

Assessing Aggregate Labour Productivity Trends in Canada and the United States: Total Economy versus Business Sector Perspectives

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SINCE 1981, BUSINESS SECTOR productivity growth (output per hour) has greatly exceeded total economy output per hour growth in the United States, but not in Canada. The growth differential for the 1981-2003 period was 0.46 percentage points per year in the United States, compared to only 0.08 percentage points per year in Canada. This situation has important implications for the assessment of Canada's productivity performance relative to that in the United States. U.S. aggregate labour productivity growth exceeded that in Canada according to both productivity measures over the 1981-2003 period, and in almost all sub-periods within this period. But the U.S.-Canada productivity growth rate gap was much higher for the business sector than for the total economy (0.76 versus 0.37 percentage points per year). Thus a focus on the business sector leads to a more pessimistic conclusion regarding Canada's relative aggregate labour productivity performance than a focus on the total economy. This

article examines the sources of the sensitivity of Canada-U.S. productivity growth comparisons to the total economy/business sector choice. Further, it attempts to ascertain at which level aggregate productivity growth comparisons are most meaningful.

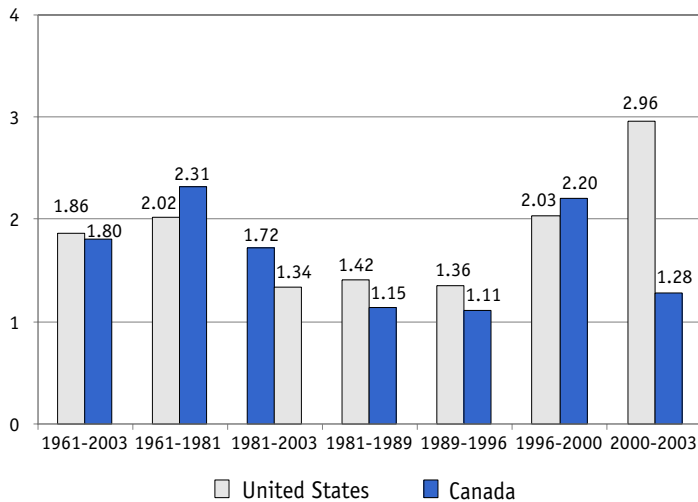
The first section of this article attempts to explain the smaller gap between business sector and total economy productivity growth in Canada versus the United States, and finds that the main factor behind this difference is measured productivity growth in the non-business sector. This section also discusses the methods used to measure non-business sector output in the two countries. The second section outlines the advantages and disadvantages of the business sector and total economy for assessing aggregate productivity trends. The final section concludes by suggesting that, given these advantages and disadvantages, the appropriateness of each level for making productivity comparisons depends on the specific purpose of the comparison.

¹ The author is an economist at the Centre for the Study of Living Standards. He would like to thank Andrew Sharpe for much assistance in the preparation of this article. Numerous others have also provided useful comments, including Renée St-Jacques, Someshwar Rao, Jianmin Tang, Benoît Robidoux, Frank Lee, Jeanne Lafortune, Jean-Pierre Maynard, Bart van Ark, Dirk Pilat and Paul Schreyer. This article is based on a paper entitled "Aggregate Labour Productivity Growth in Canada and the United States: Definitions, Trends and Measurement Issues" (Smith, 2004) that was originally prepared for an inter-departmental seminar on Canada-U.S. labour productivity growth comparisons organized by Industry Canada in December 2003. The paper is available with this article at www.csls.ca under the *International Productivity Monitor*. Email: jeremy@csls.ca.

Chart 1

Output per Hour Growth in the Total Economy in Canada and the United States, 1961-2003

compound average annual rates of change, per cent



Source: Output estimates are expenditure-based GDP estimates from the national accounts for each country. Hours data are taken from the Productivity Program Database of Statistics Canada for Canada, taking growth rates from an Aggregate Productivity Measures series for 1961-1997. Hours for the United States are from an unpublished Bureau of Labor Statistics series.

The focus of this article is on labour productivity *growth* and comparisons of *growth rates* between the United States and Canada. This is in contrast to comparing *levels* of labour productivity at a given point in time between the two countries, which is a more complex procedure as output series must be converted to a common currency using estimates of purchasing power parity.² Also, the focus is on labour productivity exclusively, with no discussion of capital and total factor productivity. The number of workers employed is a poor measure of total labour input since individuals vary greatly in the average hours that they are at work. For this reason output per hour is a superior measure of labour productivity compared to output per worker,

both over time and across countries. It is the labour productivity concept used in this article.

