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Forthcoming Industry Canada Research Volume on The Asia Pacific Region in the Global Economy: A Canadian Perspective

International trade is the lifeblood of the Canadian economy. Exports and imports of goods and services presently represent close to 85 percent of Canada's real GDP, and their importance in the Canadian economy has been increasing very rapidly.

Canada's international commerce has been dominated by the United States. Canada could benefit a great deal by developing stronger investment and trade links with non-U.S. countries.

The greatest opportunities for this diversification are in the Asia Pacific Region: by the year 2000, this region is expected to account for over 25 percent of world GDP.

Industry Canada's forthcoming research volume will fully examine the Asia Pacific opportunities and challenges from a Canadian perspective. The 14 individual research papers cover a wide spectrum of economic issues ranging from trade and investment, to environment, tourism, immigration, and the implications of policy developments in the region for Canada's commercial and innovation policies.

Productivity Growth in Canadian Communications Equipment and Manufacturing

Advances in technological knowledge, achieved mainly through investment in research and development (R&D), are a prime determinant of productivity growth in Canadian manufacturing over the long term. In a study recently released by Industry Canada, Jeffrey Bernstein of Carleton University, writes that R&D capital accumulation in one segment of the economy influences productivity growth in other industries. An industry's productivity growth, therefore, depends on its own R&D activities and on those of other knowledge-generating industries. This, notes Bernstein, has stimulated a growing interest in the sources of R&D spillovers. High-tech industries, in particular,

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exhibit relatively high rates of productivity growth and are important sources of R&D spillovers. In his study, Bernstein focuses on firms operating in the Canadian communications and other electronic equipment industries.

The study has three main objectives:

- to estimate the effects of R&D spillovers from the communications equipment industry on the structure of production or factor intensities in the Canadian manufacturing sector. The effects of spillovers from U.S. manufacturing are also examined.
- to analyze productivity growth in Canadian manufacturing as a whole and determine the sources of that growth, including spillovers from the communications equipment industry and the U.S. manufacturing sector. The study also looks at the productivity performance of communications equipment in Canada.
- to estimate the private and social rates of return to R&D capital. Private rates of return measure the benefits that accrue to those engaged in R&D activities, while social rates measure gains to all the users of the investment.

Findings and conclusions

- Between 1966 and 1991, the rate of productivity growth in communications equipment was 150 percent higher than in manufacturing. Unlike manufacturing, the communications equipment industry did not experience a productivity slowdown in the post-1973 period. Scale economies linked to output growth accounted for 65 percent of all productivity gains in the industry, according to Bernstein.
- As a source of R&D spillovers, the communications equipment industry affects the production structure of the whole manufacturing sector. In particular, these spillovers reduce factor intensities associated with physical capital, labour, and intermediate inputs, while increasing knowledge intensity in manufacturing.
- The communications equipment industry is also a source of important productivity gains in Canadian manufacturing. This contribution even increased during the post-1973 period, when Canada experienced an overall productivity slowdown. Bernstein shows that communications equipment spillovers had a moderating influence on the erosion of productivity performance in Canadian manufacturing.
- In relative terms, the effects of R&D spillovers from U.S. manufacturing are even greater than those from the Canadian communications equipment industry, accounting for 76 percent of the average annual rate of productivity growth in Canadian manufacturing. Bernstein reckons that R&D capital inputs in Canadian and U.S. manufacturing are substitutes.
- When the effects of these spillovers are combined, expanding R&D capital in communications equipment will increase R&D intensity in manufacturing. In turn (and all other factors being equal), this reduces the need for further R&D expansion in communications equipment.
- Spillovers from the U.S. electrical products industry increase R&D intensity in the Canadian communications equipment industry. R&D capital stocks in these two industries are therefore complementary. In addition, R&D capital in the U.S. electrical products industry has a greater impact on the production structure of the Canadian communications equipment industry than does R&D capital in Canadian manufacturing.
- Bernstein estimates the social rate of return to R&D capital in the communications equipment industry to be about 55 percent, or 225 percent higher than the private rate of return. In manufacturing, the differential is estimated at 21 percent, or 24 percent. These differences suggest that there is an underinvestment in R&D in communications equipment, but the industry is not unique in that regard; there are other manufacturing industries where social rates of return to R&D capital also exceed the private rates.

