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# MICRO

*The Micro-Economic Research Bulletin*

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Vol. 2, No. 3  
Fall 1995

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## *Upcoming Conference. . .*

### *Importance of the Asia-Pacific Region*

Industry Canada recently commissioned a number of experts to analyze the implications of the growing importance of the Asia-Pacific Region for Canada. **Professor Richard Harris** of Simon Fraser University has agreed to act as the intellectual guide for the project and as the general editor of the research volume. The authors will present their findings and submit their work for peer review at a conference in Vancouver on December 1-2.

The conference will cover a number of research and policy issues. Trade between the Asia-Pacific region and North America will be analyzed. Papers will focus on resources trade, services trade and, in particular, on the impact of financial institutions, regulation, and obstacles to trade. Other topics include foreign investment, immigration, and the environment.

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## *A New Working Paper . . .*

### *"Steppin' Out": The School-to-Work Transition*

For the freshly-minted university graduate, the move from academe to the world of work is one of life's more important transitions. In spite of that, surprisingly little research has so far been done on how Canadians fare in the crossover.

A large part of that gap has now been filled by a study of bachelor-level graduates conducted by **Ross Finnie** of Statistics Canada and Carleton University, based on a Statistics Canada survey of 1982 graduates of universities, colleges and trade schools. The full title of this Working Paper is *Steppin' Out: An Analysis of Recent University Graduates into the Labour Market*.

Combining unique data, cross-tabulations and regression analysis of educational programs and early job experience, the study provides a new and revealing perspective on the school-to-work transition.

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*This publication is printed quarterly. Information on all publications can be obtained by phone at (613) 952-5704 or by facsimile at (613) 991-1261. Specific purchasing information can be found on the last page of this publication.*

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ISSN 1198-3558



The study compares the level of satisfaction of the graduates with their training -- in particular its relevance to the jobs they were doing. It compares the attitudes and experiences of two categories of students: Natural Science and Engineering (NSE) versus non-NSE graduates and men versus women.

The background for the study was a growing perception that Canada needs to improve both the quantity and quality of technically oriented graduates entering the labour force. This has led governments to offer new enticements to students in general and women in particular, to major in the science-based disciplines. One example is the *Canada Scholarships in Science and Engineering Program (CSP)* which rewards students entering into relevant fields. Half of these scholarships are reserved for women.

**Finnie's** study provides some interesting evidence on the efficacy of this program as demonstrated by post-graduation experience. For example:

- Engineering (ENG) and Mathematics/Physical Sciences (MATHSCI) graduates emerged with higher rates of full-time employment than others. They were also happier than other graduates with the narrower career-oriented aspects of their programs.
- Non-NSE men and women expressed greater satisfaction with the more general developmental aspects of their programs. Agricultural and Biological Science (AGBIOSC) graduates were the least satisfied with their overall programs and with the jobspecific aspects in particular.
- On the subject of relevance of education to subsequent employment, the match was closest for ENG and MATHSCI, followed by the Non-NSE group, AGBIOSC, and Social Science (SOCSCI) graduates (the latter having the weakest match of all).

- Overall, graduates expressed high levels of satisfaction with their jobs but less enthusiasm about their earnings. On this score, MATHSCI graduates seemed to be somewhat happier than AGBIOSC and SOCSCI graduates. In this respect there were no differences in male and female attitudes.

The author notes that how graduates felt about the quality of their training and education was closely linked to whether they had found relevant employment or had gone back to school. This suggests, the author notes, that it may be useful to build into policy, measures to help students to select fields in which job opportunities are good.

On the subject of earnings differentials between occupations, ENG and MATHSCI men and women earned significantly more than their non-science counterparts in 1984, and AGBIOSC men and women made considerably less. But just three years later, ENG and MATHSCI men had lost most of their earnings premium.

#### **The gender gap**

The report confirms the existence of a marked gender gap in earnings. Women graduates are more likely than their male counterparts to wind up in part-time jobs and their mean earnings are lower than men's almost everywhere.

The study showed that in 1984 the gender gap was relatively even across all educational groups. By 1987 it had increased in every field. It was narrowest among ENG and MATHSCI graduates -- but even here women's pay lagged behind men's.

