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Productivity and Competitiveness Challenges Facing Canadian Industries

Someshwar Rao and Jianmin Tang*

Micro-Economic Policy Analysis Branch
Industry Canada

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Abstract

With increased globalisation of economic activity and growing integration of the North American economies, the competitive pressures on Canadian firms are intensifying. The main purpose of this paper is to evaluate the competitive position of Canadian industries vis-à-vis their competitors, mainly their American counterparts. Our results suggest that the recent good economic news and the strong trade performance mask Canada's serious competitiveness difficulties. The export surge and the big increase in trade surplus were largely the result of strong U.S. economy and a large real depreciation of Canadian dollar vis-à-vis the U.S. dollar and other currencies, but were not due to any improvement in underlying competitiveness. As a matter of fact, Canada lost a substantial ground to the U.S. and other G7 countries in productivity, the fundamental determinant of the underlying competitiveness. Canada's relatively weak performance in terms of capital accumulation, innovation, labour force with university degrees, greater importance of small-sized firms in the Canadian economy and a slower shift to new economy industries all have contributed to Canada's productivity and competitiveness difficulties.

* Views expressed in this paper are our own and do not necessarily reflect those of Industry Canada or Government of Canada.

1. Introduction

Capital, R&D and skilled workers are increasingly mobile across countries. It takes place because of rapid improvements in information and communication technologies, growing globalisation of production and innovation, rising trade and investment orientation and fierce international competition for markets, capital and labour among jurisdictions. A small open economy like Canada that depends heavily on foreign trade, foreign capital and immigration needs to be highly competitive. Otherwise, it will be extremely difficult to attract and retain these factors in Canada and sustain a decent pace of economic growth. Canada's problems are compounded by the fact that our dominating trading partner is the largest, richest and most dynamic economy in the world, the United States.

According to the United Nations, Canada is one of the top five countries in the world in terms of quality of life (human development). Rich endowments in natural resources and human capital have contributed to the high standard of living and quality of life in Canada. In addition, the Canadian economy has performed very well relative to other G7 countries in the last five years. For example, during the period 1997-2002, Canada outperformed other G7 countries in terms of economic growth and job creation. Furthermore, Canada registered a steller trade performance during this period. Exports of goods and services increased at annual pace of 10 percent, leading to huge improvements in trade and current account balances.

But, Canada's ability to compete effectively in an increasingly integrated and fierce global market place cannot be judged by short-term good economic trends, because they might be just a cyclical phenomenon. In addition, the recent good economic performance relative to other G7 countries might be simply the result of relatively weak performance in earlier periods. Moreover, broad macro-economic trends hide a great deal of interesting and important industry detail. Therefore, we need to examine Canada's competitive position from a longer-term perspective using industry data.

The objective of this paper is to provide a comprehensive analysis of Canada's competitive position. We hope to shed some light on the following important policy research questions.

What is competitiveness? How is productivity related to competitiveness? What are the other possible indicators of competitiveness? How has Canada performed in terms of productivity relative to other G7 countries, especially the United States? What were the key factors behind Canada's relatively weak (strong) productivity record? And finally, what does Canada need to do to improve its longer-term competitiveness?

Our results suggest that the recent good economic news and the strong trade performance mask Canada's serious competitiveness difficulties. The export surge and the big increase in trade surplus were largely the result of strong U.S. economy and a large real depreciation of Canadian dollar vis-à-vis the U.S. dollar and other currencies, but were not due to any improvement in underlying competitiveness. As a matter of fact, Canada lost a substantial ground to the U.S. and other G7 countries in productivity. Moreover, Canada's productivity problems are acute in new economy industries. Canada's relatively weak performance in terms of capital accumulation, R&D, adoption of new information and communication technologies, university graduates, greater importance of small and medium-sized firms in the Canadian economy and a slower shift to new economy industries all have contributed to Canada's productivity and competitiveness difficulties.

In the next section, we will provide a conceptual discussion of issues related competitiveness, comparative advantage and productivity, and their interrelations. We will discuss some possible indicators of competitiveness and examine briefly Canada's relative performance in section 3. In section 4, we will provide a comprehensive analysis of Canada's productivity record in relation to the United States and other OECD countries. We will analyse possible key factors behind Canada's productivity difficulties in section 5. In the last section, section 6, we will outline some of the key policy implications of our findings.

2. Conceptual Issues

Before we proceed with a discussion of possible key indicators of competitiveness, it would be useful to outline some of the important conceptual issues associated with competitiveness and its relation to comparative advantage and productivity. This section does precisely that.

What is competitiveness? The term "competitiveness" is often used very loosely. As a result, its meaning varies across different users. Competitiveness is a micro concept. It is more applicable at the company or firm level (McFetridge, 1995). A firm is said to be competitive if it is profitable and maintains or gains market share in a world of fair and freer markets and intense domestic and international competition. But, this definition cannot be easily extended to an industry or a country. For instance, trade performance of an industry or a country can be influenced by a number of factors such as domestic and international trade barriers and distortions, differences in tastes and population growth rates, economic cycles at home and abroad, exchange rate changes, etc. Therefore, a gain (loss) in market share and an improvement (deterioration) in trade balance do not necessarily imply a gain (loss) in competitiveness. As a matter of fact, they might go in opposite directions if improvements (deterioration) in trade performance results in lower (raise) real wages and real incomes for citizens. For example, a real exchange rate depreciation, other things remaining constant will increase exports, reduce imports and improve trade balance but will depress real wages and real incomes because it raises the cost of imports and the cost of living.

To account for those factors, the President's Commission on Industrial Competitiveness (1985) in the United States defined competitiveness of a country as "the degree to which it can, under free and fair market conditions, produce goods and services that meet the test of international markets while simultaneously maintaining and expanding the real incomes of its citizens". According to this definition, competitiveness is a multidimensional concept that reflects general "health " of an industry or a country. Productivity is a good summary indicator of this.

The efficiency with which an industry or a nation employs its productive resources such as natural resources, physical capital and human capital in the production of goods and services relative to other countries plays a key role in determining its longer-term competitiveness. It depends on how well the industry or nation can meet the test of international competition and the extent to which it can achieve high and rising real wages and real incomes (Rao and Lempriere, 1992; Porter, 1990). In other words, total factor productivity (TFP) is the ideal measure of the

overall health of an industry or a nation. It is measured as the weighted sum of all individual input productivities – natural resources, capital and labour.

Although TFP is the most appropriate measure of overall efficiency, in practice labour productivity is commonly used in international comparisons for the following three key reasons. First, improvements in living standards, measured as per capita real GDP, are directly influenced by improvements in labour productivity, measured as real GDP per person employed. Second, the concept of labour productivity, calculated as real GDP per person employed or person-hour, is simple to understand and, most importantly easy to calculate and easy to update. Finally, in general TFP and labour productivity tend move closely across countries and over time. However, it is important to remember that changes in capital –labour ratio also contribute to changes in labour productivity. In short, labour productivity could be used as a good proxy for TFP, therefore a measure of competitiveness.

How are comparative advantage and competitiveness are related? They are two different concepts. Irrespective of big differences in productivity levels, a country cannot be expected to produce every thing or import every thing. Instead, a country will tend to specialise in products and services in which it is relatively more efficient and less expensive than its trading partners. On the other hand, it imports those products and services that its trading partners produce more efficiently and less expensively. In other words, the pattern of trade among countries will be determined by the comparative advantage position. Differences in living standards among countries, on the other hand, are largely influenced by differences in productivity levels.

The endowment of natural resources, accumulation of physical and human capital, technology and economic organisations play an important role in shaping the comparative advantage position of nations. For example, countries with rich endowment of natural resources, such as Australia and Canada, tend to specialise in industries and products that depend on resources while countries with abundant supply of unskilled labour tend to specialise in labour-intensive products, and so on.

