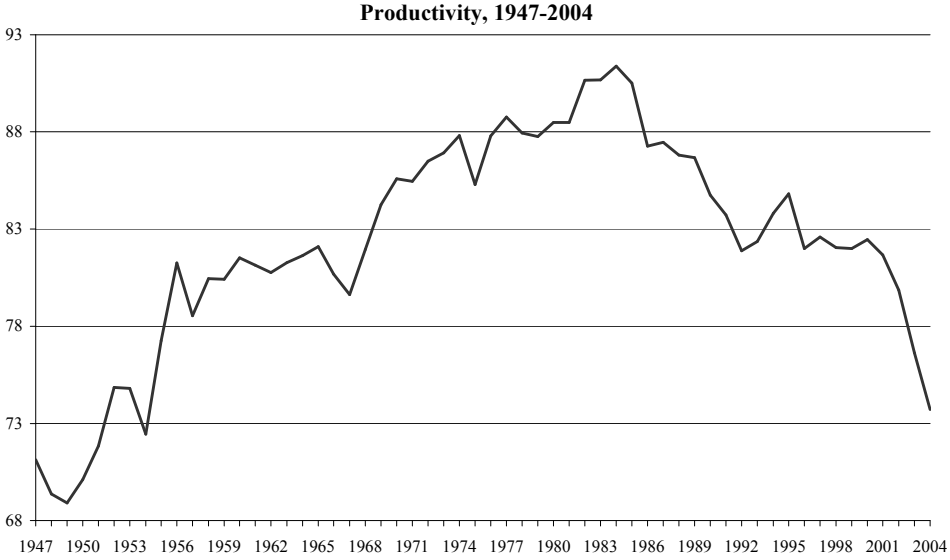
The 2000-2004 period marks an extreme departure from the historically similar productivity experiences over the long term in Canada and the United States, with productivity growth of 3.78 per cent per year in the United States dwarfing the meager 0.92 per cent per year growth in Canada (Chart 1). On the other hand, in the context of the post-1984 period, the post-2000 fall-off in Canadian productivity growth continues a well-established trend of a deteriorating productivity level versus the United States, with the 1996-2000 period the only notable respite (Chart 2). In 2004, Canada's business sector labour productivity level stood at 73.7 per cent of the U.S. level, a figure not recorded since the early 1950s. This turns the concepts of catch-up and convergence on their heads, and no convincing explanations for this situation have yet been found.

3) The Sources of Labour Productivity Growth in Canada since 1981

Rao, Sharpe and Smith (2005) look at the industry, provincial and production function sources of labour productivity growth in Canada in the late 1990s and in the post-2000 period. Their growth accounting decomposition can be extended here for the

entire 1981-2004 period for which data are available, as shown in Table 2. Such growth accounting decompositions must assume a mathematical expression of a production function that describes how the factors of production are combined to produce output. Briefly, the production function underlying the data in Table 2 assumes that business sector output as measured by value added is a function of capital services, labour services and Multifactor Productivity (MFP, also called Total Factor Productivity of TFP).[6] In this framework, labour productivity growth is likewise a function of growth in capital services per hour worked, growth in a labour quality measure that captures changes in the composition of the workforce, and MFP growth.

Chart 2: Ratio of Canadian to U.S. Business Sector Labour Productivity, 1947-2004



Source: CSLS Income and Productivity Database, available at www.csls.ca/data.asp, based on official Productivity Program data from Statistics Canada and the U.S. Bureau of Labor Statistics current as of June 14, 2005 as well as on a benchmark level estimate of 82 per cent in 1999 by Rao, Tang and Wang (2004).

For the overall 1981-2004 period, labour productivity growth was 1.44 per cent per year. Of this, growth in capital services per hour contributed 0.66 per centage points or 45.9 per cent. This contribution from capital services per hour can be divided into its

[6] Capital services refers to the productive stock of capital goods, that is the accumulation of past investments corrected for the retirement of older assets and for the decline in the productive efficiency of assets over time. This is distinct from the concept of the net capital stock, which measures the present market value of past investments. For example, the value of a building is not what is important to the output of the firm that owns or rents that building, but it is rather the role of the building in providing shelter and office space that is important. Estimates of capital services in this case attempt to measure the shelter and space services afforded by the building. In a similar sense, labour services is not simply the sum of hours worked, but is rather an aggregation of the skills and other characteristics of the workers who are working those hours. MFP refers to the overall efficiency with which capital services and labour services are combined in production. Since it is calculated residually, it is influenced by any factor affecting production other than capital services and labour services; but MFP growth is sometimes interpreted as a measure of technological progress.

information technology component (around 0.49 per centage points) and its non-information technology component (around 0.25 per centage points).[7] The remaining portion of labour productivity growth was accounted for by MFP growth (29.9 per cent) and labour quality growth (25.4 per cent).

Table 2: Sources of Growth in the Canadian Business Sector

	1981-2004	1981-1989	1989-2000	1989-1996	1996-2000	2000-2004
Growth Rates (compound average annual rates, per cent per year)						
Output	3.01	3.32	3.02	1.47	5.78	2.38
Hours Worked	1.55	1.83	1.38	0.49	2.95	1.43
Hours Worked of University-Educated Workers	5.05	5.78	5.05	4.57	5.89	3.61
Hours Worked of Non-University-Educated Workers	1.07	1.44	0.82	-0.09	2.42	1.01
Capital Services	3.15	3.84	3.35	2.58	4.71	1.27
Information Technology Capital Services	17.31	22.11	18.81	17.64	20.87	4.57
Non-Information Technology Capital Services	2.21	2.94	2.16	1.55	3.24	0.88
Labour Productivity	1.44	1.45	1.62	0.98	2.76	0.93
Capital Services per Hour	1.58	1.97	1.95	2.08	1.72	-0.17
Information Technology Capital Services per Hour	15.53	19.92	17.19	17.06	17.41	3.09
Non-Information Technology Capital Services per Hour	0.65	1.09	0.77	1.05	0.28	-0.54
Absolute Contributions to Labour Productivity Growth (percentage points)						
Labour Productivity	1.44	1.45	1.62	0.98	2.76	0.93
Contribution from Capital Deepening	0.66	0.83	0.80	0.85	0.72	-0.07
Information Technology	0.49	0.50	0.61	0.56	0.70	0.15
Non-Information Technology	0.25	0.42	0.30	0.41	0.10	-0.23
Multifactor Productivity Including Effects of Labour Quality	0.80	0.63	0.84	0.15	2.07	1.01
Contribution of Labour Quality	0.37	0.54	0.29	0.32	0.25	0.22
Multifactor Productivity Net of Labour Quality	0.43	0.09	0.55	-0.17	1.82	0.79
Relative Contributions to Labour Productivity Growth (per cent)						
Labour Productivity	100	100	100	100	100	100
Contribution from Capital Deepening	45.9	57.5	49.7	87.2	26.3	-7.9
Information Technology	33.9	34.1	37.6	57.3	25.3	15.7
Non-Information Technology	17.3	29.0	18.3	41.8	3.6	-24.3
Multifactor Productivity Including Effects of Labour Quality	55.3	43.2	52.0	15.0	75.2	109.0
Contribution of Labour Quality	25.4	37.1	18.1	32.7	9.1	23.9
Multifactor Productivity Net of Labour Quality	29.9	6.1	33.9	-17.7	66.1	85.1

Source: Statistics Canada, Canadian Productivity Accounts, CANSIM Tables 383-0016 and -0018, July 15, 2005.
For illustrative purposes, the "Multifactor Productivity Including Effects of Labour Quality" growth rates have been calculated as the sum of the labour quality growth rates and the growth rates of the official multifactor productivity series (which is net of labour quality).
Contributions do not sum exactly due to the use of geometric average annual growth rates.

[7] The growth in capital services per hour worked over 1981-2004 was 1.58 per cent per year (15.53 per cent per year for information technology capital services per hour and 0.65 per cent per year for non-information technology capital services per year). The contribution to labour productivity growth of capital services per hour worked is defined as the growth rate of capital services per hour worked multiplied by the share of capital income in total income (around 45 per cent). The contributions of the two types of capital services are defined as the growth rate of the specific type of capital services per hour multiplied by the capital income share and the share of the user costs associated with that type of capital services in total user costs of capital. Contributions do not sum exactly due to rounding and the use of compound (geometric) average annual growth rates.

The most important message from Table 2 is that the contribution of MFP growth to labour productivity growth has risen dramatically since the 1980s and early 1990s. In 1981-1989 the contribution of MFP growth to labour productivity growth was just 6.1 per cent, and in 1989-1996 MFP actually fell, making a negative contribution to the weak labour productivity growth of 0.98 per cent per year. However, in 1996-2000, MFP growth accounted for two thirds of Canada's remarkably strong labour productivity growth. In contrast to the large labour productivity growth deceleration after 2000, MFP growth experienced a less extreme deceleration, and accounted for 85.1 per cent of labour productivity growth in 2000-2004. This may suggest that innovation and technological advance, which appear to largely drive MFP, will be the most important elements in ensuring rapid future labour productivity and hence income growth in Canada in general and in improving Canada's currently dismal labour productivity growth specifically. Since such innovation is usually linked to the adoption of physical capital embodying the newest technologies, it is worth noting that information technology capital services per hour growth decelerated from 20.87 per cent per year in 1996-2000 to just 3.09 per cent per year in 2000-2004.

4) The Relationship Between Policy and Productivity in Canada

Given the productivity trends over the past half century and more discussed above, one could conceivably take a detailed look at the evolution of specific government policies over the same period and attempt to relate policy to productivity. Such an approach is well beyond the scope of this report. However, some work in this general direction can be reviewed briefly.

An important general tenet to remember when discussing policy's effects on productivity is that productivity trends are ultimately determined by the production decisions of firms, and that productivity is therefore largely the prerogative of the private sector. Higher productivity is often congruent with the profit objectives of firms, but when this is not the case and companies are free to pursue profits or other objectives within the prevailing legal framework, government calls for higher productivity or more rapid productivity growth are likely to be utterly ineffective if not accompanied by well-designed policies that fundamentally affect the incentives facing private decision makers.

One branch of the productivity literature that has focused on policy effects is the set of case studies undertaken by the McKinsey Global Institute (MGI). These studies have been reviewed by Kellison (2004), and are also discussed in the next part of this report. They mainly discuss policy in terms of the impediments it can impose on productivity by creating barriers to competition among firms. For example, zoning policy was found by MGI to be responsible for part of the difference between U.S. and European productivity performance. The ultimate conclusion of much of MGI's research is that in a highly competitive atmosphere, firms are forced to innovate and continually improve productivity in order to survive. From this perspective, the most effective policy to ensure high productivity and rapid productivity growth is to avoid burdening firms with competition-diminishing regulations. Governments and central banks should generally limit their interests in the area of productivity to providing a level and barrier-

free playing field. Broadly, this could be characterized, among many other things, by low and stable inflation and interest rates, clear and simple regulations governing corporate behaviour, and the absence of specific tax measures or subsidies that benefit one industry or group of firms to the exclusion of others.

For Canada specifically, the linkages between productivity and policy have perhaps been most comprehensively addressed by the volume *Productivity Issues in Canada* edited by Someshwar Rao and Andrew Sharpe (2002). Contributions that may especially be of interest include those by Harris (2002a and 2002b), Bernstein (2002), and Hirshhorn, Nadeau and Rao (2002). Another general reference on this topic is *The Review of Economic Performance and Social Progress 2002: Towards a Social Understanding of Productivity* edited by Andrew Sharpe, France St-Hilaire and Keith Banting (2002). In addition, some recent contributions to the *International Productivity Monitor*, produced by the Centre for the Study of Living Standards, address this topic, notably Nicholson (2003), Baily (2003) in his review of OECD (2003), Howitt (2004), and Pilat (2005). Finally, Coulombe and Tremblay (2001), Coulombe (2003) and Coulombe, Tremblay and Marchand (2004) have investigated the relationship between education/literacy and growth and suggest that Canadian policy may have affected this relationship in the past across Canadian regions. Given the volume of this research, the numerous perspectives and the sometimes conflicting findings, a review of all of this material is avoided here, and the references left for the interested reader to explore.

B. Labour Productivity Levels in OECD Countries

Table 3 presents estimates in index form (United States=100) of levels of total economy output per hour, based on purchasing power parities, for 23 OECD countries for 1950, 1973, 1995, 2000, and 2004. The source of these estimates is the total economy database maintained by the Groningen Growth and Development Centre at the University of Groningen in the Netherlands.

In 2004, Norway had the highest level of output per hour in the OECD at 128.9 per cent of the U.S. level, followed by Luxembourg (121.3 per cent), France (115.6 per cent) Belgium (110.1 per cent), Ireland (108.1 per cent), the Netherlands (102.5 per cent), and the United States (100.0 per cent). Thus six European countries had higher labour productivity levels than the United States despite the very strong U.S. productivity growth of the last decade. Indeed, in 1995, eight European countries had higher output per hour levels than the United States (Germany, Italy, and Denmark in addition to the six countries listed above minus Ireland).

Cette (2005) argues that these high labour productivity levels in a number of European countries relative to the United States reflect the influence of two factors. First, the low employment rate in Europe keeps low productivity youth and older workers out of the workforce, boosting labour productivity through a composition effect. Second, lower annual hours worked in Europe promote high levels of productivity as workers are less tired on the job and hence more productive. He makes a correction for these two factors to estimate what he calls the structural hourly productivity level and finds that for

two of the three data sets, all European countries except Norway fall below the U.S. level (Table 4).

Table 3: Output per Hour Levels and Growth Rates in Selected OECD Countries, 1950-2004

	(United States=100)					(compound average annual growth rates)				
	1950	**1973**	**1995**	**2000**	**2004**	**1950-1973**	**1973-1995**	**1995-2000**	**2000-2004**	**1973-2004**
Australia	74.9	77.1	82.5	83.2	80.8	2.68	1.55	2.29	2.19	1.75
Austria	37.3	78.4	99.0	103.8	97.7	5.91	2.32	3.09	1.40	2.32
Belgium	54.2	88.4	117.0	121.0	110.1	4.75	2.54	2.82	0.54	2.33
Canada	81.1	89.0	85.3	83.1	79.0	2.96	1.05	1.57	1.66	1.21
Denmark	63.9	76.3	100.6	100.5	94.7	3.35	2.52	2.09	1.44	2.31
Finland	39.6	66.1	88.7	93.0	91.9	4.86	2.60	3.11	2.64	2.69
France	49.3	86.9	119.7	121.5	115.6	5.11	2.73	2.43	1.65	2.54
All Germany			102.9	103.9	97.0			2.32	1.18	2.51
West Germany	39.7	84.7	116.2			5.99	2.71			
Greece	24.2	56.7	62.4	63.6	63.1	6.41	1.69	2.50	2.73	1.95
Ireland	31.4	48.0	86.1	102.7	108.1	4.47	3.96	5.80	4.26	4.29
Italy	45.8	81.2	106.4	101.6	89.0	5.14	2.49	1.18	-0.41	1.90
Japan	19.7	55.4	76.1	76.8	75.1	7.27	2.71	2.30	2.39	2.60
Luxembourg	80.2	103.0	133.3	136.9	121.3	3.67	2.43	2.67	-0.13	2.14
Netherlands	69.3	103.7	120.7	112.1	102.5	4.36	1.94	0.63	0.66	1.56
New Zealand*	94.6	87.1	68.6	66.7	62.5	2.18	0.15	1.55	1.30	0.52
Norway	58.1	82.6	130.2	130.7	128.9	4.13	3.36	2.20	2.58	3.07
Portugal	18.7	46.8	55.9	56.6	51.7	6.71	2.05	2.41	0.61	1.92
South Korea**	10.7	16.1	35.3	38.1	39.6	6.68	4.92	3.71	3.96	4.60
Spain	24.8	52.2	92.0	81.5	72.6	5.92	3.88	-0.30	-0.01	2.69
Sweden	59.8	84.9	89.1	89.7	88.5	4.12	1.47	2.26	2.57	1.74
Switzerland	87.1	106.2	95.0	93.3	86.7	3.43	0.73	1.74	1.07	0.94
United Kindom	67.9	72.7	92.6	92.3	88.9	2.85	2.36	2.05	1.99	2.26
United States	100	100	100	100	100	2.55	1.24	2.12	2.94	1.60
Unweighted Average***	51.5	74.7	92.7	93.3	88.4	4.59	2.32	2.29	1.70	2.24

Source: Groningen Growth and Development Centre and the Conference Board, Total Economy Database, January 2005, http://www.ggdc.net.
* Data for New Zealand are available for 1956 onwards only. The relative level shown for 1950 is actually for 1959, the first year for which data are available for both New Zealand and the United States. The growth rate shown for the 1950-1973 period is actually for 1956-1973.
** Data for South Korea are available for 1963 onwards only. The relative level shown for 1950 is actually for 1963, the first year for which data are available for both South Korea and the United States. The growth rate shown for the 1950-1973 period is actually for 1963-1973.
*** The average excludes the United States for relative levels but includes the United States for growth rates. For 1950 and 1973 and the 1950-1973 and 1973-1995 periods, West Germany is included and All Germany is not included. For 1995, 2000 and 2004 and the 1995-2000, 2000-2004 and 1973-2004 periods, All Germany is included and West Germany is not included. The 1973-2004 growth rate for All Germany is a weighted geometric average of the 1973-1989 growth rate for West Germany and the 1989-2004 growth rate for All Germany. (The All Germany data series is available for 1989-2004 only, while that for West Germany is available for 1950-1997 only.)