Analysing the difference, the study finds that in 1987, about two-fifths of the earnings gap stemmed from the fact that women were more likely than men to be in part-time versus full-time employment. This in turn was linked to marriage and parenting variables and to the different impact of family responsibilities on employment.

Examining the gender earnings gap in relation to fields of study and occupation, the study finds that while ENG and MATHSCI men lost most of their earnings edge over Non-NSE men between 1984 and 1987, ENG and MATHSCI women actually increased their lead slightly.

### **Policy implications**

Noting that ENG and MATHSCI men and women earn considerably more than Non-NSE students two years after graduation, Finnie finds some confirmation of the value of the CSP. The finding that ENG and MATHSCI women retain that edge five years into their careers seems to validate the goal of encouraging women to enter the sciences.

On the other hand, the study shows that the earnings of ENG and MATHSCI men are only average or slightly above average earnings in the later years, while AGBIOSC men and women have consistently lower earnings.

With half of the CSP scholarships reserved for women, and the majority of NSE women found in the AGBIOSC fields, the study questions whether women are being encouraged to enter fields in which career results are likely to be disappointing. The author suggests that this may be so. He concludes that this makes a strong case for more research into these relationships and for a fine-tuning of educational counselling and incentives programs.

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### ***Innovation and Economic Growth: Implications for Canada***

The devil, as the saying goes, is in the detail. There too, observers can find grounds for concern about the Canadian economy.

Looked at over a 30-year time frame, the Canadian economy has performed remarkably well. Canada has been one of the fastest growing economies in the world -- with real per capita income more than doubling. In fact, Canada now enjoys one of the five highest levels of per capita income in the world. But narrowing the focus to the past two decades, economists point to a slowdown in growth that began in 1973 and has persisted ever since.

*Endogenous Innovation and Growth: Implications for Canada*, tries to explain these economic trends by examining what endogenous (inner-generated) growth models can tell us about the role of investment in R&D and its relationship to productivity and economic growth. The implications of those theories for public policy are also discussed.

Commissioned as a part of a series of papers on science and technology (S&T) issues, this new Occasional Paper was prepared for Industry Canada by **Pierre Fortin** of Université du Québec à Montréal and the Canadian Institute for Advanced Research (CIAR) and **Elhanan Helpman** of Tel Aviv University and CIAR.

Reviewing the 1973-1994 period, the authors find that during fast and slower growth subperiods, labour productivity growth consistently accounted for about 60 percent of Canada's economic growth performance. They conclude that this factor, not demographic trends, will continue to be the dominant determinant of growth.

### **Sources of the slowdown**

The authors suggest that labour productivity growth is derived from two sources: capital accumulation and technological progress. They find that the labour productivity slowdown in Canada since 1973 was not caused by a decline in the rate of capital accumulation but was entirely due to a decline in total factor productivity (TFP) growth.

Turning to the theory of labour productivity growth, the authors show that technological progress influences economic performance at several levels. New technologies impact directly on output growth. At the same time they exert an indirect influence by raising the return to capital and making investment more attractive.

Looking at human capital accumulation, the authors conclude that policies to encourage investment in human capital can enhance efficiency and speed up the economy's growth rate. They also explore the gains made possible through "learning by doing" and demonstrate how investment in R&D can help labour productivity rise.

This sets the stage for an exploration of mechanisms through which investment in R&D can influence productivity growth. The authors find that one requirement is an economic environment that protects intellectual property rights and allows firms to enjoy the fruits of their innovation. Other necessary conditions are some form of increasing returns to investment in R&D and a "lack of perfect competition" (i.e. a degree of monopoly power for the innovator).

The authors note that theoretically, investment in R&D can have positive and negative effects on output growth. Positive spillovers arise when the social benefits to investment exceed the costs. But negative effects are possible too as when R&D, by creating new products and processes, destroys existing ones, along with the profits they generated.

#### **R&D: The case for subsidies**

On balance, **Fortin and Helpman** conclude that Canada does not invest enough in R&D. One reason is because, they say, Canada is a small open economy with an abundance of natural resources which, as an enticement for R&D investment, is a poor substitute for highly skilled labour. This leads the economy to specialize in resource-intensive sectors and to invest too little in R&D.

