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Productivity in the “New” Economy

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Productivity in the "New" Economy

1. Overview

Evidence from the U.S. indicates that productivity growth within the 'New' Economy - defined as computing, software development, communications, information processing, e-commerce and related activities (hereafter referred to as the IT sector) - has grown at a rapid pace within recent years. Whether measured in terms of labour productivity (LP) or multi-factor productivity (MFP), productivity growth in the IT sector has clearly outpaced that of the remainder of the U.S. economy.

Productivity improvements in the IT sector have been driven by two fundamental cost trends. The rapid decline of the costs of computing and the increasing capacity and falling incremental costs of telecommunications. These cost trends are related to technological improvements in computers and communications which as yet show no sign of abating.¹

As a result of these developments, the IT sector has grown much more rapidly than the rest of the U.S. economy. Furthermore, the growth of output and productivity in this sector has been strong enough to have significant impacts on aggregate output and aggregate labour productivity growth.

¹Indeed they have accelerated in recent years cf Jorgenson (2000)

Although the proliferation of computing and telecommunications throughout the U.S. economy has proceeded at a rapid pace, there is some disagreement about the impact of the IT sector on the rest of the economy and in particular on its impact on productivity growth.

Whether the recent growth spurt in the U.S. will continue - hence raising the 'speed limit' for U.S. potential growth - or whether it is largely a flash in the pan is one key issue for forecasters and macro policy analysts.

An important issue facing Canadian policy makers and analysts is whether the recent U.S. growth spurt can be anticipated to be replicated in some fashion in Canada. Will Canada's potential growth rate increase, and will the increase be sustained over the medium term?

The expansion of the IT sector may have important structural and transitional effects on labour markets. As the long U.S. expansion has continued, with real growth in the latest years higher than in the earlier recovery period, the unemployment rate has declined to about 4% without signs (until very recently) of an acceleration of inflation. The U.S. equilibrium unemployment rate or NAIRU may have declined by as much as two percentage points.²

The growth of the IT sector, by reducing transaction costs in product markets and search costs in labour markets, should tend to reduce the NAIRU. On the other hand, the rapid expansion of the IT sector could generate structural imbalances (shortages of IT workers coupled with layoffs

²The U.S. has also benefited from a number of favourable transitory factors: the strong U.S. dollar, and until 1999, stable energy prices.

elsewhere) that could raise the NAIRU during the transition period. (The U.S. economy may have been spared the latter effect because of strong growth of aggregate demand - the proverbial tide which raises all boats). Again, these developments have relevance for Canada. Reduced transaction and job search costs should reduce the NAIRU (although the adverse transitional effects may be more apparent here if demand growth is more moderate).

The remainder of this paper is arranged as follows: The next section considers some methodological issues and briefly reviews the U.S. literature. We focus mainly on the academic literature, but do draw on other sources for key facts. The third section reviews the papers by Globerman and Hirshhorn, Nadeau and Rao prepared as backgrounders for this conference. The fourth section considers the implication of the U.S. analysis for Canada. The fifth and final section considers the policy implications of this analysis.

2.1 Measuring the Impact of the New Economy: Methodological Issues

The development of the IT sector in the U.S. has had important effects on aggregate demand as well as aggregate supply. The vast investments in computers, software, and telecommunications infrastructure add substantially to aggregate demand. One of the strongest components of final demand in the U.S. (and in Canada) in recent years has been investment in machinery and equipment (M&E) (which in the U.S. includes most software as well as hardware), and investments in IT equipment and software account for about 80% of the growth of M&E spending since 1995.

This investment surge contributed to the growth of output when the economy has sufficient slack to expand. But it is important to note that such demand effects cannot have a permanent effect on growth: once capacity limits are reached, increased strength in one component of aggregate demand must be offset by slower growth of other components if an increase of inflation is to be avoided.

Nevertheless, the impact of the development of the IT sector on aggregate demand has been an important factor explaining rapid growth in the U.S. over the past five years.

There are other demand effects of the development of the IT sector: demand will be displaced from other sectors towards IT products. Telecommunications - e-mail, faxes, etc. - may displace ordinary mail; e-commerce may displace mail order and ordinary retail sales. The measurement of e-commerce and its effects on the economy have become a major concern.³

While these developments are important, in that they reflect and reinforce the reallocation of resources towards the IT sector, they do not indicate how IT contributes to aggregate economic growth over the medium term (although the investment associated with the development of e-commerce adds to aggregate demand - see above). The contribution of the IT sector to long-term

³One large and important study in Canada is "Fast Forward: Accelerating Canada's Leadership in the Internet Economy" by the Boston Consulting Group for the E-Business Roundtable. This study borrows some of its methods and principles from studies collectively titled "Internet Economy Indicators" by researchers at the University of Texas at Austin.

We have some concerns about the methods used to measure the size of the Internet economy in studies of this sort, but these do not seriously impact upon the points made in this present review. For a more recent official estimate of the size of e-commerce see "E-Commerce and Business Use of the Internet" (Statistics Canada Daily, August 10, 2000).

growth requires an analysis of its *supply side* effects. Does it raise the level and growth of labour productivity? Of MFP? It is here in many ways that the most serious impact of the 'new economy' on long-run growth and productivity will be.⁴ The next section considers these issues for the U.S. economy.

