Industry Canada Industrie Canada

Micro

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Micro-Economic Policy Analysis Branch Bulletin

In this issue...

FEATURES

DISTINGUISHED SPEAKERS SERIES

A closer look at productivity

The last issue of *MICRO* looked at several papers focusing on the productivity gap between Canada and the United States, and the serious consequences that this gap has for Canada's income levels and standard of living. In this issue of *MICRO*, we keep our focus on productivity. But in contrast to the broad scope of some of the studies reported on earlier, those reviewed here deal with more specific aspects of the productivity issue.

Steven Globerman of Washington State University looks at the linkages between technological change and productivity growth. Industry Canada staff members Someshwar Rao and Jianmin Tang compare the productivity of Canadian-controlled manufacturing firms with that of their foreign-controlled counterparts. Raynauld Létourneau and Martine Lajoie, also of Industry Canada, examine income levels and productivity performance in Canada and the United States at the regional level.

This issue also reports on several lectures given in the context of Industry Canada's Distinguished Speakers Series: Nobel laureate Franco Modigliani speaks on European unemployment, Paul Milgrom of Stanford University looks at spectrum auctions, and Daniel Trefler of the University of Toronto talks about productivity in Canada.

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No. 9: *Is Canada Missing the "Technology Boat"? Evidence from Patent Data,* Manuel Trajtenberg.

WORKING PAPER SERIES

No. 31: *Are Canadian-Controlled Manufacturing Firms Less Productive than their Foreign-Controlled Counterparts?* Jianmin Tang and P. Someshwar Rao.

No. 32: *The Canada-US Productivity Growth Paradox,* Serge Coulombe.

OCCASIONAL PAPER SERIES

No: 22: *A Regional Perspective on the Canada-US Standard of Living Comparison,* Raynald Létourneau and Martine Lajoie.

No. 23*: Linkages Between Technological Change and Productivity Growth*, Steven Globerman.

RESEARCH IN PROGRESS

Industry Level Productivity and International Competitiveness between Canada and the United States, Dale W. Jorgenson and Frank C. Lee, editors.

Investment and Productivity Growth–A Survey From The Neoclassical And New Growth Perspective, Kevin J. Stiroh.

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Linkages Between Technological Change and Productivity Growth

The search to explain Canada's stagnating productivity performance relative to that of the United States has given rise to various possible explanations, including a long-standing concern in Canada about the relatively small amount of research and development carried out by Canadian-based firms as well as a slowdown in the rate of technological change in developed countries generally. But the linkages between technological activities and productivity changes are complex and difficult to measure. In an effort to shed some light on these linkages and identify promising areas for further research, Steven Globerman reviews and synthesizes the relevant literature in Industry Canada's Occasional Paper No. 23, *Linkages Between Technological Change and Productivity Growth*.

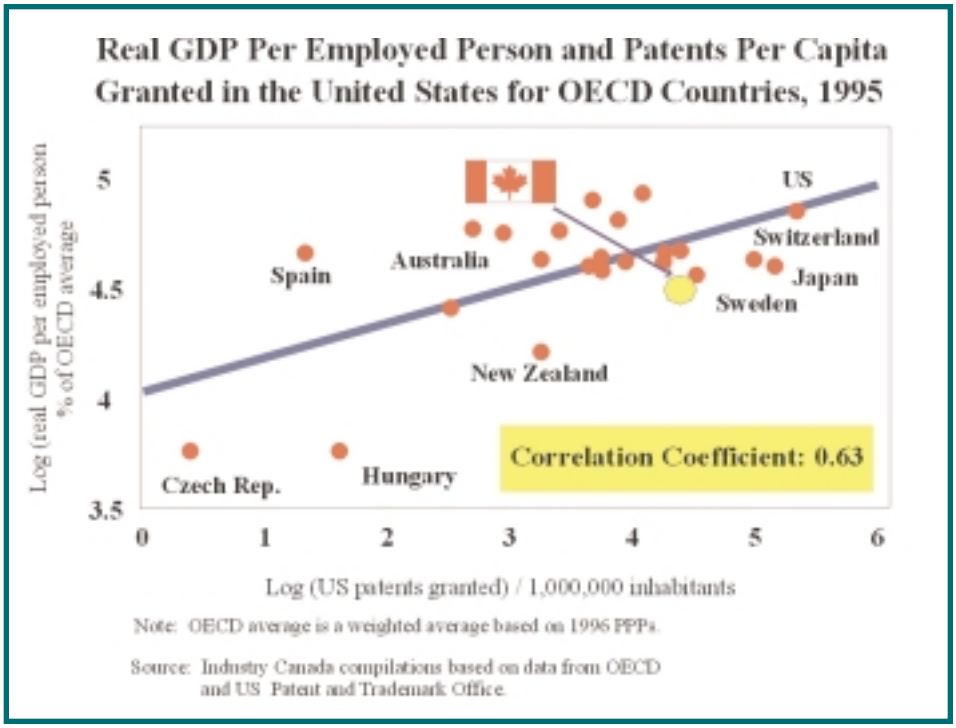
Globerman notes that there is a fair degree of consensus on several issues. One is that technological change indeed makes a major contribution to productivity growth. A second point of broad consensus is that social rates of return to R&D (and innovation, more generally) exceed private rates of return by a substantial margin, and that international technology spillovers are especially important for smaller countries such as Canada. A third point of agreement is that the domestic economic climate influences the linkages between technological change and productivity growth. For example, the adoption of new technology, as well as the benefits derived from new technology adoption, will depend on domestic economy attributes such as the exposure of domestic industries to competition, the general educational level of the work force, and the availability of venture capital, among other things.