Here, the authors find a strong economic rationale for subsidizing investment in R&D in Canada. They caution, however, that this subsidization must be carefully assessed to determine the true extent of the spillover effects. Also, they note, while R&D subsidies may be desirable, output subsidies for sectors that invest in R&D may be detrimental.

**Fortin and Helpman** suggest that more research is required on the impacts of investment in R&D on unemployment and on the types of education and training that would do the most good.

Turning to international economic relationships and their role in shaping a country's economic fortune, the authors conclude that trade and foreign direct investment generate positive spillovers via the flows of knowledge that they cultivate. Trade also encourages firms to specialize and this reduces duplication of research in different countries.

Furthermore, trade, by expanding service to a larger market, raises the return to R&D and therefore the level of activity. However, trade can have negative effects on R&D investment too, stemming from the exposure of firms to international competition and the reduced budgets for innovation that sometimes ensues. Having weighed benefits and costs, the authors conclude, on the basis of available empirical evidence, that trade is good for productivity.

In conclusion, **Fortin and Helpman** say that policies which encourage the accumulation of human capital, directly support R&D activity and ensure access to international knowledge and markets can improve growth prospects. They caution though that in each case, there is the risk of negative effects and that policy-makers must consider both costs and benefits.

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### ***Science and Technology: Managing Sociocultural Adaptation***

The benefits to society of applying new science and technology are well documented. Less so are the possible costs -- and least of all those associated with social and cultural adaptation.

This lack of information is the subject of a new Occasional Paper by **Liora Salter**, Professor, Osgoode Hall Law School, titled *Mechanisms and Practices for the Assessment of the Social and Cultural Implications of Science and Technology*. This paper was also part of the series on S&T issues.

In her study, **Professor Salter** looks critically at Canadian mechanisms for assessing the social and cultural issues that flow from the development, adoption, diffusion and use of new S&T.

#### **Monitoring and measuring**

**Professor Salter** believes that in this environment, it is crucially important both to monitor developments constantly and to evaluate the usefulness of the things governments do to adapt to scientific and technological change. Without that, she believes, it is quite likely that the hoped-for benefits of S&T will fail to materialize.

She points in particular to the need to reconcile science and public policy and the risk of conflict and controversy if issues are not resolved. She makes it clear that there is no easy administrative fix for this problem.

Looking at the status quo, **Salter** notes that a number of mechanisms and practices exist in Canada to assess the social and cultural implications of S&T. They include public inquiries and royal commissions, task forces, special panels and advisory committees, regulatory hearings, hearings on specific issues and government organizations specifically mandated to assess S&T either periodically or con-

tinuously. In her view this machinery cannot provide policy makers with the information they need to do a good job of evaluating the social and cultural impact of S&T.

What is lacking, she says, are research studies, rigorously focused, conducted according to the tenets of science and peer-reviewed by people with appropriate expertise. Also needed is a mechanism for broader evaluation of this same research through some kind of consultation process involving all stakeholders.

#### **The three arenas**

**Salter** focuses on three "arenas" of science policy and finds different problems, needs and opportunities in each case.

The first "arena" encompasses planning, introduction, or regulation of products, standards, production processes and economic developments. In this field, **Salter** finds that systematic processes do in fact exist in Canada for the assessment of new S&T. However, up to now, research in this area has been uneven in quality, quantity and coverage; conducted by parties seeking to influence decisions; and limited by a narrow conceptualization of social, cultural, and ethical issues.

To correct this situation, **Salter** suggests the use of scientific focus groups made up of experts in specific areas of S&T to report on the state of knowledge relative to issues likely to be the subject of assessment. Input from these groups would make the process of priority-setting more effective and efficient and would also provide a foundation of credible information for wider debate.

The second "arena" is promotion of an S&T and research culture. **Salter** believes that no solid basis now exists for assessing initiatives in this field and that not enough attention has been paid to establishing benchmarks for their success. As a result most

initiatives have been uncoordinated and, in some cases, poorly supervised.

The third "arena" is science policy in the new economy. The author sees a need to monitor the new economy with comprehensive environmental screening and suggests some ways this could be done. They include the mandating by government of a regulatory agency to scan the evolving environment; the establishment of councils; and support for research.