This article draws on Smith (2004), which provides a thorough discussion of issues associated with defining and measuring aggregate labour productivity in Canada and the United States. Among these issues is the choice of the different data sources available for constructing labour productivity series in both countries. That study makes recommendations as to the series that are the most appropriate for constructing productivity measures based on their underlying statistical methodologies as well as cross-country comparability. This article examines labour productivity trends based only on these recommended series. Not surprisingly, the most appropriate underlying output and labour input series, where available, are the ones produced by the productivity authorities in each country to conform as closely as possible to international System of National Accounts guidelines.

Productivity Trends in the Canadian and U.S. Business and Non-business Sectors

Data Sources and Trends

The Statistics Canada Productivity Program Database (PPD) contains official productivity estimates for the business sector. Statistics Canada does not produce an official labour productivity series for the total economy, and does not currently officially release the labour productivity series for the non-business sector. However, Statistics Canada does produce labour input estimates for both the total economy and non-business sector that are consistent with the labour input estimates used in the construction

2 See Sharpe (2003) for a discussion of the factors behind Canada's productivity level gap with the United States, the benefits of closing this gap and the data issues encountered in measuring productivity levels in Canada and the United States. Also see Conference Board of Canada (2003:57) for a checklist of issues encountered in comparing income levels across countries.

of the official business sector labour productivity series. Labour productivity series for the total economy and non-business sector can hence be constructed with these labour input estimates and with output estimates from the national accounts.³

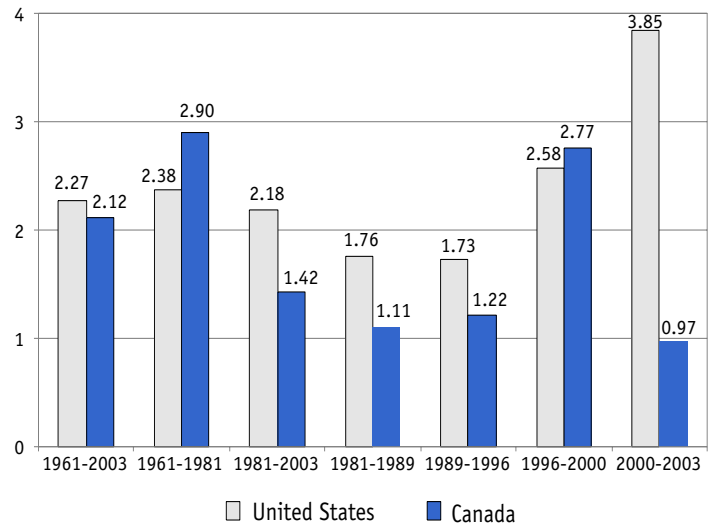
The Productivity and Costs program of the U.S. Bureau of Labor Statistics – the official productivity authority in the United States – produces official business sector estimates, but does not produce total economy or non-business sector labour productivity series. Labour input estimates for the total economy consistent with those used in the official business sector labour productivity series are produced but are not published. As with Canada, a total economy labour productivity series can hence be constructed with these labour input estimates along with output estimates from the national accounts. This article calculates non-business sector hours for the United States from the unpublished BLS total economy hours series and an unpublished version of the official business sector hours series, both in level form (as opposed to the published index form for the business sector series). Non-business sector output is calculated from total economy and business sector GDP estimates in level form from the Bureau of Economic Analysis (which are consistent with the official business sector output series used by the Bureau of Labor Statistics).

Charts 1 and 2 show growth rates in output per hour in Canada and the United States for 1961-2003 and selected sub-periods, at the total

Chart 2

Output per Hour Growth in the Business Sector in Canada and the United States, 1961-2003

compound average annual rates of change, per cent



Source: Productivity and Costs Program of the Bureau of Labor Statistics for the United States. Productivity Program Database of Statistics Canada for Canada, quarterly converted to annual averages for 1987-2003, taking growth rates of an Aggregate Productivity Measures series for 1961-1987.

economy and business sector level respectively.⁴ Productivity growth in the United States has outpaced that in Canada in every period since 1981 except 1996-2000, at both levels.⁵ For example, output per hour growth in the total economy was 1.34 per cent per year in Canada in 1981-2003, compared to 1.72 per cent per year in the United States for the same period. In the business sector, the corresponding growth rates were 1.42 and 2.18 per cent per year respectively. The Canada-U.S. growth differential was similar in magnitude

3 It should be mentioned that the non-business sector output series from the GDP by industry accounts has been modified in that the value of imputed rents from owner-occupied dwellings has been added. This is necessary for consistency with the official Productivity Program Database business sector output series, which excludes imputed rents, and the total economy expenditure-based GDP estimate, which includes imputed rents.

