

**Innovation in Canada:
Why is Canada's productivity lower than the US**

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I was asked to report on the report of the expert panel on business innovation in Canada which was set up by the Council of Canadian Academies. The Panel was asked by Industry Canada, the sponsoring agency, to answer the following question

“If innovation is good for business, why is Canadian business less committed to innovation than most policy-makers believe it should be?”

I will provide an overview of the major conclusions of the report, namely its answer to the question, and will also share with you how we arrived at it and how we were led to explore that old chestnut of Canadian economists, the reasons for the lower productivity growth in Canada.

But let me first explain the functioning of the panel and why I am here to present the report. The panel was chaired by Bob Brown, CEO of CAE, and included 18 members, drawn for the business community, academia, labour and NGO communities, and all sharing an interest for innovation. The panel met six times, formed committees that also met, and was exposed to countless versions of the final report. The report was written mostly by Peter Nicholson, but I also had a strong input in several chapters, and indeed, the gist of the report was based on countless exchanges between Peter and me. But the report also reflected a lot of insights that came from panel members, and indeed, I can vouch for the high intellectual productivity of the panel method to address major public policy issues, as it enhance the focus and relevancy of the analysis while enriching it with countless unexpected insights.

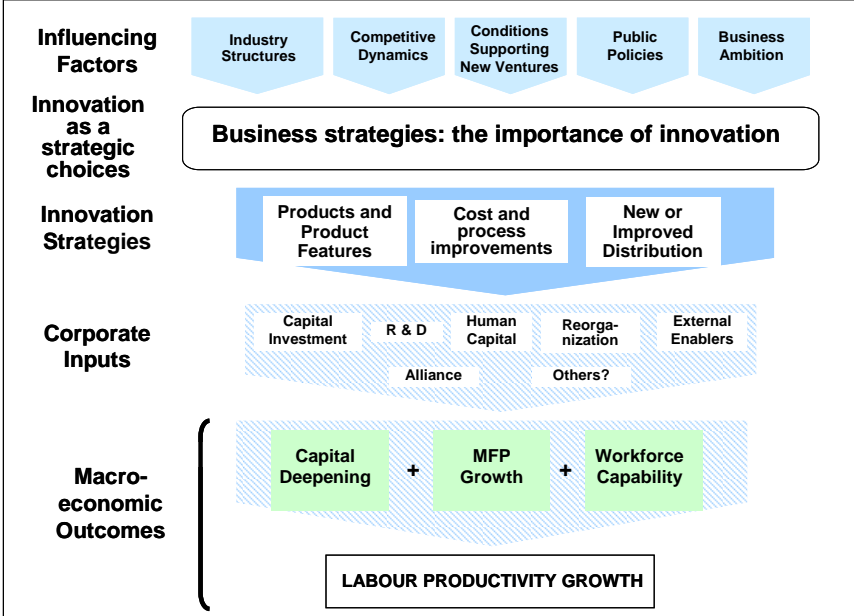
The panel was asked for a diagnosis of the situation, and not policy prescription. That mandate brought us rapidly to the core of what the report dealt with - namely how can we explain the lower business sector productivity in Canada. We tackled that question from a novel approach, namely why business firms in Canada do does not emphasize innovation as much as their American counterparts in their competitive strategies. In other words, we rapidly concluded that much of the lower business productivity in Canada resulted from demand conditions, and not from supply factors, a position which has also been suggested recently by Paul Boothe and Richard Roy of Industry Canada¹.

Innovation is defined by the Oslo Manual as the introduction of new or significantly improved products to the market or the introduction of new or significantly improved processes to the firm. Why are Canadian firms less likely to invest in product and process innovation than their US counterparts, and by extension, most of their global counterparts, when developing and implementing their business strategies that allows them to compete and to generate profits? The figure on the next page presents the Panel’s analytical framework. Whereas the usual analytical approach by economists focused on corporate inputs as the main explanatory factors, our analysis bears on why business would – or would not – emphasize innovation as a competitive strategy in the first place and which types of innovation strategies are they most likely to favour. This led us to ask what was so different in the Canadian business environment that could explain broad differences in competitive strategies between Canadian and US firms.