2.2 The Contribution of the New Economy to Productivity Growth in the U.S.

The role of the IT sector in explaining the acceleration of U.S. economic and productivity growth was the focus of a recent Brookings Panel discussion (see Jorgenson and Stiroh (2000) and the comments by Gordon and Sichel).

There is consensus on two important issues. First, productivity growth within the IT sector was a significant factor explaining both the rate of growth of MFP and the acceleration of MFP growth after 1995. Second, rapid price declines for IT goods and software has led to an increase in investment which stimulated aggregate labour productivity growth.

There is divergence of opinions about two other important issues: the extent to which the adoption of IT productivity has stimulated MFP outside the IT sector, and whether the estimated increase of real economic growth in recent years is sustainable or transitory.

⁴A point also made in some the commissioned papers for this conference which will be reviewed in Section 3.

Jorgenson and Stiroh indicated that the MFP growth outside the IT sector is highly sensitive to rates of deflation of IT prices. Gordon estimates that cyclical factors account for about one-half a percentage point of growth over the past four years, and that MFP growth outside the IT sector was relatively low and did not accelerate. In contrast, Jorgenson and Stiroh and Oliver and Sichel estimate that MFP outside the IT sector increased by 0.4%. It would appear that the differences between Gordon's estimate and the other two estimates are largely due to his cyclical adjustment term.

However, it is interesting that none of these authors attribute widespread spillovers from IT production to MFP growth outside the IT sector. Rather, the contribution of IT products is through capital deepening in the non-IT sectors, augmenting labour productivity but not MFP.

Jorgenson and Stiroh emphasize that there is considerable uncertainty in projecting productivity growth related to data quantity and to the short period of observation of accelerated growth: "Caution is warranted until productivity patterns have been observed for a longer period" (p. 185). ". . . we must emphasize that the uncertainty surrounding intermediate-term projections has become much greater as a consequence of widening gaps in our knowledge . . ." (P. 185).

We summarize what we have learned from our brief review of the U.S. literature, as follows:

1. The development of the IT sector itself directly contributed to an acceleration of aggregate MFP growth in the U.S. economy.
2. The high rate of investment in IT software and hardware contributed to an acceleration of labour productivity outside the IT sector.

3. The combination of those two factors has raised U.S. potential growth by 0.6 to 1.0%, thus raising the 'speed limit' guideline for monetary policy.
4. The NAIRU in the U.S. has declined, partly as a result of the transitory effects of higher productivity growth, and partly as a result of more efficient labour and product markets.

We shall consider the implications of this analysis for Canada in section 4 below.

3. Review of Canadian Literature

As part of this study, we include a review of three papers previously commissioned by Industry Canada as background studies for this conference.

(1) 'Electronic Commerce and Productivity Growth' by Steven Globerman

The first of these is "Electronic Commerce and Productivity Growth: Defining and Assessing the Linkages" by Steven Globerman. These linkages the author sets out very well, and we agree with his observation that, despite the vast and diffuse literature on e-commerce, surprisingly little has been done on possible productivity impacts.⁵ We also agree with him, however, that the sector is so new, and expanding so rapidly, and data are so thin, that little in the way of concrete conclusions can yet be drawn.

The paper amply rewards a complete reading. Our review summarizes those part of the paper that we found to be most new and interesting, and adds our own occasional questions or commentaries when appropriate.

The paper has four major sections. The first offers some definitions for electronic commerce (hereafter 'e-commerce') and for types of productivity or efficiency gains. The second lays out a schema of the various paths by which e-commerce could potentially affect productivity. The third section looks for evidence that these linkages are occurring and how large they might be. The fourth section examines some policy implications.

In his "Definitions" section the author sensibly confines e-commerce to "commercial transactions conducted on the Internet or the World Wide Web". These transactions are, as usual, further divided into "business to consumers" (B2C) and "business to business"(B2B). The author notes from a number of sources that there is a wide range of estimates of the size of e-commerce, but that almost under any measures to the extent of e-commerce is small relative to total retail and wholesale trade. (He further notes that there is greater agreement that B2B makes up by far the lion's share of e-commerce at some up some 70 to 80% of the total).⁶ The author at this point makes the comment that with e-commerce relatively so small, its potential productivity impact in the aggregate must be limited -until it gets to be significantly larger. We have found this to be a

⁵Most of the large >impact= analysis of e-commerce has focused on contributions to GDP and employment - and most of these studies, as we will argue elsewhere, are seriously flawed in that they only count output (rarely even GDP) and employment in new e-commerce itself and make no allowances for displacement from more traditional enterprises.

⁶More recent data on the size and breakdown of the e-commerce sector is forthcoming from the Statistics Canada special survey taken earlier in 2000.

common misconception: that the primary impact of e-commerce on aggregate productivity will be from productivity gains *within* this sector itself and that the size of the productivity contribution depends on the size of the sector. We do not believe this to be the case, and indeed the rest of the Globerman paper also makes this quite clear: the primary impact of e-commerce on aggregate productivity will be through its impact on *other* sectors. In order to achieve this, the sector need not be large, nor indeed does it need to show huge productivity gains within itself.

In much of the remainder of his definitions section, the author discusses traditional classifications of efficiency, primarily in the customary breakdown into allocative, technical and dynamic efficiency. In fact, the author makes relatively little use of these categories in the rest of his discussion and instead concentrates on, in our opinion, a more interesting breakdown into cost and competitiveness effects. However, whenever categorization is used, the author does a great service in pointing out that the potential productivity impacts of e-commerce come from a wide set of linkages. He concludes this section with the excellent observation that the fundamental contribution of e-commerce is improved communication which will have its effect through two main channels: reduced transactions costs and increased competitiveness and "contestability"⁷.