In 2004, Canada ranked a dismal 17th out of 23 OECD countries in terms of its level of labour productivity. Output per hour worked in Canada was only 79.0 per cent of that of the United States,[8] with only three southern European countries (Portugal, Spain

[8] Estimates of Canada's total economy labour productivity level relative to that of the United States from some other sources, e.g. Baldwin et al. (2005) and Sharpe (2003), are much higher than the 79 per cent from the Groningen data. There are several reasons for this difference, including adjustments made to the output data, different labour input sources, and different estimates of purchasing power parity. Unfortunately it is not possible to make comparisons across other countries on the same basis as the Canada-U.S. comparisons from these other sources are made, as the necessary data are not available; but the Groningen data set is one of the most comparable available in terms of comparing labour productivity across a large number of countries. Also note that the labour productivity levels discussed here are for the

and Greece), two Asian countries (Japan and South Korea) and New Zealand reporting a lower level. In contrast, in 1950 Canada had the fourth highest labour productivity level among OECD countries, behind only the United States, New Zealand, and Switzerland. Even by 1973 we still ranked fifth. These developments reflect relative productivity growth rates.

Table 4: Observed and "Structural" Hourly Productivity in 2002

Country	Observed Hourly Productivity As a per cent of the U.S. figure			Effect (as a per cent) of the Gap with the United States …		Structural Hourly Productivity As a per cent of the U.S. figure		
	Groningen [a]	Eurostat [b]	OECD [c]	…in hours worked [d]	…in the employ-ment rate [e]	[f] = [a]-[d]-[e]	[g] = [b]-[d]-[e]	[h] = [c]-[d]-[e]
Australia	83.2	na	78.4	-0.5	2.0	81.7	na	76.9
Austria	101.7	87.4	88.3	5.2	2.5	94.0	79.7	80.6
Belgium	113.7	108.1	108.3	5.7	7.5	100.4	94.9	95.1
Canada	82.9	87.9	85.2	1.4	-0.4	81.8	86.9	84.1
Denmark	98.5	89.4	93.5	8.1	-3.3	93.6	84.5	88.7
Finland	91.7	83.3	81.9	2.4	0.0	89.4	80.9	79.5
France	119.8	106.0	113.2	8.2	5.2	106.5	92.7	99.9
Germany	101.7	92.4	92.5	8.7	3.7	89.4	80.1	80.2
Greece	64.7	65.2	64.6	-2.3	11.7	55.3	55.8	55.2
Ireland	106.1	101.5	105.0	2.8	5.5	97.8	93.3	96.7
Italy	95.8	81.5	93.7	4.4	12.1	79.3	65.0	77.3
Japan	75.3	70.0	70.5	0.0	4.8	70.5	65.2	65.7
Netherlands	108.9	101.4	101.5	12.1	0.1	96.8	89.2	89.3
New Zealand	64.8	na	62.9	-0.3	0.3	64.8	na	62.8
Norway	131.6	125.0	125.5	11.9	-3.9	123.6	117.0	117.4
Portugal	53.9	53.5	53.3	2.1	2.7	49.1	48.7	48.6
Spain	76.9	76.7	74.2	-0.3	10.6	66.6	66.3	63.9
Sweden	88.6	85.5	85.6	4.8	-3.7	87.4	84.3	84.4
Switzerland	91.3	na	83.5	6.7	-2.8	87.3	na	79.5
United Kingdom	90.5	84.8	79.3	2.2	-0.1	88.4	82.7	77.2
United States	100.0	100.0	100.0	0.0	0.0	100.0	100.0	100.0

Source: Cette (2005).

In terms of the six countries whose productivity experience is examined in this report, Ireland was the most productive in 2004 at 108.1 per cent of the U.S. level, followed by the United States, (100.0 per cent), Finland (91.9 per cent), the United Kingdom (88.9 per cent), Sweden (88.5 per cent), and Australia (80.8 per cent). The output per hour level in all these countries exceeded that in Canada (79.0 per cent of the U.S. level).

C. Productivity Growth Rates in OECD Countries

1) Labour Productivity

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total economy, in contrast to the levels of business sector output per hour in Canada relative to the United States in Chart 2 and discussed in the previous section.

Table 3 also presents estimates of average annual growth rates for total economy output per hour, based on purchasing power parities, for 23 OECD countries for the 1950-73, 1973-95, 1995-2000, 2000-2004, and 1973-2004 periods. The source of these estimates is the total economy database maintained by the Groningen Growth and Development Centre at the University of Groningen in the Netherlands.

In the 1950-73 postwar period, known as the golden age of capitalism, the average rate of productivity growth in OECD countries was a robust 4.59 per cent per year.[9] This rapid productivity growth in many countries was due to convergence toward the U.S. productivity level. In 1950, the labour productivity gap between the United States and almost all other countries provided considerable scope for technological catch-up. Japan experienced the fastest productivity growth (7.27 per cent), followed by Portugal and South Korea. All three of these countries had very low relative productivity levels in 1950. New Zealand experienced the slowest labour productivity growth over this period (2.18 per cent), followed by the United States (2.55 per cent). Both of these countries had high relative productivity levels in 1950, with the United States the productivity leader and New Zealand close behind at 94.9 per cent of the U.S. level.

All 23 OECD countries experienced a slowdown in output per hour growth in the 1973-1995 period relative to the 1950-73 period, with average productivity growth falling by nearly one half (2.27 points) from 4.59 per cent to 2.32 per cent per year. This development in many countries reflects the ending or slowing down of the period of convergence to the U.S. productivity level. The country with the most rapid labour productivity growth during this period was South Korea (4.92 per cent per year), followed by Ireland and Spain. New Zealand again experienced the slowest productivity growth (0.15 per cent), followed by Switzerland, Canada and the United States.

The year 1995 is said to represent the beginning of the "new economy" era, although this trend has not manifested itself in the aggregate labour productivity data. Average output per hour growth in the OECD in 1995-2000 was only 2.29 per cent, virtually identical to that recorded in the 1973-1995 period. In the 2000-2004 period, average productivity growth fell to 1.70 per cent. Of the 23 countries, about half (13) experienced an acceleration of output per hour growth in the 1995-2000 period relative to 1973-1995. The largest change in productivity growth was not in the United States, where a 0.88 per centage point acceleration took place (with average annual output per hour growth rising from 1.24 per cent to 2.12 per cent), but in Ireland (1.84 points), followed by New Zealand (1.40 points), and Switzerland (1.01 points). Canada experienced a productivity growth pick-up of 0.52 points from 1.05 per cent to 1.57 per cent per year.

[9] The averages across countries in Table 3 are simple arithmetic averages. This means that they have not been weighted to control for differences in the size of countries. If the growth rates were recalculated using as weights the population shares of each country in the total population across all countries considered, the resulting weighted average growth rates would be slightly lower, since countries such as Ireland, with rapid productivity growth rates, would receive less importance in the calculation of the weighted average than in that of the unweighted average. For the simple exposition of this section, this distinction is moot.

In terms of the six countries whose productivity experience is examined in this report, all six had faster productivity growth than Canada (1.55 per cent) in the 1995-2000 period: Ireland (5.80 per cent), Finland (3.11 per cent), Australia (2.29 per cent), Sweden (2.26 per cent), the United States (2.12 per cent), and the United Kingdom (2.05 per cent). Equally, four of the six outperformed Canada's 0.52 point rise in productivity growth between the periods: Ireland (1.84 points), the United States (0.88 points), Sweden (0.79 points), and Australia (0.74 points). Finland had virtually the same acceleration (0.51 points) as that of Canada. Only the United Kingdom saw a deceleration in productivity growth (-0.31) between periods. If the longer 1995-2004 period is used instead of 1995-2000, the same country patterns emerge.

Between the 1995-2000 and 2000-2004 periods, 14 of the 23 OECD countries in Table 3 experienced a productivity growth deceleration. The only country that experienced a significant acceleration in productivity growth after 2000 was the United States, with output per hour growth rising 0.82 points to 2.94 per cent from 2.12 per cent per year. The country with the second largest productivity improvement was Norway (0.38 points). In the 2000-2004 period, only Ireland and Korea had labour productivity growth exceeding that of the United States.

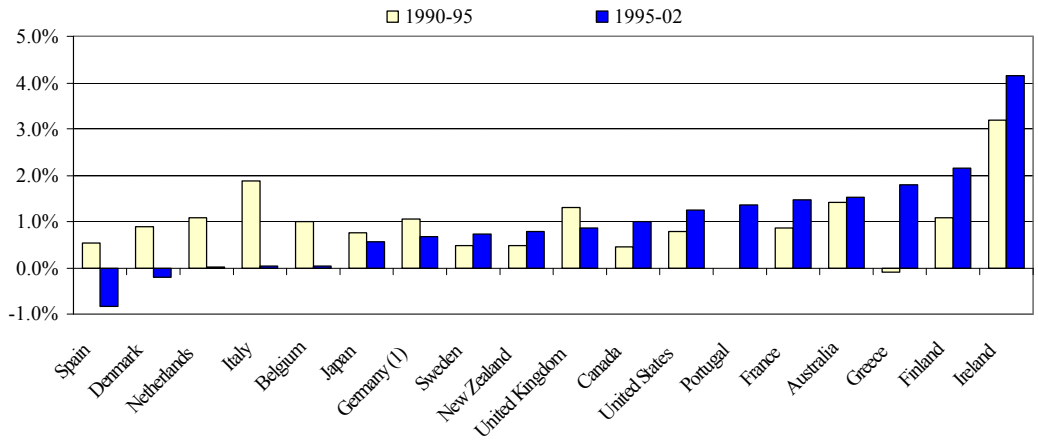
2) Multifactor Productivity

In addition to labour productivity, many economists are interested in multifactor productivity (MFP), which provides a better indication of trends in the efficiency of use of both capital and labour together. As discussed briefly in the first section in this part of the report, in a production function framework, MFP is a component of labour productivity. The term "technological coefficient" is often applied rather than MFP in theoretical contexts, and since the pioneering work of Solow (1957), researchers have generally associated MFP growth with technological progress. However, not all economists agree that MFP reflects the state of technological development fully or even partially. This issue is discussed by Lipsey and Carlaw (2000) and by the two other contributions to the Symposium on Total Factor Productivity in the inaugural issue of the *International Productivity Monitor*. The least optimistic opinion on what MFP means is that it is a measure of our ignorance in the sense that measured MFP growth captures all effects that are not explicitly accounted for by the production function. Nonetheless, the interpretation of MFP growth as technological change – or at least "disembodied" technological change unrelated to new technologies embedded in capital goods – persists. Given the disagreement surrounding the meaning of MFP, the following discussion will limit itself to a simple enumeration of MFP growth in OECD countries.

Chart 3 provides estimates of multifactor productivity growth at the total economy level for 18 OECD countries for the 1990-95 and 1995-2002 periods based on the OECD productivity database. In terms of the six countries whose productivity experiences are examined in this report, four had more rapid MFP growth than Canada in 1995-2002 (Ireland, Finland, Australia and the United States), one (the United Kingdom) performed about as well as Canada, and one (Sweden) had slightly slower MFP growth

than Canada. Ireland had the most rapid MFP growth out of all 18 countries for which data are available in both the 1990-95 and 1995-2002 periods. Finland had the next most rapid MFP growth in 1995-2002, at about half of Ireland's rate. Australia and the United Kingdom had the most rapid MFP growth in 1990-1995 next to Ireland out of the six countries whose productivity experiences are examined in this report, but were out-paced by Italy.

Chart 3: Multifactor Productivity Growth in the Total Economy, 1990-95 and 1995-2002, compound average annual growth rates, per cent



(1) 1992-1995 instead of 1990-95.
Note: 1995-2001 instead of 1995-2002 for Belgium, Denmark, Finland, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden and the United Kingdom.
Source: Pilat (2005) based on OECD Productivity Database, March 2005.

D. The Relationship Between Labour Productivity and GDP Per Capita in OECD Countries

High relative labour productivity levels for a country, as represented by output per hour, do not necessarily translate into high relative income levels, as represented by GDP per capita. This is certainly the case for many European countries, which, as noted above, have very high relative levels of output per hour, but which also have levels of GDP per capita well below that of the United States. As discussed in the first section in this part of the report, this situation reflects the fact that GDP per capita is determined not just by output per hour, but also by the number of hours worked per employed person and the share of the population that is employed. This latter factor is in turn affected by the unemployment rate, the participation rate, and the proportion of the working age population in the total population.

Table 5, drawn from van Ark (2002), provides a reconciliation of GDP per capita and output per hour relative levels for OECD countries in 2001. The United States had by far the highest level of GDP per capita in the OECD, with Norway a distant second at

83.3 per cent of the U.S. level. Despite its high relative income, the U.S. labour productivity level was exceeded by four European countries, with many more close to it.

Table 5:

Reconciliation of GDP Per Capita and Labour Productivity, OECD Countries, 2001
(preliminary estimates)

	GDP Per Hour Worked[1]		Effect of Working Hours[1]	Effect of Employment Share in Total Population (in % points)				GDP Per Capita	
	in 1996 US$	as % of US	in % points	Unemployment[2]	Labor Force to Population (15-64 yrs)	Population (15-64 yrs) to Total Population	Total[3]	in 1996 US$	as % of US
United States	36.97	100.0	0.0	0.0	0.0	0.0	0.0	33.538	100.0
Norway	40.55	109.7	-28.9	1.0	3.1	-1.6	2.5	27.940	83.3
Ireland	36.36	98.4	-8.8	0.6	-9.7	1.0	-8.1	27.318	81.5
Switzerland	31.73	85.8	-12.8	2.1	5.5	0.6	8.2	27.236	81.2
Denmark	34.58	93.5	-16.4	0.1	2.4	0.4	2.9	26.857	80.1
Canada	30.53	82.6	-3.5	-2.1	-1.2	1.5	-1.8	25.923	77.3
Australia	30.32	82.0	-3.1	-1.7	-1.7	1.5	-1.9	25.818	77.0
Belgium	41.54	112.4	-18.9	-2.1	-15.4	-0.7	-18.2	25.252	75.3
Netherlands	37.32	100.9	-28.1	1.5	-1.1	1.3	1.7	24.989	74.5
Austria	35.46	95.9	-17.9	0.8	-6.3	1.5	-4.0	24.828	74.0
Japan	26.64	72.1	-2.7	-0.1	1.4	1.7	3.0	24.267	72.4
Finland	31.92	86.3	-10.7	-3.4	-2.2	0.9	-4.7	23.795	71.0
Sweden	30.22	81.7	-10.7	-0.3	1.7	-2.0	-0.5	23.636	70.5
Germany	34.20	92.5	-16.6	-2.5	-5.1	1.0	-6.6	23.247	69.3
France	37.63	101.8	-17.8	-3.6	-9.6	-1.6	-14.8	23.176	69.1
Italy	32.53	88.0	-11.0	-4.1	-5.2	0.9	-8.4	22.991	68.6
United Kingdom	29.40	79.5	-9.2	-0.2	-1.8	-0.6	-2.7	22.696	67.7
Spain	27.93	75.6	-1.8	-6.6	-12.2	0.9	-18.0	18.723	55.8
New Zealand	22.49	60.8	-3.6	-0.3	-0.7	-0.8	-1.9	18.560	55.3
Korea	15.18	41.1	13.6	0.4	-8.4	3.3	-4.7	16.747	49.9
Portugal	19.25	52.1	-3.1	0.3	-1.1	1.2	0.4	16.548	49.3
Greece	21.64	58.5	2.4	-3.9	-10.9	0.7	-14.1	15.696	46.8
Czech Rep.	14.43	39.0	3.2	-1.5	-3.0	2.0	-2.5	13.346	39.8
Hungary	17.44	47.2	-1.8	-0.5	-10.8	1.0	-10.4	11.730	35.0
Poland	11.90	32.2	2.7	-4.8	-4.2	1.1	-7.9	9.021	26.9
Mexico	12.13	32.8	3.0	0.9	-9.6	-2.7	-11.5	8.156	24.3
Turkey	10.16	27.5	1.1	-0.9	-10.2	0.2	-10.9	5.933	17.7
European Union[4]	32.30	87.4	-12.1	-2.4	-6.0	0.2	-8.2	22.511	67.1
OECD excl. US	24.87	67.3	-2.8	-1.5	-7.0	0.1	-8.4	18.818	56.1

[1] Calculated on basis of actual hours worked per person per year.
[2] Calculated on basis of standardized unemployment rates from OECD.
[3] Sum of previous columns plus rounding differences.
[4] European Union is weighted average for 14 EU member countries, excluding Luxembourg.

