DOES CANADA NEED A PRODUCTIVITY BUDGET?

Canada's productivity performance in low-end manufacturing is actually pretty good, thanks to the Canada-US Free Trade Agreement. At the high end, however, we trail the Americans in product innovation. The solution is more funding for basic research conducted in a fully open way. The integrity of the patent system could also be restored at little budgetary cost. The only productivity policy that would cost lots is a tax cut to stem the brain drain. A social policy focused on keeping our cities livable would help accomplish the same end.

La performance du Canada en termes de productivité dans le secteur manufacturier est somme toute assez bonne, grâce à l'Accord de libre-échange canado-américain. Pour ce qui est de l'innovation toutefois, nous sommes à la remorque des Américains. La solution consiste à mieux financer la recherche fondamentale et que celle-ci s'effectue d'une façon tout à fait ouverte. Il serait par ailleurs possible de rétablir l'intégrité du système de brevets sans qu'il en coûte des sommes astronomiques au gouvernement. La seule politique susceptible d'entraîner des coûts prohibitifs est une réduction de l'impôt pour mettre un frein à la fuite des cerveaux. Une politique sociale qui viserait à maintenir un mode de vie agréable dans nos villes accomplirait le même résultat.

Daniel Trefler

By all reports, Canadian productivity is lagging. We are among the least productive of the major industrialized countries and are in danger of falling even farther behind. Yet we do not have a deep understanding of the causes of Canada's lagging productivity. Indeed, analysts do not even share a common understanding of the term "productivity." The policy stakes in the current debate about productivity are high: Many of the proposed solutions are expensive and will divert limited public funds away from projects such as early childhood education, where the bang for the buck is known to be large. The purpose of this paper is to embed the productivity debate within the larger question of whether Ottawa should bring down a productivity budget or a budget for babies.

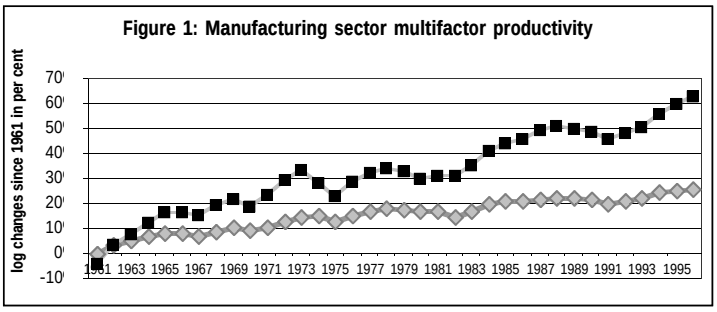
Productivity is an emotive word. I remember as a child how my parents would argue about whether housework is "productive." Times (mercifully) change. Today no one would deny the productivity of housework. For economists, however productivity usually is not an emotive word. To understand it, imagine an assembly line that produces cars with labour and materials. Productivity is said to be rising if over time cars are produced with less labour and/or materials. I will argue later that such a definition (which focuses on standard measures of economic income) is too narrow for current policy debates. But let me first take heed of a Sherlock Holmes' admonition: "It is a capital mistake to theorize before you have all the evidence."

Two facts about Canadian productivity have come to dominate current discussions. First, that the level of productivity is lower in Canada than in the United States. Second, that productivity growth is lower in Canadian manufacturing than in American. Not only are we not catching up to our competitors, we're actually falling behind. Let's take a look at these facts.

There is little doubt that Canadian productivity is lower than American productivity, though exactly how

much lower depends on how you measure it. In 1998, Statistics Canada reports, output per hour worked was 15 per cent lower in Canada than in the United States. By contrast, the OECD says the Canada-US productivity gap is 35 per cent. It gets this much larger number by looking at output per worker, not per hour. Since, partly because of our higher unemployment rate, Canadian workers average fewer hours per year, it's not surprising that they do better in per hour rather than per worker comparisons. The OECD also converts Canadian dollars into US dollars by using the current exchange rate. Because the Canadian dollar is undervalued, doing the calculation this way undervalues Canadian output. So 35 per cent is probably too big a gap. Still, there is no doubt that a gap exists and that it has real consequences. One of the few hard facts of economics is that earnings of workers are determined by productivity. In view of the Canada-US productivity gap it is not surprisingly that Canadian real income per capita is 20 per cent lower than in the US.

