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Aggregate Labour Productivity Growth in Canada and the United States: Definitions, Trends and Measurement Issues

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Abstract

The purpose of this paper is to provide a thorough discussion of the definitional and data issues associated with the measurement of aggregate labour productivity growth in Canada and the United States. The paper examines all data sources for output, employment and hours estimates in the two countries, and attempts to identify the series that are the most appropriate for the calculation of aggregate labour productivity – both from the perspective of the methodological merits of each series and of cross-country comparability. It also assesses the sensitivity of Canada-U.S. aggregate labour productivity growth comparisons to the choice of monitoring trends at the total economy or business sector level, investigates the sources of the differences between trends and comparisons assessed at each level, and discusses the advantages and disadvantages of making comparisons at each level. The paper finds compelling reasons to believe that the monitoring of total economy productivity trends is desirable in addition to the more common practice of focusing on the business sector. Canada has lagged the United States in terms of aggregate labour productivity growth over 1981-2003 to a much smaller degree according to total economy trends than according to business sector trends. This is caused by very high measured labour productivity growth in the non-business sector in Canada relative to the United States, which calls into question the reliability of productivity growth comparisons made at the total economy level. This also raises questions about the comparability of GDP growth between the two countries.

Aggregate Labour Productivity Growth in Canada and the United States: Definitions, Trends and Measurement Issues

Executive Summary

The purpose of this paper is to provide a thorough discussion of the definitional and data issues associated with the measurement of aggregate labour productivity growth in Canada and the United States. Labour productivity is the simplest measure of productivity, requiring for its calculation only data on real output and labour input. But despite the simplicity with which labour productivity can be calculated, there is a fairly wide range of estimates of aggregate labour productivity growth that can be obtained from official published data sources, and a number of measurement issues that must be addressed if aggregate labour productivity trends are to be monitored in a meaningful way.

This paper has been motivated by an important stylized fact. Since 1981, labour productivity growth in the total economy in Canada has been very similar to that in the business sector, while the same has not been true for the United States. Indeed, the gap between business sector and total economy output per hour growth for the 1981-2003 period was 0.12 percentage points per year in Canada, compared to 0.46 points in the United States.

A related observation is that the aggregate labour productivity growth differential between Canada and the United States is larger at the business sector level than at the total economy level. Estimates show a 0.69 percentage point per year gap in output per hour growth in the business sector between the United States and Canada over the 1981-2003 period, but a gap of only 0.34 percentage points per year in the total economy. Thus, while Canada's labour productivity growth has lagged that in the United States according to both measures, 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.

In addition to this issue of different productivity measures telling very different stories about the relative productivity growth of the two countries, one must also choose between several different data sources, some whose cross-country comparability is highly suspect. This paper identifies no less than eight employment series for the United States that can in principle be used in constructing estimates of total hours worked, and in turn, labour productivity. The most important choice to make in identifying appropriate sources for data on hours of work is between household-based data sources, establishment-based data sources, and data sources that construct estimates from multiple sources.

This paper accomplishes three things.

- First, all data sources for output, employment and hours estimates in Canada and the United States are examined. Further, an attempt is made to identify the series that are most appropriate for monitoring productivity growth within a country and for making cross-country comparisons.

- Second, the differences between productivity growth at the business sector and total economy level across Canada and the United States are assessed in detail, and the sources of these differences are sought out.

- Third, the advantages and disadvantages of the total economy and business sector for monitoring aggregate labour productivity trends and for making cross-country comparisons of aggregate labour productivity growth are discussed.

In terms of appropriate data sources, the paper makes the following observations:

- Statistical agencies in both Canada and the United States provide official estimates of business sector output per hour, and these estimates should always be used for monitoring business sector trends. However, no official total economy series exist in either country.

- For total economy output, expenditure-based estimates from the national accounts in each country should be used. There is some methodological incomparability across countries, but from the perspective of expenditure-based measurement techniques this incomparability is not expected to be large. However, as will be discussed later, measurement techniques at the non-business sector level do not appear to be comparable across countries, and this does affect the comparability of total economy output estimates.

- For total economy hours estimates, the series constructed by the productivity authorities in each country should be used. Statistics Canada's Productivity Program does provide labour input estimates for the total economy even though there is no corresponding total economy productivity series. A similar series is produced by the U.S. Bureau of Labor Statistics for the United States, but is not officially released. It is, however, available on request.

In terms of explaining Canada's poor performance at the business sector level relative to the United States, in contrast to the less pessimistic performance implied by total economy comparisons, the paper comes to the following conclusions:

- The difference could be due to three factors, namely a stronger business sector performance in the United States than in Canada, different sizes of the business and non-business sectors relative to the total economy, or a stronger non-business sector performance in Canada than in the United States.

- The weaker Canadian business sector performance is driven by a very poor productivity performance in manufacturing in Canada relative to the United States. However, business sector productivity trends are not the most important factor in the difference between Canada and the United States in business sector-total economy labour productivity growth rates.