My presentation is divided into four sections. In the first section, I draw the link between productivity and innovation in business, highlighting the critical gap observed in multifactor productivity. Section 2 focuses on the tradable sectors of the Canadian economy and why

Canadian businesses in the tradable sectors could be less concerned about innovation than their American counterpart. Section 3 dwells on the domestic sectors of the economy and ask the same question. Section 4 bears on new markets, such as that of the Blackberry, and asks whether Canadians do as well as the Americans in such markets, and if not, what could explain it. My conclusions are in Section 5.

Figure 1
Business Productivity: an analytical Framework



Two caveats are worth mentioning at the outset. First, we do not pretend to have the full answer to the Canadian productivity riddle. What the Panel work has allowed us to do was to formulate hypotheses about what could explain Canada’s lower productivity growth. These hypotheses should be further researched and tested. Second, in various areas, I go somewhat beyond what the Panel has concluded, mainly because the numerous presentations of the report allowed us to develop further our thoughts on the topic.

1- The Canadian Productivity Issue

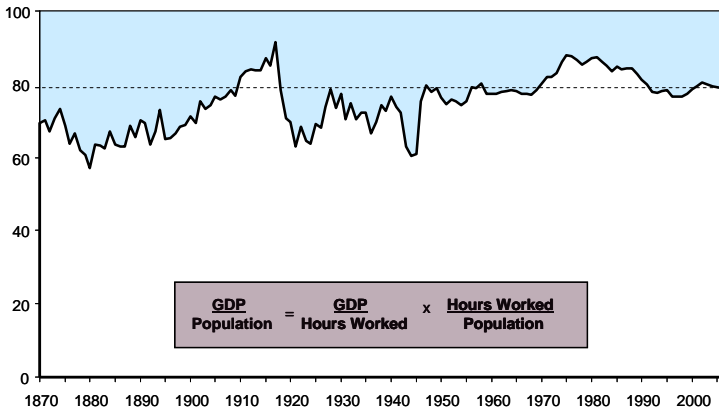
Despite sharing technologies, values, human capital and increasingly markets, Canada has maintained, for well over a hundred years, a structural gap in its GDP per capita with the US. Such a gap may not be abnormal. A similar gap may appear if the GDP per capita of the Plains states would be mapped against that of the rest of the United States: geography and many other structural factors may explain lower income. But as the figure on the next page indicates, that gap fluctuated over time, closing significantly in the 1975 to 1985 period, indicating that the factors behind it can be modified. In that regard, Figure 3 highlights the role played by business productivity over the period 1947 too 2007, by taking out the quantity of labour. What can explain the significant drop starting in 1984, when Canadian business productivity was at 93% of the US level?

Figure 4 brings the analysis one step further, by pointing to the growth of labour productivity (GDP per hour worked) and its sources between 1961 to 2006 in Canada (the left columns)and in the US (the right columns). Canada gained during the 1961 1980 period, and lost during 1980 to 2006. Canada did better on capital deepening and in labour composition in both periods, while doing worse on multifactor productivity, especially during the latter

period. In fact, Canada's poor showing on multifactor productivity growth since 1980 explains the full gap in labour productivity growth.

Figure 2
GDP per Capita:

The structural Canada – US gap



Data Source: Conference Board, Groningen Growth and Development Centre, 2008; Maddison, 2008

Figure 3
Business Productivity

Real GDP per Hour: Canada as % of U.S.