Figure 1: Manufacturing sector multifactor productivity



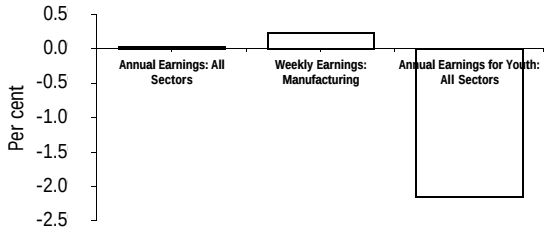
Source: *The Daily*, March 23, 1999, Statistics Canada.

Turning to the alleged growth of the productivity gap, since 1980 Canadian productivity has in fact grown faster than US productivity. To be precise, the gap is closing at the rapid clip of 0.25 per cent a year. (This is the number for "multifactor productivity," the change in net economic output less the change in all inputs, including hours worked, capital, energy, materials and services.) That's the good news. The bad news is that this number is dominated by growth in service sector productivity, which is notoriously hard to measure.

A very different picture emerges from looking at the manufacturing numbers (whose quality is much higher). Although manufacturing accounts for only one-fifth of the economy, I hope to persuade you that it displays trends which reflect what is going on in the wider economy. Figure 1 shows that, since 1980, US manufacturing productivity has been growing much faster than Canadian manufacturing productivity — almost one per cent per year faster. Lagging productivity growth is mirrored in lagging earnings growth. As Figure 2 shows, Canadian earnings have been growing no faster than 0.25 per cent per year since the early 1980s. The earnings picture is particularly bleak for youth aged 16-24, a point to which I will return.

It is the universal view among bank economists and the business press that lagging Canadian productivity is pervasive, infiltrating all sectors of manufacturing. This has led to any number of crazy conclusions, including the idea that Canadians are lazy, hiding behind an undervalued dollar, and victims of free trade. In fact, manufacturing is not uniformly lagging in productivity. Figure 3 shows that almost all of our productivity woes come from two industries: "electrical and electronic products" and "industrial and commercial machinery." The first is primarily computers, one of the most technologically innovative sectors. The second industry, machinery, is the link

Figure 2: Earnings 'growth' per year since the early 1980s



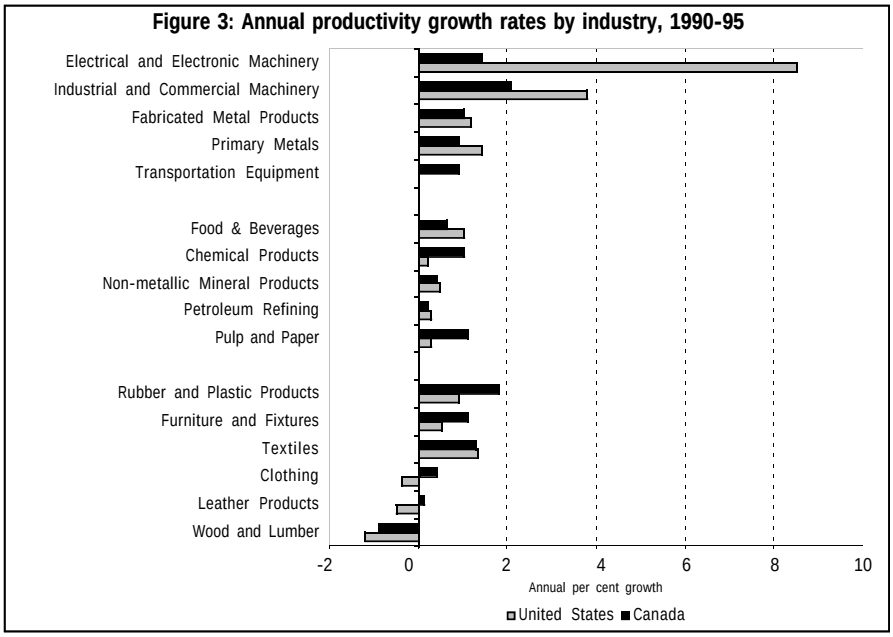
Source: Author's calculations using data from Cansim and G. Picot, "What is Happening to Earnings Inequality and Youth Wages in the 1990s?", *Canadian Economic Observer* (September 1998), Statistics Canada, Cat. no. 11-010-XPB.

between innovative activity and commercialized final products. If I have a single message it is this: Canada's productivity gap is a product innovation gap.