However, changes in competitive position can affect the comparative advantage position over time. A large and sustained improvement in the competitive position of an industry will also improve its comparative advantage position. For instance, the substantial improvements in efficiency in the Canadian automobile industry, driven largely by the Auto Pact and the integrated North American production, raised its comparative advantage position considerably over the last 30 years. On the other hand, despite a steady deterioration in the competitive position of Canadian paper and allied products industry, Canada still has a comparative advantage position in this industry, because it can still produce these products more efficiently than its trading partners. However, this advantage declined significantly during the last 15 years.

3. Other Indicators of Competitiveness

Before we turn to a detailed discussion of Canada's relative productivity performance, it would be useful to examine other indictors of competitiveness often used by researchers and policy analysts. These include unit labour costs, output price, trade performance measures, R&D, profitability, human capital, capital accumulation, patents, commercialisation of innovations, etc. Among these, here we will concentrate on the first three indicators: unit labour costs; output price; and trade performance measures. All the other above mentioned indicators impact productivity directly or indirectly. Therefore, we will look at these factors while examining the reasons for Canada's productivity strengths and weaknesses.

Unit Labour Costs

Unit labour costs are the cost of labour input required to produce one unit of output. They are computed as labour compensation in nominal terms divided by real output, that is, for industry *i* in year *t*

$$(1) \qquad ULC_{i,t}^{N} = \frac{C_{i,t}^{N}}{Y_{i,t}^{N}},$$

where ULC_i^N denotes unit labour costs in national currency, C_i^N is the labour compensation in national currency, and $Y_{i,t}^N$ is real output in national currency. The superscript *N* here denotes national currency.

For purposes of international comparisons, however, unit labour costs have to be converted in to common currency, in our case, the U.S. dollar. Labour compensation in Canadian dollars is commonly converted into the U.S. dollar by the market exchange rate and real output is converted to the U.S. dollars by the purchasing power parity (PPP) exchange rate.[1] The rationale for these practices is that labour compensation is a nominal concept, while output is a real concept. Unit labour costs in the U.S. currency can then be written as

$$(2) \qquad ULC_{i,t} = \frac{C_{i,t}^N / EX_t}{Y_{i,t}^N / PPP_i} = \frac{C_{i,t}}{Y_{i,t}},$$

where *EX* denotes the market exchange rate ($CDN per $US) and *PPP* denotes the output purchasing power parity exchange rate ($CDN per $US).

Denote $W_{i,t}$, defined as $C_i / L_{i,t}$, the labour cost per unit of labour input in U.S. dollars, and $LP_{i,t}$, denoted as $Y_{i,t} / L_{i,t}$, the labour productivity in U.S. dollars. $L_{i,t}$ is the labour input (number of employees or total hours worked). Then, the relative unit labour cost in Canada relative to that in the U.S. for industry *i* in year *t* is

$$(3) \qquad \ln(RULC_{i,t}) = \ln(RW_{i,t}) - \ln(RLP_{i,t}),$$

where $RULC_{i,t}$ is the relative unit labour cost in Canada relative to that in the U.S. $RW_{i,t}$ is the relative wage rate. $RLP_{i,t}$ is the relative labour productivity level.

[1] The output PPP is defined as the ratio of the amount of Canadian dollars received by Canadian producers for a basket of output sold in Canada to the amount of U.S. dollars received by U.S. producers for selling the same basket of output in the United States.

The relative unit labour costs are equal to the relative wage rate minus the relative labour productivity. Changes in relative labour compensation and changes in relative labour productivity influence trends in relative unit labour costs, or cost competitiveness. If labour compensation relative to the U.S. is the same, then relative productivity solely determines the relative unit labour cost. In the short-term, changes in cost competitiveness and productivity could move in opposite directions because of the dominating influence of large movements in unit labour costs due to changes in market exchange rates. More important, a depreciation led improvement in cost competitiveness will lower real wages and real incomes, because of higher cost of imports and cost of living. In addition, a prolonged real depreciation also might undermine innovation and productivity, hence living standards, by retarding the necessary reallocation of resources from inefficient to more efficient firms in a given industry, delaying the resource shifts from resource-based and labour-intensive industries to high-tech and knowledge-intensive industries and postponing the necessary investments in technology, R&D and skills development. Therefore, sustained improvements in cost competitiveness and living standards can only come from longer-term improvements in relative productivity.

Recent trends in Canada's unit labour costs:

In this sub-section we will analyse recent trends in Canada's cost competitiveness, proxied by unit labour costs in the manufacturing sector. We chose to concentrate on the manufacturing sector for two important reasons. First, manufactured products account over 80 percent of global trade and competition is intensely fierce. Second, the quality of productivity and compensation data for manufacturing industries is generally much better than for other industries.

Canada's cost competitiveness, as measured by ULC, in the manufacturing sector improved considerably in the 1990s. Between 1990 and 2001, the ULC in the Canadian manufacturing sector declined by 21.3 percent compared to a meagre 2.5 percent reduction in the U.S. In other words, there was a 18.8 percent gain in cost competitiveness over U.S. manufacturers (Figure 1). But, the improvements in cost competitiveness came entirely from the depreciation of Canadian dollar, which depreciated by 28.4 percent during this period. On the other hand, the Canadian manufacturing sector lost a substantial ground in labour productivity -- U.S. manufacturing

productivity increased by 40.7 percent, almost double the pace in Canada. Some of the lost ground in productivity, however, resulted in lower growth in hourly compensation -- i.e., hourly compensation in Canada increased 10 percentage points slower than in the U.S. manufacturing sector.

In short, the depreciation of the Canadian dollar, slower growth in hourly compensation more than offset the large deterioration in relative labour productivity, resulting in a considerable improvement in cost competitiveness of the Canadian manufacturing sector during the 1990-2001 period. But, as pointed out earlier in this section, a depreciation driven improvements in cost competitiveness come at the cost of lower living standards and could also seriously undermine innovation and productivity in the medium to longer-term.

Relative Output Prices

Unlike unit labour costs, the relative output price measure takes into account all costs associated with the production of goods and services. Thus, it is a broader measurement of competitiveness of an industry. It takes into account not only labour cost but also capital cost and intermediate input cost. Capital is becoming increasingly important input in production. Therefore, capital cost has become an important determinant of the overall competitiveness.

A relative output price for an industry is defined as the output PPP of the industry divided by the market exchange rate, that is, for industry *i* in year *t*,

$$(4) \qquad RP_{i,t} = \frac{PPP_{i,t}}{EX_{i,t}} .$$

Essentially, this is the output price ratio of Canada to the U.S. for industry *i*, with output prices in both countries expressed in U.S. dollars. If the relative output price for the *i*th industry is below one, then the industry is said to be more competitive in Canada than in the United States and vice versa. This indicator has been used Jorgenson and Kuroda (1995) and Lee and Tang (2000a) to

assess the international competitiveness of industries between Japan and the U.S. and between Canada and the U.S., respectively.

As in Jorgenson and Nishimizu (1978), the theoretical framework for international competitiveness comparisons is based on a translog production function, originally introduced by Christensen, Jorgenson and Lau (1971, 1973). By working with the dual price function of output, Lee and Tang (2000a) show that the relative output price for the *i*th industry can be expressed as a weighted average of the differences between the logarithms of relative input prices minus the difference in total factor productivity (TFP) levels between Canada and the United States,

$$\ln RP_i = \hat{v}_i^K \ln RP_i^K + \hat{v}_i^L \ln RP_i^L + \hat{v}_i^M \ln RP_i^M - \hat{v}_i^D, \quad (5)$$

where RP_i is the relative price of output; RP_i^K, RP_i^L, and RP_i^M are the relative input prices for capital, labour, and intermediate inputs respectively. As the relative output price, the relative input prices for capital, labour and intermediate inputs are defined as their PPPs divided by the monetary exchange rate. $\hat{v}_i^D$ is the difference in TFP levels between Canada and the United States for the *i*th industry. $\hat{v}_i^j = \left[v_i^j(Can) + v_i^j(US)\right]/2$, the average compensation share of input *j* in Canada and the United States for the *i*th industry.