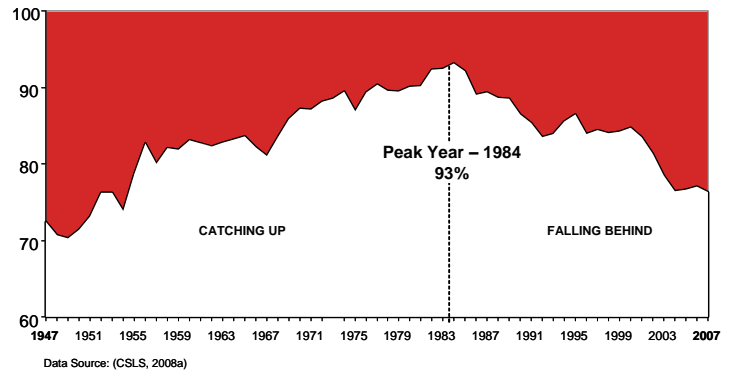


Figure 4

Average Annual Growth Contributions (%)
1961-1980: 1980-2006

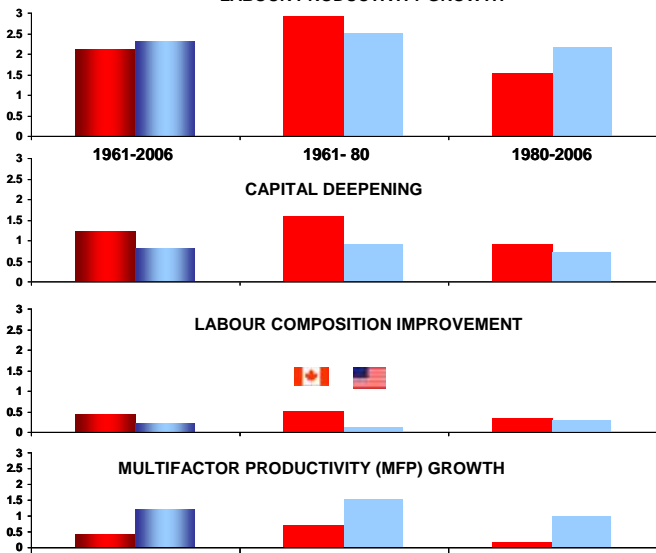


Figure 5

GROWTH RATE (%) DIFFERENCE: CANADA MINUS U.S.

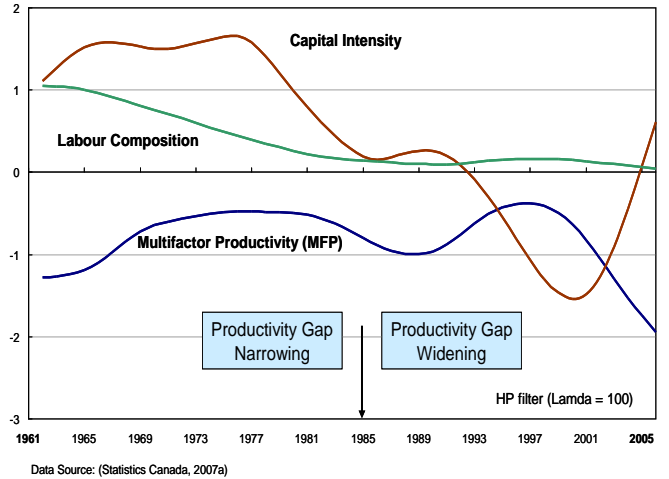
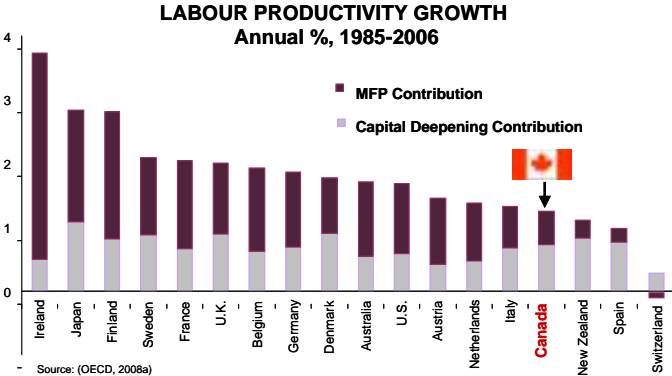


Figure 5, also taken from Baldwin and Gu, presents the fluctuations over the years of the various components of labour productivity. Since at least the early sixties, multifactor productivity growth has always been lower in Canada than in the US. On the whole, capital intensity grew faster in Canada and we always had an advantage in the rate of improvement of labour composition, reflecting more rapid increases in educational attainment and workforce experience. Up to 1985, our deficiency in MFP was compensated by the other components, and we slowly gained on the US. Since 1985, that situation has reversed. The figure also clearly shows the worsening gap in MFP since 2000.