In general, there are two types of innovations: product innovation and process innovation. Product innovation, as its name implies, involves the introduction of new products. At the top of Figure 3 are the high-end manufacturing industries such as computer and material science-based industries. Such industries tend to be product innovators. In most of the industries, Canadian productivity growth has not kept abreast of US developments. That is, Canada is not as competitive as the US in industries where product innovation is central.

By contrast, process innovation involves reductions in the cost of producing existing products. At the bottom of Figure 3 are the low-end manufacturing industries such as leather goods and clothing. Such industries tend to be process innovators. In most of them, Canada has been able to cut costs more effectively

Figure 3: Annual productivity growth rates by industry, 1990-95



Source: *The Daily*, March 23, 1999, Statistics Canada.

than the United States. Canadian firms do apparently know how to cut costs, but we are not as good as US firms at developing and marketing new products.

There is an immediate implication of this observation. Since there is no across-the-board productivity crisis, across-the-board explanations are senseless. In particular, Canadians are not lazy, they are not hiding behind an undervalued dollar, and they are not victims of free trade.

What, then, is the source of Canada's product innovation gap? The answer is: a combination of low R&D expenditures, failure to tap into the US knowledge base, and slow rates of technology adoption. Let's examine these in turn.

R&D expenditures: US R&D expenditures are 2 per cent of GDP, much higher than the Canadian level of 0.75 per cent. Can this difference explain the productivity gap? Higher US R&D translates into higher US productivity growth in innovative sectors. Of course, because Canadians piggy-back on US research efforts, it also raises Canadian productivity. Thus, it is an open question as to whether higher US R&D created the US Canada productivity gap. Fortunately, Elhanan Helpman of the Canadian Institute for Advanced Research (CIAR) has investigated this point in some detail. He has estimated that a 0.5 per cent rise in US R&D would raise US productivity by 6.7 per cent and, via piggy-backing, raise Canadian productivity by 2.4 per cent. In other words, US productivity growth in innovative industries would be almost three times higher than Canadian growth. The prediction is bang on and fingers low Canadian R&D as one source of the productivity gap.

The Canadian knowledge pool: The patent system is designed to walk a fine line between protecting innovators from imitators while at the same time making innovators' ideas publicly available so that others may build on them. Canadians have certainly exploited the knowledge pool created by the US patent system. Manuel Trajtenberg of the CIAR developed a novel way of tracking this. When Canadian firms take out a patent in the United States, they are legally required to cite all related older US patents. Trajtenberg calculated that between 1977 and 1993 Canadian patents taken out in the US cited US patents 15,000 times. This is hard evidence of Canadian piggy-backing. The problem is that Canadians cite US patents much less than expected — only 65 per cent as often as US patents cite previous US patents. Canadian firms clearly are not fully exploiting the knowledge made public by the US patent system.

The Helpman and Trajtenberg analyses operate at the macro level. To be credible, it's necessary to see how they play out at a micro level. One useful piece of evidence comes from technology adoption rates. Figure 4 examines adoption of the most common technologies by Canadian and US firms in five advanced industries (machinery, electronic and electric equipment, transportation equipment, instruments and fabricated metal products). In 1989, Canadian adoption rates were everywhere lower than

in the United States. Further, there is little evidence that by 1993 Canadian firms had caught up. The implications are not surprising. In survey data, 35 per cent of Canadian firms in advanced industries say they consider themselves to be behind their US competition and only 20 per cent think they are ahead. In contrast, when all manufacturing industries are surveyed (including low-end, less-innovative industries) Canadian firms do not complain about a competitive gap. Thus, in high-end industries, where product innovation is crucial, there is a technology adoption gap that translates into a competitive disadvantage. The same is not true in low-end manufacturing where process innovation is dominant.