Thus, relative output price is a weighted average of relative costs of all inputs minus TFP. If production inputs are perfectly internationally mobile with no transportation costs, prices of all factor inputs will be same in Canada and the U.S. In this case, the relative price will be equal to the negative relative TFP. If the relative output price of an industry is less than one, then the industry Canada is said to be more competitive than its U.S. counterpart and vice versa.

In reality, capital is internationally more mobile than labour. The difference in capital costs is largely due to the differences in corporate tax regimes (for details of discussion of capital cost, see Jorgenson and Yun (1991)). Although relative output prices are preferred to unit labour costs

in measuring international competitiveness,[2] they are not easy to come by since statistical agencies in both Canada and the U.S. do not produce estimates on industry output PPPs due to substantial data requirements.

Recent trends in Canada's output prices

Lee and Tang (2000a) assessed the competitive position of Canadian industries using this approach. Their results show that the competitive position of the Canadian private business sector improved steadily between 1975 and 1995, primarily due to the decline in capital input price and the depreciation of Canadian dollar. On the other hand, the TFP gap between Canada and the U.S. increased somewhat during this period (Figure 2). In 1995, in all the 33 industries, Canada had lower labour input price compared to their U.S. counterparts. Despite a steady decline in relative capital price in the post 1975 period, in 27 of 33 industries capital cost was still higher in Canada than in the U.S. TFP was lower in 23 Canadian industries.

Like unit labour costs, the relative output price measure is also strongly influenced by movements in the market exchange rate. Therefore, it too can give misleading information about the underlying competitive position of Canadian industries.

Trade Performance Measures

International trade is the lifeblood of the Canadian economy. More than 45 percent of its GDP is exported, and imports represent about 40 percent of Canadian GDP. In other words, more than 85 percent of our economy is exposed to international competitive pressures. The exposure is even larger for the manufacturing sector. Hence, it is argued that our performance on the trade front will reflect our competitive strengths (weakness).

A number of trade indicators are often used to analyse the competitive position. These include growth of exports, trade balance, shares in global or regional trade, the share of high-tech exports

[2] Lee and Tang (2000b) assess the competitiveness of the manufacturing sector in Canada relative to the U.S., using both relative output price and unit labour costs. They show that the manufacturing sector in Canada was less competitive than its U.S. counterpart in 1995 in terms

in total trade, etc. In the 1990s, Canada performed very well on the trade front. Canada's exports increased over 10 percent per year. Canada's trade and current account balances improved dramatically in the second half of the 1990s (Figure 3). The share of high-tech products in total Canadian merchandise trade increased significantly (Acharya, Sharma, Rao, 2001). Similarly, Canada's share of global trade also increased. However, Canada's share of North American trade declined somewhat. In sum, the trade measures suggest a considerable improvement in Canada's competitiveness.

But, a closer look at the factors behind the trade numbers suggest otherwise. The strong trade performance in the 1990s was mainly the result of three key factors: the strong U.S. economy; the depreciation of Canadian dollar and the two free trade agreements, FTA and NAFTA (Acharya, Sharma and Rao, 2001).[3] Among these, the rapid economic expansion in the U.S. was the most important factor. For instance, over the past 10 years, total U.S. imports and Canadian exports to the U.S. moved in tandem (Figure 4). Therefore, trade performance measures do not imply an improvement in Canada's underlying competitiveness. On the contrary, the opposite is true. As pointed out earlier, Canada's manufacturing labour productivity grew at about half the pace in the United States, our largest trading partner. Furthermore, as discussed earlier, the Canadian dollar depreciation might be adversely impacting innovation and productivity in Canadian industries.

In sum, all three indicators could give misleading information about underlying competitiveness. Therefore, we need to focus on trends in relative productivity performance for analysing Canada's ability to compete effectively in free and fair international exchange of goods and services while expanding the real incomes of Canadians.[4]

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of relative output price, but more competitive in terms of unit labour costs.

[3] See Goldstein and Khan (1985) for detailed discussion of general factors affecting trade performance.

[4] As shown earlier, if factor inputs are perfectly internationally mobile with no significant transportation costs, the PPP exchange rates for capital, labour and intermediate inputs will be equal to the market exchange rate. In other words, input prices will be same in both Canada and the U.S. Therefore, movements in real output price will be solely influenced by trends in relative TFP.

4. Productivity Performance of Canadian Industries

As mentioned in previous sections, only improvements in relative productivity will improve cost competitiveness on a sustained basis while maintaining and expanding real incomes. In this section, we will provide a detailed analysis of Canada's productivity record over the last 15 years relative to the U.S., our largest trading partner and the most dynamic and vibrant economy in the world. First, we will examine the aggregate trends in real incomes and productivity in the two countries. Next, we will turn to industry detail.

In 2001, Canada's per capita real GDP was only 82.2 percent of the U.S. level, compared to 89.0 percent in 1987. According to our analysis, almost 90 percent of the Canada-U.S. gap in per capita real income was due to the aggregate labour productivity gap. In addition, the productivity growth lagged behind the U.S. during the 1977-2001 period, contrary to the predictions of convergence theory. The gap in productivity growth was larger in the second half of the 1990s than for the entire period. Labour productivity (GDP per hour worked) increased at an annual pace of 2.0 percent in the U.S. over the 1995-2001period, compared to 1.6 percent in Canada (Figure 5). Consequently, the Canada-U.S. labour productivity widened during the past 15 years. Similar picture emerges from the trends in TFP gap. More important, the productivity problem is very serious in the manufacturing sector, the battleground for fierce international competition. The Canada-U.S. manufacturing labour productivity gap increased from just about 10 percent in 1977 into over 35 percent in 2001.

Is the manufacturing sector productivity problem generally pervasive or concentrated in few key industries? Our analysis indicates that productivity levels are considerably lower in most of the Canadian manufacturing industries. Moreover, in the two key machinery industries, the productivity gap is almost 60 percent (Figure 6). On the other hand, Canada enjoys a productivity advantage in three resource-based manufacturing industries: paper and allied products; primary metals; and lumber and wood products. In addition, Canada's productivity compares well with the U.S. in transportation equipment (thanks to the Auto-Pact) and furniture and fixtures. On average, Canada's productivity is about 20 percent below the U.S. level.

How did industries in Canada do in terms of productivity growth vis-à-vis their U.S. counterparts in the past 15 years or so? The U.S. service industries in general registered higher productivity growth than in Canada (Table 1). Similarly, the two machinery industries in the U.S. experienced considerably faster growth in productivity. For instance, non-electrical machinery industry productivity increased by 7.4 percent per year during the 1987-2000 period, compared to just 2.0 percent in Canada. On the other hand, Canada did significantly better in primary industries, resource-based manufacturing industries such as lumber and wood, paper and allied products, and primary metals, and transportation equipment.

Canada is also outperformed by many other OECD countries in productivity growth. Out of 25 selected OECD countries, only four countries experienced a slower labour productivity than Canada over the period of 1987-2000 (Table 2). Moreover, five countries (Finland, Ireland, Luxembourg, South Korea, and Turkey) registered productivity growth rates that are twice the pace in Canada.

In summary, Canada lags behind the U.S. and most of OECD countries in productivity growth – the fundamental source of the underlying competitiveness. But productivity performance between the countries varies at the industry level. Canada lags badly behind the U.S in knowledge-intensive industries such as the two machinery industries and in service industries. These industries are more innovative and dynamic than other industries. On the other hand, Canada has a competitive edge in primary and resource-based manufacturing industries. In these industries, Canada also has a comparative advantage (Acharya, Sharma and Rao, 2001).