What should government do?

While he does not support a return to "picking winners," Bernstein does have a number of policy suggestions for government:

- Encourage R&D investment through policy incentives that focus on R&D capital formation; these policies should not be directed at particular industries.
- Provide information to facilitate joint ventures aimed at new product development and promote joint research or "laboratory" ventures.
- Amend legislation and regulation in order to lower transaction costs associated with joint ventures.
- Reduce the regulatory burden on producers to encourage more indirect means of internalizing the spillovers arising from R&D.
- Use tax expenditures and tax subsidies to encourage R&D capital formation.
- Take into account R&D spillovers in any analysis of the relative costs and benefits of government tax policies aimed at R&D investment, in order to understand the full benefits associated with these policies, not only in encouraging R&D investment, but also in contributing to improved living standards through higher rates of productivity growth.

Long-run Perspective on Canadian Regional Convergence

Most of the income convergence that has occurred since the mid-1970s has been brought about by taxes and transfers, according to Serge Coulombe of the University of Ottawa and Frank Lee of Industry Canada. Moreover, they say in a recently released working paper, factor mobility may have reached its limit in helping to reduce regional disparities within the existing Canadian economic structure, and only taxes and transfers (and possibly other government programs) are left to close regional gaps further.

In their examination of the long-term evolution of regional disparities in per capita incomes in Canada, Coulombe and Lee take a broad view, first surveying the numerous empirical studies of convergence across OECD countries and regions that have been published since the late 1980s. Many of these studies document convergence among OECD countries during the 1870-1913 period; they note that income convergence subsided between 1914 and 1945 but resumed its course after World War II.

Until the 1990s, the general view on the persistence of large regional economic disparities in Canada was somewhat pessimistic. In recent years, however, many empirical studies devoted to this subject have somewhat altered the conventional wisdom regarding the persistence of these regional disparities.

Income per capita: a provincial overview

The authors discuss the evolution of the provinces' per capita incomes over the period studied. By far the poorest province when it joined Canada in 1949, Newfoundland has made quick progress since then, and its per capita income today is close to the average for the other Atlantic provinces. In Prince Edward Island, the catch-up process appears to have steadied since the early 1950s. After the shock of World War II, relative incomes of New Brunswick and Nova Scotia also began a steady catch-up process in the early 1950s.

Relative per capita incomes in Quebec, the second largest province, decreased throughout the 1930s and early 1940s, but started climbing slowly from World War II until the mid-1970s. On the other hand, relative per capita income in the richest (and biggest) province, Ontario, remained steadily at 20% above the Canadian average from the early 1930s to the early 1970s; the gap has since narrowed.

Manitoba remained closed to the Canadian average until the end of the 1950s, but its relative per capita income has steadily declined since. In Saskatchewan, the evolution has been very volatile, driven by the success of crops and the evolution of

relative prices of agricultural products. The collapse of relative agriculture prices in the 1930s had a particularly devastating effect on the economy of that province.

Until the mid-1940s, Alberta's economy depended on agricultural products and its relative personal income per capita followed much the same path as that of Saskatchewan. The pattern became smoother with the rapid expansion of the petroleum industry in the postwar period, but Alberta's relative per capita income rose and fell again between 1975 and the 1990s, in line with changes in the relative prices of oil and natural gas. Until very recently, the diversified resource-based and export-oriented economy of British Columbia generated per capita incomes above the Canadian average.

Income convergence

Neo-classical growth theory suggests, say Coulombe and Lee, that within regions with similar technology and preferences, the catch-up process of poor regions to rich ones follows a smooth, transitional dynamic path altered only temporarily by random shocks. Based on four different concepts of per capita income (earned income, personal income minus government transfers, personal income, and personal disposable income), the authors show that this theory is not representative of the convergence process observed among Canadian provinces since 1926.

There is no evidence of convergence for the nine provinces prior to the entry of Newfoundland into Confederation in 1949. All four types of per capita income began to converge after 1950, but there is no evidence that convergence has occurred with respect to earned income and personal income minus government transfers since 1977. Thus, say the authors, taxes and transfers have been the main contributors to income convergence over the past two decades.