4 The rationale for the specific sub-periods included in Charts 1-3 is provided in Smith (2004). For the calculation of growth rates, this article treats the first year in a given time period as the base year. All growth rates unless stated otherwise are compound average annual growth rates. For example, a growth rate for the 1981-2003 period is the compound average annual growth rate using 1981 as the base year and 2003 as the last year.

5 Note that this observation, as well as the small gap between business sector and total economy productivity growth in Canada after 1981, is a reversal from the 1961-1981 period.

Table 1
Output per Hour Growth in Canada and the United States in the Total Economy and the Business Sector, 1981-2003
 compound average annual rates of change, per cent

	Canada	United States	United States - Canada
Business Sector	1.42	2.18	0.76
Non-business Sector	1.12	0.15	-0.97
Total Economy	1.34	1.72	0.37
Business Sector - Total Economy	0.08	0.46	

Source: Output estimates for the total economy are expenditure-based GDP estimates for both countries. For the non-business sector, output data are GDP by industry estimates for Canada, and are based on a Laspeyres approximation of a chained dollar series from total economy and business sector series from the national accounts for the United States. Total economy hours are from the Productivity Program Database for Canada and an unpublished series from the Bureau of Labor Statistics for the United States. Business sector series are from the Productivity Program Database for Canada (quarterly data converted to annual averages for 1987-2003, taking growth rates from the corresponding Aggregate Productivity Measures series for 1961-1987) and the Productivity and Costs Program for the United States.

in the 1981-1989 and 1989-1996 periods, but was much larger in the 2000-2003 period.⁶ This was offset by higher output per hour growth in Canada than in the United States in the 1996-2000 period, at 2.77 per cent per year compared to 2.58 per cent per year.

As these estimates indicate, and as is shown more clearly in Table 1 for the 1981-2003 period, the gap between Canadian and U.S. labour productivity growth has been twice as large at the business sector level than at the total economy level. Table 1 also shows that, consequently, the difference between business sector and total economy productivity growth has been larger in the United States than in Canada: 0.46 versus 0.08 percentage points per year.

The Impact of Non-business Sector Productivity Growth on the Business Sector-Total Economy Productivity Growth Gap

The main source of the smaller gap between Canadian business sector and total economy output per hour growth relative to the gap in the United States is higher measured non-business sector productivity growth in Canada.⁷ Chart 3 shows that, indeed, non-business sector labour productivity growth in Canada has significantly and consistently outpaced that in the United States since 1981.⁸ The non-business sector has therefore represented a significant drag on total

6 Sharpe (2004) discusses recent productivity trends in Canada and the United States in more detail, and attempts to explain the large Canada-U.S. growth differential in the 2000-2003 period.

7 The smaller gap in Canada could in principle be caused by compositional shifts in both countries, in addition to differences in productivity trends in the non-business sector. Total economy output per hour growth is roughly a weighted average of output per hour growth in the non-business sector and the business sector (where the weights are the respective shares in total economy output in the initial period) plus a compositional shift effect. Composition, i.e. the relative shares of business and non-business sector hours worked in total economy hours worked, has a positive effect on total economy productivity growth if the sector with a higher level of output per hour experiences an increased hours share over the period examined. If Canada had experienced a stronger positive compositional effect over the 1981-2003 period than the United States, this would have increased Canadian total economy output per hour growth relative to business sector growth more so than in the United States, thereby accounting for part of the smaller gap between total economy and business sector productivity growth in Canada than in the United States. However, both countries actually experienced small negative compositional effects over the 1981-2003 period, so that this factor accounts for virtually none of the smaller Canadian gap. Additional details are provided in Smith (2004).