"....international trade and foreign direct investment are important channels for the global distribution of new technologies..."

Steven Globerman
Washington State University

A fourth point of on which there is wide consensus is that government-funded R&D has significant spillover benefits in the private sector, although Globerman cautions that most of the evidence pertains to US government activity, and that the results may be idiosyncratic to the experience of an individual government. A fifth point of agreement is that formal intellectual property protection is an important determinant of technological behaviour in only some industries. Globerman also reminds us that virtually all economists recognize that the measurement of both productivity change and technological change raises difficult problems and that, most likely, "official" estimates are seriously biased.

As for the gaps in our knowl-



edge and the need for further economic research, Globerman concludes that, from both a Canadian and an international perspective, we know relatively little about the linkages between technological change and productivity growth in major public sector activities such as health care and education. As the author notes, despite the suggestion that advances in information technology are a major source of future productivity growth in service industries, most available studies of the linkages between technological change and productivity growth focus on manufacturing industries and agriculture. Similarly, most of our understanding of international technology spillovers is associated with the experience for manufacturing industries. Globerman concludes that, given the size and policy importance of service sectors such as health care and education, the relative lack of information about international technology spillovers linked to these activities is a serious shortcoming and that, consequently, policy makers would benefit from an examination of the role of technological change in those areas.

Finally, given the importance of international technology spillovers to Canadian productivity growth, he calls for research that would attempt to contrast and compare the role of Canadian universities with that of US universities in promoting and enhancing the linkages between technological change and productivity growth.

Are Canadian-Controlled Manufacturing Firms Less Productive than their Foreign-Controlled Counterparts?

Canada has participated actively in the globalization of business and investment that has characterized the international economy in recent years. Both theoretical and empirical research strongly suggest that an increase in foreign direct investment (both inward and outward) leads to trade expansion, increases technology and knowledge exchange, and improves productivity. Despite Canada's growing trade and investment orientation, however, its productivity and real income performance have been lagging behind that of other members of the OECD. More worrisome, the Canada-US manufacturing labour productivity gap has widened considerably since 1985.

As might be expected, Canada's weak productivity record in the 1990s has attracted considerable attention among policy makers, the media, and academics. Some observers have actually blamed freer trade and the growing trade and investment orientation of the Canadian economy for the observed widening of the productivity gap. In an effort to shed some light on this issue, Someshwar Rao and Jianmin Tang explore the role of foreign-controlled firms with respect to Canada's poor manufacturing productivity record in Industry Canada's Working Paper Number 31, *Are Canadian-Controlled Manufacturing Firms less productive than their Foreign-Controlled Counterparts?*

"Foreign investment was not responsible for Canada's poor productivity performance in the 1990s."