I will not dwell on the debate on the meaning of multifactor productivity, knowing too well that it is a residual factor that can encompass many elements. But on the whole, there is a consensus in the profession to associate MFP growth over a suitably long period mainly with business innovation, broadly defined - that is, new or better products, better ways of doing

things, better business models, etc. On the whole, multifactor productivity is what businesses end up improving with their innovation strategies. Before addressing why Canadian businesses underperform on that dimension, two other issues must be dealt with.

Figure 6



First, this is not only a Canada versus US issue. On the whole, Canada’s productivity growth ranks near the bottom of its OECD peer group of countries, as Figure 6 indicates. This low performance is mostly due to multifactor productivity, as our performance on capital deepening is very much in the average of other OECD countries. But given the significant similarities between our economy and that of the US, the well known structural differences between the two, and the availability of comparable data, it is easier to analyse the issue by focusing on the Canada - US differences than on the difference with other countries.

Second, what are the other explanations that could account for the gap? Two factors are often mentioned in the literature. Canada’s much lower level of investment in ICT has been well documented. But why we should have less ICT investment is hard to pinpoint and has never been well explained.² More recently, Sharpe and Arsenault have argued that the adjustment to the sharp rise in the Canadian dollar and high commodity prices since 2000, as well as strong business profits, all combined to push Canadian productivity growth below its long-term trend. U.S. productivity meanwhile accelerated sharply, especially between 2000 and 2004. The persistent under-performance of Canada on MFP – evident for at least the past 45 years – nevertheless still lacks satisfactory explanation in the technical literature.³

The Panel examined a large number of potential causes. In the final analysis, two hypotheses were identified, each of which aim to explain why Canadian businesses would invest less in innovation than US business, thus generating a structural gap in productivity growth.

3- Cost competitiveness in upstream tradable markets

The report argues that a distinction should be made between the tradable sectors and the non-tradable sector to explain Canada’s deficient productivity growth. Table 1 on the next page documents the relative importance of each, through an high level allocation of the sector contribution to GDP into four broad categories.

- a. Tradable upstream: sectors largely open to international competition and where production in Canada is mostly primary and intermediate goods or in the case of automobiles, assembly work and parts manufacturing according to specs.⁴
- b. Tradable downstream: sectors open to international competition, where products are final goods sold to end-customers and whose design is made in Canada.
- c. Non-tradable, business services: business sectors mostly shielded from international competition, either by the nature of the products or services or because of regulations.

- d. Non-tradable, government and real estate services: the measure of productivity in these sectors is somewhat difficult, as the value of the output is generally defined as the cost of the inputs or simply imputed.

Table 1
2008 Sector GDP

Tradable, upstream	\$ B	Non-tradable, business	
Agriculture	26.0	Utilities	31.1
Forestry & Fishing	6.9	Construction	74.6
Oil & Gas	40.0	Trade	145.0
Mining	15.3	Transportation & Warehousing	56.8
Wood & Paper manufacturing	19.1	Information, culture, arts, leisure	56.8
Oil, Chemicals & Plastics Prod.	27.8	Finances & related	101.3
Metal manufacturing	25.2	Business services	58.5
Automobile & parts	20.4	Restoration & hospitality	27.8
Non metallic manufacturing	5.7	Other services	63.6
Sub total	186.4	Sub-total	686.9
Tradable, downstream		Public Services & Real Estate	
Food , Beverage, Tobacco	23.9	Public administrations	69.4
Textile & Clothing	3.4	Health & social services	79.3
M&E, and Electrical	24.2	Education	60.5
Other transportation material	10.4	Real estate	145.7
Other manufacturing	9.5	Sub-total	354.9
Sub total	71.4	Total	1300

Source: Statistics Canada

Upstream tradable markets comprise about three quarters of the open domain of the Canadian economy. It includes our commodities – both primary and lightly processed – as well as the automobile sector and selected intermediate manufactured goods. We would expect management of the Canadian business involved in these sectors to pursue innovation strategies targeted essentially at lowering their costs, as there are few possibilities to differentiate their products. We would expect their American counterparts to pursue the same strategies. However, Canadian manufacturers are faced with a very different context, as most of their costs are in Canadian dollars, whereas their prices are in mainly if not entirely in US dollars.