8 Mathematically, it is actually the difference between business sector and non-business sector productivity growth that affects the business sector-total economy growth gap, as opposed to the non-business sector productivity growth rate itself. The business sector-non-business sector growth differential is small in Canada compared to the United States both because of higher non-business sector productivity growth and, to a slightly lesser degree, lower business sector productivity growth. The lower business sector productivity growth in Canada relative to the United States has probably been driven primarily by very poor manufacturing productivity growth in Canada compared to the United States. This poor relative productivity performance in Canadian manufacturing, and the factors behind it, are discussed in Bernstein, Harris and Sharpe (2002). The focus of the rest of this section will be on explaining the stronger non-business sector productivity performance in Canada compared to the United States.

economy labour productivity growth in the United States because productivity growth in this sector has been only slightly above zero (e.g. 0.15 per cent per year for 1981-2003). At 1.12 per cent per year for the same period in Canada, non-business sector productivity growth dampened total economy growth less than in the United States, and contributed significantly to the smaller gap between total economy and business sector productivity growth.

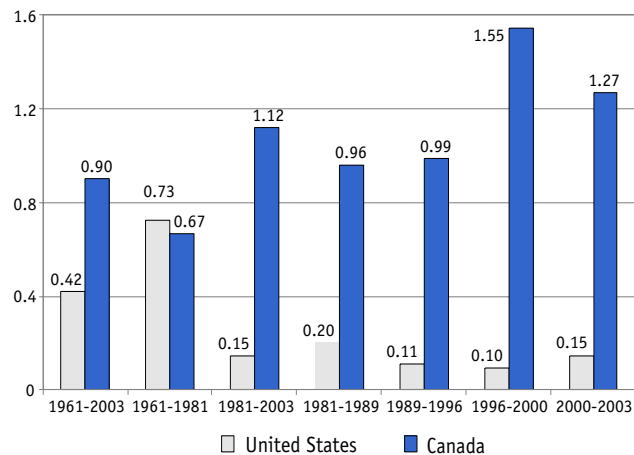
Possible Sources of High Measured Productivity Growth in the Canadian Non-business Sector

The high non-business sector output per hour growth rates in Canada are perplexing, as it is widely believed that measured productivity growth in the non-business sector (education, health, public administration) should be weak because of the widespread use of labour input as a proxy for output in many non-business industries. This yields, by definition, zero labour productivity growth. The growth rates for Canada in Chart 3 therefore seem quite high, while the growth rates for the United States appear more consistent with input-based output measurement.

The high non-business sector output per hour growth rates in Canada – both relative to the United States and relative to expectations – may be explained by several factors: high growth of imputed rents; more quality adjustment of labour used in non-business sector output measurement in Canada; and more attempts in Canada to calculate physical measures of output in some non-business sector industries.

Imputed rental value of owner-occupied dwellings is included in non-business sector out-

Chart 3
Output per Hour Growth in the Non-business Sector in Canada and the United States, 1961-2003
compound average annual rates of change, per cent



Source: Output data are GDP by industry estimates for Canada, and are based on a Laspeyres approximation of a chained dollar series, calculated from total economy and business sector series from the national accounts, for the United States. Imputed rents have been added to the Canadian output series, and are already included in the U.S. output series. Hours data are from the Productivity Program Database for Canada, and are calculated from unpublished total economy and business sector data from the BLS Productivity and Costs Program.

put in both Canada and the United States.⁹ Therefore, if imputed rents (i.e. the part of non-business sector output without a corresponding labour input) are growing significantly faster in Canada than in the United States, then there will be higher productivity growth in the non-business sector in Canada than in the United States. This certainly appears to have been the case since 1981. Real imputed rents grew by 3.3 per cent per year in Canada between 1981 and 2002, but only by 2.7 per cent per year in the United States.¹⁰ This gap of 0.6 percentage points per year between Canadian and U.S. growth in real

⁹ This point deserves clarification. In both countries, imputed rents are excluded from business sector output for the purposes of productivity measurement. However, the business sector aggregation from the national accounts includes imputed rents in Canada but excludes imputed rents in the United States. The non-business sector output series for the United States calculated for this article hence includes imputed rents, while the series taken from the national accounts for Canada does not include imputed rents. But since imputed rents are excluded from the business sector output series for Canada used by this article, they have been added to non-business sector output, both for consistency with total economy output in Canada and with non-business sector output in the United States.

imputed rents accounts for just over one half of the non-business sector output per hour growth differential for 1981-2003.¹¹

Statistics Canada officials have noted that, for the purposes of measuring the output of some non-business sector industries, there may be quality adjustments made to labour input (Baldwin and Maynard, 2004). This would entail weighting workers who are paid more than others more heavily in the calculation, under the assumption that higher paid workers produce more output. This would lead to measured output growing faster than the unadjusted labour series from which it was constructed, and result in positive productivity growth. It is not known whether such quality adjustment is more widespread in Canada than the United States. If it were, this would imply a greater gap between growth in labour input and measured output growth in the non-business sector in Canada relative to the United States, or in other words, it would explain part of the higher Canadian non-business sector output per hour growth.