5. Possible Reasons for Canada's Productivity Difficulties

In the section, pulling together the past research, done for Industry Canada as well as the other research, we will discuss some of the important factors behind Canada's productivity and competitiveness problems. The research to date suggests that a number of factors have contributed to Canada's relatively poor productivity performance. These include: lower capital-labour ratio; lower percent of workers with an university degree; lower importance of the dynamic ICT producing industries in the economy; slower rate of innovation and dynamism in

ICT producing industries; slower adoption of ICTs; lower R&D-intensity; greater importance of small and medium-sized firms in the economy; Canadian dollar depreciation; higher tax and regulatory burden, etc (Harris, 2002; Rao and Sharpe, 2002).

Here we will group our analysis into five broad key areas: capital intensity; innovation; human capital; the structure of firms; and the industrial structure. The other above mentioned variables influence productivity only indirectly by impacting the five basic factors we chose to concentrate.

Capital Intensity:

Capital input is one of the key determinants of labour productivity. The role of capital intensity (capital input per unit of labour input) in labour productivity is easy to explain and well documented. Physical capital, M&E and structures, impacts labour productivity in two important ways. First, an increase (decrease) in capital input per unit of labour directly raises (lowers) labour productivity. Second, capital input, especially M&E capital, embodies technology. Consequently, an increase in capital stock raises TFP, hence labour productivity and vice versa. In practice, it is difficult to disentangle these two effects. The econometric estimates suggest that in advanced industrialised countries such as Canada that at least 30 percent of the growth in labour productivity during the post War period came from capital accumulation.

In this section, we will discuss the possible role of capital input in the Canada-U.S. labour productivity gap. As mentioned in the previous section, the aggregate labour productivity level in Canada is about 20 percent below the U.S. level and this gap widened somewhat in the 1990s. What role did capital input play? To shed some light on this question, we looked at the trends in total capital-labour ratio as well as the M&E capital-labour ratio. These two variables suggest that capital input is one of the important factors behind Canada's lower labour productivity level. For the total economy, the aggregate capital-labour ratio is less than 85 percent of the U.S. level (Figure 7). More important, the M&E capital-labour ratio gap is about 50 percent (Figure 8). In addition, the total capital intensity gap decreased somewhat in the second half of the 1990s, suggesting that capital input also played a role in the widening of the aggregate labour

productivity gap over this period. It is important to note that total investment in ICTs per unit of labour input is 40 percent less than in the U.S. (Rao and Tang, 2001).

Capital input also played a major role in the sharp increase in the Canada-U.S. manufacturing labour productivity gap. For instance, the total capital intensity in the Canadian manufacturing sector was 5 percent above the U.S. level in 1990, but the U.S. outperformed Canada thereafter. By 2000, the Canadian capital intensity was more than 20 percent below the U.S. level (Figure 7). Similar trends are observed for the M&E capital intensity. The Canada-U.S. M&E capital intensity gap in the manufacturing sector increased from about 25 percent in 1990 over 40 percent in 2000 (Figure 8).

Our other research (Rao, Tang, and Wang (2003)) showed that M&E capital intensity has a higher impact on labour productivity than structures capital intensity. Furthermore, the inter-industry variation in labour productivity levels and the Canada-U.S. labour productivity gaps are highly correlated with inter inter-industry differences in the M&E intensity and the M&E capital intensity gaps between the two countries. More importantly, much of the widening of the Canada-U.S. labour productivity gap in the business and the manufacturing sectors was due to the widening of the capital intensity gaps in the 1990s. The depreciation of Canadian dollar and the unemployment rate gap between Canada and the U.S. seem to have contributed significantly to the faster rate of increase in the real rental price of capital (the ratio of rental price of capital to labour cost), hence to the widening of the capital intensity and the labour productivity gaps.

Innovation:

Innovation is about turning knowledge into economic activities. It is a continuous process of discovery, learning, and application of new technologies and techniques from many sources. It is fundamental to improving productivity performance. Innovation includes both fundamental and applied innovation. Fundamental innovation comprises the invention of new products and processes. Applied innovation, on the other hand, consists of the use of new processes or new products by Canadian firms invented elsewhere. Both types of innovation are important for improving Canada's productivity performance (Rao, et al. 2001).

Investments in R&D, human capital and M&E, and strong commercial links with other countries are crucial for stimulating innovation, hence productivity and competitiveness. The most often cited reason for the phenomenal productivity performance of the U.S. is its dynamism and superior innovation record. Canada lags behind the U.S. on many indicators of innovation: external patent applications; human capital devoted to R&D; business-funded expenditure on R&D; R&D intensity; technology balance of payments; and government expenditure on R&D. Canada's also lags behind several other G7 countries (Figure 9).

Human Capital:

In an increasingly knowledge-based global economy, a skilled workforce is essential not only to create and sustain innovations but also effectively make use of new technologies and knowledge to create and add value. But, the ratio of researchers to the labour force is over 30 percent below the U.S. level (OECD, 2002). Without sufficient number of researchers and scientists, it is difficult to do R&D and attract foreign direct investment, an important source of competition and dynamism and innovation. Therefore, increased investments in human capital create a virtuous cycle of enhanced innovation and productivity.

University education provides the generic skills essential to succeed in a fiercely competitive and fast changing global knowledge-based economy. It is an important determinant of productivity performance, and a strong complement to the physical capital as well as the R&D capital, as shown in Rao, Tang, and Wang (2002). However, the percentage of the labour force with a university degree in Canada is less than 60 percent of the U.S level (Figure 10), and this problem is generally pervasive across all two-digit manufacturing industries (see Table 3).

The structure of firms:

The structure of firms could influence the productivity performance directly via its impact on scale and scope economies and indirectly through its impact on capital intensity, human capital ; innovation and external commercial linkages. For example, according to the available research,

large firms benefit more from scale and scope economies than small and medium-sized firms and are generally more intensive in the use of capital and R&D, invest more in human capital and skills development, and are more outward oriented (Rao and Ahmad, 1996; Baldwin, 1995).

Therefore, small and medium-sized firms in general tend to be less productive than large firms. In 1997, small-sized firms were about 64 percent as productive as medium-sized firms, and medium-sized firms were only 71 percent as productive as large-sized firms (Figure 11). Furthermore, the productivity gap widened during the 1987-97 period. Hence, the difference in the firm structure between the two countries could be an important source of the Canada-U.S. labour productivity gap.

In the crucial manufacturing sector, small and medium-sized firms (SMEs) play a much more important role in Canada than in the U.S. For instance, the their shares of total manufacturing employment and value added are generally significantly higher than in the U.S., suggesting the structure of firms was responsible for some of the innovation and productivity gaps (Figure 12 and Baldwin, Jarmin and Tang, 2002).

Industrial Structure:

Like the structure of firms, differences in the industrial structure could explain some of the difference in the Canada-U.S. labour productivity performance. In Canada, primary and resource-based manufacturing industries play a more important role in the Canadian economy than in the U.S. economy. On the other hand, high-tech manufacturing industries such as electrical and electronic equipment and non-electrical machinery, and knowledge and ICT-intensive industries such as financial services, transportation services, communication services, trade and other business services play a commercial services play a more important role in the U.S. economy. However, on average, the difference in the industrial structure between the two countries accounts for only less than 2 percent of the Canada-U.S. labour productivity gap, because the productivity levels in primary and resource-based manufacturing industries are fairly high (Nadeau and Rao, 2002). But, the large and growing importance of the two machinery

industries contributed greatly to the large deterioration in the Canada-U.S. manufacturing labour productivity gap, because the productivity in the ICT manufacturing industries such as computers, semiconductors and telecommunication equipment industries grew at a faster pace in the U.S. than in Canada in the 1990s (Figure 13; Rao and Tang, 2002), and these industries are less important in Canada than in the U.S. (Figure 14).