Source: van Ark (2002).

In terms of the six countries whose productivity experience is examined in this report, while all six had higher levels of output per hour than Canada, only two had higher levels of GDP per capita (the United States and Ireland).This situation was largely accounted for by fewer hours worked in the United Kingdom, Finland, and Sweden relative to Canada. Ireland and Finland are notable for having quite high levels of output per hour relative to the United States (98.4 and 86.3 per cent of the U.S. level

respectively) but much lower relative levels GDP per capita (81.5 and 71.0 per cent respectively). In Ireland, about half of this gap between relative GDP per hour and GDP per capita levels was due to fewer average hours worked than in the United States, with the other half due to a lower labour force participation rate, very slightly offset by a lower unemployment rate and higher proportion of the working age population in the total population. In Finland, the gap was due mostly to fewer average hours worked, but also to a higher unemployment rate and slightly lower labour force participation rate.

II. General Lessons from OECD Productivity Experience

This part of the report briefly reviews the main findings of the OECD growth project and the numerous studies by the McKinsey Global Institute on international productivity differences.

A. OECD Growth Project

This section briefly reviews the important work that the OECD has done as part of the OECD growth project, published in the documents *Sources of Economic Growth* (OECD, 2003) and *Understanding Economic Growth* (OECD, 2004c).

The OECD growth project analyzed the sources of economic growth based upon aggregate data and using cross-country regression analysis, with a particular emphasis on the ways in which policies affect outcomes. It argued that the causal variables looked at are able to explain much of the observed growth differences over time and across countries. It was found that investment in physical and in human capital was important to growth; that sound macro policies yield higher growth; and that the overall size of government in the economy may hinder growth if it becomes too large, although the pattern was mixed. Some government spending was found conducive to growth, while high levels of direct taxation (taxes on wages and profits) discouraged growth. R&D activities by the business sector had high social returns, and hence contributed to growth, but there was no evidence in this analysis of positive effects from government R&D. The study found some evidence that financial markets are important to growth, through helping to channel resources towards the most rewarding activities and through encouraging investment.

A very interesting and surprising result from the aggregate regression analysis is that “exposure to international trade” is an important determinant of output per working age person. The analysis concludes that an increase of 10 per centage points in trade exposure (an adjusted average of exports and imports as per centages of GDP) raises output per person by 4 per centage points. Baily (2003) has noted that this result is not surprising in terms of the direction of the effect, but is remarkable in the magnitude – the report states that between the 1980s and 1990s trade exposure on average increased by about 10 per centage points. This result, if taken at face value, gives strong support to the view that increased globalization improves economic performance. It suggests that all OECD countries should move aggressively to remove remaining barriers to trade, and do so for their own advantage.

Human resources and skills development issues related to productivity also receive particular emphasis. For example, the OECD has found that policies of certain countries to re-integrate low-skilled workers, while resulting in a widening of the employment base and increased potential growth, depressed temporarily productivity growth through a negative composition effect on labour quality.

At the macro level, the OECD has thus identified education, innovation, deregulation and investment as the basic determinants of productivity growth. It has also identified inflation, fiscal policy, international trade, and the financial system as policy and institutional determinants of growth. At the industry and firm level, the OECD has identified market conditions, competition, and innovation and R&D as key productivity drivers.

Peter Nicholson has applied the results of the OECD growth project to the Canadian economy (Nicholson, 2003). In terms of his growth scorecard, Canada rates highly, with three stars for three of the five growth drivers (sound macro policy, human capital, and exposure to trade) and two stars for productive investment. According to Nicholson, Canada only fares poorly in terms of innovation, which he gives one star.

Based on the results of the OECD growth project, Nicholson provides interesting stylized estimates of the impact of seven growth drivers (human capital, physical capital, R&D, trade exposure, tax burden, inflation level, and inflation variability) on GDP per capita in a steady state environment. These estimates are provided in Table 6.

Table 6: QUANTIFYING SOME KEY GROWTH DRIVERS*
Impact on Level of GDP per Capita in Steady State

Driving Factor	Definition	Change	Impact	Typical Change over 80s and 90s in OECD
Human Capital	Average years of education	+ 1 Year	**4% - 7%**	+ 1.5 years in G-7
Physical Capital	Private non-res. Invest. as % GDP	+ 1 pct. Pt	**1.3%**	Variable
R&D	Business R&D % GDP	+ 0.1 pct. pt.	**> 1.2%**	About 0.1 pct. pt.
Trade Exposure	Ave of Exp/Imp % GDP	+ 10 pct. Pts	**4%**	About 10 pct. pts
Tax Burden	Govt. Revenue % GDP	+ 1 pct. pt.	**(0.6%) – (0.7%)**	About 1.5 pct. pts
Inflation Level	Final Consumption Deflator	- 1 pct. pt.	**0.4% - 0.5%**	About 4 pct. pts.
Inflation Variability	Standard Deviation	- 1 pct. pt.	**2%**	About 2/3 pct. pts

*Based on regression analysis of 21 OECD countries over 1971-98.
Source: Nicholson (2003) based on OECD (2003).

B. McKinsey Global Institute Productivity Studies[10]

The McKinsey Global Institute (MGI) is a think tank based in Washington, D.C. founded in 1990 by McKinsey & Company with the objective of analyzing international productivity levels from both economic and management perspectives. Over the last fifteen years, MGI has studied most of the world's major economies. In each case, MGI uses microeconomic analysis on a sector-by-sector level to study the effects that industry decisions ultimately have on national productivity. This section seeks to synthesize some of these findings to see what potential lessons can be drawn regarding productivity level differences between Canada and other countries.

1) General Findings

Time and again, the McKinsey Global Institute's studies have returned to the same story in trying to explain productivity gaps between countries: a lack of competitive intensity. To the extent that certain European and Japanese sectors seem to consistently trail the United States in productivity, these sectors are nearly always characterized by a small number of domestic firms who engage in little price or service competition because of regulatory protection in the form of product market restrictions and trade barriers. MGI finds that such restrictions lead to managerial complacency, a consequent lack of innovation in production processes, and ultimately to a productivity performance below that of the technological leader. Potential factors related to competition that have been identified by MGI as directly affecting productivity are the following.

- **Concentration:** A high market share held by a small number of firms is not necessarily inconsistent with intense competition. Concentration can improve productivity through achieving economies of scale, and it can also boost productivity if it allows a small number of large firms to compete intensely with each other. Examples of highly concentrated yet highly competitive industries include the Dutch banking industry and the Swedish automobile industry.

- **Trade Protection:** Tariffs and quotas reduce productivity through shielding industries from international competition and so making the adoption of global best practices unnecessary. The automobile industry in Germany, France and the United Kingdom, the food processing industry in Japan, and many Swedish service industries are all examples highlighted by MGI of industries whose productivity performance has been hindered by trade protection.

- **Deregulation:** MGI highlights the airline, telecommunications and banking industries as cases in which deregulation has boosted productivity, and in which countries that have chosen to delay or forgo deregulation have consequently suffered lower productivity levels than the early deregulators.

[10] This section draws on a recent CSLS research report by Kellison (2004).

Other competition-related factors can affect productivity in a more indirect fashion.

- **Minimum Wages:** Higher wages typically have the effect of reducing the number of low-skill jobs, as the benefit of these low-skill services is outweighed by the higher cost of providing them. While this has the effect of raising conventionally-measured average labour productivity, MGI argues that overall "service productivity" is negatively affected because the range of services that is offered shrinks.

- **Work Rules:** MGI recognizes that some labour market inflexibilities can be beneficial. However, collective agreement terms that are not adjustable to market realities can negatively affect productivity by preventing productivity-enhancing reorganizations of work.

- **Zoning Laws:** Some European countries have zoning regulations that have a negative impact on productivity by making it difficult for firms to purchase parcels of land of a required size, and through creating an artificial scarcity of land and thereby making land overly expensive. This affects productivity because high rents hinder the ability of smaller firms to innovate, and because larger firms have difficulties achieving optimal scale.

Perhaps even more important than the market conditions under which a firm operates is the way its managers choose to react to those conditions. Competitiveness is the main driver of managerial innovation, but that managerial innovation (or lack thereof) is what affects productivity, first at the firm level, then the industry level, and ultimately at the national level. MGI makes the following observations related to managerial innovation.

- **Best Practice:** Managers need to be aware of best practices in a given industry, and be prepared to implement them. MGI states that sufficient exposure to competition will ensure that this is the case.

- **Human Capital:** MGI finds little evidence that labour skills at the production level differ greatly across countries. However, the qualifications of managers can have a significant impact on productivity, through entrepreneurship and the training of production workers.

- **Marketing:** MGI finds that the U.S. telecommunications sector's productivity performance has been positively affected through marketing, since the resulting greater demand for telecommunication services means that there is greater output for a given investment in fixed capital.

- **Information Technology:** Although few would dispute that investment in information technology can have a significant impact on productivity growth,

MGI concludes that realizing its full benefit requires an appropriate application. In addition to the effect of IT use on productivity growth, the presence and strong productivity performance of industries producing IT goods also positively affect overall manufacturing productivity growth.

- **Capital Intensity:** MGI finds that improvements in capital intensity are a necessary but not sufficient condition for improvements in productivity. This is because increasing the amount of capital per worker does not necessarily mean that the capital is being used efficiently. Improvements in capital productivity are often dependent on other managerial and competitive factors.

The final category of productivity determinants is demand factors. If a competitive market forces a firm to innovate in order to create better goods and services at lower prices (and costs), then there should be an increase in demand for those improved products, which should more than justify the initial costs of innovation and increase firm profits. There are other demand factors besides this general desire for improved goods that can affect a firm's decisions and thus productivity. Briefly, income levels, cyclical demand factors, and general consumer preferences can all affect the format, output level, and ultimately productivity of a firm.

2) Implications for Canada

The McKinsey Global Institute has not produced a report on Canadian productivity. However, the findings from the McKinsey productivity studies on industry productivity differentials between the United States and a number of major developed and developing countries may have relevance for the explanation of industry productivity differentials between the United States and Canada. In some respects, the Canadian economy is a bit of a hybrid between the U.S. free-market system and the more sheltered, socially-conscious systems of countries like France or Sweden. Canada is more globally-exposed than most EU countries, yet it also retains a certain level of trade protection and restricts entry to some domestic sectors. It also has a more developed welfare state than the United States in terms of more government control of social programs such as health care and pensions.

However, given the overall similarity between Canada and the United States, which is much greater than between the United States and Europe, Japan, Brazil, and India, the findings of the MGI studies cannot be indiscriminately applied to Canada-U.S. productivity differences at the industry level. Nonetheless, in lieu of undertaking an MGI-style detailed report on a number of industries for Canada, a few broad conclusions can be made.

Many managerial and consumer behaviour factors are similar across the two countries. One area in which Canada appears to be lagging the United States to a large degree is the retail trade sector. It appears that managers in the Canadian retail industry may not have adopted new processes as rapidly as their U.S. counterparts, although direct evidence of this has not been found. Wal-Mart has lead the U.S. retail trade industry in

this regard, spurring other firms to innovate through competitive pressure. Apparently Wal-Mart has not yet had this effect in Canada.

In terms of competitive factors – the focus of so much of MGI's work – Canadian service-sector firms may be less exposed to competition than U.S. firms and have a smaller market in which to operate. The poor productivity performance of financial and cultural industries is consistent with this hypothesis. Likewise, the strong relative performance of Canada's natural resource industries may be related to the intense international competition they face.

Many competitive factors are quite similar across the two countries, such as zoning laws and minimum wages. However, the OECD (2004), in its 2004 survey of Canada, provides an in-depth analysis of product market competition. It finds that, out of 21 OECD countries, Canada scored 11th according to a composite competition indicator, compared to a 4th place ranking for the United States. Specifically, the OECD sees barriers to foreign direct investment as Canada's largest weakness in terms of product market competition. The survey also states that the Canadian Competition Act still faces some challenges in providing Canada with a fully effective anti-trust regime.

III. Lessons from Country-Specific Productivity Experience

This part of the report examines the productivity experiences of six OECD countries and attempts to draw possible lessons for Canadian productivity policy. As it is well beyond the scope of the report to discuss the productivity experience of all OECD countries, a sub-set of OECD countries has been selected on the basis of the productivity performance and relevance to Canada of these countries. Based on discussions with HRSDC officials, it was decided to focus on the following six countries: the United States, Ireland, Australia, the United Kingdom, Finland and Sweden.

Given the similarities between Canada and the United States, the productivity experience of the United States, and in particular the reasons for that country's superior productivity growth, is very relevant to Canada. Ireland, with the highest labour productivity growth rate among OECD countries since 1973, has been a fantastic economic success and the reasons for its success merit careful study. Australia has a slightly higher labour productivity level than Canada and has enjoyed faster productivity growth since 1973, and especially since 1995. It is extremely similar to Canada in many ways, so policies that fostered productivity growth there may have particular relevance to Canada. The United Kingdom in 2004 had a labour productivity level above that of Canada, and has undergone a number of market-oriented reforms that may have relevance for Canada. Finland and Sweden have higher labour productivity levels than Canada and both countries have been very successful in the high-tech area, with possible lessons for Canada.

A. United States

The United States has seen remarkable labour productivity growth since 1995, and this growth is even more remarkable when compared to the stagnant growth of the 1973-1995 period. Furthermore, it is now widely accepted that, in addition to the original acceleration in labour productivity growth in 1995-2000 relative to 1973-1995, the United States has experienced an additional post-2000 labour productivity growth acceleration.

The resurgence of U.S. labour productivity growth after 1995 has been an enormous boon to living standards in the United States, is perhaps the most important factor in the competitiveness of U.S. firms in the global market, and has important implications for increasing the fiscal room to manoeuvre as the demographic crunch sets in. Given the desire of other countries to pursue these same outcomes, the important questions raised by the impressive U.S. labour productivity performance are what factors have been behind this performance and will these factors be successful at raising labour productivity growth if implemented in other countries.

1) Information Technology and the "New Economy" Explanation

The earliest explanation of the U.S. labour productivity growth acceleration, and one that is still widely accepted by the general public today, is that the advent of information technology in the workplace revolutionized production processes and supply-chain management, thereby ushering in a "new economy" characterized by virtually limitless technology-driven productivity gains. The logic of this argument, which focuses on the use of information technology, is appealing; but is this explanation the whole story, or is it even correct?

A large literature has developed around this question of a new economy, and the generally accepted conclusion seems to be that information and communications technologies (ICT) were indeed responsible for much of the post-1995 labour productivity growth acceleration in the United States, although not in the straightforward way that has typically been postulated. Most importantly, it has been found that the production of ICT can be as important or even more important than the use of ICT in terms of improving labour productivity growth.