In his section on the linkages between e-commerce and productivity, the author discusses impacts on transactions costs and on competitiveness in greater detail. Within transactions costs

⁷The latter term refers to potential competitors who, through low barriers to entry into a market or service, will keep the market competitive by their potential to contest any attempt by the current market participants to exert some market power.

the author distinguishes four subcategories: search, contracting, monitoring, and adaptation costs. For the latter three the author sees relatively little scope for cost-reduction from e-commerce until principles of standardized contracts are worked out. However, e-commerce has the potential to reduce the search costs significantly. This is especially true for "search goods"- those goods whose different characteristics can be readily distinguished by consumers. Computers and some financial products fall within this category and have made their way into e-commerce quite rapidly. 'Experience' goods, where some contact with the product is required by the typical buyer, (a test drive for a car, pinching a tomato) may or may not be amenable to e-commerce selling depending on the particular experience required and the skill of the web site designers. (Some goods can indeed be 'experienced' by the Internet; e.g., music or game demos). The kinds of goods and least likely to make it into e-commerce are 'credence' goods where some trust or faith in the quality of the good or service must be built (e.g. medical care). Here, branding can help and existing firms may carry that advantage into e-commerce if they choose to go there. There is no question, however, that the improved communication system that is e-commerce can dramatically lower search costs, both B2C and B2B, for some kinds of goods and services.

On the issue of competition and contestability the author notes that "the predominant view of e-commerce is that it will promote increased competition". The primary mechanism for this is again the reduction in search costs, which would presumably increase the geographic size of a market, bringing in more competitors. Supposedly, e-commerce also lowers barriers to entry into a market because setting up an e-commerce site is inexpensive. The author, however, points out some important limitations to these effects: For many goods, the ability of potential buyers to

search a wider area may not be matched by a willingness of sellers to increase their distribution channels or deal across administrative borders. While the cost of setting up an e-commerce site may be low, for any physical product the need to inventory, warehouse and ship is not eliminated and still can pose a barrier to entry. Finally, the proliferation of web sites and the difficulty new sites may have in obtaining customer notice and trust may still be a formidable barrier to entry. Bundling strategies and purchasing networks may also serve to limit the competitive pressures of e-commerce on more established sales networks. In brief, while the author believe there will certainly be some pressures for additional competition through e-commerce, he is much more skeptical of the potential impact of e-commerce on productivity through improved competition than through reduced transactions costs.

In the third major section of his paper, Globerman makes a very interesting assessment of the microeconomic studies indicating whether the linkages between e-commerce and productivity discussed above are actually occurring. (Some, of course, may still occur in the future). Before considering the evidence he lists eight hypotheses about what should be observable if the linkages discussed above were actually at work. For example, "reductions in search costs should lead to less market segmentation and increased price uniformity across geographical markets associated with e-commerce", or "e-commerce transactions should have lower costs as a consequence of the reduction of .. intermediation activities." After listing these hypotheses the author then proceeds to test them against the micro evidence under the two main groupings of 'pricing' and 'costs'.

One the whole, the evidence Globerman could find for pricing effects is quite thin. There are clear cases of lower prices available for particular items via e-commerce (e.g., online brokerage)

but many where there is not (e.g., air fares) and some in which prices seem to be higher, but where purchases are still made because additional services or convenience are offered through e-commerce purchase. While there are, of course, exceptions, there is also little evidence of a breakdown in borders and wide extension of geographic reach, especially across national boundaries. Without this increased competition, downward pressure on prices has not been as forthcoming as once predicted. Price changes appear to be more frequent in e-commerce but price dispersion seems to be as large as in traditional sales media.

There does, however, appear to be strong evidence that e-commerce reduces costs. Globerman sorts costs into three categories: costs of executing a sale, costs of procuring inputs, and costs of making and delivering products. The evidence he reviews suggests significant savings in all three areas. Web sites, where they can be used, are cheaper per dollar of sales to maintain than 'storefronts' and the Internet also offers major savings in terms of customer support and after-sales service. For purchased inputs, estimates show savings in the range of 2%-40%, with significant examples at the higher range. Some of these savings may be due to pooled market power in coordinated purchasing, but most represent true efficiency gains. Finally, there are large cost savings in distribution where services (like financial transactions) can occur directly over the Internet, but also sizeable savings from reduced inventories and administration when goods are being sold. An OECD estimate puts cost savings "at around 14% at the wholesale level and 25% at the retail level".