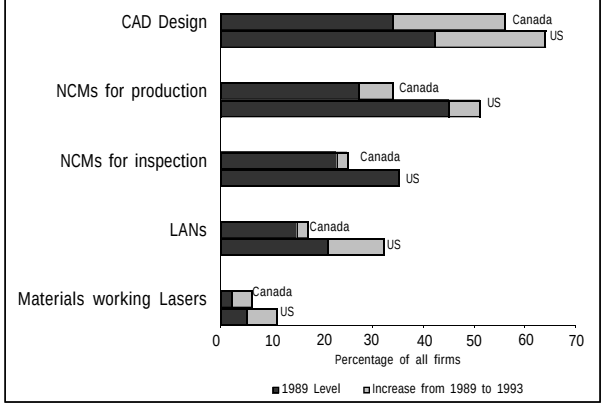
A second piece of evidence comes from a study of the factors explaining the success of small- and medium-sized enterprises (SMEs) in Canada. As shown in Figure 5, labour skills and management skills generally were not important in explaining firms' success. What ranked highest was the capacity for innovation (as measured by "R&D capability" and "technology ability"). Access to markets, a reference to international trade, was next most important. Delving deeper into successful technology strategies of SMEs, the single most important factor is developing new technology. In short, the key to success is technological innovation combined with market access. Yet technology innovation is a Canadian weak spot.

Current thinking has it that Canada has been the victim of free trade, and that foreign direct investment is relegating Canada to the status of a branch-plant economy. There is some truth to these assertions. But the real world is far more complicated.

If, as Figure 5 suggests, market access is central to firm success, has the the Canada-US Free Trade Agreement (FTA) helped? The business establishment seems convinced that the FTA made no difference to Canadian productivity and that tariff elimination has not closed the productivity gap. Closer inspection shows this to be wrong. We have seen that productivity growth was faster in Canada than in the United States for low-end manufacturing industries — precisely the industries that experienced the largest tariff cuts under the FTA. Tariff cuts evidently have contributed to closing the gap.

I recently looked at this question in considerable detail, using evidence for over 200 Canadian manufacturing industries. The statistical design controlled for long-term industry trends, US productivity trends, and macroeconomic fluctuations. Figure 6 summarizes the main finding relevant here. For industries that experienced average tariff cuts, the FTA raised productivity by 0.6 per cent per year over the 1988-95 period. In industries that experienced large tariff cuts, productivity grew by 1.5 per cent per year. These are very large numbers. The FTA boosted productivity further by reallocating workers and investment out of low-end manufacturing and into high-end, product-innovation oriented manufacturing. By the narrow criterion of raising productivity, the Canada-US trade deal must be judged a success.

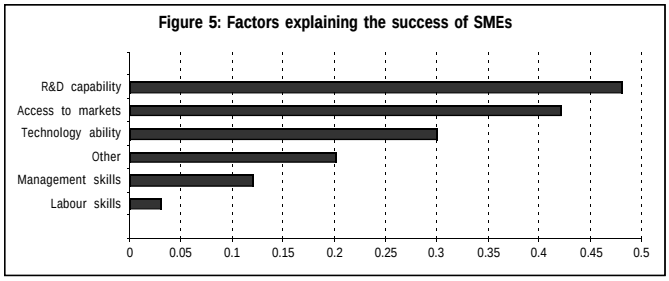
Figure 4: Technology adoption



Source: Baldwin and Sabourin, "Technology and Competitiveness in Canadian Manufacturing Establishments," *Canadian Economic Observer* (May 1996), Statistics Canada Cat. no. 11-010-XBP.

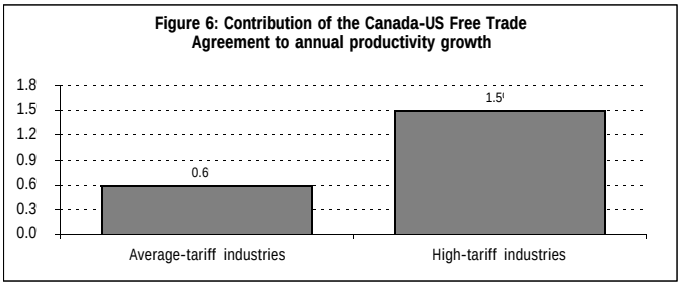
What about foreign direct investment? US firms are buying up Canadian plants at an unprecedented rate and are at least partially returning Canada to branch-plant status. Without the opportunity to exercise decision-making, Canadian management will atrophy. Stories abound among human resource officers about the Canadian executive who makes a mistake and is fired by the US head office. No thought is given to training the manager on how to do his job properly.