Someshwar Rao and Jianmin Tang
Industry Canada

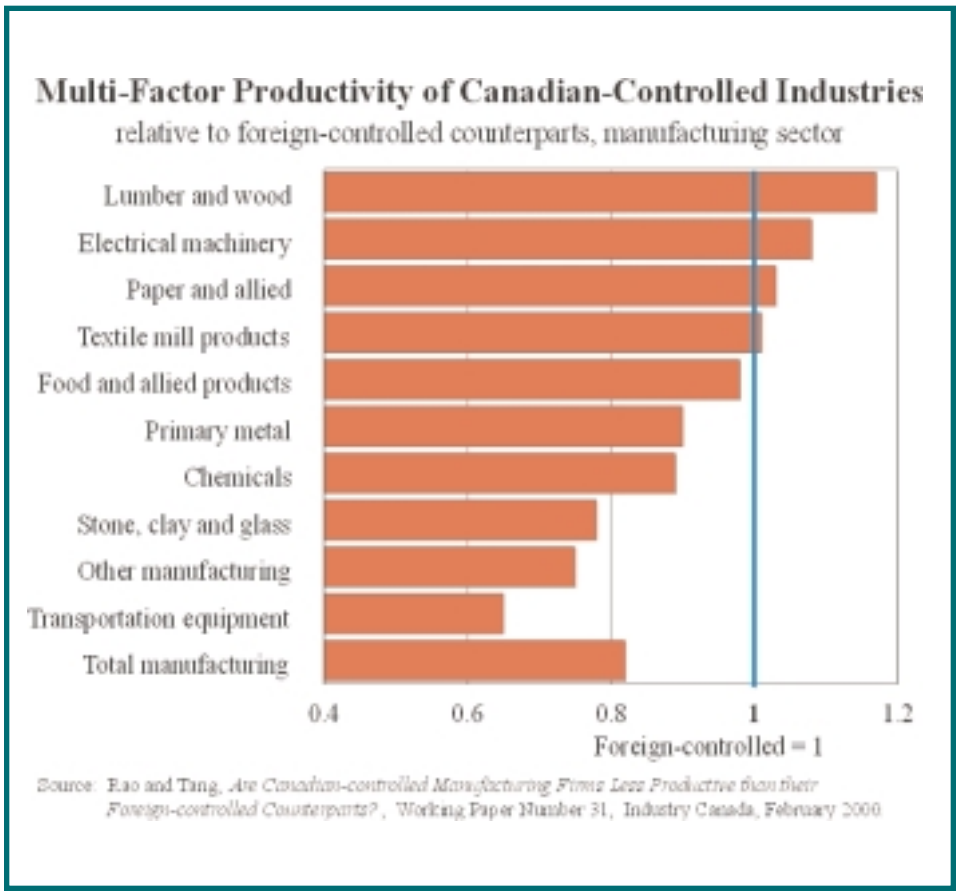
The authors try to answer three important questions:

- Are foreign-controlled manufacturing firms more (or less) productive than Canadian-controlled ones?
- Did the productivity gap widen (or narrow) during the 1990s?
- What factors explain (or do not explain) the difference in productivity performance?

They analyze multi-factor productivity measures and find that, on average, Canadian-controlled manufacturing firms were 25 percent less productive than foreign-

controlled firms during the 1985-88 period. The gap in MFP levels, however, narrowed to 16 percent over the 1989-95 period. Testing for differences in labour quality, firm vintage, unionization, export orientation, firm size, and industrial structure revealed that these elements were not responsible for the superior productivity performance of foreign-controlled firms.

These results lead the authors to conclude that foreign ownership is not responsible for the widening of the Canada-US productivity gap in manufacturing. On the contrary, they argue that without the greater foreign direct investment orientation, the gap would have been wider. One policy implication of their results is that Canada needs to rethink foreign ownership restrictions in several sectors where such restrictions are currently applied. As well, they note that previous studies suggest that superior managerial practices and strategies, and technological know-how may account for the large differences in productivity observed between Canadian- and foreign-controlled manufacturing firms in Canada.



A Regional Perspective on Canada-US Standard of Living Comparisons

Most comparisons of standards of living between Canada and the US focus on the national perspective. On the other hand, comparisons at the provincial level are generally restricted to a Canadian context. In Industry Canada's Occasional Paper Number 22, entitled *A Regional Perspective on the Canada-US Standard of Living Comparison*, Raynald Létourneau and Martine Lajoie combine these approaches by presenting a comparison between Canadian provinces and US states, for both the standards of living and productivity levels.