#### **Progress... but**

Salter notes some new and promising developments in all of these areas. One is the requirement, now built into the mandate of the Canadian Radio-Television and Telecommunications Commission (CRTC), that the commission weigh social and cultural implications as a top priority in its decision making. Another is the emergence of various sectoral councils such as the new Information Highway Task Force. A third is the development of new independent research institutes concentrating specifically on the social and cultural implications of S&T.

This is progress, says Salter, but something is still lacking: the ability of these institutions to see beyond the fences of their defined mandates and thus to put issues in the necessary context. To correct this tunnel vision, the author believes, current initiatives should be better coordinated and strengthened; they should deepen and widen their research to cover the challenge of new S&T; and they should improve their outreach efforts.

In conclusion, Professor Salter reminds us that institutions and cultural contexts change with time. Because they do, S&T policy will need to tackle social problems with mechanisms that are themselves adaptable to change. She notes too that there is no single, all-purpose model to assess the implications of S&T.

#### **The role of scientists**

On the subject of who gets involved in assessment, Salter concludes that scientists have a crucial contribution to make. They bring their expertise to bear to answer questions about what is known, what is not known, what remains uncertain and what is subject to debate within any field and with respect to any issue.

This is precisely the information needed by public policy makers and it takes scientists to provide it. But, she cautions, too often, scientists are called on to participate in another debate -- the implications of S&T for specific policies under development. In the latter discussion, although the scientists bring an informed view to the table, their expertise is not necessarily relevant to the types of questions being addressed.

In short, although scientific assessment is an indispensable ingredient in the recipe of public policy, it is crucially important not to over-estimate the capacity of scientists to contribute to the process or to misunderstand what they bring to the table. Otherwise, she warns, the price could be not just poor policy but poor science.

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### *In the Distinguished Speakers in Economics Series...*

#### *World Trade after Uruguay: Sylvia Ostry's Assessment*

Two powerful, ongoing trends are transforming the world's trade policy agenda. One is the globalization of the international economy which has created ever-tighter and more complex linkages among nation states. The other is the fundamental shift in U.S. trade policy to one based on an expanded

concept of "unfairness." Their combined impact has redefined the concept of the market and blurred the boundary between international and domestic policy.

This was the theme of a presentation given to Industry Canada employees by **Dr. Sylvia Ostry**, of the University of Toronto, when she spoke last May in the department's *Distinguished Speakers in Economics Lecture Series*.

In surveying recent forces that have led to deep economic integration, **Dr. Ostry** pointed to the "increasing ubiquitousness" of the multinational enterprise driven by a surge in foreign direct investment (FDI) in the second half of the 1980s. She noted that effective market access today involves trade, technology, and investment and that the worldwide presence of MNEs is creating system frictions and pressure for system harmonization. Increasingly, the focus of international negotiations is shifting from border barriers to an ever-widening range of policies and practices inside the border.

In spite of these developments, **Dr. Ostry** sees the shift in U.S. trade policy as the most important element in shaping the character of the world trade policy agenda. In recent years, U.S. trade policy interests shifted to what were once considered domestic policies and practices and their specific trade concerns expanded to include investment and technology (intellectual property rights) issues. Their notion of asymmetry of access marked the intrusion of international negotiations into an undefined range of domestic policies and programs.

### **Whither WTO?**

Speaking of post-Uruguay challenges, **Dr. Ostry** focused on three issues: the definition of structural impediments, the multilateral agreement on investment and the accession of China to the World Trade Organization (WTO). She proposed some

immediate policy options designed to establish the mandate and credibility of the WTO as a global institution.

In the new trade environment, effective market access or effective market presence in the case of investment, involves reduction not only of border barriers but also "structural impediments" including both government regulation as well as private sector actions. She suggested that a listing of offending government regulatory practices be compiled so that an agreed definition of structural impediments could be reached. Efforts should also be made to quantify the costs associated with these impediments through a study of price differentials.

Business practices such as upstream and downstream agreements and alliances, and corporate governance structures involving the role of banks and complex industrial cross-ownership structures also must be addressed. Progress here, she concluded, would mean reconciling differences between competition policy and trade policy objectives.

### **Liberalizing Investment**

On the topic of the Multilateral Agreement on Investment (MAI), **Dr. Ostry** noted that the scope and depth of a potential MAI remains unclear and it is not clear whether non-OECD countries of the WTO would embrace an agreement worked out by the OECD countries.