As table 2 suggests, the fluctuation of the Canadian dollar easily trumps any gains from productivity that they can aspire to get. (Table 2 compares on a yearly basis the overall MFP growth for all sectors to a measure of the volatility of the Canadian dollar, that is the difference between the minimum value and maximum during the year over the average value of the dollar, divided by two.) Thus whatever Canadian producers get from productivity gains is overshadowed by the vagaries of the Canadian dollar.

Table 2
The Canadian dollar fluctuation and MFP growth differentials

	Average C\$ / US \$	C \$ Volatility*	Diff. MFP %		Average C\$ / US \$	C \$ Volatility*	Diff. MFP %
1999	1.486	± 2.9%	0.4	2004	1.302	± 8.4%	-3.2
2000	1.485	± 4.2%	1.2	2005	1.212	± 4.9%	-1.1

2001	1.548	± 3.5%	- 0.7		2006	1.134	± 3.2%	-0.9
2002	1.570	± 3.3%	-1.6		2007	1.075	± 12.5%	-1.4
2003	1.402	± 10.1%	-3.2		2008	1.067	± 15.2%	N/A

That additional and overwhelming factor may lead them to invest less than their American counterparts in innovation strategies to improve their cost position. In periods of falling exchange rates, Canadian producers have an easier life and are less stimulated to invest in productivity gains, as the falling dollar does the job. In period of rising exchange rates, productivity gains could soften the blow, but there are probably other strategies which are more effective in that regard (such as redirecting production out of Canada) and these will be pursued, softening the need for innovation strategies. Moreover in such periods, experimentation is just not on the agenda.

The complexities and noisiness underlying the MFP data make it challenging to establish clear relationships between the environment faced by businesses in the tradable sectors and MFP. The Panel felt that this was a challenge best left to further research. But everything else being equal, we would expect innovation strategies to be pursued more intensively in the United States than in Canada in upstream sectors. (Similar situations should be observed in upstream oriented small currency areas such as Norway, and there is cursory evidence that MFP growth is also low in such countries.)

It is also interesting to note that if the hypothesis holds true, it would explain the fact that the Canada's MFP growth was lower than that of the US even before 1984, when as a whole labour productivity growth was higher in Canada than in the US due to the other components – capital intensity and labour composition - moving in Canada's direction.

The lowering of cross border barriers in the wake of the free trade agreements (FTA and NAFTA) hasn't changed the basic dichotomy between Canadian firms and US firms as to the relative importance of innovation strategies, and may even have exacerbated its importance. By enhancing cross-border interdependence, the free trade agreements have only accentuated the impact of the exchange rate uncertainties in Canada, relative to the benefits of innovation. As Figures 4 and 5 shows the average relative MFP growth has actually declined since the Free Trade treaties, contrary to predictions at the time, which called for greater Canadian productivity gains as a result of economies of scale and more efficient allocation of production.

To get a better understanding of the hypothesis, the panel also analysed the case of the Canadian automobile sector, where innovation efforts were all related to cost and flexibility related, as opposed to product-oriented. As expected, in the final analysis, the profitability of the Canadian automobile sector depended very much on where the Canadian dollar stood, and much less on the efforts to improve productivity at the Canadian assembly plants.

4- The cosiness of the small domestic markets

Canada is one tenth the size of the US market. It is also a much more fragmented market, essentially by geography and by language. Table 4, derived from Richard Florida⁵, illustrates the North American market hierarchies. Canada has one large megapolis, a corridor from Niagara Falls to Québec City that includes Toronto, Montréal and which has also a US component with Buffalo and Rochester. This is Canada's only large market, although it is fractured between its two linguistic components and spans a large geographical territory compared to the US urban megapolis. Canada also hosts two 3 M population conurbations,

namely Vancouver which belongs to what Florida calls Cascadia, with Seattle and Portland, and Calgary – Edmonton. The other populated areas of Canada are much less dense.