Briefly, then, Globerman finds there is strong evidence for cost savings, at least compared to the impact on prices. But he notes that the implication for productivity growth over time depends on

whether the cost savings are one time only (more likely in our view) versus ongoing and the relative growth rates of sectors more and less amenable to cost savings from e-commerce. He concludes by citing an OECD study estimating that e-commerce will reduce economy-wide costs by about one-half to two-thirds of a percentage point - and that these savings are a proxy for total factor productivity (TFP) gains. He notes that this estimate is likely to be conservative because it does not include welfare gains to consumers from greater choice - but the latter will not show up in productivity as currently measured anyway, although it is a gain nonetheless.⁸

Globerman's final section is on policy issues, of which he distinguishes three major areas: Because a number of the benefits of e-commerce come from efficiencies associated with expansion of geographical markets, improved international agreements are needed to foster e-commerce. Globerman also notes that in the area of international relations, Canada's restrictions on foreign ownership in, for example, banking and telecommunications may be restricting Canadian participation in the full international benefits of market integration and technology and innovation transfer. The second policy area mentioned is competition policy. Here the challenge is in cooperative arrangements and joint ventures among e-commerce participants that might end up restricting competition and reducing the potential benefits from greater competition promised by e-commerce. The third area is "agglomeration policies and domestic industrial policies". Here Globerman is concerned about whether e-commerce will tend to shift economic activity in Canada among the regions, either further concentrating it or dispersing it; he calls for careful study to check for such impacts.

⁸In a number of places in his review Globerman includes consumer welfare gains as part of the productivity linkages from e-commerce. Again, such welfare gains are important, but they will not show up in productivity statistics as currently measured.

Finally, in his overall policy conclusions, Globerman is of the opinion that there is little in the way of an "economic case for emphasizing the promotion of e-commerce" by public policy, and especially through subsidies or tax advantages. He believes it would be difficult to show that any such programs would have benefits offsetting the associated "dead-weight" costs and that they would, moreover, distort the evolutionary transition from conventional to e-commerce that will undoubtedly impose costs on the former. On this point we heartily agree, but we note that the paper is not primarily written to support this particular conclusion.

In sum, the Globerman review is, in our view, an excellent starting place for assessing the linkages between e-commerce and productivity growth. Three major conclusions, especially, need to be carried away from the study:

- 1) To overstate somewhat, 'not all of the hype about e-commerce is true': For example, while some cost reductions are indeed found to be large and significant, both theory and evidence to date suggest a much weaker impact than commonly touted for price reductions, increased competition and greater geographical reach.

- 2) The productivity impacts of e-commerce may occur in large part outside the sector itself. This is a point that we will emphasize elsewhere: Some of the largest productivity gains from e-commerce will not occur necessarily within e-commerce itself or as e-commerce substitutes for more traditional retail sales, but in other sectors as e-commerce comes to be used in place of more traditional retailing and wholesaling. This will show up in actual measured productivity

increases in other sectors as B2B e-commerce permits administrative, inventory and labour savings, and in improved consumer welfare from greater choice via B2C e-commerce (although the latter will not affect aggregate productivity as currently measured).

3) In the policy realm, e-commerce will benefit from breaking down international barriers and enhanced competition, as well as the better education and infrastructure provision that will assist all productivity growth, but there is no need for special subsidies or tax breaks.

2) 'Innovation in a Knowledge-Based Economy' by Hirshhorn, Nadeau and Rao

The second background paper is 'Innovation in a Knowledge-Based Economy: The Role of Government' by Ronald Hirshhorn, Serge Nadeau and Someshwar Rao. Again, the paper is a timely and effective summary of its subject and well repays full reading. What follows is our brief summary and comments.

The paper proceeds in three major sections: The first makes the point that technological change is important for growth and competitiveness and that Canada has some important deficiencies; the second reviews the various market failures that may result in less-than-optimal investment in R&D and science and technology; and the third reviews how governments can offset some of these failures.

The authors do not spend much time making the case that technological improvement is important - nor need they do so. They spend most of this section outlining Canadian deficiencies, especially compared to the U.S. These are evidenced by relatively low R&D expenditures in Canada, low numbers of patents and the relatively slow pace of technology adoption in Canadian manufacturing. They also point to relatively lower levels of Canadian machinery and equipment investment in the 1990s as indicative of Canada's falling behind. Our own view is that, while one can quibble about some of these figures (e.g., the U.S. measures M&E investment differently than Canada (it includes software, which will bias the comparison)) the basic conclusion is still valid and it is worthwhile for Canada and Canadian governments to be concerned in this area, so long as the comparisons do not lead to 'panic' and result in wasteful and misguided public policy.

As the authors point out, the principal reason for private market failure in R&D and technology is the large spillovers that occur from such activities and that will not accrue back to firms. This is likely to lead to serious underinvestment. The problem may be less serious for a small economy like Canada, which will benefit from worldwide spillovers, but is made worse for a small country in that many such investments are 'risky' and 'lumpy'; large firms can pool risks and undertake large projects (there are economies of scale) which will potentially disadvantage a smaller country. Imperfect information, or the costs of acquiring information, can be serious impediments to small and medium size firms (SMEs), especially in what is already a small country. The problems indicated by the authors are real, but there is throughout their discussion an very healthy note of caution: Newer work has made some of the cases for intervention less

clear than before, and there is a wider appreciation that governments cannot omnipotently address cases of market failure as imperfect information hampers governments as well.

It is in discussing the present and potential role of governments in the technology sector in Canada that the paper makes its largest contributions. Again, and importantly, there is a healthy tone of skepticism and humility. At the same time, the authors make the plea that government policy not be assessed against impossibly perfect ideals, but rather on the humbler criteria of whether it made a net improvement or met the test of benefits vs. costs. On this basis they find that a number of Canadian programs have been success stories, as has also been recognized by the OECD, while it is clear that there also have been some failures.

They consider three major areas of policy action: (1) promotion of R&D, (2) facilitating national innovation, and (3) creating a favourable framework for technological advances.