Baldwin and Maynard (2004) also note that Statistics Canada calculates output estimates for

the university sector based on physical quantity measures that are independent of labour input, and furthermore that statistical agencies in the United States are opposed to adopting such practices. Therefore, the faster non-business sector output per hour growth in Canada relative to the United States may be due in part to this and other similar differences in statistical practice, since physical measures of non-business sector output, unlike labour input-based measures, likely show positive productivity growth.

An evaluation of the full extent and effect of such measurement differences as quality adjustment and physical non-business sector output measurement would require a much more detailed examination of the measurement techniques used by statistical agencies. But one very rough method of quantifying the effect of differences in measurement techniques is to examine the non-business sector implicit price deflators for Canada and the United States. The non-business sector implicit price deflator should grow less rapidly in the country in which the most quality adjustment and physical output measurement takes place, *ceteris paribus*.¹² This

10 Data on expenditure on housing services of owner-occupied non-farm dwellings are taken from the National Income and Product Account tables on expenditure by detailed type of product for the United States, and are only available in quantity index form to 2002. Data on personal expenditure on imputed rent of owner-occupied dwellings in Canada are taken from the Canadian national accounts, and are only available from 1981 onwards.

11 It can be shown that non-business sector output per hour growth is roughly a weighted average of growth in imputed rents per hour worked in the non-business sector and other components of non-business sector output per hour worked in the non-business sector, where the weights are the relative importance of rents and other components in non-business sector output respectively. The proportion of rents in non-business sector output is about 35 per cent in both countries, and non-business sector hours grew by 0.9 per cent per year in Canada in 1981-2002 and by 1.9 per cent per year for the same period in the United States. The weighted difference between Canadian and U.S. rents per hour worked in the non-business sector in 1981-2002 is hence approximately 0.56 percentage points, accounting for 58 per cent of the 0.97 percentage point gap between Canadian and U.S. non-business sector output per hour growth. It should be noted that the U.S. non-business sector output per hour growth rate of 0.1 per cent per year and the growth rate of imputed rents per non-business sector hour worked of 0.9 per cent per year imply that productivity growth in the U.S. non-business sector excluding imputed rents was actually slightly negative for the 1981-2002 period. Further research would be required to determine the sources of this negative productivity growth.

12 Growth in a nominal series is by definition equal to the sum of growth in the corresponding real series and growth in the implicit price index. Quality adjustment and physical output measurement have the effect of increasing real non-business sector output growth for a given growth rate of nominal output. Therefore, since quality adjustment and physical output measurement make growth in real non-business sector output closer to growth in nominal non-business sector output, the growth in the implicit price index for the non-business sector must be lower when quality adjustment and physical output measurement take place than when they do not.

is precisely what is observed for Canada and the United States. The growth of the non-business sector implicit price deflator was 3.7 per cent per year in 1981-2000 in Canada, but a significantly higher 4.2 per cent per year in the United States. This compares to growth in the total economy GDP deflator of 2.8 per cent per year in the United States and 3.0 per cent per year in Canada, so overall inflation trends cannot account for the lower increase in the Canadian non-business sector deflator. Differences in statistical practices may hence plausibly account for the remaining unexplained half of the faster non-business sector output per hour growth in Canada relative to the United States.

It is interesting to note that, like the Canada-U.S. experience, the European Union has also experienced a smaller productivity gap with the United States at the total economy level than at the business sector level, at least for the 1995-2001 period (O'Mahony and van Ark, 2003). In the European Union for that period, output per hour growth in the "market economy" was 1.95 per cent per year, compared to 3.11 per cent per year in the United States. The productivity growth differential between the European Union and the United States was hence 1.16 percentage points per year, more than twice the size of the 0.54 percentage point gap at the total economy level (reflecting output per hour growth of 1.71 and 2.25 per cent per year respectively).