6 Conclusions

The main objective of this paper has been to analyse the international competitive position of Canadian industries. Productivity performance relative to its trading partners is the fundamental determinant of the underlying competitiveness, because only with a higher productivity growth a country can effectively compete in international markets while maintaining and expanding the real incomes of its citizens. All other measures of competitiveness could give misleading information about competitiveness.

The improvements in unit labour costs and relative output price and the strong trade performance in the 1990s mask Canada's serious competitiveness difficulties. Canada's aggregate labour productivity and real incomes are only about 80 percent of the U.S. Levels. Further more, contrary to the expectation of the convergence, the Canadian levels diverged significantly in the 1990s. More important, in the manufacturing sector the Canada-U.S. productivity gap increased from about 10 percent in 1977 to over 35 percent in 2001. In addition, the productivity problem is generally pervasive across two-digit manufacturing industries. However, Canada enjoys a productivity advantage in few resource-based manufacturing industries: paper and allied products; primary metals; and wood products. On the other hand, the productivity disadvantage is almost 60 percent in the two key machinery industries.

Our research suggests that lower capital intensity, slower capital accumulation, lower rates of innovation, lower percentage of researchers and university graduates in labour force and greater importance of SMEs and primary and resource-based manufacturing industries, feeding on each other, all contributed to Canada's productivity and competitiveness difficulties. Therefore, to improve Canada's underlying health of the Canadian industry, governments, private sector and

universities need to work together in a concerted manner on several fronts. Canada competes head to head with the U.S. for capital, R&D, skilled workers and higher value added activities. Hence, Canada needs to create a highly competitive business climate to attract and retain these footloose activities. To improve the investment climate, we need to make sure that our tax and regulatory burdens on business, universities and individuals, tax structure, investment incentives, real interest rates and market framework policies are highly competitive, flexible and dynamic vis-à-vis the U.S.

The competition for skilled people is going to intensity between advanced industrialised countries because of the growing importance of skills in the global economy, the ageing of population and the low and declining birth rates. Canada's ability to attract and retain skilled workers will be the key to create a virtuous cycle of capital accumulation, innovation and productivity enhancement. A competitive personal income tax system, removal of impediments towards faster recognition of foreign diplomas by Canadian business and an aggressive marketing of Canada abroad, similar to our investment promotion activities, might go a long way.

Canada also needs to pursue only those commercial and micro and macro economic policies, which are generally neutral and do not favour directly or indirectly particular industries, firms or regions. In such an environment, the resources will move freely from low productivity and low growth industries, firms and regions to high productivity and high growth activities and areas.

The innovation strategy of the government of Canada (Government of Canada, 2001a and 2001b) and public consultations were successful in sensitising Canadians of the serious competitive challenges and developing a longer-term action plan for making Canada one of the most innovative and dynamic economies in the world.

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Table 1: Labour Productivity[a] Growth by Industry in Canada and the United States
(Average annual per cent rate of change)

Industry	Canada			U.S.		
	1987-95	1995-00[b]	1987-00[c]	1987-95	1995-00[b]	1987-00[c]
Primary industries	3.2	4.5	3.7	1.1	0.4	0.8
Construction	-1.3	0.0	-0.8	0.1	-0.7	-0.2
Manufacturing (total)	3.2	1.5	2.5	2.9	4.3	3.4
Food and Beverage	2.0	-0.9	1.4	2.4	-6.4	0.8
Tobacco	2.8	2.4	2.7	-1.1	-4.6	-1.8
Rubber & Plastics	2.0	1.8	2.0	4.2	5.2	4.4
Leather	1.0	0.4	0.9	4.3	-0.5	3.2
Textiles[d]	2.5	0.9	2.2	2.9	2.9	2.8
Lumber & Wood	-0.9	1.5	-0.5	-2.9	-2.6	-3.1
Furniture & Fixtures	3.1	1.1	2.7	0.9	2.7	1.2
Paper & Allied	3.3	2.8	3.2	-0.1	6.4	1.2
Printing & Publishing	-2.0	-0.3	-1.7	-2.4	-1.6	-2.5
Primary Metal	5.3	4.7	5.2	2.6	2.6	2.6
Fabricated Metal	1.3	0.7	1.2	1.6	1.6	1.6
Machinery Except Electrical[e]	2.7	-0.3	2.0	6.6	10.5	7.4
Transportation Equipment	5.8	2.3	5.1	0.8	-1.6	0.3
Electrical & Electronic Equip[e]	7.7	3.8	6.9	12.7	16.5	13.5
Stone, Clay & Glass	-0.1	7.1	1.3	3.0	4.1	3.2
Petroleum and Coal Prod.	7.8	-1.8	5.8	0.4	0.1	0.4
Chemicals	4.0	1.6	3.5	2.3	5.7	2.9
Other manufacturing	2.0	1.8	1.9	0.4	-2.5	-0.3
Transportation & Warehousing	1.9	1.7	1.8	1.7	1.6	1.7
Communications & Utilities	1.0	3.7	2.0	4.0	1.7	3.1
Wholesale trade	1.8	1.9	1.9	2.9	7.2	4.5
Retail trade	0.1	3.8	1.5	0.9	4.8	2.4
FIRE[f]	1.4	1.0	1.2	1.7	3.4	2.4
Total Economy	1.0	1.8	1.3	1.3	2.4	1.7

[a] Real GDP per worker.
[b] 1995-1997 for detailed Canadian manufacturing industries.
[c] 1987-1997 for detailed Canadian manufacturing industries.
[d] Including primary textile mills, apparel and other textile products.
[e] Computer and office equipment are included in machinery in the United States and in electrical & electronic equipment in Canada.
[f] Finance, insurance and real estate.

Sources: Statistics Canada and U.S. Bureau of Economic Analysis.

Table 2: Labour Productivity* Growth in Selected OECD Countries

Countries	1987-1995	1995-2000**	1987-2000***
Australia	1.2	2.2	1.6
Austria	2.3	2.1	2.2
Belgium	2.0	1.5	1.8
Canada	1.0	1.7	1.3
Denmark	1.7	1.8	1.7
Finland	2.6	2.9	2.7
France	1.7	1.3	1.5
Germany	2.0	1.1	1.5
Greece	1.0	2.8	1.7
Iceland	-0.6	2.7	0.7
Ireland	3.5	3.9	3.7
Italy	2.4	0.9	1.8
Japan	1.9	1.5	1.7
Luxembourg	4.4	4.8	4.6
Netherlands	0.9	1.0	1.0
New Zealand	1.3	1.6	1.4
Norway	2.9	1.3	2.3
Portugal	2.2	2.2	2.2
Republic of Korea	4.9	4.2	4.6
Spain	1.8	-0.3	1.0
Sweden	2.2	2.1	2.1
Switzerland	0.5	1.2	0.8
Turkey	1.8	3.8	2.6
United Kingdom	1.7	1.4	1.6
United States	1.3	2.4	1.7

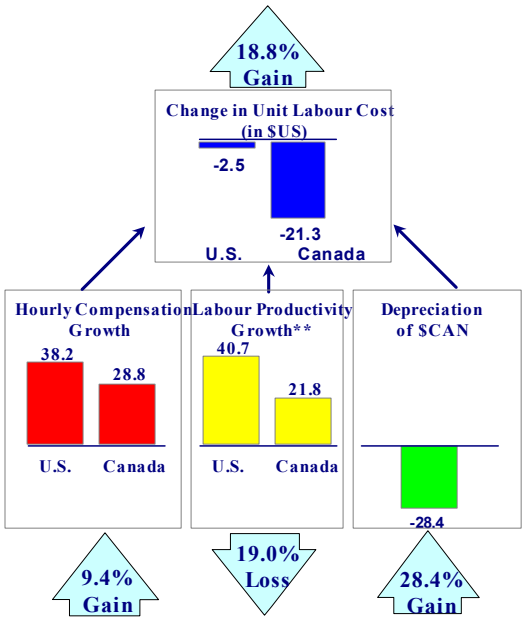
*Real GDP per worker
**1991-1995 for Germany
***1991-2000 for Germany
Source: OECD Economic Outlook, January 2003.