Under promotion of R&D we think it is safe to say that the authors think (and we agree) that Canada is doing about all it can and should in terms of providing tax incentives and subsidies - which are among the most generous available. Additional funds and resources would be better placed elsewhere - for example in general corporate tax reductions that would also have favourable effects on risk/return calculations for R&D and for the location of high-tech activity in Canada. On the international dimension, they make the point strongly that, as a small country that will generally benefit from spillovers, it is in Canada's interest to work for fewer restrictions on technology transfer and, where appropriate, to make sure that intellectual property (IP) rights do not become too restrictive.

In the area of facilitating innovation the authors point to a strong role for government in disseminating information and in bringing research groups together. A catalogue of a number of government programs deemed to be successful in this area is provided, with a prominent place for the 'National Centers of Excellence' programs. Again, however, the authors are (rightly) cautious: "Part of the appeal of existing programs is that government is mainly acting as a facilitator or catalyst and public expenditures are relatively modest. With large program expenditures, there is a danger that marginal benefits will be less than those that could alternatively be achieved by reducing tax rates." (p. 31)

Finally, the authors consider how the wider policy framework that could encourage technology and productivity growth. Our own view is that this dimension of technology policy is extremely important and it is very encouraging to see it given such strong emphasis in a study from Industry Canada.

A number of policy-framework areas are highlighted by the authors:

The first rests on the fact that Canada is a small economy that depends strongly on technology transfers from abroad. The authors conclude that therefore general policy should continue to open trade and especially foreign direct investment (FDI). They point to general taxation levels as possibly important tools for attracting or keeping human talent and FDI with all the technology gains that come with it. While we are not convinced by the 'brain drain' arguments for across the board PIT cuts, it is clear that the area merits further research - something that should be very interesting as the recent federal and provincial PIT cuts take effect.

The authors are also concerned about the relatively low level of M&E investment in Canada, compared to the U.S. They point to the high federal debt burden as a possible cause. While this might have contributed to higher real long rates in Canada in the past, tight monetary policy, stagnant growth in the early and mid 1990s and weak profit performance we would view as just as important. In any event, the federal deficit has been replaced by a surplus and M&E investment is now climbing strongly, and the focus must be on the future. We think Hirshhorn et al. are right to suggest further debt reduction as a spur to M&E investment, but from hereon the reason is not to reduce the risk premium on Canadian borrowing but to get the proper mix of fiscal and monetary policy. We make the point elsewhere but, briefly, as the Canadian economy approaches full employment it must be determined how much of its limited resource will go to investment and how much to current consumption and government spending. With too many personal tax cuts and government spending increases, the economy will threaten to overheat and monetary policy will tighten and the dollar rise. This will impede investment and possibly competitiveness and FDI, with eventual losses to technological improvement and productivity gains. On the other hand, tighter fiscal policy (and more debt reduction as a result) will give more scope for lower interest rates and a lower dollar, which will encourage investment and, possibly, FDI. It is a difficult decision of "jam today" vs. "jam tomorrow", but I think we can say we are in agreement with Hirshhorn et al. that there is a major danger of too much "jam today" in the present conduct of aggregate fiscal policy.

As part of their 'framework' review, the authors indicate that there is still a strong role for human capital development and the support of education at all levels. They note that Canada already

devotes a relatively high level of resources to this area, but indicate that significant improvements could be made in particular areas, and in perhaps making current expenditures more efficient.

Hirshhorn et al. reiterate the importance of having a competitive corporate tax system (instead of more generous direct R&D support) and strongly endorse (as do we) the proposals of the Technical Committee on Business Taxation to make the overall corporate tax system more neutral.

Finally, the authors point to the need to remove policies that impede economic change and transformation. They note, with approval, that government policies are shifting away from "bail-outs" and more to the assistance of workers and families to respond to change. They would like to see further freeing up of markets and breaking down of barriers within the Canadian economy as a whole.

Briefly then, the paper by Hirshhorn, Nadeau and Rao is an excellent review of the policy challenges of the new economy and technological change in general, with refreshing caution about what Canadian governments can do, and a pleasing willingness to consider wider policy and its implications.

3) 'The Location of Higher Value-Added Activities' by Steven Globerman

The third paper, 'The Location of Higher Value-Added Activities' is by Steven Globerman. It discusses a very particular issue regarding the information economy and its policy challenges -

namely, the issue of whether and why particular high-tech industries cluster together and what the implications might be for policy. As this is, again, a very specific subject and not immediately related to the issues on which our paper focuses, we provide only a brief summary.

Globerman concludes that there is a 'growing perception' at least among economists that knowledge-intensive sectors show regional clustering for a variety of reasons. Presumably, if policy makers wish to foster knowledge-intensive sectors in Canada they need to ask why such clustering occurs and if policy can help the process - especially in the context of a small economy, since clustering may favour larger economies. Globerman finds that the essential policy objective is to promote "conditions within regions that contribute to the realization of scale economies" since it is these scale economies that are at the heart of why clustering occurs. As he notes, "relevant conditions include an educated workforce, ... infrastructure and workable competition". Globerman also suggests that it is probably better, especially for a small country, to build on existing locations with specialized advantages rather than to try to compete directly with "rival" locations.