In the typical growth accounting framework,[11] ICT use affects labour productivity growth through two channels. First, investment in ICT capital increases capital intensity

[11] The standard growth accounting framework divides labour productivity growth into its capital deepening and multifactor productivity (MFP, also called total factor productivity, or TFP) growth components. Such a growth accounting framework was presented in the first part of this report for Canada. In the language of that example, capital intensity is synonymous with capital services per hour, and capital deepening refers to increases in capital intensity. Extensions to this standard framework have allowed a finer level of decomposition, for example into these two components as well as into the contributions of labour quality and capital quality (also called capital broadening). The contribution of capital deepening can be further broken down into contributions from ICT capital and non-ICT capital; and the contribution of MFP growth can be broken down into that from ICT-producing industries and that from ICT-using industries. Extended

in the same fashion as any other type of investment. Second, the MFP growth of ICT-using industries can be improved by the effects of the ICT goods that have been invested in, for example a new internet-connected computer facilitating more efficient procurement and distribution. This second channel is the proposed new economy effect.

In order to clarify this process, the most recent growth accounting exercise undertaken by Jorgenson, Ho and Stiroh (2004) can be taken as an example (Table 7). Investment in ICT shows up in the contribution to labour productivity growth from information technology capital deepening (sixth row from the bottom). But this contribution only reflects the simple effect of workers having more capital to work with. The intangible (new economy) effects of ICT in terms of revolutionizing production processes show up in the bottom-most row, the contribution to overall labour productivity growth of MFP growth among ICT users (defined simply as non-ICT producers).[12]

Gordon (2000) and Bosworth and Triplett (2001) expressed skepticism when the new economy hypothesis started to attract attention. For example, the latter state that the post-1995 U.S. labour productivity growth acceleration was driven to a large extent both by ICT capital deepening and by MFP growth among ICT users, but find that there is little evidence to suggest that the MFP gains among ICT users were actually driven by the putative efficiency effects of ICT. On the other hand, Kiley (1999), Brynjolfsson and Hitt (2000a and 2000b) and Stiroh (2001) use econometric and case study evidence at the industry and firm level to show that ICT users do indeed appear to exhibit more rapid productivity growth than firms or industries that use ICT less intensively.

Leaving this disagreement aside for a moment, it is also important to note that the growth accounting studies identify a third major driver of labour productivity growth after 1995. This is the MFP growth among ICT-producing industries, which, although a smaller source of labour productivity growth than MFP growth for ICT users, still makes a sizeable contribution. Such evidence is the basis for claims that ICT production is at least as important for labour productivity growth as ICT use. The argument is that there have been phenomenal technological advances in the manufacture of semiconductors, computers, communications equipment, and other types of machinery and electronics, which accounts for rapid MFP growth in these industries.[13] Furthermore, as the demand

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growth accounting exercises such as these have been carried out for the United States extensively, for example by Oliner and Sichel (2000 and 2002), the Council of Economic Advisers (2001), Jorgenson and Stiroh (2000), Jorgenson (2001), and Jorgenson, Ho and Stiroh (2003 and 2004). The latter study's estimates will be discussed in this section.

[12] This process can even be examined from a step earlier. The reason investment in ICT increases in the first place is that the price of ICT assets falls relative to that for other types of capital. These price declines in ICT assets are related to technological progress in the manufacture of these assets, e.g. the case of Moore's Law, which states that the computing power of newly manufactured semiconductors doubles every 18 months or so. This technological progress in the manufacture of ICT goods shows up in the contribution to labour productivity growth from MFP growth among ICT producers (the second row from the bottom in Table 7).

[13] Bosworth and Triplett (2001) state that the growth accounting evidence may not be wholly accurate due to errors in the measurement of ICT capital and the output of some industries. In particular, these technological advances lead to quality improvements, and it is difficult to completely account for such quality improvements when estimating price indices for ICT goods.

for ICT goods has vastly expanded, so too has the output of these industries, which consequently make a very large contribution to the acceleration of productivity growth.

Table 7: Sources of Growth in the U.S. Business Sector

	1981-2003	1981-1989	1989-2000	1989-1995	1995-2000	2000-2003
Growth Rates (compound average annual rates, per cent per year)						
Private Output	3.51	3.78	3.60	2.64	4.76	2.48
Hours Worked	1.36	2.11	1.53	1.06	2.09	-1.23
Average Labour Productivity	2.15	1.67	2.07	1.58	2.67	3.71
Absolute Contributions to Labour Productivity Growth (percentage points)						
Average Labour Productivity	2.15	1.67	2.07	1.58	2.67	3.71
Contribution from Capital Deepening	1.13	0.73	1.13	0.83	1.50	2.17
Information Technology	0.62	0.43	0.72	0.49	1.01	0.77
Non-Information Technology	0.50	0.30	0.41	0.34	0.49	1.40
Contribution of Labour Quality	0.26	0.26	0.30	0.37	0.21	0.11
Total Factor Productivity	0.77	0.68	0.65	0.38	0.96	1.43
Information Technology	0.36	0.26	0.41	0.27	0.58	0.43
Non-Information Technology	0.41	0.43	0.23	0.11	0.38	1.01
Relative Contributions to Labour Productivity Growth (per cent)						
Average Labour Productivity	100	100	100	100	100	100
Contribution from Capital Deepening	52.4	43.6	54.6	52.4	56.2	58.5
Information Technology	29.0	25.7	34.9	30.8	37.9	20.7
Non-Information Technology	23.4	17.9	19.7	21.6	18.3	37.7
Contribution of Labour Quality	12.0	15.6	14.3	23.6	7.7	2.9
Total Factor Productivity	35.6	40.8	31.1	24.1	36.1	38.6
Information Technology	16.6	15.3	19.9	17.1	21.9	11.5
Non-Information Technology	19.0	25.5	11.2	7.0	14.3	27.1

Source: Jorgenson, Ho and Stiroh (2004).

The relative importance of these three major sources of the U.S. aggregate labour productivity growth acceleration – economy-wide ICT capital deepening, MFP growth among ICT users, and MFP growth of ICT-producing industries – can be discerned by considering evidence from industry case studies undertaken by the McKinsey Global Institute (MGI). Kellison (2004:16-17), in reviewing MGI (2001), shows that industries experiencing little or no labour productivity growth acceleration between 1987-1995 and 1995-1999 (and, due to offsetting, accounting together for less than one per cent of the business sector labour productivity growth acceleration between these periods) accounted for 69 per cent of total business sector output and 62 per cent of the acceleration in ICT capital intensity between these same periods. This highlights three important points: the U.S. labour productivity growth acceleration has not been broadly based across industries; the increase in ICT capital intensity, on the other hand, has been distributed fairly evenly across industries; and consequently, much ICT capital intensity growth has not been effective in terms of increasing labour productivity growth.

Indeed, MGI (2001) finds that the 38 per cent of the U.S. business sector that contributed 99 per cent of the labour productivity growth acceleration was made up of just six industries, namely retail trade, wholesale trade, telecommunications, computer manufacturing, semiconductor manufacturing, and the portion of the financial sector

dealing in securities.[14] Furthermore, these six industries, for the most part, saw only modest accelerations in ICT capital intensity growth; and MGI states that ICT in general played only a minor role in the labour productivity growth accelerations of these industries.

For example, the surge in retail labour productivity growth was found to be caused in part by the ICT-driven managerial innovations at Wal-Mart, but was found to be amplified to a large degree by the competition among other retailers that this set off, and the cost cutting and matching innovation that this competition necessitated. Likewise, the productivity performance of the semiconductors industry was found to be primarily attributable to intense competition. MGI (2001) states that the other industries experiencing large labour productivity growth accelerations were affected by more traditional process innovations rather than ICT-induced changes, and that some of the aggregate acceleration also appeared at the time to be largely cyclical in nature, a point also made by Gordon (2000).

The bottom line from the McKinsey study, in the context of the growth accounting evidence discussed above, is that the production of ICT was an extremely important factor in the labour productivity growth acceleration between the periods examined. The technological advances fuelling the phenomenal accelerations in telecommunications, computers and semiconductors would have lead to a large acceleration in MFP growth among these ICT producers, and hence a large contribution to the aggregate labour productivity growth acceleration from MFP growth among ICT-producing industries.

The importance of ICT use for the productivity growth acceleration cannot be discounted completely, although MGI does largely dismiss the new economy hypothesis. ICT use, according to the case study evidence provided by MGI, has only proven to be effective in increasing labour productivity growth at the industry level (i.e. through increasing the MFP growth of ICT users) in those industries in which complementary managerial innovations were also undertaken. ICT, in other words, is no panacea in terms of increasing productivity growth at the industry or firm level, and is therefore not able to fully explain the labour productivity growth acceleration at the aggregate level.[15]

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[14] Sharpe (2004b) finds that an additional acceleration in U.S. labour productivity growth after 2000 has also been concentrated in a small number of industries, namely professional and business services, information services, wholesale trade, and retail trade. The issue of the contribution of ICT to this post-2000 acceleration will be addressed briefly below.

[15] To put this argument in terms of the growth accounting estimates in Table 7, the 14.3 per cent contribution of MFP growth among ICT users to overall labour productivity growth in 1995-2000 obviously cannot simply be dismissed as unimportant. However, this contribution would perhaps have been much larger – and labour productivity growth more rapid – if more ICT users had made complementary management and process changes. MGI suggests that such management innovations were much more important than the technology involved; but to the extent that the management changes were only made possible by the availability of the new technologies, clearly ICT investment cannot be seen as entirely superfluous. Also note that in the 2000-2003 period, which could not have been observed by MGI in 2001, the contribution to labour productivity growth of MFP growth among ICT users rose substantially to 27.1 per cent. The post-2000 period will be discussed in more detail below.

The MGI evidence also provides an interesting perspective on the increasing rate of ICT capital deepening. In a growth accounting framework, such accelerating investment will always make a positive contribution to increasing labour productivity growth, since such growth decompositions are based on a mathematical identity. But MGI doubts that the ICT accumulation of the post-1995 period really had the effect suggested by the capital intensity estimates. Much of the ICT capital deepening acceleration, according to the findings of MGI, was associated with year 2000 preparedness, and also with equipment upgrading that was perhaps slightly overzealous in the sense that the associated productivity gains would be minimal.

The revised new economy explanation recognizes the importance of both ICT production and use in the U.S. labour productivity growth acceleration, and this explanation has been largely confirmed in terms of Canada-U.S. differences as well. Rao and Tang (2001) find that the productivity increases among ICT producers in Canada between 1989-1995 and 1995-1999 were impressive on their own, but that they were exceeded by U.S. ICT producers, and more importantly, that the ICT production sector in the United States is much more important relative to the total economy than is the case in Canada. In updating this work, Ho, Rao and Tang (2004) find that about 70 per cent of U.S. labour productivity growth in 1995-2000 was accounted for by ICT use and ICT production together, but that this figure was only around 60 per cent in Canada. Similar conclusions are also reached by van Ark, Inklaar and McGuckin (2003).

2) Factors Underlying the ICT Revolution

Information and communications technologies, whether through their production or through their usage, have propelled U.S. labour productivity to an unprecedented growth performance. However, this is not an entirely satisfying explanation of the U.S. labour productivity growth acceleration, because it leaves the sources of the ICT revolution unaddressed. Veugelers (2005) adds to Gordon (2004) in attempting to uncover some of these sources.

Probably the most important aspect of the U.S. economy in terms of facilitating the take-off of ICT production and use is the university system. The combination of competition between private and public universities with the system of peer-reviewed research grants ensures that the best students are attracted to the United States, and consequently that the United States is always a world leader in research. More importantly, the world-class research produced by U.S. universities gives a strong incentive for linkages to form between the higher education sector and private businesses in terms of commercializing this knowledge.[16]

[16] This cycle of leading research spurring linkages with businesses and the resulting market for knowledge feeding back into attracting the brightest researchers may be weakening. With increasingly strict visa laws and procedures being implemented in the United States in recent years, some of the best students and researchers are either choosing to forego the tedious process required to obtain a visa or are being denied the ability to work and study within U.S. borders altogether. While it would not appear that the United States is in immediate danger of losing its status as the world leader in research, the weakening of this virtuous cycle may indeed have implications in terms of sustaining the currently torrid pace of productivity growth over the long term.

Other aspects mentioned by Veugelers as driving the ICT revolution include strong intellectual property rights;[17] flexible labour markets in terms of both international and internal migration of highly skilled workers; a large and unified market that is mostly free of barriers related to language, customs and standards; and well-developed and flexible financial markets.[18] This latter factor is especially important in terms of providing entrepreneurs and innovating firms with access to venture capital and other sources of finance. Above all, intense product market competition, embodying traditionally strict laws against anti-competitive practices, ensures that the most innovative firms are able to grow quickly and thereby challenge less innovative firms to improve their performance or exit the market. Such competitive intensity would appear to be crucial in motivating the diffusion of ICT, as industries protected from competition would find the reductions in costs and enhancements to efficiency afforded by ICT less necessary.[19]

3) The Recent Importance of Non-ICT Factors

As ICT became the dominant focus of the productivity debate in the United States, along with the related issues of innovation and competition to a lesser extent, other productivity drivers, such as human capital, capital intensity in general (rather than ICT-specific) and traditional managerial and process innovations, were overlooked to a certain degree. While these drivers were undoubtedly playing some role in the rapid U.S. labour productivity growth of the late 1990s – both on their own and as complementary forces to ICT production and use – they appear to have become more important in the continuation of impressive productivity growth after the collapse of the ICT revolution in 2000.

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[17] Intellectual property rights do not have a simple linear relationship with innovation and hence productivity. When they are too weak, businesses and researchers may feel that invention and innovation are not worthwhile since there will be limited opportunities to market the invention and recoup its development costs before it is copied by other businesses. On the other hand, overly strict intellectual property rights can prevent the diffusion of inventions once they have been marketed by allowing the inventors to charge high monopoly prices for their inventions for an overly long period of time and by denying other researchers enough information on which to invent technologies complementary to earlier inventions. While it is tempting to state that the United States must have struck the right balance between these competing concerns based on evidence of U.S. innovativeness, it is worth noting that the basic legal framework concerning intellectual property in the United States is a century or more old and that some believe that current laws are becoming too strict.

[18] To all of these factors behind the U.S. ICT revolution might be added the large U.S. government expenditures over the past several decades associated with national defence and space research. While much of this expenditure was motivated by the Cold War or simply the protection of such a large homeland, it fostered much cutting edge research. For example, the method used to send data over the internet was pioneered in response to government funding to establish an emergency communication system. Research originally directed towards space or defence applications in many cases proved useful and groundbreaking in other contexts or provided essential knowledge for progress in other fields of research.

[19] The importance of competition for productivity growth is echoed by MGI (2001), although it is suggested there that the operative channel is not necessarily through inducing ICT diffusion, but rather that ICT adoption is just one effect of competition that has the effect of increasing productivity.

Sharpe (2004a) identifies a labour productivity growth acceleration in the U.S. business sector after 2000 that is distinct and in addition to that of the post-1995 period. This is unexpected, given the recession in 2001 and the general stagnation or collapse of much of the high-tech enthusiasm of the late 1990s. Sharpe (2004a) and Sharpe, Rao and Smith (2005) discuss the probable factors behind this post-2000 acceleration in detail. One explanation they suggest is that, even as the adoption of ICT tailed off, the effectiveness with which the ICT were used in the workplace and in production processes continued to increase, so that the overall effect of ICT was only realized with a lag. In other words, organizational practices and production processes were being reformed in response to ICT, although these reforms may not have been high-tech in nature. The increase in the effectiveness of ICT use may also have been facilitated by the increased qualifications of workers, especially in the form of workplace training to fine-tune the skills of highly qualified workers.

The authors also suggest that cost pressures continued to be present for U.S. businesses after 2000 and especially after the recession of 2001, and in the absence of newer ICT, more traditional cost-cutting mechanisms were pursued. One such mechanism is the outsourcing of peripheral operations to low-cost countries who have a competitive advantage in such activities, but it is also possible that ICT have allowed cost-cutting to take new forms within the United States. Whatever particular mechanisms have been pursued, cost-cutting behaviour is certainly evident in a surge in corporate profits as a proportion of national income after 2000.