Figure 5: Factors explaining the success of SMEs



Source: Baldwin, Rafiquzzaman and Chandler, "Innivation: The Key to Success in Small Firms," *Canadian Economic Observer* (August 24), Statistics Canada Cat. no. 11-010.

But there is also a positive spin on US FDI into



Source: Trefler, "The Long and Short of the Canada-US Free Trade Agreement," Industry Canada, 1999.

Canada. US firms bring with them a knowledge base that is often unavailable to Canadians. As a result, Canadian affiliate plants of US multinationals are more productive than similar Canadian-owned plants. Evidence to that effect appears in Figure 7, which reports results that control for firm size as well as other background differences across industries. I am willing to bet that a similar picture would emerge if one were to examine Canadian firms that go the multinational route: They are undoubtedly more productive than their host-country counterparts. By implication, Canada should be not be worried by outward or inward FDI.

At the moment, a number of policy responses to the productivity gap are currently being considered. They could (and should) all be examined in detail, but for present purposes I only want to point out that none is perfect and some are likely to be counter-productive.

First, what not to do: Canada's productivity gap is not uniformly spread across manufacturing. It is a product innovation gap effecting high-end, not low-end manufacturing. This puts the lie to a number of claims and policy prescriptions. In fact, Canadians are not lazy. We are not hiding behind an undervalued dollar. We are not victims of free trade. Rising foreign direct investment into and out of Canada is not a problem. The solutions to our problems lie in a very different direction.

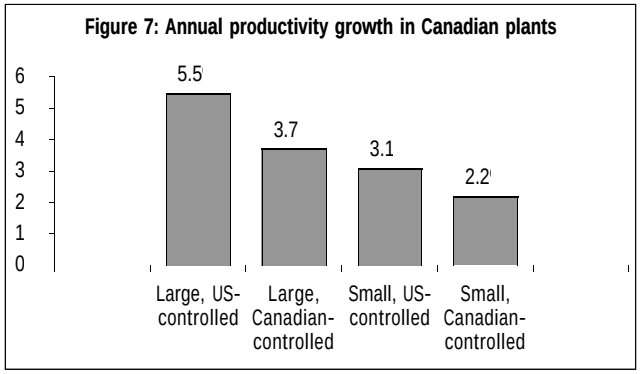
Subsidies to R&D are clearly important. Canada must continue to put money into R&D, but exactly how is more complicated. Our R&D tax provisions for large firms are the most generous in the OECD and cost upwards of $2.5 billion for the R&D tax credit alone. More thought must be given to subsidies for small firms, however. We must also recognize that we are rapidly losing our leading edge in basic research. It is mistaken to think that we can piggy-back on US research efforts. Without the expertise here in Canada, the significance of US scientific breakthroughs will not be understood until US firms have already commercialized them — which is too late.

Federal and provincial governments have done well to offer matching fund programs for projects involving links between the university and private sectors. However, it must be understood that such projects are not a substitute for basic research. They are often narrowly conceived and profit-oriented. For example, had Canadian research into superconductivity followed the example of profit-centred Bell Labs in the United States, Canada would not have emerged as the world leader in superconductivity research and applications.

As Peter Howitt of the CIAR has noted, innovation is a process of creative destruction. New products do enhance our well-being, but not always by very much. A cure for a previously incurable carcinoma yields incalculable benefit. But much of what passes for research is jockeying for position in a market that is saturated with similar products. This has led to a disturbing distortion of the patent system. Distressingly, firms are finding expensive, litigious ways of circumventing public disclosure of their inventions, thereby redirecting funds away from real R&D, retarding open science, and making innovation more expensive. It is up to Canadian policy makers to redress the apparently increasing bias against open science.

In return for access to the patent system, firms should be forced to disclose their knowledge base. And they must be prevented from using the legal system to suppress the knowledge base of others. It amazes me how little discussion there is of such issues. Putting the patent system back on solid ground is a cheap policy. It largely involves changes to the legal and institutional environment. But we must act now before we are forced into a corner, both by the corporate drive for profits and by our WTO commitments on intellectual property.