Globerman also points to a danger, in the Canadian context, that provincial governments will try to compete with each other for clusters, wasting resources and possibly ending up with several nascent centers none of which reaches "take-off" size. The federal government will need to mediate amongst regional claims and avoid the temptation to foster multiple clusters to achieve shorter-term political ends. In the meantime "competition policy, laws and regulations surrounding foreign investment, immigration law, federal tax legislation, and funding for R&D" are available to promote clustering, without selecting where it will necessarily occur. Note here,

as in the other two papers reviewed, the emphasis on general policies, generally applied, in place of picking "winners" either by firm, sector, technology or regional concentration.

4. Implications of U.S. Analysis for Canada

As noted above, the recent acceleration of U.S. productivity growth has probably raised U.S. potential growth by 0.6 to 1.0%. Whether this higher potential growth can be sustained over the medium term is an open question.

With the more recent increase of productivity growth in Canada, some observers have argued that we should enjoy a comparable period of robust growth as the benefit of investment in IT products and increased productivity growth in IT production are realized. While we share some of this optimism, at least in our short-term forecasts, we nevertheless must caution readers that it would be inappropriate to assume that Canada will achieve the same increase in growth over the next four years as the U.S. achieved over the past four years. We base this caution on both structural and cyclical factors.

First, the contribution of IT to potential growth in Canada should be somewhat smaller than in the U.S. for the simple reason that the IT sector is smaller in Canada. It is particularly noteworthy that the computer manufacturing industry, which accounts for the bulk of MFP growth within the IT sector of the U.S., is much smaller in Canada, so that the direct contribution of MFP growth within the IT sector will be correspondingly lower.

Jorgenson and Stiroh estimate that computer capital services contributed 0.46% to aggregate growth since 1995 (up 0.27% from the previous 5 year period). MFP within computer manufacturing contributed 0.32% to aggregate growth since 1995 (about double the rate over the previous 5 years). Since computer manufacturing in Canada is much smaller relative to GDP, the latter contribution must be reduced by a factor of about a factor of four.

Second, unless and until Statistics Canada adopts the U.S. treatment of software, measured investment in IT in Canada will be lower because much software is 'expensed' and hence does not enter investment (or aggregate output). This is purely a measurement issue,⁹ but one which should be borne in mind when Canada and the U.S. are compared. According to Jorgenson and Stiroh, over the 95-98 period, software capital services contributed 0.19% to growth and MFP in the software industries contributed 0.08%. Taken together these two effects could account for a quarter point difference in potential growth between Canada and the U.S. Increased investment in software accounted for a 0.1% increase in potential growth in the U.S. (1995-98 vs. 1990-95). When account is taken of these structural and measurement differences, Canada's potential growth could increase by 0.4 to 0.8% if the recent U.S. developments are replicated here.

On the demand side, as noted above, investments in IT have contributed to the strength of aggregate demand in the U.S.. Strong demand growth has accompanied the supply side

⁹Another measurement issue relates to the base year for measuring real GDP. The U.S. uses a chain-linked price deflation for estimating real GDP growth, whereas Canada uses a Paasche price index. When the Canadian N.A. are rebased to \$1997, the weight of investment in real GDP will be reduced, with real growth lowered as a consequence.

improvements in productivity, allowing the U.S. economy not only to realize its higher potential growth, but also to grow above its potential, reducing the unemployment rate to 4%.

Whether Canada could anticipate such higher aggregate demand growth is problematical. Unlike the US economy, where domestic demand dominates foreign trade, and the economy itself is an "engine" of global growth, the Canadian economy is trade dependent (and the global impact of Canadian aggregate demand growth is weak).

Also, the current degree of slack in the Canadian economy may not provide as much room for non-inflationary growth above potential as existed in the US in 1995. This depends on the value of the NAIRU in Canada (and of the Bank of Canada's estimates of the NAIRU).

A related issue of importance here is whether the recent increase in labour force participation rate continues. If "discouraged workers" can be drawn back into the work force, above potential growth becomes more feasible.

Because of the greater importance of foreign trade to Canada, real demand growth here depends more strongly on the growth of our trading partners, in particular on U.S. growth. With the likelihood that US growth will slow, at least down to the U.S. potential rate, that development will put a damper on Canada's export growth.

With core inflation creeping up towards the mid-point of the Bank of Canada's target zone, we would anticipate that the Bank would validate any productivity improvements on the supply side, but would be unlikely to accept growth much above the increased potential rate.

5. Policy Implications

This final section considers the policy implications of the analysis. We first consider macroeconomic policy issues, and then turn to review some selected micro-policy issues.

5.1 Macroeconomic Policy Issues

The macroeconomic effects of IT include increased productivity growth and increased potential output growth, possibly accompanied by a decline in the NAIRU. These effects have important implications for the appropriate conduct of monetary (and fiscal) policies. With a higher 'speed limit' because of higher potential growth, demand management policies should seek to accommodate higher real demand growth. Easier monetary policies coupled with selective fiscal policies can be used to stimulate demand growth while facilitating increased investment which will re-enforce potential growth.

To determine whether the NAIRU has declined, the Bank of Canada should tolerate growth somewhat above potential, allowing the unemployment rate to probe the limit of the NAIRU.

5.2 Microeconomic Policy Issues

Microeconomic policy issues have been ably considered by the three background papers. We fully concur with the view that the government should not attempt to "pick winners". We do not need a new industrial policy designed to favour IT. The growth of the 'new economy' deserves policy support where possible, but so does high-productivity growth in general, and with no attempt to select 'winners' whether by sector, type of technology, region or 'cluster'.