The Choice of Business Sector Versus Total Economy for Assessing Aggregate Productivity Growth

Given the significant difference in the picture of Canada's relative productivity performance that emerges from business sector and total economy definitions of the aggregate economy,

this section outlines the strengths and weaknesses of the business sector and total economy perspectives for assessing aggregate productivity performance.

Advantages of the Business Sector Level

The main argument for focusing on the business sector for the purposes of monitoring aggregate productivity growth is that measurement of real output is conceptually difficult in non-business sector industries such as education, health and public administration, leaving the potential for measurement error in terms of not capturing true productivity gains. By convention, labour input (or nominal labour compensation deflated by the rate of change of labour compensation) is used as a proxy for output in most non-business sector industries, resulting by definition in zero labour productivity growth. This leads in principle to a downward bias in total economy productivity growth relative to that of the business sector.

With such measurement error inherent in non-business sector (and hence total economy) output estimates, it is argued that business sector productivity trends give a more accurate picture of true aggregate productivity developments. Even though a portion of the economy is excluded, productivity gains in this part of the economy are not accurately captured in any case. In the same sense, it is argued that business sector productivity trends are preferred for comparisons across countries. This is because more effort has been focused on standardizing measurement techniques in the business sector than the non-business sector across countries, given the pitfalls in measuring non-business sector output.¹³

It is important to note though that total economy real GDP calculated on the basis of expen-

13 It should be mentioned that there are some service industries within the business sector, such as banking services, whose output is conceptually difficult to measure as well.

diture and income must by definition equal total economy real GDP calculated on an industry basis. This implies that these non-business sector mis-measurement issues are implicit in total economy real GDP estimates. To be clear, this point needs to be stressed: if one believes that non-business sector output is severely mis-measured, one must accept in turn that the expenditure-based GDP estimates that are such a ubiquitous part of economic and financial analysis also suffer from mis-measurement, in terms of not accurately capturing true developments in a portion of the economy. Likewise, probable differences across countries in statistical practices in terms of calculating output in non-business sector industries – two of which were discussed above for Canada and the United States – have implications for the cross-country comparability of expenditure-based GDP and GDP per capita growth comparisons.¹⁴

A second reason for focusing on productivity developments in the business sector is that increased productivity is an indicator of increased international competitiveness. When workers in a given industry become more productive, the output of that industry can generally be sold more cheaply, and that output in turn becomes more attractive to consumers in other countries, boosting income through higher exports. Competitiveness on a domestic industry basis, therefore, is usually of concern only for industries whose output is traded in international markets. These industries are concentrated in the business sector, so business sector productivity trends are a superior indicator of the broadly-defined international competitiveness of a country than total economy productivity trends.

Finally, business sector productivity trends are seen as more meaningful than total economy

trends because business sector output for productivity purposes excludes the value of imputed rents from owner-occupied dwellings. Imputed rents are certainly a part of the real income of a country – they represent the services available from the capital stock of the household sector, i.e. dwellings – but they are produced without a corresponding labour input. It is therefore argued that when imputed rents grow at a pace above that of the other components of GDP, total economy productivity growth will overstate the true productive capacity of the economy. This is the case because output will be growing at a rate beyond that which is implied by the rate of growth of the labour input (holding other drivers of labour productivity, such as capital intensity, constant). Besides restricting analysis to the business sector, which in addition to imputed rents leaves out the measured output (and associated labour input) of the public and other non-market sectors, an alternative way to deal with this concern is to remove imputed rents from total economy GDP to create an output measure that is more suitable for productivity analysis.

Disadvantages of the Business Sector Level

Arguments against restricting attention to the business sector in comparing productivity developments across countries focus on the fact that the composition of the business sector in a given country is sensitive to the institutional environment and definitional conventions. The distinction between market and non-market sectors may not be very meaningful in the modern economy since the definition of a marketed good is not the same in different countries and can change over time within a given country. Perhaps more

14 Of course it is possible that for a given country pairing the techniques used to measure non-business sector output are identical across countries, but that non-business sector and hence total economy productivity growth differs across countries due to different growth rates in imputed rents. In this circumstance, expenditure-based GDP estimates would be methodologically comparable across countries. As discussed in the previous section though, this does not appear to be the case in Canada and the United States.