World Mandate Strategies for Canadian Subsidiaries

What factors contribute to the success of the world product mandates of foreign-owned subsidiaries in Canada? How competitive are these subsidiaries in domestic and world markets? In a recently released working paper, Julian Birkinshaw, of the Institute of International Business and the Stockholm School of Economics, examines how world product mandates are obtained and how they are related to various aspects of subsidiary performance.

Three key factors

- According to Birkinshaw, the key predictors of world mandate success are the subsidiary's internal attributes and, most critically, its upstream capabilities – i.e., research and development (R&D) and manufacturing.
- World product mandates are gained through two types of subsidiary initiatives, says Birkinshaw. Internal initiatives are associated with tight integration and an entrepreneurial subsidiary culture; external initiatives, with high autonomy, R&D capabilities, and strong leadership.
- Mandate performance is related to that of the subsidiary as measured by "subsidiary value-added," which is a qualitative estimate of its contribution to the corporation.

Implications of findings for public policy.

- As Birkinshaw sees it, mandate success is driven from within the subsidiary rather than by the nature of the parent/subsidiary relationship. This conclusion points to the importance of nurturing an entrepreneurial business culture in Canada's foreign-owned industrial sector.
- Subsidiaries with world product mandates seem to develop in industries with a relatively low level of Canadian competition – an unexpected result, writes the author. This finding suggests that Canadian subsidiaries are better at gaining "niche" mandates in relatively uncompetitive industries than at gaining leading-edge

mandates in those industries in which Canada has a stronger presence.

Market Framework Policies in APEC Economies

Intellectual property protection has been a source of considerable friction among members of the Asia Pacific Economic Cooperation (APEC) group over most of the past decade. These tensions, writes Ron Hirshhorn, an economic consultant, largely reflect differences in perspective between net exporters and net importers of goods that embody intellectual property (IP) rights. While APEC members have implemented some important IP changes in recent years, a number of economies still have some distance to go in order to meet international requirements. There are also gaps in some areas of IP enforcement within APEC.

IP protection is one of a number of market framework policies that are the focus of debate among trading countries. The rapid growth of foreign direct investment (FDI) and the dominant role of transnational corporations in the globalization process are creating new challenges in the design of these policies. In his recently released discussion paper, Hirshhorn examines how policies aimed at achieving national goals have the potential to undermine growth and welfare maximization objectives in an interdependent world. Large differences in market framework laws and policies and in their implementation among the trading partner economies could distort the allocation of FDI and other productive resources, create trade frictions and conflicts, slow down the integration process, and reduce the extent to which countries could individually and collectively benefit from the activities of transnationals.

An effective competition policy promotes innovation, provides greater consumer choice, improves product quality, and lowers prices to consumers. Liberalized trade and investment policies can increase domestic competition, but while competition and FDI are complements in principle, they may collide in practice. For instance, an overly restrictive merger legislation in APEC member economies would discourage FDI and slow down economic integration in the region. Similarly, transnational corporations, with their specialized assets and enormous economic power and networks, could exert considerable market power and engage in anti-competitive activities.

Adequate protection of intellectual property rights – in the form of trademarks, copyrights, patents and industrial designs – would stimulate innovation, improve economic efficiency and facilitate economic integration within APEC. On the other hand, inadequate IP protection will retard innovation and dynamism, slow down the integration process, and increase conflicts and frictions among APEC member economies. At the same time, IP protection has the potential to increase the monopoly power of the producers of brands, literary and artistic works, and new products and processes. Accordingly, the member economies need to take into account the interests of both producers and consumers in deciding how much protection should be granted to intellectual property.

These two issues – competition policy and intellectual property rights – are very important to APEC because FDI has played a key role in the integration of its member economies. Hirshhorn examines in some detail potential problems and possible solutions in these two key policy areas.

He expresses three major concerns with regard to competition policy in APEC. First, a number of Asian economies do not have competition legislation. He notes, however, that in Hong Kong and Singapore the dominance of foreign trade and investment has limited the potential for anti-competitive practices. Second, significant differences in competition policy approaches and enforcement have, on occasion, been a major source of friction among APEC member economies. Third, export agreements and other anti-competitive

practices tend to be assessed almost entirely in terms of their impact on domestic residents, although they may also affect other APEC member economies.