The authors mention several other possible factors behind the post-2000 U.S. labour productivity growth acceleration, including: increasing capital intensity due to extremely low interest rates, although interest rates have been increasing since the middle of 2004; generally strong short-term macroeconomic conditions (i.e. rapid output growth driven by strong consumer demand); and possible favourable changes to the composition of the workforce, such as through increased skills. They also mention the possibility that some of the acceleration may be due to measurement error related to quality adjustment and the preliminary nature of some data, although they do not speculate that this is a particularly important factor.

4) Conclusion

In short, the United States economy possesses just about all of the virtues that are typically associated with improving productivity growth. In this sense, there is much to learn from the U.S. experience, although several questions remain, first of all as to how these numerous factors came precisely together to create the phenomenal productivity success since the mid 1990s, and second as to whether these factors could produce such productivity success if transplanted to other countries.

While much research still remains to be done on these questions of coordination, it is tempting to suggest that the intense competition and strong market forces present in the United States have been responsible for or have at least played a facilitating role in the development of the many factors that have proven crucial for the U.S. productivity

growth resurgence. Such competition attracts the brightest talent to the country, gives a strong incentive to commercialize the knowledge produced by that talent, and ensures a large market for such successful innovations as firms adopt them as part of their comprehensive and ongoing efficiency improvement efforts. However, while competition may have been the integral ingredient bringing all of these positive factors together in the United States, it is unclear whether such an ingredient exists that would ensure success in Canada and other countries.

B. Ireland

Since the 1990s, the economic performance of the Irish Republic has been exceptional. Its per capita income (measured by real GDP divided by the total population) increased by 97 per cent between 1989 and 2000, almost doubling in 11 years (Fortin, 2001). Over that period, Ireland had by far the best performance of all OECD countries. The Irish standard of living has now outstripped the UK level and the European average.

Generally, there are two basic ways to create more income per working-age adult: (1) by increasing productivity; and (2) by increasing the employment rate. Fortin (2001) breaks down the trend in Irish real GDP per working-age adult into its productivity and employment rate components, and finds that the Irish economic boom is an outcome of the winning combination of a long-term increase in productivity and a short-term employment boom.

Ireland's productivity performance over the past forty years has been very good by international standards, coinciding with the opening up of the economy from the late 1950s. The growth in Irish productivity has averaged 3.3 per cent per year since 1976. This is a rare occurrence in the post-war period among OECD member countries, particularly over the last quarter century. Its output per worker now exceeds that of most other industrial countries, and is beginning to challenge U.S. productivity levels.

At the same time, the extraordinary income growth performance of Ireland in recent years also stems from a dramatic turnaround in employment. The employment boom has seen the number of jobs expand by 44 per cent since 1993, and the unemployment rate decline from double digits to less than 5 per cent. Therefore, the Irish higher economic growth during the period can be explained by improvements in both labour productivity and labour utilization.

However, for a mature economy, productivity developments are the key to future growth potential. As is well known, when an economy is operating at close to full employment conditions, the potential for further growth from this source is inevitably more limited. In contrast, a broader scope for development can be achieved through introducing better technologies, providing better education and training, or putting in place better public infrastructure and high-quality machinery and equipment. Indeed, the acceleration of Irish structural productivity growth, which has contributed to the economic boom over the past decade, has been the key factor in improving Irish economic performance.

The rapid Irish productivity growth over forty years was not driven by only one single factor. According to Cassidy (2004), the main drivers behind the fast productivity growth during the period were: (1) the substantial foreign direct investment inflows from the United States; (2) the continuing shift of economic activity and employment from the primary sector to the secondary and tertiary sectors, especially the high-technology sectors including the chemical and the ICT sectors; (3) the availability of a young, relatively well-educated workforce; and (4) the increased European integration and increased subsidies from the European Union.

Economists believe that economic policy can have a central role in determining the productivity potential of an economy. This is especially true when we review Irish policy development over the past fifty years.

Irish public policy has been very active in promoting economic growth since the 1950s. Its main strategy has three components:

- promote free trade and monetary integration;
- develop a regulatory environment favourable to business and entrepreneurship; and
- provide free secondary and post-secondary education.

To better interpret the Irish long-term productivity development and to better understand the important role played by Irish economic policy, it is necessary to review in detail Ireland's policy strategy in such key areas as commercial policy, tax policy, industrial policy, innovation policy, and education policy.

1) Free Trade and Monetary Integration

Ireland located is on a small island, and has a relatively small population of 3.8 million. The geographic and demographic characteristics make it impossible to achieve an outstanding economic development with only its own resources. Thus Ireland has had to obtain wide access to external markets and to make its domestic economy competitive by exposing it to import competition. Ireland believes in great openness and considers it the only way for a small economy to expand and prosper. Therefore, the past forty years have seen the implementation of a series of policies to improve openness.

First, from the 1950s onward, Irish commercial policy became an ardent and consistent promoter of free trade and monetary integration. This early abandonment of protectionist policies led Ireland into the European Union in 1973, the European Monetary System in 1979, the Single European Market in 1993, and the European

Monetary Union in 1999. Recently, Ireland's export-to-GDP ratio[20] exceeds 85 per cent, the corresponding ratio for Canada is only half as large (Fortin, 2001). Openness to trade and foreign investment has a catalytic effect on technological diffusion and innovation, which is mostly where long-run productivity growth comes from (Coe and Helpman, 1995).

Second, Irish industrial policy has also been an early supporter of greater openness to international investment. By repealing the Control of Manufactures Act in 1958, Ireland switched from a protectionist economy to a very liberal regime toward foreign direct investment by the early 1970s. As a result of this evolution, Ireland now has a very welcoming attitude toward foreign investment and has built a generous system of capital grants. Moreover, it ended the restrictions on multinational corporations to remit profits abroad. No country had such a liberal regime toward foreign direct investment during the 1970s. Thus Ireland became one of the most attractive regions for international investments, particularly for those from U.S. multinational corporations.[21]

Third, Irish tax policy has been strongly supportive of free trade and monetary integration for several decades. The 1950s saw the introduction of a preferential rate of corporate taxation on profits from exports and manufacturing activity. This was replaced in the 1980s by the 10 per cent corporate tax rate on profits from manufacturing and internationally traded services, and from activities located in the international financial services centre in Dublin. In 2003, Ireland began to apply a single corporate profit tax of 12.5 per cent to the entire corporate sector. The support to foreign direct investment provided by tax policy is the real and important factor in sustaining the long-term international investment inflow, which in turn is a strong driver of long-term productivity growth.

2) Business-friendly Environment

Business activity flourishes more in a rules-based, transparent and business-friendly environment than in a discretionary, arbitrary and non-friendly environment. Irish commercial, industrial and tax policies have taken a generally positive attitude toward business. These policies have been successful in attempting to create a regulatory environment favourable to business and entrepreneurship. The implications of business-friendly policies include the following:

- Greater efficiency in administration – through quickly responding to business queries and needs, removing the restrictions on choice of business locations and use of profits, reducing regulation and administrative barriers and providing stable

[20] The export-GDP ratio is the ratio of the total value of a nation's exports to the total value of the nation's GDP. Because exports are partially, fully or more than offset by imports in the calculation of GDP, the value of this ratio can exceed 100 per cent.

[21] Two more factors contributed to the large inflow of U.S. multinational corporations into Ireland in this period: first, U.S. investors liked the English-speaking environment there; and second, U.S. investors considered Ireland the best platform providing access to the EU.

and transparent rules – ensures that firms can access resources quickly, and also decreases administrative costs.

- Greater competition in both domestic and international market, by fostering a more efficient and flexible environment, can enable firms to achieve higher productivity growth through encouraging specialization, increasing R&D expenditures, employing more ICT and new equipment, and strengthening innovative capacities.

- Better public infrastructure – especially adequate international transportation, roads, and energy and telecommunications infrastructure – support business activities in the global market by decreasing transaction costs, thereby increasing productivity.

- A flexible labour market, by allowing for a more efficient allocation of existing labour resources, can help ensure that expanding businesses in innovative sectors can be matched with appropriately skilled workers.

Ireland's manufacturing sector has benefited greatly from the business-friendly environment generated by these policies. According to the OECD, Ireland's exceptional performance was driven mainly by developments in the manufacturing sector. And Ireland's superior productivity performance in manufacturing has been largely a consequence of two factors. One factor is the higher productivity growth in the high-technology sectors than the European average. Another factor is the greater degree of specialization in these sectors.[22] These sectors include chemicals, publishing and printing (which includes manufacture of software products) and electrical and optical equipment (essentially ICT products).

3) Effective Education Policy

Educational attainment is a key determinant of human capital, which is an important driver of labour productivity. Increasing an economy's skill base can also have a positive impact on total factor productivity growth by facilitating structural change and technological improvements.

Education is also an important variable in terms of attracting inward foreign direct investment flows, which is particularly important for small open economies like Ireland. Internationally mobile capital always seeks high education environments as well as other factors such as favourable tax structures, a competitive cost base and low regulation. Ireland has effectively achieved the combination of all of these factors, and has seen an improvement in its productivity growth rate as a result.

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[22] However, it should be noted that Ireland has a low R&D intensity by international standards. Even in the high-tech sectors, the share of R&D expenditures is very small. Honohan and Walsh (2002) discuss this issue.

Two factors have contributed to the high level of educational attainment in Ireland's labour force. First, from the 1960s onward, Irish education policy has been to provide free secondary and post-secondary education. As a result, Ireland has a high share of its population having completed higher education. Indeed, OECD data indicate that the share of the population that has completed post-secondary education in Ireland is the highest among the EU countries and not far below that of the United States. Ireland also ranks well in terms of science and engineering graduates. A recent European Commission report placed Ireland highest in terms of the number per thousand of population, among 12 countries including the United States, United Kingdom and the larger European countries (Cassidy, 2004). The performance of Irish students in international comparisons of proficiency in mathematics is also significantly above average.

Second, compared to foreign educational systems, the Irish educational system generally supports shorter, more practical courses. Since the traditional university approach is to provide more conceptual and abstract courses to students, it sometimes takes a relatively long time for new graduates to adapt themselves to firms' requirements. The more applied nature of some post-secondary courses in Ireland has been instrumental in making Irish domestic firms more productive and in attracting multinational corporations to Ireland.

As Fortin (2001) points out, there was one negative consequence of rising levels of education in Ireland when its economy fell into depression before the 1990s, since lots of well-educated and highly skilled young Irish chose to emigrate. But when employment prospects brightened in early 1990s, these young workers came back to the Irish labour market again and have provided solid support for Irish productivity growth.

Skilled workers play a key role in the development and implementation of new technologies. Education can also act as a force against rising inequality in the knowledge-intensive economy. Ireland's experience provides a feasible example for other countries to improve labour quality and productivity through educational reform.

4) Lessons from Irish Productivity Growth

The Irish economic boom provides other countries with many lessons. With most of its economic growth taking place in the last twelve years, the economic miracle has two dimensions: one is a continuing rapid long-term increase in productivity (output per worker); and another is a short-term employment improvement. However, the long-term productivity growth plays a key role for Irish potential economic growth. And the causes of this productivity growth have important policy implications for other countries pursuing productivity improvement.

In sum, Irish commercial, industrial, tax and education policies have been very supportive of the rapid pace of long-term productivity growth. This strong and consistent support is not recent, but began to develop in the 1950s and matured in the 1970s. The goals of these policies included but were not limited to the promotion of greater openness

to foreign trade and investment, the development of a business-friendly environment, and the provision of a highly skilled labour force. The right policies eventually paid off.[23]

More specifically, the continuing Irish productivity growth implies three main lessons related to economic policies, namely that such policies should be directed towards:

- increasing openness to international markets and promoting free trade and monetary integration;
- maintaining macroeconomic stability and fostering a culture supportive of enterprises; and
- promoting and supporting formal education and encouraging lifelong learning within the workforce.

C. Australia

Australia and Canada have similar economies. They both are relatively small economies and have similar economic structures. During the 1990s, Australia was an outstanding economic performer among leading economic nations in the world. Its real growth per capita averaged above 4 per cent per year, outperforming Canada, and this was driven by real advances in productivity, rather than simply catching up from a low productivity baseline.

According to Harchaoui et al. (2003), Australia's rapid productivity growth during the post-1995 period was mostly due to more capital deepening and, to a lesser extent, higher multifactor productivity. Canada's productivity growth rate gap with Australia arose partly because investment in Canada grew less rapidly than in Australia. In contrast, labour increased more rapidly in Canada than in Australia. As a result, the rate of increase in capital per hour worked – the key factor behind labour productivity growth – increased more slowly in Canada.

Australia's ability to grow so strongly, even in the midst of economic challenges such as the Asian financial crisis, has led some to label Australia as the "miracle" economy. However, according to Parham (2002), this was no miracle. The productivity surge was certainly remarkable, but it was also "predictable."

There are several drivers of this success behind Australia's outstanding economic performance. Gans and Stern (2003) point out that relative macroeconomic stability and a substantial modernization of the tax system contributed to this substantial level of achievement. However, the policy reform in Australia that has "fostered a transition to

[23] It should, however, be noted that productivity growth and welfare improvements are not always correlated. Hubert (2005) points out that Ireland's remarkable productivity growth since 1989 has been paralleled by a 50% rise in alcohol consumption. To counter this phenomenon, he suggests that the government should urge the drinks industry to discourage youth from drinking.

more competitive, open, flexible, innovative and resilient economy" has been particularly important to promote productivity growth (Parham, 2000).

Parham believes that the approach of the reforms was not to attempt to raise productivity growth via a targeted or industry-specific strategy. Rather, the approach was largely to release the shackles that had previously restricted productivity growth and to pursue social objectives through more targeted and less distortionary instruments.

The policy reforms mainly included but were not limited to: deregulation of access to finance; floating the currency; marked reductions in barriers to trade and foreign direct investment; commercialization (and some privatization) of government business enterprises; strengthening competition policy; enhancement of public utilities in key infrastructure areas such as telecommunications and energy; and enabling greater labour market flexibility.

Australia began to introduce these reforms in the mid 1980s and continued to apply them throughout the 1990s. But implementation of policies does not come into effect overnight. According to the McKinsey Global Institute's evaluation in 1995 (MGI, 1995a), Australia's economic reforms did little to improve its relative performance at that time. However, the post-1995 period saw Australia's high rate of growth in productivity. Indeed, it is believed that Australia has only just begun to feel the impact of these reforms on productivity, and reform-driven growth can continue in the long term.

Among those drivers that promote Australia's efficiency gains, three policy-related factors have been given particular attention.

- Sharper competition – through lower trade and foreign investment barriers and domestic deregulation and pro-competition regulation –"has provided greater incentives for business to improve productivity by seeking out more value-adding products and new markets and by reducing costs" (Parham, 2002). The reform of public sector services has improved efficiency and has especially benefited businesses.

- The promotion of innovation – through encouraging rigorous domestic competition and establishing strong protection of intellectual property – has transformed Australia from an adopter to a producer of global technology. The development of a national innovation system, which includes a common innovation infrastructure, the cluster-specific environment and the quality of linkages (Gans and Stern, 2003), has strengthened Australia's innovative capacity and stimulated the development even of traditional industries such as wine and agriculture.

- Businesses are able to adjust production and distribution processes more flexibly, due to a newly-established ability to negotiate work arrangements at the enterprise level, rather than relying on arrangements imposed through centralized "one-size-fits-all" bargaining. The greater flexibility in the labour market has provided the

workforce with a greater incentive to invest in education and training, which in turn has influenced productivity growth positively. The greater openness accompanied with greater flexibility has encouraged greater specialization and has provided easier access to up-to-date technology and know-how.

In order to understand Australia's productivity surge in the 1990s and learn lessons from its success to promote Canada's labour productivity, special attention should be given to Australia's experience with ICT, its labour market, and the innovation system.

1) An Industry Perspective on Productivity and ICT

A small number of industries was largely responsible for Australia's productivity surge in the 1990s. Wholesale trade made the largest contribution to the strong labour productivity growth. Construction and finance and insurance are stand-out performers as well. At first, the productivity acceleration in some of the service industries, particularly wholesale trade, seems surprising and unrelated to policy reform. Closer examination, however, reveals the importance of some of the reform-related mechanisms discussed above. In short, these industries have benefited greatly from openness to trade and investment and from competition with foreign and domestic counterparts.