importantly, different countries define the two sectors differently in terms of the treatment of imputed rents, public enterprises, and health and education industries. Moreover, the relative sizes of the two sectors can differ across countries even if the composition is the same.¹⁵

Consequently, it can be argued that business sector productivity estimates may not be fully comparable across countries. Weaker business sector productivity growth in one country relative to another could in principle be driven by identical productivity growth in every industry in both countries (and therefore identical total economy productivity growth) but one industry with below-average productivity growth being defined as within the business sector in the first country but outside the business sector in the second. For example, the proportion of the health industry defined as within the business sector in the United States is much larger than that in Canada. To the degree that real output in the health sector is measured by labour input and exerts a downward bias on business sector productivity growth, U.S. business sector productivity growth will have a greater downward bias than Canadian business sector productivity growth.

It must also be recognized that there are major institutional differences in the health, education and government sectors across countries. Restricting attention to the business sector, from which different countries exclude these sectors to various degrees, effectively ignores these differences. A comprehensive assessment of relative aggregate productivity performance would ideally take these differences into account.

Advantages of the Total Economy Level

The weaknesses of the business sector for assessing aggregate productivity trends can largely be overcome by monitoring trends at the total economy level. There are no concerns at the total economy level of whether certain industries are included in the analysis for certain countries. In other words, the definition of what is included in the total economy is a fixed concept across countries.

Another reason for monitoring total economy labour productivity trends, at least within countries, is that central banks and other analysts typically define potential output, the output gap, and the capacity of the economy to support sustainable real wage and employment growth at the total economy level. Of course it is also possible to undertake such analysis for the business sector as well, or for that matter at the level of individual industries. But possible dangers – in terms of not meeting objectives for aggregate output, employment and wage growth – may arise when conclusions drawn from trends in a subset of the economy are applied in making policy decisions affecting the total economy. An additional reason for preferring total economy productivity analysis within countries – or for comparisons at the regional rather than national level – is that business sector aggregations are typically not available, at least publicly, at sub-national levels.

There is in addition a very good reason for considering the total economy, not just for comparing productivity growth across countries but for monitoring productivity growth within an

15 The definition of the business sector is the same in both Canada and the United States in that the labour inputs associated with general government output (including health and education services provided by the government) and the output of non-profit institutions are excluded. The only difference is that, in the United States, the labour input from employees of private households is also excluded (BLS, 1997:chapter 10 and Baldwin and Harchaoui, 2002:185). However, the size of the business sector relative to the total economy is much larger in Canada: in 2003 the share of business sector hours worked in total economy hours was 82.6 per cent in Canada and only 75.5 per cent in the United States. Also, institutional differences lead to differences in the classification of some health and education activities as non-marketed and hence excluded from the business sector.

individual country too. The correct measurement of productivity growth is such an important issue in the first place because productivity gains improve the living standards of society – but it is aggregate, total economy productivity growth that matters from this perspective. Indeed, the growth of living standards, defined as output per capita, can be easily decomposed into changes in the employment/population ratio, average hours of work, and output per hour at the total economy level. The relationship between growth in business sector productivity and living standards is more complex. The business sector is only a portion of the total economy – indeed that portion varies, often differently for different countries, every year – and so productivity trends in the business sector give only a partial and fluctuating idea of the potential for improving aggregate living standards.

It should, however, be reiterated that since total economy GDP on an industry basis is equivalent to that on an expenditure basis, the mis-measurement and non-comparability across countries of non-business sector output is inherent in expenditure-based GDP estimates. This implies in turn that growth in total economy GDP per capita is not a well-measured or comparable metric of growth in living standards for country pairings in which non-business sector measurement techniques differ across countries.¹⁶

Disadvantages of the Total Economy Level

This measurement error inherent in total economy output estimates is the central weakness of assessments of aggregate productivity

trends at the total economy level. While analysis at the business sector level leaves out entirely the health, education and government sectors, analysis at the total economy level can only capture developments in these sectors imperfectly. Further, different conventions in measuring the output of these sectors in different countries mean that productivity trends at the total economy level are not comparable across countries. Assessing aggregate productivity trends at the total economy level hence improves comparability relative to assessment at the business sector level, since the definition of what activities are included is equivalent across countries. But at the same time, comparability suffers relative to assessment at the business sector level, since measurement techniques are less standardized across countries.