In **Dr. Ostry's** view, the most formidable challenge is China's accession to the WTO. A more market based economy is gradually emerging in China but there are increasing calls for immediate change. **Dr. Ostry** proposed that a transitional review mechanism be put in place with monitoring and liberal assistance made available to China to aid in its transformation.

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***Martin Baily on S&T, Human Capital and Investment***

**Dr. Martin Baily**, member-nominee of the Council of Economic Advisers to the President of the United States was a recent guest speaker in Industry Canada's *Distinguished Speaker Series*. His subject was human capital, science and technology and the importance of investment in these areas to long-term productivity growth.

**Dr. Baily** noted that education and training -- i.e. investment in human capital -- constitutes the basic foundation of a country's long-run growth and is also the ladder of opportunity for individual citizens. He added that advances in scientific and technological knowledge are another important determinant of long run productivity growth and that economists have long recognized a powerful rationale for national support for scientific investigation and technological innovation.

In this connection, **Dr Baily** cited the market failure problems associated with investment in research and development (R&D). Individuals and companies may invest too little in R&D because market incentives do not reflect the full value to society of such investment. Also, significant gains from scientific discovery and technological innovation may remain unexploited because markets alone cannot guarantee that the innovator will capture all or even most of the economic rewards of innovation.

Market failure problems are particularly evident in basic research and generic technologies. Basic research is pivotal because it increases the store of fundamental knowledge that underlies innovation. For many generic technologies, the benefits flow quickly and in some cases automatically beyond the laboratory or the factory floor. These characteristics provide the rationale for government support of basic research and innovation.

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***Distinguished Speakers in Economics Schedule for 1995-96***

Industry Canada's *Distinguished Speakers in Economics Series* begins anew this Fall. Here is the schedule for the season:

**September, 1995 -- JOHN BALDWIN**, Statistics Canada, on *Technological Change and Innovation in Canada*

**October 4, 1995 -- PAUL R. KRUGMAN**, Stanford University, on *Trade and Wages*

**October 20, 1995 -- JEFFREY BERNSTEIN**, Carleton University, on *Innovation and R&D Productivity*

**November 24, 1995 -- RICHARD E. CAVES**, Harvard University, on *Growth and Decline of Multinational Enterprises: From Equilibrium Models to Turnover Processes*

**January 12, 1996 -- JOHN WHALLEY**, University of Western Ontario, on *Taxes and International Competitiveness*

**February 9, 1996 -- JUDITH MAXWELL**, Canadian Policy Research Networks, on *Social Dimensions of Economic Growth*

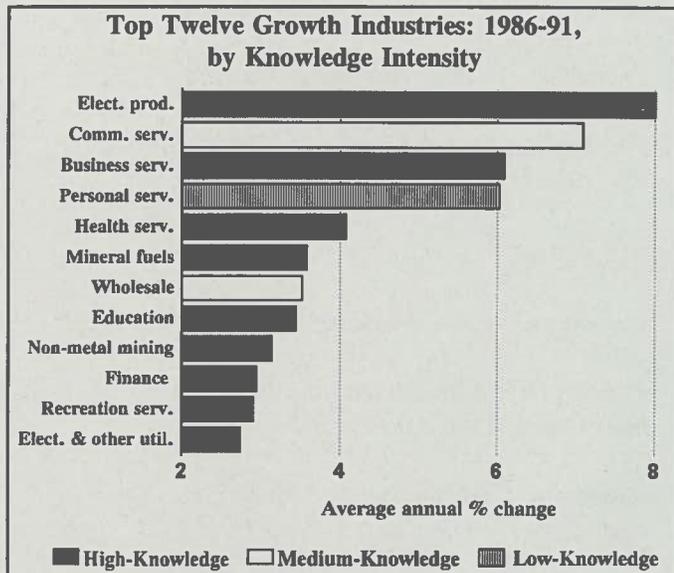
**March 15, 1996 -- JAMES BRANDER**, University of British Columbia, on *Renewable Resources, Trade and Growth*