As part of Australia's "modernization", information and communications technologies (ICT) appear to have contributed significantly to the transition to a more competitive, open and flexible economy in the 1990s. The Australian market for ICT goods and services was $77.5 billion in 2000-01, almost trebling since 1992-93.[24] Indeed, ICT have made a large contribution to the acceleration in labour productivity growth in Australia through increasing capital deepening, as they have done in other OECD countries.

There was very little in the way of policy strategy to encourage ICT uptake. Moreover, much of the increased use of ICT in the 1990s has been offset by slower growth in the use of other forms of capital. ICT-productivity links are strongest in distribution, financial intermediation and business services. These industries are more intensive ICT users and have shown stronger productivity accelerations.

Productivity gains were generated through process and product innovation, both of which were enabled through ICT use. The finance and insurance industry has been restructured to operate much more through ICT than through traditional face-to-face contacts. Australian banks, in particular, have been able to support strong growth in output, with quite major reductions in the number of branches and employees. A study also found that ICT played a part in the restructuring of wholesaling activities (Parham, Roberts and Sun, 2001). For example, bar coding and scanning of products, initially introduced by grocery retailers, became widespread in the wholesale trade sector in the 1990s. By enabling accurate electronic records to be kept of products all along the supply

[24] Mapping Australian Science and Innovation, "Business Innovation Working Paper", retrieved from http://www.dest.gov.au/mapping/pubs/bgd_papers/innovation.pdf.

chain, this technology has reduced inventory levels, the amount of time goods need to be handled, as well as the response times of wholesalers to the demands of their customers.

Therefore, policy reforms acted as the underlying drivers and facilitators of productivity gains, and ICT were just one component of change. As businesses became more flexible and competitive pressures increased, ICT became part of a general process of restructuring and transformation. In this sense, it is not important for Australia to become an ICT producer and master up-to-date technology. As a smart user of ICT, Australia has enjoyed a sizeable terms of trade gain due to the rapid declines in ICT prices.

2) Labour Market Flexibility and Proficiency Gains

Increased labour market flexibility has also played a role in Australia's productivity improvement. A shift from a highly centralized labour market under the Accord arrangements of the 1980s to a greater emphasis on enterprise bargaining has given individual firms the incentives to restructure their labour forces to improve productivity and more flexibly respond to changing circumstances. The introduction of split shifts and reduced rigidity of job demarcations between different occupational groups has improved opportunities for business operators to meet the competitive challenges from the domestic and foreign market.

A more educated and high-skilled workforce associated with labour market flexibility has also likely been one of the main contributors to Australia's productivity surge. Secondary school retention rates and tertiary participation have increased in Australia, particularly among females, over the last two decades.

Increased skills can influence productivity growth in two ways. First, skills can directly raise the productivity of workers. Second, in line with endogenous growth theory, a more educated and experienced workforce can promote the uptake and further development of advanced technologies. Relatively high skills in the Australian workforce, for example, are likely to have played a part in the rapid uptake of ICT. The influence of skills on the rates of absorption of technology and innovation warrants further investigation.

3) The Innovation System and Productivity Growth

In a global economy, innovation-based competitiveness provides a more stable foundation for productivity growth than the traditional emphasis on low-cost production. Gans and Stern (2003) point out that the important gains that Australia has made in innovative capacity throughout the 1990s have been the key drivers of rapid productivity growth, and that the real concern for Australia's long-term prosperity lies in innovative performance.

During the 1980s, Australia could be characterized as a "classical" imitator economy. That is, productivity improvements were primarily driven by the ability to

import technology and ideas developed elsewhere. Over the past decade, Australia has more than doubled its level of innovative capacity (relative to its levels in the early 1980s) and transformed itself into a second-tier innovator economy. Gans and Stern believe that this improvement has been the result of the following policy-relevant factors:

- Australia has maintained a high share of national income devoted to higher education and university R&D performance. Indeed, these investments in a research-oriented educational sector were the stepping stones upon which the improvement in Australian innovative capacity was founded.

- As an important consequence of key reforms to Australia's competition policy, increasing openness and other factors made Australia an attractive location for foreign investment after 1990. The strengthened competition has given domestic firms greater incentive to invest in R&D departments and promote innovations.

- Proactive policy changes in intellectual property protection and other areas improved the perception of how conducive the Australian environment was to innovation. Australia has secured a position as a leading user of global technology by creating an innovative and politically stable environment.

Together, a record of sound macroeconomic policy, microeconomic reform and openness, and an enhanced R&D workforce all contributed to Australia's ability to achieve second-tier innovator status by the mid-1990s.

With a decade of structural reforms and with continued operational improvement in education and infrastructure now a given, Australian companies are able to rapidly acquire and deploy technology from around the world. Perhaps the wine industry in Australia provides a good example of visible innovative clusters. Though it has only recently emerged as a leading force in the international market, the growth of Australia's wine industry is the consequence of decades of investment, from the establishment of the Australia Wine Research Institute in 1955 to the flurry of institutions for collaboration on international markets founded over the past decade.

Achieving a higher level of innovative capacity requires attention to all aspects of the innovation system. Australia's experience illustrates the importance of the availability of a world-class pool of highly skilled people, an investment environment that encourages the deployment of risk capital, and a policy that encourages vigorous domestic competition and strong protection of intellectual property. As a result of these factors, the innovation system has played a key role for Australia's productivity growth and will continue to sustain Australia's evolution towards a first-tier innovation economy.

4) Conclusion

Australia experienced a resurgence of productivity growth in the 1990s. The fact that most other OECD countries did not share this experience suggests that domestic factors must have played an important role in this resurgence (Parham, 2004). According

to the studies reviewed above, policy reforms that were introduced in the mid 1980s have been major drivers and enablers of Australia's impressive productivity performance.

Policy reforms in Australia have enhanced competitive pressures; opened the economy to trade, investment and technology; raised investment in R&D; and encouraged firms to become more flexible in terms of adjusting all aspects of production, distribution and marketing. On top of these foundations, the widespread use of ICT, the increased labour market flexibility and the strengthened national innovative capacity have been specific factors driving the remarkable productivity growth.

D. United Kingdom

1) The UK's Productivity Growth: the Drivers and the Barriers

The growth record of the UK economy for much of the 20th century has been disappointing. Its performance between 1960 and 1980 was particularly dismal relative to that of other countries. In 1960, real GDP per capita in the UK stood at a similar level to that of West Germany's and was 15 per cent higher than that of France (Bureau of Labor Statistics, 2000). By 1979, real GDP per capita in the UK was 12 per cent less than that of France, 15 per cent less than that of Germany and one-third less than that of the United States. Over the next two decades, the growth performance of the UK was somewhat mixed as it managed to make up some lost ground. By 1998, real GDP per capita in the UK was 11 per cent less than that in Germany and 3 per cent less than that of France. In part, this catch up was due to the poor performance of these two economies as the gap in real GDP per capita between the UK and US widened slightly from 32 to 34 per cent.

Growth in real GDP per capita is driven by a combination of growth in employment and the productivity of labour. The labour market in the UK has performed well with respect to employment growth over the 1980s and 1990s and has one of the lowest unemployment rates among the G-7 economies (HM Treasury and DTI, 2004). The strong performance of the labour market in the UK suggests that the continued income differential is due to lower labour productivity.

The UK's labour productivity gap with France and Germany has varied over the course of the post-war period. Before 1979, labour productivity growth in the UK was one per cent per year slower than that for Germany or France. The timing of the disappearance of this growth rate differential after 1979 coincides with the economic reforms enacted by the Conservative government under Margaret Thatcher's leadership. These reforms sought to reduce government intervention in labour and product markets and increase the efficiency with which they operated, two measures that fostered productivity gains observed over the next two decades (Card and Freeman, 2002) Evidence of the market-oriented nature of these reforms comes from the change in UK's ranking with respect to measures of competitiveness and "market friendliness". In the late 1970s, several of these indices ranked the UK in the middle of a group consisting of other Western economies. By the late 1990s, the UK stood at or near to the top of several

of these indices and in some cases ranked ahead of the US. Thus, economic reforms in the UK over the past 20 years appear to have yielded benefits in the form of higher productivity growth and halted the relative decline in living standards, at least with respect to France and Germany.

2) Economic Reforms: the Main Drivers of Productivity Growth

What UK policy reforms helped to halt the relative decline in labour productivity and raise its growth rate? Card and Freeman (2002:48) identify 3 reforms in particular that have promoted growth in labour productivity over the past two decades. These are listed as follows:

- Reductions in trade union power. This has increased labour market flexibility, promoted competition among workers and made it easier to implement and reform labour market regulation. These policies also successfully increased the freedom of business to manage its workplace. Each of these measures has growth promoting effects.

- Privatization of state-owned industries. Privatization has raised labour productivity of the UK economy as a whole as industries and firms were made more responsive to market conditions and shed excess labour.

- Creation of incentives for self-employment and share ownership of firms. The creation of share ownership plans aligned the incentives of the firm with that of the workers. Workers now had a direct stake in the success of their firms which has a direct consequence of their productivity. Self-employment did not promote higher labour productivity as much as policy makers had desired but it did let individuals who may have had a comparative advantage in terms of generating successful self-employment opportunities separate themselves out from other types of workers.

How did each of these three measures contribute to higher labour productivity growth? The empirical evidence suggests that there is a negative relationship between productivity and the presence of collective bargaining (Pencavel, 2002). In the post-war period, the growth of unions in the UK was widespread. By 1980 over 50 per cent of wage and salaried workers belonged to a union. The Thatcher government enacted a series of reforms with the Employment Acts of 1980, 1982 and 1984 that were designed to reduce the power of trade unions. These Acts substantially reduced government support for unions and their collective bargaining rights. By 1999, union membership had fallen to 30 per cent of the workforce. The prevalence of multiple unions in the same workplace, which was commonplace prior to 1980 and introduced significant obstacles to labour productivity growth, was also reduced (Card and Freeman, 2002:48). Together, these reforms reduced union power and increased the labour market flexibility, promoting labour productivity growth.

Privatization of state-owned firms, which came to be a hallmark of the Thatcher government, also made a significant contribution to labour productivity growth. State ownership blunted incentives for firms to reduce costs and increase productivity created by competitive pressures present in the marketplace. State ownership also left firms open to political interference and a lack of funds for investment as they frequently operated at a loss and proved to be a drain on public funds. A substantial proportion of the economy was affected by privatization. In 1979, state-owned industries accounted for over 10 per cent of gross domestic product in UK. By the end of the 1990s, the per centage had fallen to 2 per cent.

One way to gauge the effects of privatization on productivity is to examine price changes across industries. An investigation conducted by the UK National Audit Office indicated significant price changes occurred in those sectors that underwent privatization and this resulted from productivity gains (Marshall, 2000). Exposure to increased competition after privatization was the key factor differentiating price changes in sectors from those where it was associated with stagnation or declines in productivity relative to private firms or international benchmarks. For instance, by 1996, electricity prices had fallen by nearly 20 per cent, gas prices by 40 per cent, and telephone prices had more than halved (all in real terms), in contrast to water and sewerage bills that had nearly doubled for all customers. In sum, privatization coupled with the presence of competitive markets appears to have provided firms with sufficient incentives to increase their productivity.

Empirical evidence suggests that productivity is higher in firms that have some kind of share compensation scheme in place compared to those which do not. Consequently, the introduction and expansion of such programs under Thatcher's Conservative government is thought to have raised labour productivity. These reforms included arrangements for profit-sharing, profit-related pay, save-as-you-earn schemes and company stock option schemes. In 1979, approximately one-quarter of workers in the UK were covered by such plans. By 2002, the reforms had expanded the range of eligibility to include 45 per cent of the workforce. Freeman (2001) estimated that firms that implemented such measures improved their labour productivity by 12 per cent.

In sum, two decades of economic reforms have increased the market orientation of the UK economy relative to that of other advanced economies. Through reductions in trade union power, privatization of publicly owned industries and introduction of share compensation plans, the UK has increased the number of people in employment and narrowed the productivity gap with international competitors. Consequently, labour productivity in the UK has risen by 55 per cent since 1979 and recorded an average annual growth rate of 1.9 per cent per year.

This growth record is no small achievement. On an international basis, however, the performance of the UK looks less impressive. OECD data show that UK labour productivity still lagged behind most of its key overseas competitors in 2002. On the basis of output per worker, productivity was almost 40 per cent higher in the US, 11 per

cent higher in France, 4 per cent higher in Germany and marginally higher in Japan. The next section will examine explanations for the persistent productivity gap between the UK and its international counterparts.

3) The UK's International Productivity Gap: An Explanation

The definitive reason for why the UK has lagged behind its international competitors remains elusive. In reality, the explanation is likely to consist of a set of explanations. Three explanations in particular have been identified by those who have studied the gap. They are listed as follows:

- Under-investment in education. The failure to provide sufficient numbers of well-educated and highly skilled workers to industries has limited the development of the UK economy's capacity to innovate. In turn, this has reduced the potential for productivity growth.

- Low rate of ICT diffusion. Low rates of ICT usage has led to reduced opportunities for firms and organizations to compete with their international counterparts through cutting prices or providing fast and efficient service. This has exacerbated the UK's "skill shortage".

- Excessive government regulation. Despite earlier efforts at reform, regulations still prevent labour and goods markets from being truly competitive. There still exist barriers to entry or expansion by best-practice operators. These barriers also hinder the adoption of best-practice techniques and reduce the competitive pressure on industry participants to raise their productivity.

Why do these three reasons matter for the explanation of the gap? The link between high levels of educational attainment and the productivity of workers is firmly established. Even at a basic level, however, the UK seems to experience problems. Many international comparisons of numeracy and literacy put the UK near the bottom of the list in relation to its international competitors. A 1998 survey indicated that a far lower proportion of the UK workforce holds post-secondary qualifications than in Germany and France (Millar, 2005). Despite 11 years of compulsory education, about 25,000 pupils left school at 16 without a single GCSE to their name in 2004, and approximately four and a half million people had no qualifications at all. Successive generations of policy-makers have been aware of deficiencies in education and training, but have failed to rectify them.

The UK has also failed to develop an adequate system of vocational education and on-the-job training. Many businesses in UK experience skill shortages and are unable to recruit the adequately skilled individuals from the labour market that they need. In 2004, 135,000 vacancies could not be filled because of skill shortages. Other businesses suffer from skills gaps, whereby some of their employees lack the skills that they need to carry out their jobs effectively (Millar, 2005). Higher skill levels also allow workers to generate new ideas and adapt to the changing economic environment. As a

result, the UK's low level of human capital relative to other countries acts as a brake on its economic performance.

Skilled workers are only productive in the presence of capital and the link between ICT usage and economic growth is strong in developed economies. The slow rate of ICT diffusion in the UK has led to a low level of ICT capital and makes a strong contribution towards its productivity gap. Notaro (2004) points out that the weaker output and labour productivity growth in the UK is due to a growth rate of ICT capital that is lower than other countries. The ICT industry itself and its diffusion has a positive effect on labour productivity by providing a demand for and training high skilled workers.

Evidence on the connection between ICT usage, the shortage of skilled workers and the UK's poor productivity performance comes from Mason and O'Mahony (2004). They find that the level of ICT usage was low in the presence of a skills shortage. In turn, they observed that rapidly changing skill requirements occasioned by the use of ICT helped to create these skill shortages. This went hand-in-hand with the under-investment in education and training on the part of individuals and government. The slow rate of diffusion of ICT that results from this feedback effect also acts to worsen the problem since it lowers the demand for highly skilled workers.

Government regulation of product markets and land use form the third reason why the international productivity gap exists. These regulations influence competitive behaviour, investment and pricing and preclude faster productivity growth. This was the conclusion from a report by the McKinsey Global Institute (1998) on UK productivity:

> This conclusion may seem counterintuitive to many; after all, the United Kingdom is widely perceived as having a relatively deregulated and open economy. Indeed, that is the case in the areas of labour regulation and capital market operation. However, in two other major areas, specific product market and land use regulations, the UK appears to have far more in common with its continental neighbors than with the more deregulated United States.

The study also shows that the reasons most frequently invoked for the United Kingdom's economic underperformance such as low investment in education, poorly skilled management and operation and low capital investment, results from the presence of market restrictions. For instance, regulatory barriers that prevent the entry of new firms into markets protect low productivity firms. As a result, labour and capital that would otherwise be associated with those higher productivity firms will seek out business opportunities outside of the UK. A study by Haskel et al. (2004) shows that foreign-owned multinational firms typically have higher productivity. Consequently, government regulations that reduce the level of competition in market can partly account for the UK's productivity gap.