"All US regions post a standard of living well above the Canadian average."

Raynald Létourneau and Martine Lajoie
Industry Canada

The authors find that all Canadian regions have an income and productivity gap when compared to the United States and that the standards of living of Canada's provinces are well behind those of US states.

They note that, at a national level, the standard of living is 22 percent higher in the US, on aver-

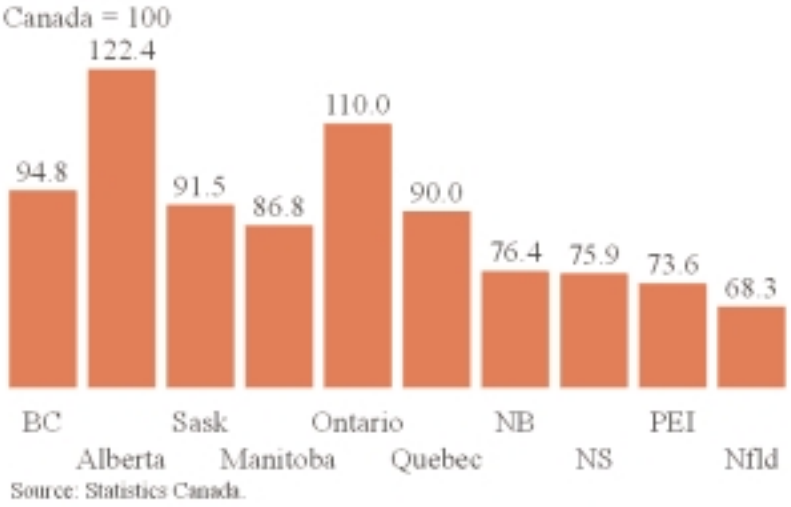
age, than in Canada. In addition, all US regions post a standard of living well above the Canadian average. The gap with the highest income region, New England, reaches up to 40 percent. Even the US region with the lowest standard of living–the Southeast–leads the Canadian average by 10 percent.

At the state and provincial level, only seven US states recorded standards of living below the Canadian average. As a result, Canadian provinces tend to rank at the lower end of the spectrum relative to their US counterparts. The best Canadian performer, Alberta, ranks 18th among the 60 states and provinces, while Ontario is in 37th place. In fact, most Canadian provinces are concentrated at the bottom of the list.

The authors argue that productivity is the predominant factor explaining income gaps among provinces and states, a conclusion supported by findings at the national level. As a result, they conclude that differences in employment rates play a limited role in explaining these gaps and, therefore, do not influence final rankings. When they turn their attention to the productivity rankings of provinces and states, a picture similar to that of the standard of living emerges: except for Alberta and Ontario, Canadian provinces appear at the bottom of the list.

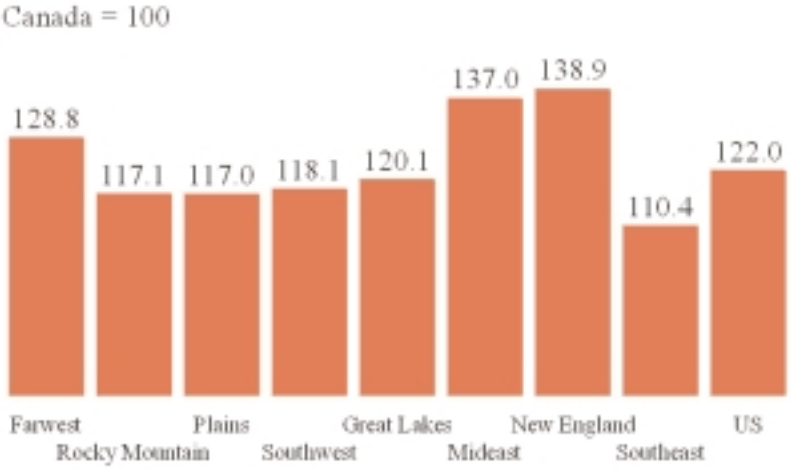
This study illustrates empirically the extent of the income and productivity gaps between Canada and the US, gaps that have important implications for Canada's competitiveness in an era of growing Canada-US economic linkages.

Standard of Living, Canadian Provinces, 1995-97



Source: Statistics Canada.

Standard of Living, US Regions, 1995-97 Average



Source: Bureau of Economic Analysis, Bureau of Labor Statistics and Statistics Canada.