**April 26, 1996 -- CHRISTOPHER GREEN**, McGill University, topic to be determined

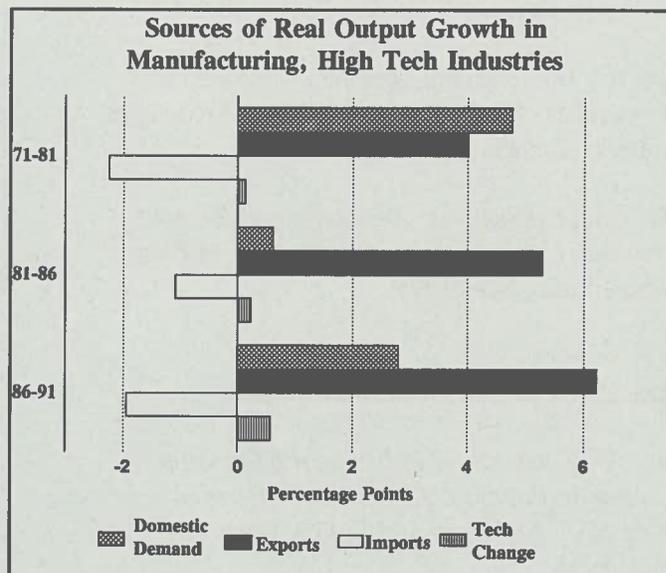
**May 17, 1996 -- ROBERT LACROIX**, Centre interuniversitaire de recherche en analyse des organisations (CIRANO), on *Le partage du travail: les leçons à tirer de l'expérience Bell Canada*.

# FROM THE COMPETITIVENESS NOTEBOOK

## SHIFTING TOWARD AN INNOVATIVE ECONOMY



Source: Industry Canada



Source: Industry Canada

- Canada is shifting towards high-knowledge and high-technology industries and an increasing proportion of output is accounted for by industries with higher skill requirements and higher pay. On this basis, we can say that Canada is becoming more innovative.
- All sectors of the Canadian economy are making efforts to become more innovative. This turn around has been evident since at least 1971-81. Also, more innovative industries appear to register stronger economic performances.
- For example, the data suggests that high-knowledge intensive industries have outpaced the growth of medium- and low-knowledge industries since the 1970s. Here, knowledge intensity is measured by the extent to which industry employees have a university education. In fact, nine of the top twelve fastest growing industries in Canada in recent years were high-knowledge intensive industries (see above).
- Factors that are driving the Canadian economy to become more innovative include domestic demand, trade, and technological change which is leading to changes in production techniques. Looking at high technology industries ( i.e. industries that invest the most in R&D) suggests that in the 1970s and early 1980s the most important factor driving growth was domestic demand. In more recent years, however, exports have played a pivotal role (see above).

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# PUBLICATIONS

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## RECENT RELEASES

### Industry Canada Working Paper Series

No. 4 - *The Economic Impact of Mergers and Acquisitions on Corporations*, Gilles McDougall, Industry Canada, February 1995.

No. 5 - *Steppin' Out: An Analysis of Recent University Graduates into the Labour Market*, Ross Finnie, May 1995.

### Industry Canada Occasional Papers

No. 7 - *Competition Policy as a Dimension of Economic Policy: A Comparative Perspective*, Robert D. Anderson and S. Dev Khosla, May 1995.

No. 8 - *Mechanisms and Practices for the Assessment of the Social and Cultural Implications of Science and Technology*, Liora Salter, July, 1995.

No. 9 - *Science and Technology: Perspectives for Public Policy*, Donald McPetridge, July, 1995.

No. 10 - *Endogenous Innovation and Growth: Implications for Canada*, Pierre Fortin and Elhanan Helpman, August, 1995.

No. 11 - *The University-Industry Relationship in Science and Technology*, Jérôme Doutriaux and Margaret Barker, August, 1995.

## FORTHCOMING

### Industry Canada Research Volumes

*Corporate Decision Making in Canada*

*The Implications of Knowledge-Based Growth for Micro-Economic Policies*

### Industry Canada Working Paper Series

*Foreign Direct Investment and Economic Integration in the Asia-Pacific Countries*

*Measuring the Compliance Cost of Tax Expenditures: The Case of R&D Incentives*

### Industry Canada Discussion Paper Series

*Technological Change and International Economic Institutions*

### Industry Canada Occasional Papers

*Technology and the Economy: A Review of Some Critical Relationships*

*Management Skills Development in Canada*