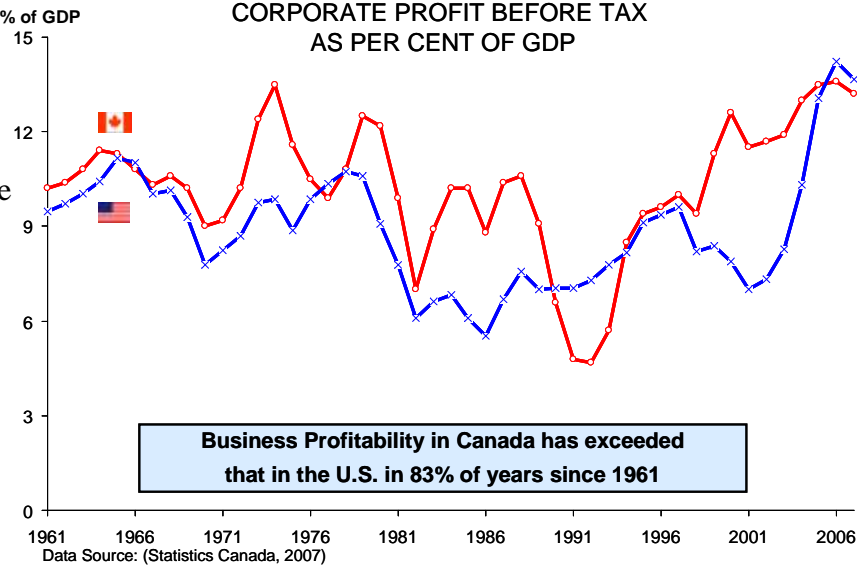
Table 4
North American megapolis

	Region	Population.			GDP \$ Bill
		Total	US	Canada	
1	Boston Washington	54.3	54.3		2 200
2	Chicago-Pittsburgh	46.0	46.0		1 600
3	Charlotte Atlanta	22.4	22.4		730
4	Southern California	21.4	21.4		710
5	Toronto-Buffalo-Montréal Québec City	22.1	5.1	17.0	530
6	Northern California	12.8	12.8		470
7	South Florida	15.1	15.1		430
8	Dallas Austin	10.4	10.4		370
9	Houston-New Orleans	9.7	9.7		330
10	Cascadia	8.9	5.9	3.0	260
11	Phoenix-Tucson	4.7	4.7		140
12	Denver Boulder	3.7	3.7		140

Source: adapted from Richard Florida

The small scale and diversity of Canadian regional markets impacts the competitive dynamics within the domestic side of the economy, along with market regulation, which affects the large swath of the domestic economy that is managed in a public framework, such as health care. As a result, economies of scale play a lesser role and entries are more regulated, and thus less of a competitive factor than in the US. Retailing offers several examples of the consequences. Wal*Mart and Best Buy, two US retailers that had profound structural impact on their industry, came later in Canada, through acquisitions. Target is not even present yet. The Canadian food market is highly concentrated, structured around only four national players (Loblaw, Metro, Sobeys and Wal*Mart).

Figure 7



This oligopolistic structure may make innovation strategies less useful in the Canadian domestic sector than in the US, where entry is much easier and there are more players. In Canada, the return to innovation is lower, partly because of the size, but also because profits are already higher, as a result of the more oligopolistic nature of the Canadian domestic economy. Figure 7 illustrates this clearly, by comparing corporate profitability in both countries over the years.

The Canadian banking sector was also analysed by the panel. The sector, structured around six banks, was always more profitable than its US counterpart. Canadian banks believe that they are relatively innovative. But there is no doubt that the Canadian banks benefited from the higher concentration level, and the relatively low foreign entry in local markets. Whereas the US banking sector was largely reshaped by mergers in the eighties and nineties, with the emergence of national banks and super-regional banks, and the merger of investment banking and commercial banking, the Canadian banking sector structures barely changed during the period, beyond the absorption of the relatively smaller Canadian brokerage industry. That stodginess did not favour innovation as much as the much more open competition and ease of entry observed south of the border

In two other sectors – air transportation and telecommunication (especially mobile and internet services) – regulations and the smaller size of the Canadian market have resulted in sustained higher prices in Canada. As a result, innovation both to differentiate the product offering and to lower cost is less rewarding and less necessary to protect market share in Canada than in the US, and we would expect Canadian businesses to lag behind their US counterparts on innovation activities and efforts.