Table 3
Educational Attainment, Per Thousand of Employed Persons
Relative Position of Canadian Manufacturing Industries, U.S.=100

Industry	**1-3 Years post-secondary education**		**University degree or above**	
	1987	**1998**	**1987**	**1998**
Food & Kindred Products	105.9	153.3	49.6	60.4
Rubber & Plastic	109.0	175.3	47.4	50.3
Textile Mill	62.0	204.7	106.7	53.6
Primary Metals	129.5	189.7	63.5	54.8
Fabricated Metal	144.0	195.0	49.4	50.3
Machinery, Except Electrical	136.0	161.7	59.9	61.3
Transportation Equipment	108.9	148.5	36.5	49.1
Electrical & Electronic	167.9	151.2	64.3	93.0
Non-metallic	102.9	175.1	40.6	36.7
Refined Petroleum & Coal	169.2	150.6	64.0	52.1
Chemicals & Allied	134.6	143.9	77.5	95.5
Clothing, Hosiery Industries	97.5	146.1	30.3	44.6
Lumber & Wood	119.2	184.9	56.0	38.2
Furniture and Fixture	123.9	162.0	49.5	53.7
Paper	132.4	213.4	63.6	59.0
Printing	114.2	140.8	54.8	51.1
Total Manufacturing	117.6	152.9	53.7	59.8
All Industries	130.7	153.3	65.2	67.5

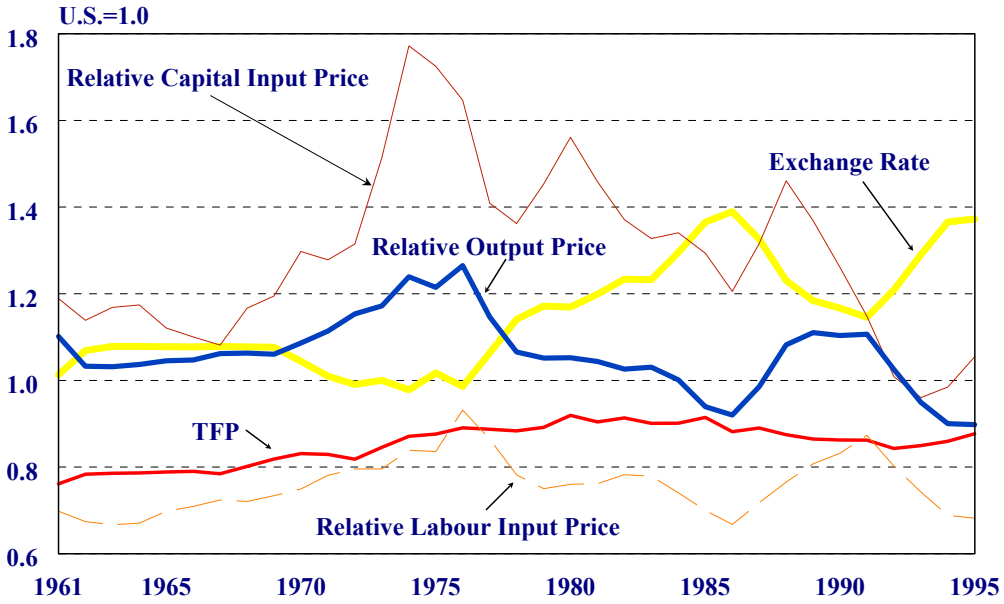
Sources: Rao, Tang, and Wang (2002).

Figure 1
Cumulative Change in Unit Labour Costs in Manufacturing: Canada and the U.S., 1990-2001 (Percent)*



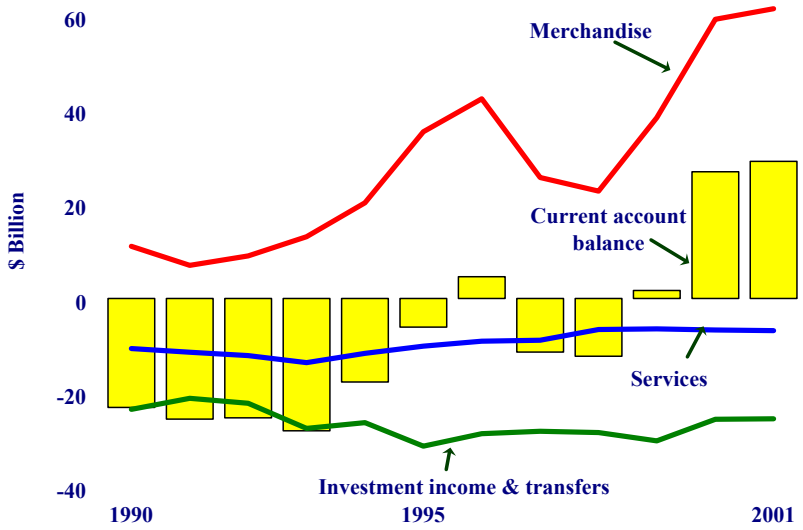
* Based on logarithmic decomposition.
** Growth in real value added per hour worked.
Source: US Bureau of Labour Statistics

Figure 2
Relative Productivity and Competitiveness between Canada and the U.S. for the Private Business Sector



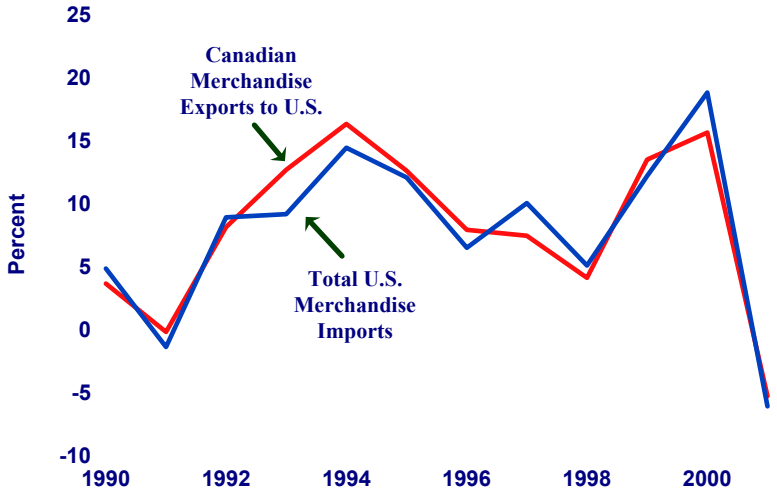
Source: Lee and Tang, 2000, "Productivity Levels and International Competitiveness Between Canadian and U.S. Industries," *American Economic Review* (Papers & Proceedings), 90(2), pp.176-79.