Rather the government should focus on policies which facilitate private sector adaptation. These include appropriate investments in public sector infrastructure (including support of networks which generate positive externalities), training and education and designing a tax structure which does not penalize new economy industries. The 5-year corporate tax reduction plan in budget 2000 addresses some of these issues. We would recommend timely implementation of the planned corporate income tax cuts (which would reduce the tax burden on services relative to manufacturing). Other tax reforms should be considered which would improve the overall tax structure, while reducing barriers to entry in the IT sector. Examples include increased CCA rates for systems software and computers, and increased loss carryforward periods for ordinary business losses.

Nevertheless, it is inevitable that advocates and participants in the sector should plead for special treatment. For example, a number of special tax measures were asked for in the report 'Fast Forward' prepared by the Boston Consulting Group for the E-Business Roundtable, and tax and other disincentives are again the subject of a report released by the Roundtable on September 18 (including, according to one report, that student loan rates are too high for e-business students!)

'Fast Forward' identifies several tax issues which may act to inhibit both the creating of startup companies and taking them public. These include the higher rate of tax on capital gains in Canada relative to the US, the absence of rollover provisions for venture capitalists, and the tax treatment of stock options. However, the federal budget of February, 2000 has taken three important steps which address these concerns:

1. The general rate of capital gains taxes was lowered by about 4 percentage points.
2. The tax treatment of stock options was changed to make options much more attractive. Henceforth stock options are taxable only at the time the stock is sold.
3. A rollover provision will allow some venture capital investment to be realized and reinvested without attracting capital gains tax.

In addition, the 5 year tax reduction plan commits the federal government to eliminating the 5% surtax for higher income tax payers as well as reducing the basic federal tax for the middle income bracket by 3 percentage points.

In some provinces provincial tax changes will also contribute to a more favourable tax environment. In Alberta, a flat tax (at a rate of 10.5%) will go into effect at the beginning of next year. In Alberta, therefore, the top marginal rate of tax on capital gains next year will be 27%. Ontario is phasing in another round of general tax reductions. When Ontario switches to a tax on income base system, we anticipate that the existing high rate of provincial surtax (currently 56%) will be reduced, allowing top marginal rates on capital gains to decline from their current 32% level.

Other features of the Canadian tax system are actually favourable to start-up enterprises. Canada's tax treatment of small Canadian Controlled Private Corporations (CCPCs) is more favourable than that of the US. CCPCs are taxed at low rates (which vary from 18% to 22% depending on the province) on the first \$200,000 of active business income. This allows retained earnings to be reinvested in business assets at a low rate of tax. As important, shares qualifying in CCPCs (including large firms as well as small) are eligible for the \$500,000 lifetime capital gains exemption.

While Budget 2000 represents a good start, more remains to be accomplished. A further reduction in capital gains tax rates would be feasible as part of a more general reform of the tax treatment of corporate income, dividends and capital gains. The current tax credit for labour sponsored venture funds could be replaced by a more general venture capital incentive system¹⁰.

However, any such incentive should be generally available for *all* qualifying ventures, and not restricted to Internet or 'new economy' ventures. We see no need for special tax incentives for e-business, as recommended in the 'Fast Forward'¹¹. A tax incentive which is restricted to Internet-related activities is distortionary and could be subject to abuse.

¹⁰See Jack M. Mintz and Thomas A. Wilson *Capitalizing on Cuts to Capital Gains Taxes*, C.D. Howe Institute Policy Commentary No. 137, Feb 2000, p. 21.

¹¹ See *Create a time-limited tax incentive* on p. 37 of *Fast Forward* and *Permit deferred capital gains taxation on qualified investments* in *Internet-related companies* on p. 39.

References

- Baldwin, John R.; Rama, Ed and Sabourin, David. "Growth of Advanced Technology Use in Canadian Manufacturing During the 1990s." Statistics Canada, Analytical Studies Branch, Research Paper Series No. 105; Ottawa, December 1999.
- Baldwin, John R. and Hanel, Petr. "Multinationals and the Canadian Innovation Process." Statistics Canada, Research Paper No. 151; Ottawa, June 2000.
- Baldwin, John R. and Sabourin, David. "Technology Adoption: A Comparison Between Canada and the United States." Statistics Canada, Research Paper No. 119; Ottawa, August 1998.
- Baldwin, John R.; Hanel, Petr and Sabourin, David. "Determinants of Innovative Activity in Canadian Manufacturing Firms: The Role of Intellectual Property Rights." Statistics Canada, Research Paper No. 122; Ottawa, March 2000.
- Boston Consulting Group. "Fast Forward: Accelerating Canada's Leadership in the Internet Economy." Report prepared for the Canadian E-Business Roundtable, January, 2000.
- Coppel, Jonathan. "E-Commerce: Impacts and Policy Challenges." OECD, Economics Department Working Paper No. 252, June 2000.
- Coulombe, Serge. "The Canada-U.S. Productivity Growth Paradox." Industry Canada Research Publications Program, Working Paper 32, March 2000.
- Gellatly, Guy and Peters, Valerie. "Understanding the Innovation Process: Innovation in Dynamic Service Industries." Statistics Canada, Research Paper No. 127; Ottawa, December 1999.
- Globerman, Steven. "The Location of Higher Value-Added Activities." Paper prepared for CSLS-Industry Canada volume *Productivity Issues in a Canadian Context*, Draft, June, 2000.
- Globerman, Steven. "Electronic Commerce and Productivity Growth: Defining and Assessing the Linkages." Paper prepared for CSLS-Industry Canada volume *Productivity Issues in a Canadian Context*, Draft, August, 2000.
- Gordon, Robert J. "Foundations of the Goldilocks Economy: Supply Shocks and the Time-Varying NAIRU." *Brookings Papers on Economic Activity*, 1998(2), pp. 297-333.