Finally, in the broad fields of health care and education, government funding and regulations in Canada reduce both the need for, and the potential scope of, innovation as compared with free wheeling US environment. Again, this should show up in productivity statistics

Additional studies should be done to assess the hypothesis that the structural characteristics of the smaller Canadian domestic markets and the more concentrated industry structure in these market result in a less attractive environment for experimentation and for innovation, thus leading Canadian business to invest less in activities that drive productivity gains.

5- New markets: are Canadians good in these innovation games?

Innovation is associated strongly with new markets, where innovators break into wide open field with a breakthrough products and even build new industries. Canada lately has the Blackberry and the Cirque du Soleil. But how important is this avenue and how good are Canadians in exploiting it. On both counts, the reality is somewhat sobering.

New markets are continually created, sometime by the convergence of technologies, such as in the Blackberry case, but also often helped by the convergence of social forces and demographics, as with the rise of fast food outlets less than 50 years ago or Cirque du Soleil and other “high tech” theatrical experiences more recently.

A new market starts with a breakthrough innovation which typically triggers the emergence of a slew of emulators. The new product (or service) is gradually and significantly refined over a period of ten to twenty years, as its customer base is developed and gradually reaches maturity. In parallel, the number of players in the industry swells for a time, then gets consolidated as primary growth and product evolution taper off. In the early stages, competitive dynamics is all about rapid product evolution – with significant differences between quasi-annual generations – and about building loyal customer bases, with marketing expenditures routinely exceeding R&D expenditures. As the market growth tapers off, the weakest competitors are shunted aside and get bought or closed down. The winners become industry leaders. Microsoft, Nokia and Apple (the latter in more than one market) made the transition recently⁶.

New markets are less important in the economy than commonly assumed. The ICT sectors, broadly defined, has many of them, although the oldest ICT products, such as the PC, electronic cameras and on-line book selling, are now in mature markets, whose innovation dynamics are much at the margin. Blackberry is a typical new market product. There are also a lot of new markets in software products, from Facebook to games, a few in the broad pharma sectors, based on breakthrough technologies. Overall, these new markets represent less than 10% of the economy and contribute probably less than 20% to the overall MFP.

Canada is not doing well in these races that build new markets. Beside Research in Motion, Cirque du Soleil and a handful of less known players, there are not many Canadian companies that are significant players in new markets. The whole Ottawa high tech sector has faded. Although there is still a significant number of high tech jobs, (but much less than 10 years ago), they are now mostly in establishments that belong to global organizations run from elsewhere and which are no longer slated to grow significantly. There are numerous smaller players in large Canadian cities that play in niche M&E markets such as instrumentation, but on the whole, none seems positioned to become major players. In pharma, where governments pump more than \$ 3 billions per year in basic research, with the hope of building a biotech industry, the results are modest. Our best hope, Biochem, disappeared a few years ago. There are still a few players, such as Biovail and QLT, but I would be surprised if they do not disappear in the bosom of a larger global pharma within a few years.

The panel wondered why Canada does not do as well as hoped in new markets. The high-tech clusters of Waterloo, Ottawa, Montréal, Toronto and Vancouver seem able to produce a lot of start-ups. But these start-ups have difficulties in growing into significant players, and most of those that do end up being taken over by a bigger firm. (The two leading firms in Waterloo, RIM and Open Text, have market capitalization of \$45 B and \$2 B. All other have smaller market cap.) Among the potential causes for this failure to build global leaders in new markets, is a venture capital industry which is not sophisticated enough and does not have deep enough pockets. Financial support through the SR&ED program is generous, but a grant-based approach as favoured by ARPA in the US may be more productive. Our reluctance to back national champions (often due to regional political considerations) could also explain why so many of our high tech jewel companies get taken over, and then their growth factors are slowly drained.