Combinatorial bidding for radio spectrum and other assets

Paul Milgrom
Stanford University

The reform of telecommunications regulations and rapid growth in new telecommunications applications in recent years has seen a shift to the use of auctions to allocate licences for radio spectrum. On October 15, 1999, Paul Milgrom, one of the designers of these auctions, examined the theory and practice of designing auctions in a lecture entitled *Combinatorial bidding for radio spectrum and other assets*.

Professor Milgrom reviewed the introduction of auctions and noted how some early experiences had been embarrassing for the governments involved, because of the poor design of the auctions process. Some resulted in different prices for similar licenses in the same market, and others resulted in winners paying much less than they were willing to pay.

Because of the problems encountered in these early auctions, when US authorities proceeded to auction parts of the spectrum in 1994, they used a method known as the *simultaneous ascending auction* which provided for successive rounds of sealed bids. The auction design incorporated notions of economic theory as well as recommendations from economists theorists, including Professor Milgrom. It was generally considered highly successful, in particular for raising revenues through the sale of licenses. The lessons learned in these auctions were subsequently applied in Canada's own successful spectrum auctions.

"...designing real auctions raises important practical questions for which current theory offers no answers."

In spite of this success, the speaker argued in his lecture that the simultaneous ascending auction still suffers from some shortcomings. Most notably, such auctions can make it difficult to achieve an efficient outcome when bidders who regard alternative bands of spectrum as complements are competing against bidders who regard them as substitutes. For example, an incumbent firm which already owns spectrum rights may only bid on limited additional spectrum to increase bandwidth or block entry by a competitor. A new entrant, on the other hand, may need to acquire substantial blocks of spectrum to achieve an efficient scale of operation.

In view of this, Milgrom argued that further refinements to the bidding process should be incorporated in future auctions. In particular, he argued for a system of *dynamic combinatorial bidding* that would permit bidding on a package of items, with winning bids being those that maximize total revenue. He conceded, however, that even with such refinements, some bidders could make strategic bids to exaggerate the relative value of larger packages, in effect, playing "chicken" with other bidders. He concluded that further refinement of the rules covering the composition of bid packages would be needed before a combinatorial approach could be fully workable.

- *Some early spectrum auctions led to inefficient outcomes in the form of different prices for the same product and to bidders paying much less than they were willing to.*
- *Simultaneous ascending auctions, which include successive rounds of sealed bids, were very successful in dealing with some of these problems.*
- *But these types of auctions can make it difficult for bidders who regard alternative bands of spectrum as complements rather than substitutes.*
- *A system of combinatorial bidding might be better because it would allow bidders to place spectrum lots into efficient groups as part of the auction.*

An Economists' Manifesto on European Unemployment

Franco Modigliani
MIT

While extended economic growth in North America has seen rates of unemployment drop to their lowest levels in many years, parts of Europe continue to experience persistent high unemployment. On May 21, 1999, Nobel laureate Franco Modigliani addressed the causes of this unemployment in a lecture entitled *An Economists' Manifesto on European Unemployment*, presented as part of Industry Canada's Distinguished Speakers Series.

"...unemployment is the most serious and urgent problem facing the European Union."

Professor Modigliani argued that unemployment is the most serious problem facing the European Union at present, but that many policy makers have adopted the position that it is beyond the capacity of governments to manage, except at unacceptable cost and at the risk of greater inequality. He contended instead that continued high unemployment results from inappropriate macroeconomic and labour policies and it was in fact possible to bring down unemployment by changing those policies.

The speaker reviewed the situation in Europe and contrasted it with that in North America. He pointed out that in the 1960s, unemployment in Europe was not higher than that in the US. He asked what had changed to create the divergence in unemployment rates and explained that European governments had made a commitment to monetary union and had established criteria for convergence to enable this policy initiative. In his view this meant that central banks had to match an excessively restrictive monetary policy established by the dominant German central bank. The situation was further aggravated by the reunification of Germany, to which the Bundesbank responded with further tightening, prompting more restrictive monetary policies elsewhere in Europe.

