Editors' Overview

The 45th issue of the *International Productivity Monitor* contains eight articles. The first part of the issue features five articles in a symposium on Canada's productivity performance which includes contributions from Finance Canada, Innovation, Science and Economic Development Canada, Statistics Canada, and the Centre for the Study of Living Standards. The second part of the issue has three articles on measurement issues related to capital, capacity utilization, and productivity.

It is well-known that Canada's productivity performance is recent years has been weak. To understand the reasons for this situation, it is important to have a full understanding of the nature of this performance. In the introductory article for the symposium, **Chris Haun** and **Timothy Sargent** from the Centre for the Study of Living Standards provide a detailed analysis of both the post-2000 productivity growth slowdown as well as the more recent slowdown during the pandemic. They find that Canada's productivity growth since 2000 is similar to other advanced OECD countries. However, Canada's productivity levels are at the bottom of the ranking of advanced countries. This is particularly apparent in comparison with Canada's neighbour, the United States. Canada's business sector now has only 70 per cent the productivity levels of the U.S. business sector. The authors also look at industry sectors: they find that weak productivity growth since 2000 is largely a result of within sector productivity changes, rather than reallocation of labour to sectors with lower productivity levels or weaker productivity growth. Finally, the authors find that while lower growth in the 2000-2019 period overall is largely attributable to much weaker multifactor productivity growth, there was a pronounced slowdown in capital accumulation, particularly of ICT capital, that put downward pressure on productivity growth after the financial crisis.

The United States has experienced a much smaller fall-off in productivity growth than Canada after 2000, resulting in an increased divergence in labour productivity growth rates between the two countries, up from 0.5 points in 1987-2000 to 0.9 points in 2000-2019. The second article by **Wulong Gu** and **Michael Willox** from Statistics Canada examines the reasons for this situation, with a focus on the information and cultural services industry. They point out that labour productivity growth in this industry in the United States jumped to 7.8 per cent per year in 2000-2019, compared to only 1.5 per cent in Canada. Despite the small size of this sector, this difference in productivity growth increased the Canada-U.S. productivity growth gap by 0.45 percentage points. In addition, they argue that the information and cultural services sector, especially the important telecom component, is an important input into other industries and that Canada's poorer productivity performance in the sector led to greater price increases than in the United States, with a negative effect on the productivity of the industries using the output of the information and cultural services industry as inputs. The authors make the case that lower

productivity growth and greater price increases in the sector in Canada reflects a lower level of competition in this country than in the United States.

While there is no consensus on the reasons for slower productivity growth in Canada, it is widely recognized that Canada's productivity performance is negatively affected by weak investment in R&D, machinery and equipment investment, and information and communications technologies (ICT). In the third article, **Carlos Rosell**, **Kaleigh Dowsett** and **Nelson Paterson** from Finance Canada provide an assessment of Canada's mediocre investment and productivity performance and the factors behind it. They identify and discuss a number of factors, including small and dispersed markets, the regulatory framework, the large presence of small firms, an increase in zombie firms, a growing productivity gap between frontier and non-frontier firms, skills mismatch, and management education. While all those factors have somewhat contributed to the shortfall in Canada's productivity performance, there is no silver bullet to solve the productivity problem. Going forward, the authors identify and discuss what they see as four structural transformations affecting productivity growth, namely population aging, the green transition, the realignment of global trade, and increasing digitization and use of AI.

The Canadian economy is currently undergoing movement toward net zero emissions, the green transition, and the adoption of information technologies such as AI, the digital transition. These twin transitions represent significant challenges and opportunities for productivity growth. In the fourth article in the symposium, **Jonathan Barr, Peter Foltin and Jianmin Tang** from Innovation, Science and Economic Development Canada explore the implications of these transitions for productivity. They recognize that a reduction in the size of the high-productivity level oil and gas sector can have a negative impact on aggregate productivity through a composition effect. But they argue that the environmental and clean technology (ECT) sector is performing well in terms of output and productivity. They also note that environmental regulation can in some instances spur innovation, as documented in the literature on the Porter hypothesis. In contrast to the uncertain implications of the green transition for productivity, the digital transition is expected to have positive effects on productivity. ICT services productivity growth has been very rapid since 2000. Artificial Intelligence has great potential to boost productivity, but Canadian firms appear to be laggards in their use of this technology.

In contrast to slow productivity growth, the number of patents granted to Canadian researchers has increased rapidly in recent years. This is paradoxical as patents are an important measure of innovation and technological progress, the driver of productivity growth. In the fifth article in the symposium **Iain Cockburn**, **Megan MacGarvie** and **John McKeon** from Boston University document and then undertake a detailed econometric analysis to explain what they call Canada's patent/productivity paradox. The authors find that neither a low quality of Canadian inventions nor a lower invention rate in the ICT area can explain the paradox. They

find suggestive evidence that foreign ownership of patents and inventor migration may play important roles in explaining the paradox. They conclude that simply increasing the number of patents is not a path to prosperity. To avoid a 'patents without growth' route the article recommends to look at ways to stem the net-outmigration of inventors, to encourage the location of immigrant inventors and R&D workers within Canada, and to review the role of tax policy for innovation.

Reliable estimates of multifactor productivity (MFP) require accurate and consistent estimates of capital stocks and capital services. In the sixth article, **Pierre-Alain Pionnier, Belén Zinni and Kéa Baret** from the OECD examine the sensitivity of MFP estimates to the different assumptions related to asset depreciation and retirement patterns and initial capital stocks made by national statistical offices in their construction of the capital stock. They use the U.S. national accounts as a laboratory and calculate what would happen in the United States if the assumptions of other countries were used. They find that most other G7 countries have faster rates of depreciation for buildings and that, under these assumptions, the net capital stock would be smaller and, U.S. GDP would be up to 0.5 per cent higher, with important implications for MFP measurement. The authors conclude with a call for more frequent review of the methods national statistical offices use for asset depreciation. The purpose of the review is not t standardize assumptions, but to ensure that differences reflect country-specific factors.

Over the course of a business cycle, the rate of capacity utilization influences productivity. This means to understand and explain short-to-medium-term fluctuations in productivity, accurate measures of capacity are needed. Capacity utilization measures have traditionally been calculated at the industry level. In the seventh article on the issue, **Jianmin Tang** from Innovation, Science and Economic Development Canada and **Weimin Wang** from Statistics Canada develop a methodology to measure capacity utilization at the firm or micro-level. The much greater availability of micro data has made such firm-level estimates of capacity utilization possible. The methodology is based on the theory of the firm in terms of profit maximizing and price taking and is exogenous to productivity shocks. The authors conclude that controlling for capital utilization is essential for evaluating the economic impact of economic policies and programs such as support for ICT adoption and that this firm-level capacity utilization measures can potentially play an important role in this regard.

In 2001, the OECD published the manual *Measuring Productivity - Productivity Manual: Measurement of Aggregate and Industry Level Productivity Growth* followed in 2009 by the publication of *Measuring Capital: OECD Manual 2009*. These two publications provided a detailed guide for national statistical offices on how to incorporate the KLEMS production account framework into national accounts, with particular implications for the measurement of productivity. In the eighth and last article in the issue, **Nicholas Oulton** from the London School of Economics provides a detailed discussion of how national

statistical offices in the United Kingdom, the United States, and Canada responded to the OECD guidelines. Oulton concludes that within the OECD, the level of support and take-up of the KLEMS approach taken up by national statistical offices has been variable. National statistical offices in both Canada and the United States follow the OECD guidelines for the production of their productivity statistics. In the EU and the United Kingdom there is still some way to go as productivity statistics are still not fully integrated into the national accounts.