6- Public policy considerations

The productivity shortfall of Canada is likely due to structural factors. The panel hypothesizes that two causes are likely to play major roles. In the tradable sectors, where much of our production is upstream and Canadian producers do not have significant relations with end-users, innovation strategies are geared toward cost improvements. Unfortunately, the impact of such strategies in Canada are trumped by the exchange rate gyrations, which means that relying on them in Canada to ensure competitiveness is not as critical as in the US, where there are no exchange rate uncertainties. In the non-tradable sector, the commercial environment is less competitive than in the US, the result mostly of the smaller size of the markets and of regulation of entry. This probably reduces the need for innovation strategy to compete and lowers the returns on innovation strategies.⁷ As a result, Canadian businesses in the domestic economy rely less on innovation strategy and that gets translated into the productivity number, and also into lower demand for innovation inputs, such as R&D. As to our perceived shortfall in engaging in new markets, there does not seem to be a clear

diagnosis about our performance and why Canada does not do better, although R&D and financial support for R&D do not seem to be the issue. The panel report points rather toward deficiencies in early stage finance and in a shortage of leading-edge customers in Canada as more critical factors.

The public policy responses to Canada's innovation shortfall are not easy to identify. The panel was not asked to be prescriptive in that regard. The anchoring of our exchange rate to the US \$ could have other impacts which could offset any gain for an environment more conducive to innovation strategies. Our small domestic markets are a structural reality. But small European countries like Sweden and Finland have overcome such limitations. Removing the remaining barriers to foreign entry could have an impact, but it is not certain that this would significantly affect local competitive situation and induce more innovation. Reducing the cost of innovation inputs, through more subsidies for R&D, is often proposed. However, R&D is not the only input to innovation. Canada's current generous support for R&D suggests a declining marginal rate of effectiveness.

A more interesting research avenue is whether we could compensate for our shortfalls in MFP with productivity enhancing investment in labour and in capital goods, as we seems to have done from the sixties to the mid eighties, when Canada was catching up to the US in terms of overall productivity. Surely, closing the big shortfall in ICT investments could be an opportunity, with the added benefits of boosting MFP. But how to bring about a significant increase in the propensity of Canadian firms to invest in ICT is a challenging but pressing research topic that could yield significant public policy prescriptions.

¹ Boothe, Paul and Roy, Richard, Business Sector Productivity: What Do We Know? International Productivity Monitor, Center for Study of Living Standard, No 16, Spring 2008

² The report develops that point.

³ Arsenaul, Jean François and Sharpe, Andrew, An analysis of the Causes of Weak Productivity Growth since 2000, International Productivity Monitor, Center for Study of Living Standard, No 16, Spring 2008

⁴ Automobile assembly and parts represent about 75% of the transportation sector. Aircraft assembly and components represent about 20%. Given the little controls that the automotive related sectors have on the end product, we postulated that this sector is behaving very much like an upstream sector, with a focus process innovation to reduce cost rather than product innovation aiming at differentiating it and increasing its value for the end customers

⁵ Florida Richard, Gulden, Tim and Mellander, Charlotta, The Rise of the Mega Region, The Martin Prosperity Institute, University of Toronto, October 2007

⁶ See Miller, Roger E., and Côté, Marcel, The Games of Innovation, SSRN, 2008, for an analysis of the unique competitive dynamics that preside over these markets as they develop and reach maturity.

⁷ Baldwin, Gu and Yan recently completed a sectoral analysis of productivity level in US and Canada, regrouping business sectors into three broad categories

- Goods: agricultural and manufacturing
- Engineering: Mining, Oil & Gas, Forestry, Utilities, Construction, Transportation, Information and Cultural industries
- Services (all but education, health care and social assistance, and owner-occupied dwellings)

Relative Canada/US MFP in 1999 were at 79.7, 85.4 and 78.5 for the three sectors. Given the particular grouping, it is difficult to infer anything about our hypotheses from this data, although there are no contradictions. (Baldwin, John R., Gu, Wulong, and Yan, Beiling, Relative Multifactor Productivity Levels in Canada and in the United States: A Sectoral Analysis, Statistics Canada, July 2008, 15-206-X, no. 019