APEC members have a common interest in reducing frictions and creating an environment that is conducive to freer movement of capital and technology. In this context, Hirshhorn suggests some broad guidelines that could serve as a guide to APEC's future strategy in the areas of competition policy and IP rights. He argues that in view of the vast economic, social, and cultural differences among APEC members, harmonization is not a realistic goal. Instead, they should agree on certain standards and benchmarks with regard to the scope and coverage of competition and IP policies, on a system of effective enforcement, and on a dispute settlement mechanism.

On competition policy, Hirshhorn believes APEC members could learn from, and build upon, the work being done at the Organisation for Economic Co-operation and Development (OECD) and the United Nations Conference on Trade and Development (UNCTAD). He also recommends that APEC explore the possibility of working on a strategy that would ultimately lead towards some degree of policy convergence. Although there remain some potentially difficult issues to be addressed, APEC economies have strengthened their IP policies significantly in recent years. However, Chinese Taipei, the People's Republic of China, and Papua New Guinea are not yet members of the World Trade Organization (WTO), nor have they signed the recent agreement on IP protection reached under the General Agreement on Tariffs and Trade (GATT). Hirshhorn's recommendation for the APEC member economies is to consult and cooperate among themselves in the implementation of the GATT agreement towards resolving issues that were not addressed by the agreement and developing a more effective enforcement mechanism.

The Introduction of Dynamics to Traditional Static Demand Analysis and the Ability of Firms to Segment Their Markets

"It may be quite economically rational for firms to set prices below costs," argues Christopher Green of McGill University. "Under certain conditions, which are not that uncommon, it is possible for firms to temporarily set prices below current short-run marginal costs or average variable costs and be profitable."

In his April 1996 address to Industry Canada staff as part of the *Distinguished Speakers in Economics* program, Professor Green examined the consequences that the introduction of dynamics and the ability of firms to segment their markets have for traditional static-demand analysis.

Innovation and economic dynamism flow not only from new products and new production technologies but also from the nature of demand and the production/distribution processes themselves. When products are characterized by 1) high start-up costs, 2) demand that is segmented over time, 3) physical durability that exceeds their economic life, and 4) variable costs that fall as a result of learning-by-doing, producers are in a position to earn substantial profits on incremental production. In turn, this profit potential acts as an inducement to further innovation.

Firms faced with such demand-production technology characteristics may well decide to set prices below current marginal as well as average costs, especially during the early stages of the product cycle. This is because such firms may rationally price on the basis of long-run production costs, which fall as production expands. During the introductory stages of the product, a set price may fall below average and/or marginal costs. At the end of the product cycle, however, prices may exceed average costs and earn excess profits, offsetting losses incurred during the early stages.

The personal computer and fashion goods industries are examples of products that meet the four criteria mentioned above: start-up costs are certainly high; purchasers appear to vary their impatience for new or updated versions; the durability of the products exceeds their technological or fashion life; and costs fall as producers learn how to produce more computers or fashion goods. The semiconductor industry is another example. In most cases, prices are observed to decline over the lifetime of any version of the product.

"Overall," concludes Green, "these theoretical underpinnings may have important implications for tests of predatory pricing, for evaluating allegations of dumping, and, possibly, for explaining the success of the Japanese industrial strategy."

Measuring the Benefits from Spectrum Auctions

There is an awful lot of money to be made through the use of our airwaves, so why shouldn't government take a piece of the cut? In an early May *Distinguished Speakers in Economics* presentation entitled "Measuring the Benefits from Spectrum Auctions," Jerry Hausman, MacDonald Professor at the Department of Economics of the Massachusetts Institute of Technology, gave Industry Canada staff an overview of the theory of auctions and the benefits from selling off various bandwidths of the spectrum.

Suppose you are the government and you have in your possession something that businesses value highly. How do you disperse the "good" so that the disparate, competing interests of business are addressed? "Well," says Professor Hausman, "if that good is the spectrum and it was many years ago, you would probably have given it away on a first-come, first-served basis; or you might have held comparative hearings or even a lottery. However, if the time is now you might consider using an auction to allocate your spectrum." This "new" option stems from a suggestion made in an economics literature article back in the 1950s. "Auctions," explains Hausman, "provide for an efficient allocation of resources since the spectrum ends up being used in the area of its highest value use. However, in order for this to happen, the rights to the spectrum must be fully transferable in secondary markets (i.e., via re-sale)."