4) Conclusion

The UK economy has lagged behind its international competitors in terms of real GDP per capita since 1979. Lower labour productivity in the UK has been responsible for this gap. In response to this productivity differential, successive UK governments have adopted policies designed to move the economy back to "premier league" status. These policies included reductions in trade union power, privatization of publicly-owned industries and introduction of share compensation plans. Together, these reforms have increased the employment rate and helped narrow the productivity gap.

However, there still remain barriers to improving the UK's productivity performance. These factors include: 1) low investment in education and training, 2) low rates of ICT diffusion, and 3) the continued presence of government regulation in specific goods market and land use. These three barriers call for more investment in formal education and skill training, research and development, encouraging the development of the ICT industry and the diffusion of ICT, and continued efforts to deregulate domestic markets. Such measures are necessary to reward entrepreneurship and encourage technological innovation that is the hallmark of modern economic growth.

E. Finland

Finland, a small country of five million people located far from the centre of Europe, has enjoyed great economic success in recent years. According to the OECD (2004b), the transformation of the Finnish economy over the last decade has been one of the few examples of the "new economy" taking hold in Europe. Output and productivity growth in the second half of the 1990s was among the highest in the OECD.

1) Finland: A High Tech Success Story

Finland is not only one of the EU leading producers of ICT (together with Ireland and Sweden), but also a prominent example of leap-frogging with respect to the rest of the OECD. Among OECD countries, it has made the most progress in the world ranking of IT producers since the early 1990s.

Finland since 1990 has gone from being a net importer to a net exporter of high-tech goods. Indeed, Finland has the largest per capita surplus in foreign trade in communications equipment in the world. The Finnish ICT sector accounted for 15 per cent of the value of market production (10 per cent of GDP) in 2001, up from 8.0 per cent in 1995, 5.8 per cent in 1990, and 3.7 per cent in 1975.

Nokia is the leading Finnish company accounting for about one half of the overall IT contribution to aggregate value added, and 3.3 per cent of GDP. The firm accounts for one fourth of Finnish exports, one third of business R&D, and 5 per cent of manufacturing employment. Perhaps surprisingly, Nokia was until 1990 a conglomerate with many business lines. The deep recession of the early 1990s propelled the firm's leadership to re-orient toward electronics and drop other activities, with cell phones becoming the dominant product line. It is interesting to note that Nokia's success has attracted much international venture capital to Finland in search of the "next Nokia."

The reasons why Finland has been so successful in exploiting new globally available technologies are still poorly understood. Lane (2004) has suggested the following factors:

- a university education system heavily oriented toward science and technology;
- high levels of R&D undertaken by both the business and non-business sectors;
- a focus on all aspects of IT products, with world leadership in both goods (Nokia cellphones) and services (Linux software);
- the early liberalization of the telcom sector;
- an historical lack of monopolization of the Finnish telephone network by the State, ensuring that competitive pressures to invest in R&D existed even before deregulation; and
- the liberalization of the financial sector, leading to better access to capital for IT start-ups.

2) The Impact of the Early 1990s Recession

Finland experienced a severe recession in the early 1990s, with output falling steeply between 1990 and 1992 and with unemployment rising to nearly 20 per cent. The causes of this recession included the abrupt loss of the Russian market linked to the collapse of the USSR, recession in other EU countries, the overheating of the Finnish economy in the late 1980s, a credit and banking crisis, and inappropriate policy response to deal with the financial crisis.[25]

The crisis appears to have had a transformative effect on Finland, with a dynamic market economy emerging out of a highly regulated one. The existence of slack resources in the mid-1990s may have facilitated the factor reallocation and organizational restructuring that was required to effectively exploit new technological opportunities. According to Daveri and Silva (2004:129), two changes arising from the recession were critical from the point of view of productivity: markets took over from the State in allocating resources and the stock market took over from the banks in the allocation of credit. Capital was now used more efficiently, and many firms actually shed capital, resulting in a drop in the capital-labour ratio and considerably higher total factor productivity in certain sectors (Maliranta, 2001). Indeed, total factor productivity growth in the non-farm market sector averaged over 4 per cent per year after 1992, well above the 2.5 per cent rate of the 1976-92 period (Daveri and Silva, 2004:130, Table 3).

[25] See Honkapohja and Koskela (1999) for a detailed analysis of the causes of the Finnish economic crisis of the early 1990s.

3) The Impact of a Strong IT-producing Sector on Productivity

Daveri and Silva (2004) find that Nokia, the world leader in cellular phone production, directly and substantially contributed to enhanced productivity growth in the Finnish ICT sector. However, productivity gains outside Nokia and a few other IT-related service industries have been small, temporary or short-lived, or non-existent. The authors find that not only has the scope of productivity gains been narrow in Finland, but what has been observed cannot be clearly ascribed to the technological champion in that country. The authors consequently conclude (page 123) that "…even in a country endowed with a world-class national champion, the 'new economy' takes a long time to show up. And in contradiction to commonly held tenets in public debates, IT diffusion has shown a limited potential in speeding up this process in Finland."

Daveri and Silva (2004) point to two pieces of evidence against the existence of technological spillovers between Nokia and other fast growing industries to other sectors. First, the thinness of the inter-industry linkages between Nokia and the rest of the economy indicates that productivity gains of the size recorded in the few fast growing service sectors can be associated to Nokia's boom only to a very small extent. Second, industries with robust productivity gains were those characterized by large declines in the price of their machinery and equipment investment goods. Thus TFP gains in those industries should be largely attributed to the decline in the world price of computing power.

Finland is a prototypical small open economy with a leading exporting industry (Nokia) relatively unconnected in an input-output sense with the rest of the economy. It was not Nokia behind the productivity acceleration in IT-related services in Finland in the 1990s. Rather such industries benefited from worldwide technical change embodied in machinery and equipment. Consequently, the IT-usage hypothesis does not appear to be applicable to Finland's new economy success since the mid-1990s. This raises the question of why IT diffusion did not materialize to a greater extent in Finland comparable to the important role it played in fostering productivity gains in the United States. Daveri and Silva (2004:153) speculate that EU-style protective labour market institutions may have hampered the necessary reallocation of resources from low to high productivity activities both across and within industries, slowing down the emergence of the new economy in Finland. This appears to have been especially the case in retail and wholesale distribution, key industries contributing to the U.S. productivity resurgence. This implies that the IT diffusion will not produce new economy growth unless accompanied by labour market flexibility.

4) The Finnish Labour Market and Productivity

The Finnish labour market has many of the characteristics of the Nordic model which some economists believe hinders productivity growth. Taxes on labour are high, wage differentials between low and high skilled workers are low, social benefits are generous, input from the labour market or social partners (i.e. business and labour) is highly valued, and collective bargaining is centralized. These features do not appear to

have seriously impeded (and may have even facilitated) Finland becoming a IT leader, but they may hurt future productivity growth.

As part of the EU's Lisbon strategy, the Finnish government has the long-term objective of raising the employment rate to 75 per cent from the current 68 per cent figure. The government's approach to attaining this objective focuses mainly on cuts in labour taxation and improvements in and expansion of active labour market policies (ALMPs). It is unlikely that the expansion of ALMPs in isolation will have much effect on aggregate labour productivity outcomes, but the OECD (2004a:5) argues that the emphasis on ALMPs is welcome to the extent that it is conceived as part of a "mutual obligations" approach whereby effective re-employment services and benefits are provided to job-seekers, who in turn have to actively seek employment. Mutual obligation approaches are believed to create an environment conducive to productivity growth, as the "win-win" nature of productivity gains is recognized by all.

A higher employment rate requires addressing the issue of labour market mismatch, in turn linked to wage compression due to centralized wage agreements. Finland currently has a scarcity of jobs for the low skilled in the service sector and a high unemployment rate for the unskilled. There is discussion of introducing flexibility into the system of centralized wage determination through lead firm-level negotiations. This could provide scope for productivity and profit-related wage differentials. There are two implications for productivity growth from such a change. First, greater wage differentials may have a positive effect on productivity by providing workers with greater incentives to work. Second, the expansion of low wage, low skill jobs, while positive from the point of view of the employment rate, may lower productivity through a composition effect. Lower productivity from higher labour force participation of marginal workers is not a negative development from a societal perspective.

5) Conclusion

At least three major lessons can be gleaned from the Finnish productivity experience. First, a vibrant high-productivity growth ICT-producing sector does not necessarily diffuse robust productivity gains to non-ICT producing sectors, especially in a small open economy. Second, an above average performance on innovation indicators such as R&D does not necessarily translate into above average living standards. GDP per capita in Finland is still only close to the OECD median country despite its innovative economy. Third, robust productivity growth across all sectors requires adaptable labour market institutions, and innovative financial markets, and a workforce well trained in science and technology. The availability and diffusion of best practice technologies is a necessary condition, but by no means a sufficient condition for productivity advance.

As is the case for all economies, Finland faces a number of mid- and long-term challenges. The OECD (OECD, 2004b:1) notes that the likelihood of smaller productivity gains in the ICT sector, a continuation of falling ICT prices, and mediocre performance in sheltered sectors, poses a threat to future living standards growth.

F. Sweden

Sweden's labour productivity growth experience in the 1980s and especially the 1990s provides an interesting perspective on the factors associated with a successful productivity performance. The Swedish manufacturing sector achieved world-class productivity growth in the 1990s, while the service sector, accounting for a much larger share of the economy, saw much slower labour productivity growth and little or no improvement in this regard relative to the 1980s. This extremely asymmetrical performance affords the opportunity to attempt to identify both the factors behind the manufacturing sector's success and the factors behind the rest of the economy's less impressive performance.

1) The Importance of Competition

Two comprehensive studies of the Swedish economy – one by the McKinsey Global Institute (1995) and the other the most recent country survey by the OECD (2004d) – identify competition as a source of both the manufacturing sector's rapid productivity growth and the poorer growth of service industries. The McKinsey Global Institute (MGI) states that, in the early 1990s, three quarters of the Swedish economy was sheltered from foreign competition. Furthermore, while that three quarters of the economy has historically failed to innovate on a consistent basis and to adopt global best practice, industries like heavy vehicle manufacturing, computer software and the deregulated banking sector – all well integrated in the global economy and free of protective barriers – showed rapid productivity growth in the 1980s and had come to define the global productivity benchmark by the early 1990s.

MGI (1995) especially notes the outstanding productivity performance of the vehicle manufacturing industry from the late 1980s onwards, in which just two firms – Volvo and Scania – were able to achieve these productivity gains through intense competition with each other and in the global market. Meanwhile, the Swedish banking industry was deregulated in the mid 1980s, and the domestic competition that this created gave banks an incentive to innovate in terms of creating new financial services and products. By 1992, the Swedish banking industry had a higher productivity level than that in either Germany or the United Kingdom, and trailed only the United States.

On the other hand, MGI notes that the Swedish retail sector has long been hampered by protective zoning rules, and the construction industry by strict union work rules that stifle labour market competition. Such strict work rules, which limit the specific tasks that a given worker is allowed to perform, were once present in the automotive manufacturing industry as well. But the intense international competition faced by this industry motivated the unions and firms to come to an agreement on less restrictive rules, which allowed this industry to achieve impressive productivity gains and remain internationally competitive. The Swedish public transportation industry has also had much productivity success, especially relative to the Netherlands, which MGI attributes in part to more flexible work rules concerning, among other things, the timing of breaks. As of the early 1990s, however, strict work rules were still a prominent feature

of the Swedish construction industry, which has performed poorly in terms of productivity even compared to the long-term productivity decline of the U.S. construction industry. Likewise, zoning laws restricting the size and expansion of retail outlets in Sweden are still present, although when some of these laws were relaxed in the early 1990s the retail sector saw some productivity gains.

The OECD (2004d) discusses Sweden's product market competition, enforcement of competition laws and other areas of domestic competitiveness from the perspective of the mobility of labour and capital and the fostering of entrepreneurship. The OECD, like MGI, stresses the success of the deregulation of some sectors in terms of boosting productivity growth, but notes that more intense product market competition is integral in reinforcing these productivity gains. But product market competition needs to be reinforced itself, since the benefits of competition will be minimal if the most competitive firms are not able to attract workers and investment in order to grow and further challenge their less successful competitors. Unfortunately, very strict employment protection legislation, a virtually flat before and after tax earnings structure that is a remnant of the centralized collective bargaining of the past and that is also driven by the extensive income redistribution system, and non-uniform corporate tax rules all impede workers and capital from moving to firms and positions in which they could be more productive.

The relatively flat earnings structure also has implications for human capital development and the innovative behaviour of firms. Morck (2001), in discussing the principle of rewarding innovative workers with higher pay in order to encourage further innovation, states that Sweden's high marginal tax rates for high income earners have discouraged young Swedes from accumulating skills, and that Sweden is consequently experiencing a skills shortage and faltering productivity. The OECD (2004d) does mention that the long period of time required for Swedes to complete tertiary education may have productivity consequences, but discusses this in the context of policies regarding application rules and study grants rather than as a consequence of the limited incentives to acquire higher education in the first place or to enter a high-paying job after graduation.

Finally, the OECD mentions that entrepreneurial activity may be weak in Sweden due to some competition-related factors. Debt receives a much more favourable tax treatment in Sweden than equity, which makes raising venture capital difficult. Also, the high level of employment protection enjoyed by workers likely discourages would-be entrepreneurs from making the transition to self-employment.

2) Industrial Structure

Given the asymmetry evident in Sweden's economy – a few industries facing intense international competition and achieving rapid productivity growth versus a majority of the economy facing little competition and experiencing little change in productivity – the question of the industry sources of aggregate productivity growth is an important one. If Sweden's aggregate labour productivity growth relies on a few

industries, some major event negatively affecting these industries might have a massive impact on overall productivity and average living standards. On the other hand, if the industries with rapid productivity growth make only a small contribution to overall productivity growth, the more diversified nature of productivity would provide a greater degree of economic security in the event of some negative shock.

Lind (2005) undertakes a shift-share analysis of productivity growth in Sweden's manufacturing sector, and finds that the stellar performance of the 1990s was largely attributable to a single manufacturing industry, namely telecommunications. This contribution includes both a large pure productivity effect and an even larger effect related to the reallocation of labour to this high productivity growth industry. Much more moderate overall effects were noted for pulp and paper, machinery, chemicals, and motor vehicles, and smaller or negative effects from the 13 other manufacturing industries. Among these other industries, the reallocation effect tended to be negative, as more productive firms shed labour and vice versa.

Østbye and Westerlund (2004) also undertake productivity analysis at the industry level for Sweden, but they do so for all industries (rather than just manufacturing) and at the regional level. They find that regions with lower overall labour productivity levels tended also to have lower productivity growth rates, or in other words, there was regional productivity divergence in Sweden in the 1980s and 1990s. Further, they find that this divergence is strongly related to labour productivity developments at the sectoral level. Although the authors do not discuss the possibility (since they do not have data below the level of major sectors), this evidence would seem to support a hypothesis that it is only the regions in which the few well-performing sub-industries are located that have managed any sort of productivity success. This underlines the point that, when aggregate productivity depends so strongly on a few small industries, the simple absence of these small industries can have large negative effects on productivity and hence living standards.

3) ICT and R&D

Dunnewijk (2003), like Lind (2005), undertakes a shift-share analysis of Sweden's productivity, except that the analysis encompasses the total economy and focuses on industry aggregates based on ICT use and production. Dunnewijk finds for both Sweden and Finland that the ICT-producing manufacturing aggregate made the largest contribution to aggregate labour productivity growth in the 1990s. This is driven by Ericsson and Nokia respectively, and confirms the huge contribution made by the telecommunications manufacturing industry found by Lind (2005). ICT-producing manufacturing industries and ICT-using service industries also made significant contributions to productivity growth in the European countries studied by Dunnewijk, although much more so in Ireland than in Sweden or Finland.