Figure 3
Current Account Balance by Category



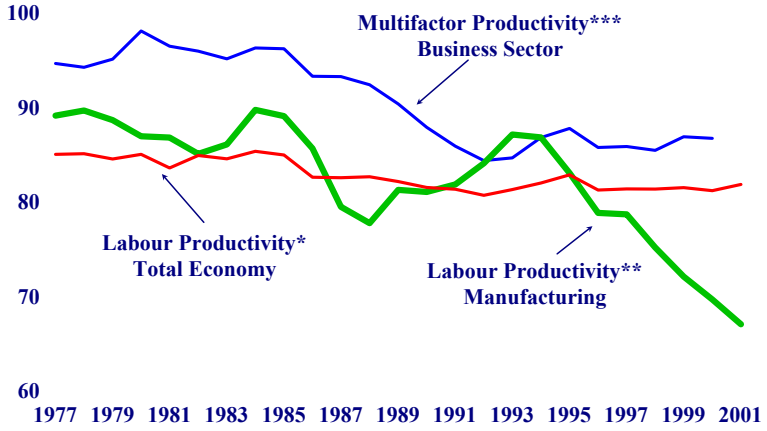
Source: Compilations based on Statistics Canada data

Figure 4
Growth Rate of Total U.S. Merchandise Imports and Canadian Merchandise Exports to U.S.



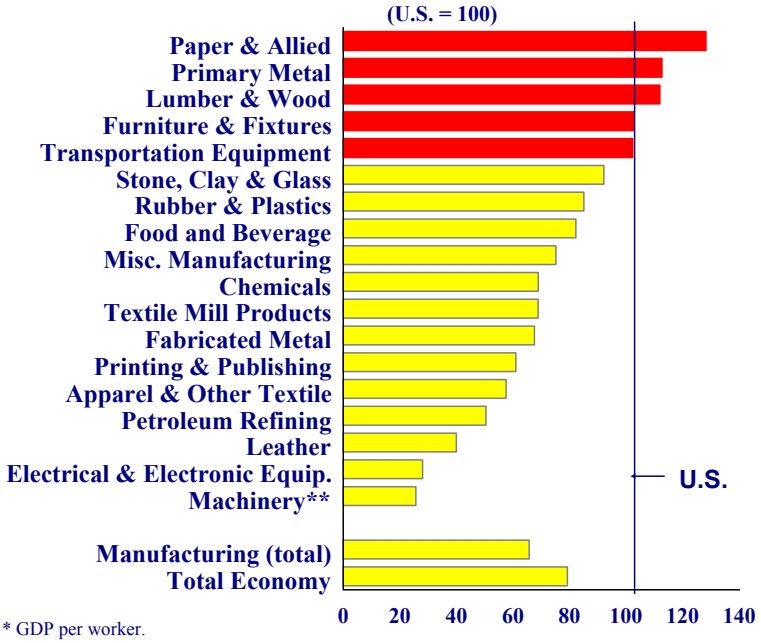
Source: Compilations based on data from U.S. International Trade Commission

Figure 5
Relative Productivity Levels in Canada (U.S.=100)



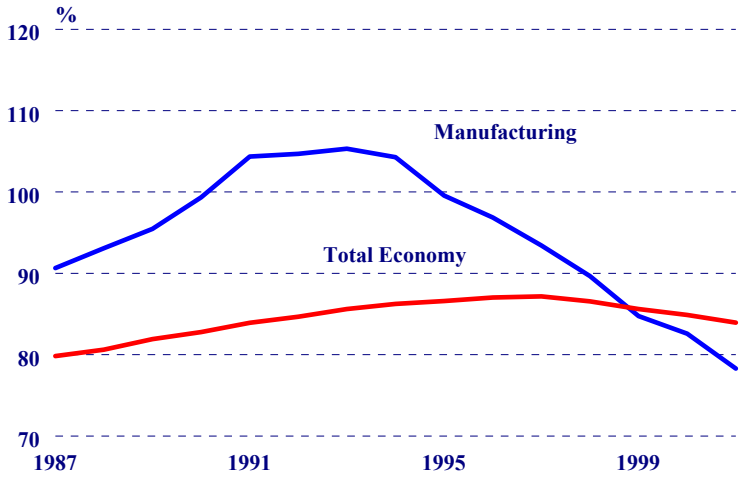
*Real GDP per hour worked, PPP based.
**Real GDP per hour worked, derived by extending a benchmark estimate (79.4) in 1987 (de Jong, 1996) using real GDP per hour worked indexes from U.S. Bureau of Labour Statistics.
***Derived by extending the estimate (87.7) in 1995 (Lee and Tang, 2001) to the 1981-2000 period, using indexes from Statisitcs Canada and U.S. Bureau of Labour Statistics, and then extended back to 1977 using estimates from Lee and Tang (2000).
Sources: Statistics Canada, U.S. Bureau of Labor Statistics, and U.S. Bureau of Economic Analysis

Figure 6
Relative Labour Productivity* of Canadian Industries, 2000



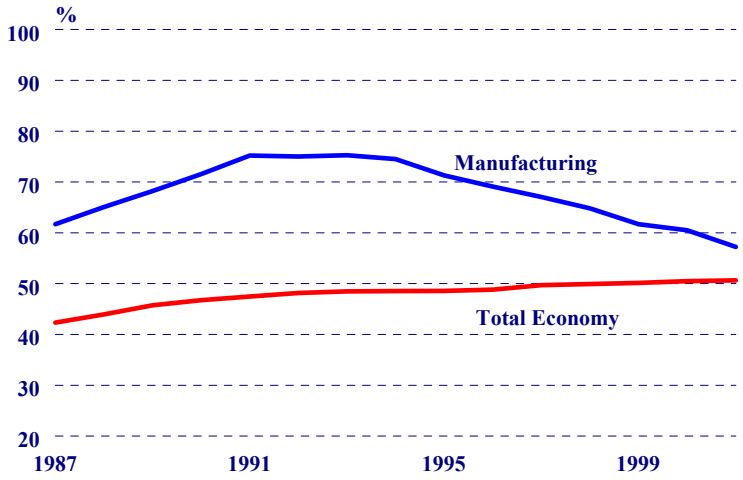
* GDP per worker.
** Machinery includes computer and office equimpment industry.
Source: Industry Canada computations based on data from Statistics Canada, U.S. Bureau of Economic Analysis, and OECD STAN.

Figure 7
Capital Intensity* (U.S.=100): 1987-2001



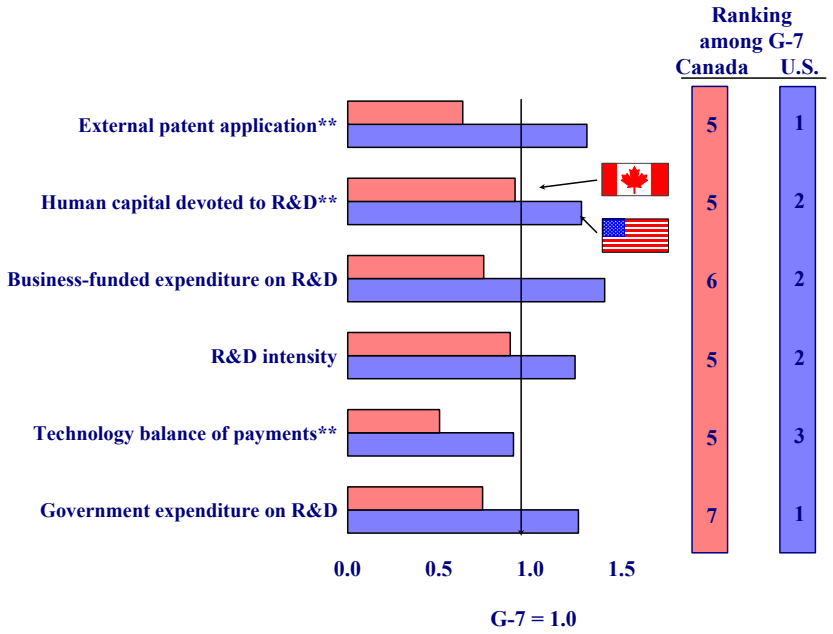
*Capital (M&E and structure) stock per worker (capital investment PPP based)
Source: Statistics Canada and U.S. Bureaul of Labour Statitistics.