The Organization for Economic Cooperation and Development (OECD) is aware of these conflicting advantages and disadvantages of assessing productivity trends at the total economy and business sector levels. The official manual on measuring productivity growth recognizes that output measurement is difficult in non-business sector industries (OECD, 2001). But the same manual also recognizes that there are differences across countries in the composition of the business sector. As discussed in Pilat and Schreyer (2004), the OECD has recently developed a productivity database that includes labour and multifactor productivity indexes for most OECD countries. These indexes refer to the total economy. At the same time, the OECD also regularly publishes labour productivity indexes for the business sector in the bi-annual *Economic Outlook*.

16 However, it does not follow that *level* comparisons of GDP per capita are not comparable across countries, even if countries have different techniques for measuring non-business sector output. This is because these measurement techniques only affect the measurement of *real* non-business sector output, and hence *real* expenditure-based GDP. Level comparisons at a point in time are done by converting *nominal* series to a common currency using estimates of purchasing power parity (PPP) in each year. All countries use nominal labour compensation (i.e. the wage bill) to measure the nominal output of non-business sector industries and to calculate PPPs, so nominal GDP estimates are in principle comparable across countries.

Conclusion

This article has discussed the issue of whether aggregate productivity trends should be assessed at the total economy or business sector level. Unfortunately, no definitive answer to this question has been found. But it is still possible to put forward several conclusions.

First, for measuring the capacity of the economy to increase living standards, and for making cross-country comparisons in this respect, productivity should in principle be assessed at the total economy level. But it must be recognized that when statistical practices in the measurement of non-business sector output differ across countries, the comparability of estimates of both living standards and productivity is highly suspect.

For the case of Canada, it appears that estimates of GDP per capita growth and total economy labour productivity growth overstate growth in living standards and aggregate labour productivity respectively relative to the United States. This is because Canada appears to expend more effort than the United States in capturing true productivity gains in the non-business sector. If the United States were to adopt Canada's non-business sector measurement techniques – or alternatively, if Canada were to adopt U.S. practices – the growth differential between the United States and Canada, for both total economy labour productivity and GDP per capita, would be larger than present estimates imply. The business sector output per hour estimates hence *may* be *better* capturing the true productivity performance of the two economies. But differences in the size and composition of the business sector across the two countries mean that business sector productivity trends are not necessarily capturing the true productivity performance of the two economies to a much greater degree themselves.

Second, business sector labour productivity trends may be useful for some purposes. These

include competitiveness analyses, forecasting the corporate tax base, and in some circumstances, measuring the output gap. But in each of these cases there is the possibility that developments in some non-business sector industries are also of interest, or even that developments in some business sector industries are not of interest. Vigilance is always called for in ensuring that restricting the analysis to the business sector does not compromise the applicability of the results.

Third, researchers should be more wary of differences in statistical methodologies before making cross-country comparisons. Recourse to business sector analysis is not necessarily the safeguard it is perhaps meant to be, in that, although international efforts are focused on standardizing business sector measurement techniques, differences in the composition of the business sector remain. Likewise, the confidence with which researchers typically take for granted the comparability of expenditure-based GDP estimates may be overstated. There is of course a point at which researchers must say “this is the best we can do, even though differences may remain” – but the remaining differences need at least to be acknowledged in order to make readers (and researchers themselves) aware of the potential margin of error of the estimates.

Finally, this article has highlighted several areas that would benefit from further research, at least for the case of Canada and the United States. One of these is the difference in the size of the non-business sector relative to the total economy in the two countries. Also, the 1981-2003 period represents a distinct break from the 1961-1981 period in terms of an apparent acceleration in non-business sector productivity growth and a shrinking of the gap between business sector and total economy productivity growth in Canada. Although growth in imputed rents seems to have accelerated after 1981,

accounting for part of this break, it would be interesting to more fully understand the sources of this break and to know if such a break occurred around this time in other countries. It would also be useful to more thoroughly understand the methodological differences in non-business sector output measurement between Canada and the United States.

This article may also suggest some areas that could benefit from further attention from statistical agencies, in particular in their communication with the United Nations and other international organizations that coordinate in the production of the international System of National Accounts guidelines. The ideal situation would of course be for non-business sector output, and hence total economy output, to fully capture productivity gains in all countries. Although it is likely that this will never be achieved, some progress towards standardization and more accurate measurement is possible. It would also be very useful if statistical agencies made detailed notes on the methodologies underlying their estimates, both technical and non-technical, more easily and regularly available to the public.

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