- *There is a misconception that unemployment in Europe is beyond the capacity of governments to manage, except at an unacceptable cost.*
- *High unemployment in Europe results from restrictive monetary policy adopted in preparation for monetary union, coupled with inflexible labour markets.*
- *Proposed solutions such as work-sharing, early retirement and minimum wage legislation are not appropriate.*
- *Instead, a more promising approach would see a reform of labour market policies with a view to increasing flexibility, combined with measures to stimulate investment.*

He noted as well that European governments have adopted a series of labour market policies that resulted in a very rigid labour market. It has become very difficult and costly to lay workers off, so firms have been reluctant to hire. This has been disproportionately hard on young people looking for their first job. Also, the structure of various unemployment and disability benefits has made workers reluctant to return to work. In addition, very high social security levies make it very costly to hire workers.

Professor Modigliani reviewed a number of proposed solutions, such as work-sharing schemes, early retirement and minimum wage legislation, and rejected them as inappropriate. He argued instead for a coordinated reform of European labour markets to make them more flexible and to make it more attractive for employers to hire new workers, particularly younger people. He pointed out the the United Kingdom and the Netherlands, which had already undertaken some of these reforms were reaping the benefits in the form of lower unemployment. Similarly, he proposed a reform of social security systems which would have the added benefit of making it less expensive to recruit new workers.

He also suggested that to be effective, these labour market reforms would have to be coupled with incentives to increase investment, to give a greater stimulus to growth. Specifically, the European Central Bank must concentrate on expanding employment, not just focus on price stability.

Professor Modigliani concluded that it is not beyond the capacity of governments to deal with persistent high unemployement in Europe, but that they had to display some ingenuity and use the price system appropriately.

Explaining Canada's Lagging Productivity

Daniel Trefler
University of Toronto

Since the 1980s Canada and the US have diverged with respect to productivity growth in manufacturing. Starting from a higher level of productivity, the US has enjoyed persistently higher productivity growth than Canada, with the result that Canada is falling even further behind its southern neighbour. On September 14, 1999, Daniel Trefler examined the manufacturing productivity gap in a lecture entitled *Explaining Canada's Lagging Productivity*.

Trefler reviewed various estimates of productivity growth and observed that although one might argue about the precise numbers, it is clear that Canada lags the US in manufacturing productivity and is losing ground. When we look at productivity at an industry sector level, however, a different picture emerges. The US shows high productivity growth in sectors such as electrical and electronic machinery, and industrial and commercial machinery, both heavily reliant on computers and characterized by high rates of new product innovation.

Canada's productivity growth, on the other hand, outstrips US productivity growth in sectors such as textiles, clothing and leather goods and furniture. The speaker characterized these sectors as very sensitive to price/cost margins, where you have to cut costs to do well. He concluded from this observation that Canada is in fact very good at process innovation while the US excels at new product innovation.

"Canadians are just not thinking [in terms of] new products."

Professor Trefler pointed to the significance of this as demonstrating that Canada's problems are not systemic–that they are not due to laziness, sheltering behind a low dollar, the effects of free trade, unionization, or any of the other generalized explanations of Canada's lagging productivity. According to him, we are suffering from a deficit in product innovation, rather than a systemic problem.

He suggested a number of policy responses. The first, which he classified as "reactive" policies, include attempting to raise R&D expenditures as a share of GDP to US levels. This, however, could be very costly, and would benefit primarily large firms. Therefore, he argued that increases in public expenditures on R&D incentives should be kept modest, in the order of $1billion, and used to increase basic research and to support the concept of "open science" to improve knowledge diffusion. Similarly, tax cuts to deal with the brain drain would also be very costly and lead to growing income inequities.

Much more important, in Trefler's view, would be less costly but more proactive policies, such as restoring the integrity of the patent regime by beefing up the legal framework to prevent the circumvention of openness which has crept into the system. He also argued for proactive policies in the form of investment in skills through education and in the health of the work force as key to longer term improvement in productivity and the quality of life enjoyed by Canadians. He concluded that in the search for innovation and new products, skills will be a key factor.

- *Canada lags the US in manufacturing productivity and has been losing ground in recent years.*
- *In some sectors productivity growth in Canada, however, outstrips that in the US, particularly in process innovation, but it trails behind in high-end product innovation.*
- *The problem, therefore, is not systemic to the entire Canadian economy.*
- *The solution is to allocate more funding for basic research to improve knowldege diffusion. The integrity of the patent system, a key driver of product innovation, could also be restored at little budgetary cost.*

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