In the United States, auctions have been held since 1995 for various spectra – two-way paging, personal communications systems (PCS), direct broadcast satellite (DBS), and enhanced specialized mobile radio (ESMR). So far, there is general agreement that the auction process has worked well. The U.S. government has raised approximately $20.5 billion from the auctions so far, and consumers have also benefited. As spectrum rights were auctioned off for many regions across the United States, not all bidders could bid in all markets. In addition, the PCS industry competes with cellular telephones. As a consequence, competition has opened up and prices have fallen, leading to more subscribers.

There are three sources of benefits from auctioning off the spectrum: 1) greater consumer value from the reduced prices due to increased competition in markets; 2) the rents appropriated by government through the auction process (i.e., what the producers are willing to pay); and 3) gains to a greater number of users resulting from falling prices. Professor Hausman estimates that for the U.S. PCS market, the gains from falling prices are about $7 billion per year; $20.5 billion has been appropriated from the producers surplus, and the additional consumer value associated with 35 million new subscribers will amount to $99.9 billion over the next ten years, for a total efficiency gain of about $190 billion over the period.

Work Sharing: Lessons Drawn from Bell Canada

Why did Bell Canada's experiment with work

sharing end in such dismal failure? Robert Lacroix, of the Centre interuniversitaire de recherche en analyse des organisations (CIRANO), provided answers to that question in an address given as part of Industry Canada's *Distinguished Speakers in Economics* program. Under the title "Work Sharing: Lessons Drawn from Bell Canada," Professor Lacroix presented the results of a case study on the efforts of Bell Canada to trim 2,200 positions from its 1994 workforce through a voluntary incentive program.

In his study, Lacroix found that the expectations of Bell Canada's senior management regarding voluntary participation in the program were quite high, while actual participation by Bell employees was very low. Bell management's main vehicle for trimming its workforce was a reduced work week. Despite efforts to assess the popularity of this option prior to devising the workforce program, the difference between projected (63%) and actual (11%) participation was enormous. A possible explanation for the discrepancy, said Lacroix, may have been the vague wording of the questions used to pre-assess employee interest in this option.

Professor Lacroix found that socio-economic factors may have played a role in explaining participation rates: marital status was found to increase the female participation rate and decrease the male participation rate. Holding a managerial position also reduced participation in the program, as did holding a university degree.

As well, Lacroix discovered that reducing the work week had unfavourable consequences for productivity growth at Bell Canada. Residential service productivity fell by 3% for repairs, by 8.3% for new installations, and by 8.6% for re-installations. In addition, delays for repair service jumped 13%, but they have diminished over time.

Professor Lacroix contrasted the failed Bell Canada experience with several successful similar efforts by the German car manufacturer Volkswagen. He concluded that, in North America, workers are apparently unwilling to take part in a voluntary program to reduce their working week in order to avoid layoffs, even when the required reduction in time is not that great and the corresponding salary reductions are largely compensated.

Future Challenges of the Information Society: A European Perspective

Should the tax bite include a "byte tax"? In a presentation made last June as part of the *Distinguished Speakers in Economics* program, Luc Soete, professor at the Department of Economics of the University of Limburg and Director of the Maastricht Economic Research Institute on Innovation and Technology (MERIT) in the Netherlands, suggested that both the production (sending) and the consumption (receiving) of electronic bytes be taxed in order for government to receive its share of the value added by electronic creation.

Professor Soete began his lecture, entitled "Future Challenges of the Information Society: A European Perspective," by focusing on the non-economic aspects of the new information society. The fundamental feature that emerges from current developments is that we are moving towards a learning society. But, argued the speaker, "we should not let the technologies become deterministic. That is to say, it is not society that should adapt to technology within some sort of international competitiveness scheme, but rather technology should adapt to the needs of society."