Figure 8
M&E Capital Intensity* (U.S.=100): 1987-2001



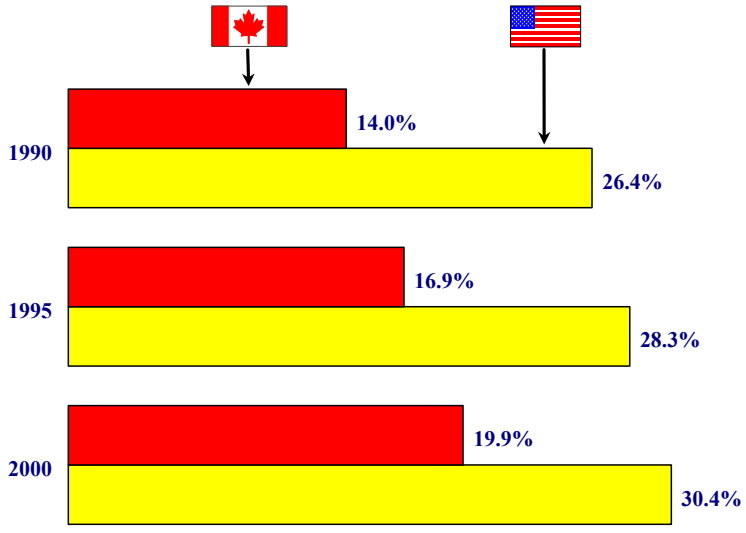
*M&E capital stock per worker (M$E investment PPP based)
Source: Statistics Canada and U.S. Bureaul of Labour Statitistics.

Figure 9
Canada's Innovation Performance
(Standing Relative to the Simple Average of G-7, 2000*)



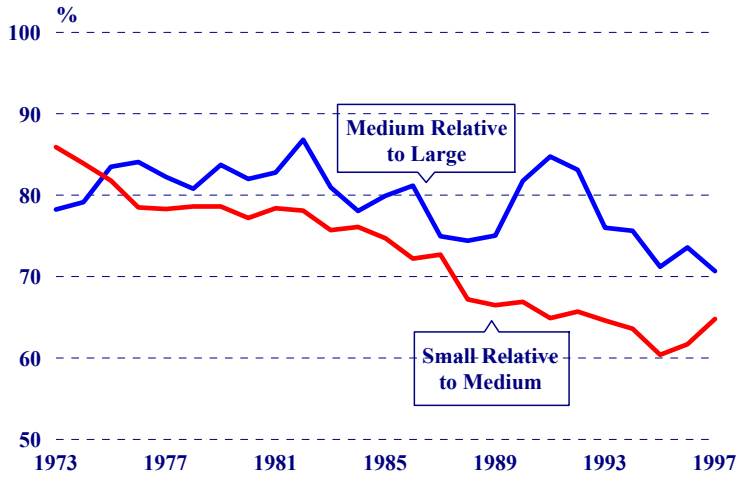
* or latest year available
**Adjusted by the size of labour force
Source: OECD, Main Sicence and Technology Indicators, 2002-1

Figure 10
Percentage of Labour Force (Aged 25-64) with
a University Degree or Above in Canada and the U.S.



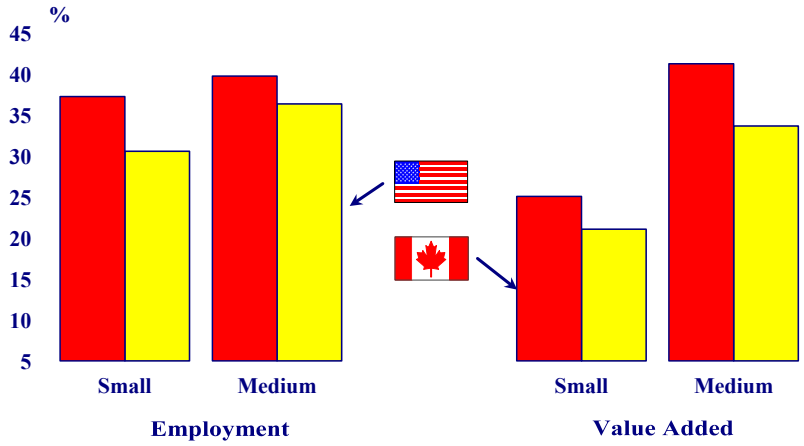
Source: Someshwar Rao, Jianmin Tang and Weimin Wang, 2002, "The Importance of Skills for Innovation and Productivity," *International Productivity Monitor*, No. 4.

Figure 11
Labour Productivity* Level by Plant Size in the Canadian Manufacturing Sector, 1973-1997**



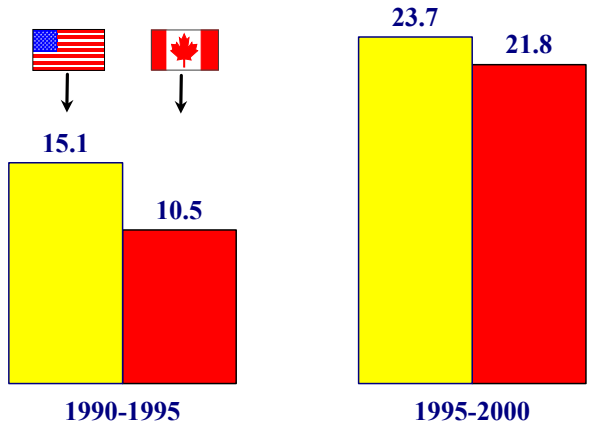
*Value added per worker
**Small: 0-100 employees; medium:101-500 employees; large: 500 or more employees.
Source: John Baldwin, Ron S. Jarmin and Jianmin Tang, 2003, "Small North American Producers Give Ground in the 1990s," (forthcoming) *Small Business Economics*.

Figure 12
Employment and Value Added Share by Plant Size* for Manufacturing, 1997



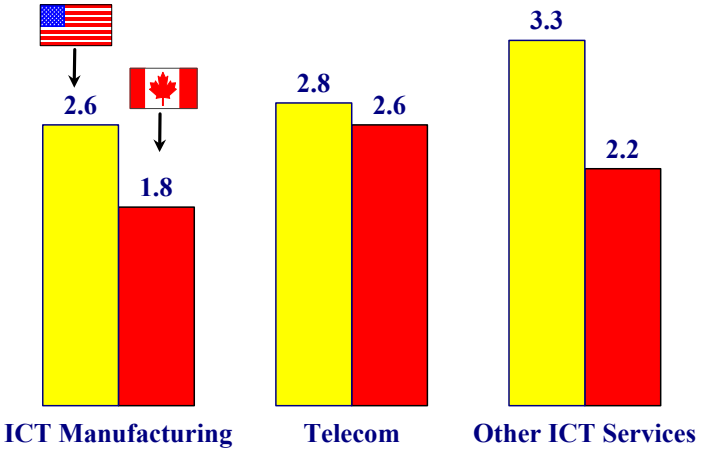
*Small: 0-100 employees; medium:101-500 employees; large: 500 or more employees.
Source: John Baldwin, Ron S. Jarmin and Jianmin Tang, 2003, "Small North American Producers Give Ground in the 1990s," (forthcoming) *Small Business Economics*.

Figure 13
Labour Productivity* Growth in ICT Producing Manufacturing**
(% per year)



* GDP per worker
**ICT producing manufacturing consists of computers, fiber optics, semiconductors, communication equipments, radio and TV equipments, and instruments.
Source: van Ark, Inklaar and McGuckin (2003).

Figure 14
Value Added Share of the ICT Sector in the total Business Sector (percent), 1998



Source: Lee and Pilat, 2001, "Productivity Growth in ICT-Producing and ICT-Using Industries: A Source of Growth Differentials in the OECD?" OECD working paper, DSTI/EAS/IND/SWP(2000)3/REV1.