- Gordon, Robert J. "Does the 'New Economy' Measure Up to the Great Inventions of the Past?" *Journal of Economic Perspectives*, forthcoming. (Draft of May 1, 2000)
- Gordon, Robert J. "Comment on Jorgenson and Stiroh." *Brookings Papers in Economic Activity*, 2000(1), pp. 212-222.
- Greenspan, Alan. "Improving our Understanding of Productivity." Federal Reserve Bank of Minneapolis, *The Region*, July 2000; (<http://woodrow.mpls.frb.fed.us/pubs/region/00-06/greenspan.html>).
- Gu, Wulong and Ho, Mun S. "A Comparison of Industrial Productivity Growth in Canada and the U.S." *American Economic Review*, May 2000 (*Papers and Proceedings*), 90(2), pp. 172-175.
- Gu, Wulong; Lee, Frank C. and Tang, Jianmin. "Economic and Productivity Growth in Canadian Industries." *American Economic Review*, May 2000 (*Papers and Proceedings*), 90(2), pp. 168-171.
- Hirshhorn, Ronald; Nadeau, Serge and Rao, Someshwar. "Innovation in a Knowledge-Based Economy: The Role of Government." Paper prepared for CSLS-Industry Canada volume *Productivity Issues in a Canadian Context*, Draft, February, 2000.
- Industry Canada. "Challenges of Rapid Technological Change." *Micro-Economic Monitor*; Ottawa, (ISSN 1206-260X), 2000.
- Jorgenson, Dale W. and Stiroh, Kevin. "U.S. Economic Growth at the Industry Level." *American Economic Review*, May 2000 (*Papers and Proceedings*), 90(2), pp. 161-167.
- Jorgenson, Dale W. and Stiroh, Kevin. "Raising the Speed Limit: U.S. Economic Growth in the Information Age." *Brookings Papers on Economic Activity*, 2000(1), pp. 125-211.
- Lee, Frank C. and Tang, Jianmin. "Productivity Levels and International Competitiveness Between Canadian and U.S. Industries." *American Economic Review*, May 2000 (*Papers and Proceedings*), 90(2), pp. 176-179.
- Martin, Roger L. and Porter, Michael E. "Canadian Competitiveness: Nine Years after the Crossroads" Mimeo, January 2000.
- Morck, Randall and Yeung, Bernard. "The Corporate Response - Innovation in the Information Age." Industry Canada Research Publications Program, Working Paper 10, December 1998.

- Oliner, Stephen D. and Sichel, Daniel E.. "The Resurgence of Growth in the Late 1990s: Is Information Technology the Story?." Federal Reserve Board, Washington; May 2000.
- Organization for Economic Cooperation and Development (OECD). "A New Economy? The Changing Role of Innovation and Information Technology in Growth." Directorate for Science, Technology and Industry; July, 2000.
- Organization for Economic Cooperation and Development (OECD). "The Knowledge-Based Economy: A Set of Facts and Figures." Document prepared for the 1999 Meeting of the Committee for Scientific and Technological Policy at Ministerial Level; Paris, 1999.
- Runkle, David E. "Old Ideas at Work in the New Economy." Federal Reserve Bank of Minneapolis, *The Region*, July 2000; (<http://woodrow.mpls.frb.fed.us/pubs/region/00-06/Runkle.html>).
- Sabourin, David and Beckstead, Desmond."Technology Adoption in Canadian Manufacturing - Survey of Advanced Technology in Canadian Manufacturing 1998." Statistics Canada, Science, Innovation and Electronic Information Division Research Paper No. 05; Ottawa, August 1999.
- Scarpetta, Stefano; Bassanini, Andrea; Pilat, Dirk and Schreyer, Paul. "Economic Growth in the OECD Area: Recent Trends at the Aggregate and Sectoral Level." OECD, Economics Department Working Paper No. 248, June 2000.
- Schreyer, Paul. "The Contribution of Information and Communication Technology to Output Growth: A Study of the G7 Countries." OECD, Science, Technology and Industry Directorate Working Paper 2000/2, March 2000.
- Schreyer, Paul. "Information and Communication Technology and the Measurement of Real Output, Final Demand and Productivity." OECD, Science, Technology and Industry Directorate Working Paper 1998/2, July 1998.
- Sichel, Daniel E. "Comment on Jorgenson and Stiroh." *Brookings Papers in Economic Activity*, 2000(1), pp. 222-229.
- Trajtenberg, Manuel. "Is Canada Missing the 'Technology Boat'? Evidence from Patent Data." Canadian Institute for Advanced Research, Discussion Paper No. 9, January 2000.

United States Department of Commerce. "Digital Economy 2000." Economics and Statistics Administration, Office of Policy Development, Secretariat on Electronic Commerce. June 2000.

Wirtz, Ronald A. "The New (and Improved) Economy." Federal Reserve Bank of Minneapolis, *The Region*, July 2000; (<http://woodrow.mpls.frb.fed.us/pubs/region/00-06/wirtz.htm>)