The relationship between ICT and labour productivity would therefore appear to be very similar in Sweden as in Finland – namely, that ICT production, dominated by a single firm, is much more important for aggregate productivity growth than ICT use, with

limited productivity and technological spill-overs to other firms and industries. Saito (2001:Chart 21-1) illustrates this point, showing a strong correlation between economy-wide multifactor productivity growth and the increase in the share of ICT industries in total GDP. Most importantly, Sweden and Finland clearly resemble the United States much more than other European countries in terms of having experienced large increases in both of these variables in the 1990s. The difference, of course, is that the performance in Sweden and Finland is driven by a single firm in each country, whereas the United States has a well-developed and diverse ICT-producing sector in addition to the extensive use of ICT.

In terms of spill-overs to other firms and industries, Ejermo (2004) finds that, despite being one of the most R&D intensive countries in the world, Sweden does not exhibit large R&D spill-overs. While there are R&D spill-overs within the group of R&D performers, they are small relative to those that have been observed for other countries. Furthermore, while there do appear to be some spill-overs from R&D performers to non-performers, these appear to be quite small (although the author predicts that they are not altogether insignificant in the aggregate). Ejermo concludes that one possible explanation of the small R&D spill-overs in Sweden is that most R&D in Sweden is performed by large multinationals, which interact more with their international competitors than with smaller Swedish firms. Indeed, Andersson (2002) suggests that it is not so much R&D intensity itself that improves productivity growth in Swedish manufacturing, but rather openness to trade, which gives better access to international technological spill-overs. From this perspective, smaller Swedish firms would appear to be more likely to absorb the benefits of R&D performed internationally than those of R&D performed in Sweden.

4) Conclusion

While Sweden's productivity performance in the 1980s and 1990s is interesting in its own right, the lessons to be drawn for other countries are not immediately obvious, given the relatively unique characteristics of Sweden such as a single dominant industry, a high degree of income redistribution and employment protection even by European standards, and the polarization of its economy into some highly competitive sectors and other heavily protected sectors. Nonetheless, some general points can be made.

- A comprehensive approach to promoting competition – encompassing deregulation and product market competition, the free movement of labour and capital, openness to trade, among other factors – is necessary for maximizing the potential for productivity gains.

- The reliance on a single industry or even firm for aggregate productivity increases can subject a country to the greater possibility of suffering a prolonged stagnation in labour productivity and hence living standards. Indeed, the present slowdown in the telecommunications industry internationally will probably mean that Sweden's aggregate labour productivity growth will fall far below the impressive rate experienced in the 1990s.

- As in Finland, the productivity-enhancing ICT revolution in Sweden is linked almost exclusively to ICT production rather than ICT use, and is dependent on a single firm. It is therefore not yet possible to state that Sweden has entered a "new economy" phase of development, defined as an acceleration in labour productivity growth that is broadly based across industries. This may in turn imply that the new economy-style productivity growth at the aggregate level experienced by Sweden in the 1990s may not be sustainable.

- In a small open economy such as Sweden or Finland, most technological spill-overs occur across international boundaries, and there appears to be very limited scope for other industries and firms to benefit from the R&D and productivity performance of the national leaders. This underlines the importance of openness for innovation and productivity growth.

IV. Conclusion: Lessons for Canada from International Productivity Experience

This report has analyzed productivity levels and trends in OECD countries; provided a brief overview of the most recent thinking on productivity drivers based on two major productivity analysis exercises, the OECD growth project and the McKinsey Global Institute productivity studies; and undertaken an examination of the productivity experience of six OECD countries – the United States, Ireland, Australia, the United Kingdom, Finland, and Sweden.

A number of potential lessons for Canada emerge from the report.

- Competition and productivity are closely intertwined. Sectors that have been opened up to market forces, both domestic and international, have generally registered significant productivity gains, as seen most strikingly in the United Kingdom. The existence of a competitive environment is an essential condition for productivity advance. One of the most important steps, if not the most important step, that governments can take to promote productivity growth is to ensure that markets, whether it be product markets, labour markets, or capital markets, are as competitive as possible.

- Human capital is the foundation of productivity advance, driving innovation. Countries that have focused on human capital investment, particularly in the higher education area, have seen a major payoff in productivity growth. The basis of the U.S. productivity resurgence is that country's world class system of research universities, which have created the knowledge that led to the emergence of productivity-enhancing ICT. Ireland's productivity success is also closely linked to the massive expansion of opportunities for higher education in that country. Thus support of the higher education sector, including both research and

teaching, likely represents the most effective means by which government resources can be used to promote productivity growth.

- R&D intensity (R&D/GDP) is crucial for innovation and productivity growth, but it is not the complete story. The strong productivity performance of Sweden and Finland is closely related to the rapid growth in these countries of ICT-producing industries, in turn related to high R&D intensity. But the Swedish and Finnish experiences have shown that the presence of highly successful firms in certain high tech industries in a country does not automatically lead to the diffusion of productivity-enhancing ICT to the non-ICT producing sectors. Rather, it is the overall openness of these sectors to world technological developments that is crucial for their adoption of leading technologies. Since Canada through its R&D efforts accounts for a very small proportion of the world supply of innovations, the wide diffusion of best practice techniques in this country depends critically on the ability of Canadian firms to keep themselves abreast of world technological developments and to assimilate those developments. As the Swedish and Finnish cases illustrate so well, R&D intensity in itself may be necessary for rapid productivity growth, but it is certainly not sufficient. Sweden and Finland have the two highest R&D intensities, yet have labour productivity levels below the United States and at least eight other European countries.

- As a general rule, institutional rigidities impede productivity advance while institutional flexibility supports it. Many examples of this general principle came to light in the six country studies. For example, both Sweden and Finland have recognized that certain of the characteristics of their labour market institutions – such as centralized collective bargaining and limited earnings differentials between high and low skilled workers – can have negative implications for productivity growth. Both countries have shown flexibility in adapting their institutions to make them conducive to, or at least not inimical to, productivity advance.

Based on the four key lessons for Canada that have emerged from this survey of the productivity experience of six counties, we could like to put forward a number of specific policies that could be usefully considered in the Canadian context.

In terms of the first lesson concerning the importance of market forces, some specific policies that could foster productivity growth in Canada follow.

- An enhanced competitive environment through deregulation. A step in this direction for the telecommunications industry was recently recommended in the recently released final report of the Telecommunications Policy Review Panel (2006). Such a move would foster faster adoption of information and communications technologies (ICTs) through greater ICT investment, an area where Canada significantly lags the United States (Sharpe, 2005). ICTs which have been identified as a key source of productivity growth and responsible for

the acceleration of productivity growth in both Canada and the United States in the second half of the 1990s.

- A gradual winding down of marketing boards which limit the supply of certain agricultural products such as milk. Such a measure would spur the entry of producers with innovative ideas and the exit of low productivity firms, thereby increasing productivity through a composition effect. As these industries affected by production restrictions are relatively small, this measure would likely not have a major impact on productivity. There would likely be strong opposition of such a move as the benefits of marketing boards are concentrated in the hands of a small number of producers, but the costs are borne by all the population through higher prices. The producers have much more incentive to organize against such a policy that the beneficiaries to organize in favour of it.

In terms of the second lesson, the federal government has recognized the importance of the importance of human capital for productivity growth. Since 1997, the federal government has taken a number of measures to boost post-secondary education, including the establishment of the Canada Research Chair program and additional funding for the granting councils. Two policies in the human capital area that could be pursued more vigorously are outlined below.

- A reduction in the underemployment of the human capital of recent immigrants to Canada through programs that better and more quickly foster the integration of immigrants into the workforce. Such programs would include language training, subsidies for employers to provide recent immigrants with Canadian work experience, and different types of integrative assistance (e.g. information on Canadian requirements in licensed occupations, individual counseling for the development of plans for recent immigrants to find appropriate employment, retraining programs to meet Canadian requirements, seminars on job search skills in the Canadian context, etc.) to immigrants so that they can meet Canadian occupational requirements, both before and after arrival in Canada. The boost to productivity growth from such measures is potentially huge. The skills of immigrants have already been acquired at no cost to Canadian taxpayers. With a small investment in workplace integration, the skills of these immigrants could become fully utilized and contribute significantly to the economy.

- A greater emphasis on the basic skills of the workforce. A characteristic of the workforce of a number of the countries studied in this report (e.g. Sweden, Finland, Ireland) was its high level of basic skills. Indeed, it has been shown that improvements in basic skills such as literacy and numeracy can significantly boost productivity growth (Coulombe, Tremblay, and Marchand, 2004). There is much room for Canada to improve the basic skills of its workforce. Policies in this area, such as basic literacy programs, would potentially have a large payoff (Fortin, 2005). One specific program is to extend Employment Insurance (EI) benefits to low skill workers who take education or training leaves as part of a formal training plan. (Jackson, 2005).

The third lesson concerns the importance of the adoption of new technologies, as opposed to the production of new technologies through R&D. This lesson was in particular identified with Ireland, a country with a relatively low R&D intensity, yet very rapid productivity growth. Specific policies that could be considered in this area for Canada include the following.

- The expansion of programs that foster the adoption of best practice technologies and management practices by small and medium-sized enterprises (SMEs) by providing these firms with information on the latest technological developments in their industry and with technical advice on how to best adopt the latest technology in their situation. The Industrial Research Assistance Program (IRAP) run by the National Research Council is an example of a program that has been recognized as effective in fostering the adoption of new technologies by SMEs. The expansion of IRAP and similar technology transfer programs would likely have a significant productivity payoff.

- As noted earlier, information and communications technologies are a key driver of productivity growth. Yet Canada badly lags the United States in ICT investment per worker across almost all industries. Measures to increase ICT investment thus could boost productivity growth. One such measure is the ICT tax credit recently proposed by the Telecommunications Policy Review Panel (2006). This measure would be targeted at SMEs and would apply on an incremental basis to all expenditures on ICT capital goods as well as complementary investments in training and reengineering needed for effective ICT adoption. A second measure is the harmonization of provincial sales tax systems with the GST. The PST in certain provinces (Ontario, British Columbia, Manitoba, Saskatchewan, and Prince Edward Island) is applied to ICT spending, increasing its cost compared to other more long-lived asset types, and discouraging ICT investment. Harmonization with the GST (under which ICT investment is not taxed) would reduce this current bias of the tax system against ICT investment.

The fourth lesson concerns the role of institutional rigidities in impeding productivity growth and the identification of these rigidities and their removal. Specific rigidities in Canada include the following.

- The Employment Insurance (EI) program, which provides income support for the unemployed in seasonal occupations, discourages to some degree mobility to regions where permanent employment prospects are more promising. Given the current high levels of interprovincial mobility in this country from high unemployment to low unemployment regions (the population of Newfoundland fell from 580 thousand in 1992 to 520 thousand in 2003, with many of the out-migrants going to Alberta), it is important not to overemphasize the importance of this rigidity to mobility (Sharpe and Smith, 2005). Nevertheless, during this time of very low national unemployment, from a national perspective there is no better

occasion to encourage the unemployed to leave high unemployment areas to seek work through a shift from passive income support role of EI to a more active role for EI that attempts to integrate the unemployed into jobs through by fostering mobility and retraining.

- Reduction in interprovincial barriers to labour mobility in the professions and the trades to allow a greater role for market forces to influence the reallocation of workers from low productivity/low wage to high productivity/high wage jobs, a an important source of productivity growth. Jurisdiction over occupational certification resides with the provincial level of government. It is essential that the federal government work with the provinces to develop certification programs that are recognized in all provinces. The Red Seal program for the apprenticeable trades is an excellent example of a program that promotes mobility throughout the country. This program, and similar programs for other occupations, should be expanded.

It is always difficult to gauge the relative payoffs to different economic policies. Nevertheless, with regard to the four key productivity drivers (human capital, competition, R&D and institutional flexibility) discussed, a case can be made that the payoff from additional investment in the area of skills development would be greater than that of additional investment in R&D. This is in part because Canada already has one of the most generous fiscal regimes for R&D in the world. In contrast, our investment in skills development by both the public and private sectors is relatively weak by international standards. From this perspective, a skills development strategy should play a salient role Canada's overall productivity strategy.

This report has surveyed the international productivity experience of six industrial countries and drawn out lessons for Canada. While there is much to learn from international experience, it is important to recognize that policies that work in one country flow from the particular context or situation of that countries and are likely not transferable holus bolus to another country. Policies to improve productivity growth in Canada, while informed by the experience of other countries, must be based on the institutional, political and economic realities of this country.

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Appendix 1

Issues Related to International Comparisons of Productivity and GDP Statistics[26]

Measurements of such macro-economic variables as employment, hours worked and GDP need to be based on conventions, which have limitations since the conventions may change over time or vary from one country to the next. This means that statistics may be not completely comparable across countries. Recent discussions on international comparisons of per capita GDP testify to their fragility and prompt us to consider only sizable differences as robust. What follows are some illustrations of problems involved in measuring GDP and employment.

Three examples of GDP measurement elements that are likely to introduce bias into international comparisons can be cited:

- The conversion of GDP into a common monetary unit for the purposes of international comparisons may be based on several different conventions. Thus, differences in the conversion conventions can change the per capita GDP rankings of countries where the figures are close. This means that rankings of countries based on the level of a per capita GDP indicator should only consider large differences as significant and rankings should not be established for countries where the indicator levels are close.

- Different statistical methodologies may be used to adjust prices for in changes in quality. Some countries such as the United States have been very aggressive in the use of hedonics to capture quality improvements in computers, while others have been more conservative.

- Some national accounts conventions may vary from one country to the next, which can lead to bias in productivity or per capita GDP comparisons. The biggest differences are between European and U.S. conventions. The latter tend to result in higher GDP and GDP growth than the former. Three illustrations of such differences can be cited. All three deal with the issue of the apportioning of consumption between final consumption and intermediate consumption:

    (i) the FISIM (financial intermediation services indirectly measured) item is treated as intermediate consumption exclusively in Europe, whereas some of it is counted as household consumption in America and thus included in America's value added and GDP. This difference in conventions appears to increase the United States GDP by 2-3 per cent relative to Europe;

[26] This appendix is drawn from Cette (2005)

(ii) spending on military equipment is treated as government intermediate consumption in Europe, whereas the United States counts some of this spending as investment, which increases GDP accordingly;

(iii) the division of business expenditure on software into intermediate consumption and investment favours investment in the United States, thereby increasing its GDP accordingly, compared to European countries. The latter difference in conventions appears to increase the United States' GDP by about 0.8 per cent compared to France.

The combined effect of these three differences in accounting conventions appears to 'inflate' American GDP 2-5 per cent compared to European standards.

Measurements of employment and hours worked can also be complicated by the lack of standard conventions and changes in conventions. We can cite three examples of such difficulties:

- aggregate employment includes self-employed and unpaid workers and the proportion of such workers varies over time and from one country to the next. Measuring hours worked for this population is very problematic. This is particularly true of the unpaid family workers included in this population. Unpaid family workers accounted for 4.4 per cent of aggregate employment in France in 1980, versus 0.8 per cent in the United States and 10.9 per cent in Japan. The figures for 2002 were 1.7 per cent, 0.1 per cent and 4.8 per cent respectively ;

- in some countries, the measurement of working hours changed over the period. For example, in France, when the statutory work week was reduced to 35 hours, the definition of hours worked was changed, which may have affected the measurement of hours worked collected from business surveys;

- also in France, the introduction of tax deductions for households' expenditure on domestic help also led to the legitimization of many previously undeclared jobs. National accountants try to account for undeclared work in the GDP estimates, but not in the measurement of employment. Thus, the legitimization of some previously undeclared jobs could lead to a reduction in apparent labour productivity, all else being equal. Some of the decrease in labour productivity seen in Spain in the mid-1990s was probably due to a bias of this type.

We should also point out that productivity comparisons between industries are even more complicated. Two examples can be cited to support this:

- agency temps are counted as business service workers, even though about half of them work in the manufacturing industry in France. This distorts productivity estimates when output is measured in terms of production. It also distorts productivity estimates when output is measured in terms of value added, because the structure of temporary jobs by skills requirements is very different from the overall structure of jobs in the industries relying heavily on agency temps. This problem is especially acute in France because the use of agency temps is much more common than it is in other industrialised countries;

- in some industries, the division of output into volumes and prices can be very difficult if these characteristics are subject to rapid change. This is particularly the case in the information and communications technology industries, where the case of mobile telephony services provides a stark illustration.

The review of these measurement problems indicates that one must be very careful when making international comparisons and only large differences should be considered as robust.