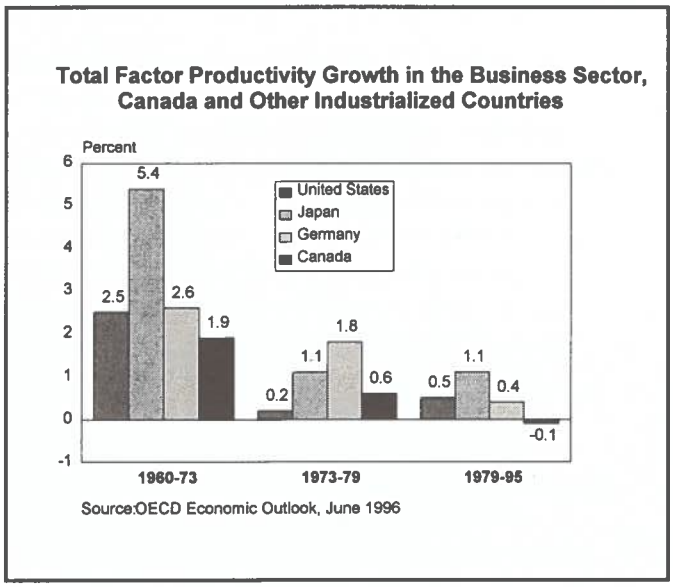
In the economic realm, we are moving towards a post-industrial, service-oriented society that is pushing manufacturing and services activities closer together. Emerging information and communication technologies are enabling us to "codify" many routine tasks and to program them so that machines can perform these functions. This has the effect of making services more "tradable," since the production of tasks (i.e., services) previously done

in person can be done by a machine or program located anywhere on the globe. In effect, service activities are being separated from their point of consumption. At the same time, new technologies are pushing manufacturing activity closer to the point of consumption, with just-in-time delivery, better inventory and information flows, etc. One impact of increasing this codification process, according to Soete, is that society must continually expand and upgrade its capacity to generate new products, new content, and new value-added.

The emerging information and communication technologies will also have a major impact on new areas of economic growth. As the employment opportunities associated with these new opportunities will be outside the manufacturing sector, Soete suggested that new methods of measuring economic performance will be needed to replace the more traditional, industrial activity-type measures currently in use. Moreover, he added, "the scope for international trade in services implies that international services will become the engine of international trade and competitive pressures, and a source of international displacement of employment." He joined those who call for a disaggregation of service data and recommended that for this purpose, activities be differentiated on the basis of three basic criteria – tradability, extent of codification, and relationship to manufacturing.

The new technologies have the potential to start moving incomes towards the notion of an economic rate of return based on the individual's activity. In other words, the potential for codification and detailed knowledge will make the individual's marginal productivity of labour more transparent, with pay being adjusted accordingly.

Finally, Soete addressed the tax issues raised by the electronic creation of value added. The "byte tax," he said, will: 1) move the tax base in the same direction as the economy; 2) counteract eroding tax bases; and 3) provide an incentive for posting only economic value-added on the system and help combat congestion.



CANADA'S PRODUCTIVITY RECORD

- Productivity growth is the driving force behind real income growth. Innovation and technical change are the fundamental determinants of long-term productivity growth.
- As in other industrialized countries, Canada's productivity growth slowed dramatically at about the same time as the first OPEC oil price shock; slow growth has continued to the present.
- The productivity slowdown is pervasive across most industries in Canada; moreover, it has been more severe in Canada than in other G-7 countries.
- Growth in total factor productivity, a measure of the combined efficiency of labour and capital inputs, declined from an average of 1.9% annually during the period 1960-73 to -0.1% since 1979.
- The productivity problem is more acute in the manufacturing sector, the front and centre of international trade and intensive competition. Between 1975 and 1995, Canada lost considerable ground to the other G-7 countries and was overtaken by France, Germany and Italy. The recent improvement in Canada's cost competitiveness vis-à-vis the United States was entirely due to the depreciation of the Canadian dollar.
- Canada's relatively poor productivity performance could be attributed to two major factors: the slower rate of innovation and technological diffusion, and slower adjustment to structural change.
- The skill requirements for the new, knowledge-based economy are increasing considerably, but Canada appears to lag behind other industrialized countries in upgrading and developing new skills.

PUBLICATIONS

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Industry Canada Working Paper Series

No. 10 - *R&D and Productivity Growth in Canadian Communication Equipment and Manufacturing,* Jeffrey I. Bernstein.

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