Another thorny policy issue that has implications for productivity is the brain drain. On the one hand, it



Source: J. Baldwin and N. Dhaliwal, "Labour Productivity Differences Between Domestic and Foreigh-Controlled Firms in the Canadian Manufacturing Sector." Paper presented at the "Policy Research: Creating Linkages" Conference, Ottawa, October 1-2, 1998.

effects only a small number of sectors. On the other hand, proposed solutions involve tax breaks to all or at least most of the rich. There are some well-conceived attempts to find compromises that would dampen the induced rise in income inequality, though one cannot help but notice how the tax-cut agenda has captured this issue.

The reactive approach may be summarized as follows. In the last year Canada has allocated $1 billion to new R&D funding. Continued modest increases are needed until private and public R&D in Canada rises by one per cent of GDP to the OECD average. This funding should be partly directed towards basic science and entirely directed towards open science. We must also focus on a cheap policy: the elimination of legal and institutional impediments to open R&D in this country.

The definition of productivity that I have been using derives an important advantage from its narrowness: an individual's productivity so measured is highly correlated with the individual's earnings. The disadvantage is in what it ignores. For example, our productivity measure ignores the unemployed, the physically and emotionally unhealthy, and those in the informal sector, such as stay-at-home moms. Being unemployed or being brought up in a dysfunctional family not only prevents an individual from working at his or her productive capacity, it also contributes additional overhead costs to society in the form of expensive benefits, inequality, crime, poor public school outcomes for the middle class, and other quality of life compromises. Here my narrow definition of productivity and my income-based measure of the standard of living must give way to more general definitions of productive capacity and quality of life.

Thanks to Ontario's recent McCain-Mustard report, we are all aware that early childhood experiences have long-term implications for an individual's productive capacity in the labour force. We also know that early interventions provide a big bang for the buck What is less understood is that Canadians under 25 are a productivity time bomb for Canada. Since peaking in the late 1970s, earnings of males under 25 have declined by 30 per cent. Paul Beaudry of the CIAR has shown that freshly minted high school graduates earned more in 1968 than freshly minted university graduates do now. Further, the dispersion in wages among the young is far greater today than it was in the summer of love. In effect, we are telling our young people that they will not have the same control over their careers that all previous generations had, and that they will remain low in the workplace "dominance hierarchy" until all older generations retire. The resulting diminished expectations and lack of control over personal outcomes cut into youths' coping skills and their incentives to invest in individual productivity. The road we are on begins with reduced productive capacity for our youth and ends with a future productivity crunch for our country.

Let me conclude by way of reminder to those in Ottawa currently battling over whether to bring down a productivity budget or a budget for babies and youth. On the one hand, we need policies that provide our high-end manufacturing firms with incentives to innovate. Only this will eliminate the Canada-US productivity gap. Luckily, the necessary incentives are relatively inexpensive. They involve modest funding increases for open, basic science and the elimination of legal and institutional impediments to socially valuable R&D. Only the brain drain poses expensive challenges. On the other hand, we must recognize that there is a longer-term threat to our productivity associated with deteriorating public schools, inequitable labour market outcomes for our young, and nascent poverty that leads to street crime. Here there is a congruence of means for solving both the brain drain and our longer-term productivity woes. It is best described in Anne Golden's *Report of the Mayor's Homelessness Action Task Force*: "The economic argument is clear. Toronto's ability to compete as a city-region in the new global economy depends on the quality of life here. Toronto has been ranked as one of the best cities in the world in which to live and work ... Because quality of life is one of the main factors in that ranking, the growth in homelessness puts at risk our ability to compete."

Don't be fooled by Golden's focus on a single social issue: Homelessness is a window on the many societal problems that downgrade our quality of life and contribute to brain drain. It is critical to recognize that the same high quality of life that keeps skilled, innovative people in Canada also helps our children, our youth, and our poor. We need a productivity budget that modestly increases R&D spending on basic, open science and focuses on the institutional and legal framework surrounding innovations. Such a budget is relatively cheap and leaves resources available for proactive child and youth solutions. In short, we need a productivity budget that tosses out the bathwater of fiscal excess, but keeps the baby.

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