- Compositional effects do not seem to be important in explaining the total economy/business sector difference across Canada and the United States, but do raise some interesting questions. The hours share of the business sector in the total economy in

Canada is much higher than in the United States, and has been rising in contrast to declines in the United States. Also, the non-business sector has a lower level of labour productivity than the business sector, which is unexpected since imputed rents from owner-occupied dwellings are included in the non-business sector and do not have a corresponding labour input, which typically causes non-business sector productivity level estimates to be very high.

- The factor accounting for most of the total economy/business sector difference across Canada and the United States is the very high productivity growth in the Canadian non-business sector relative to that in the United States. This is caused to a large extent by much faster growth in imputed rents in Canada than in the United States, but it is also due to differing conventions in measuring the real output of non-business sector industries across the two countries.

- Since GDP on an industry/sector basis must be equivalent to GDP on an expenditure basis, these differing measurement techniques are also present in expenditure-based GDP estimates, which are widely used in economic and financial analysis.

The advantages of the business sector for making cross-country productivity comparisons is that much effort has been focused on making business sector estimates comparable. Also, the business sector includes industries whose output is marketed and can therefore be measured in real terms independently of labour input, thus making measured labour productivity growth more meaningful. However, these benefits are offset by the fact that the relative size and definition of the business sector vary across countries. The proportion of the output of certain industries that is marketed – and hence included in business sector output – also differs across countries. Total economy productivity estimates overcome this problem of composition but introduce their own disadvantages in terms of cross-country incomparability in measurement techniques, as is seen for Canada and the United States. But it is total economy productivity growth that determines growth in aggregate living standards; and in any case such differences in measurement are by definition present in cross-country comparisons of living standards as well as comparisons of productivity.

This paper hence finds compelling evidence that it is important to monitor total economy labour productivity trends in addition to the more common practice of focusing on the business sector. In the case of Canada and the United States, it is clear that total economy productivity growth comparisons are hampered by different non-business sector measurement techniques; but it is not clear that business sector comparisons give a much more accurate picture of true aggregate labour productivity growth differences, due to the differing size of the business sector across countries and differences in the extent to which the output of some industries is marketed in each country.

The paper also raises several important questions for future research. In general, there is still very little known among the users of Canadian and U.S. output data about the methodologies used to estimate real output in the different components of the non-business sector in the two countries. It would hence be desirable for future work to include an in-depth study of the non-business sector in Canada and the United States, most importantly in terms of size differences and of methodological differences in output measurement.

Aggregate Labour Productivity Growth in Canada and the United States: Definitions, Trends and Measurement Issues

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Aggregate Labour Productivity Growth in Canada and the United States: Definitions, Trends and Measurement Issues[1]

I. Introduction and Motivation

Given the importance of productivity growth for improvements in the standard of living and quality of life of Canadians, aggregate labour productivity trends are closely monitored by economists and policy makers. But productivity estimates based on different definitions and from various data sources can give substantially different impressions of Canada's productivity growth performance. This paper discusses the different definitions of aggregate labour productivity, trends in these variables in Canada and the United States, and a number of data and measurement issues.

This paper has been motivated by an important stylized fact. Since 1981, labour productivity growth in the total economy in Canada has been very similar to that in the business sector, while the same has not been true for the United States. Indeed, the gap between business sector and total economy output per hour growth for the 1981-2003 period was 0.12 percentage points per year in Canada, compared to 0.46 points in the United States.[2] The similarity in Canada between business sector and total economy labour productivity growth is perplexing, as it is widely believed that measured productivity growth in the non-business sector (education, health, public administration) is 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, and should in principle introduce a downward bias to total economy productivity growth relative to that of the business sector.

A related observation is that the aggregate labour productivity growth differential between Canada and the United States is larger at the business sector level than at the total economy level.

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[1] This paper was written by Jeremy Smith under the supervision of Andrew Sharpe. The author can be contacted by e-mail at jeremy.smith@csls.ca. We would like to thank Someshwar Rao and Renée St-Jacques of Industry Canada for their invitation to prepare this paper, and Industry Canada for financial support. We would also like to thank: Jean-Pierre Maynard of Statistics Canada for much assistance with productivity and related data produced by Statistics Canada; John Glaser of the U.S. Bureau of Labor Statistics for information on and provision of unpublished BLS data; Benoît Robidoux, Frank Lee and Jeanne Lafortune of Finance Canada for comments; Bart van Ark of the University of Groningen for comments and data on the total economy versus business sector; Paul Schreyer and Dirk Pilat of the OECD for comments; Jianmin Tang of Industry Canada for comments and information on BLS data; and all participants of the inter-departmental seminar held by Industry Canada on December 4, 2003 to discuss a preliminary version of this paper. A shorter version of this paper appeared in the Spring 2004 issue of the *International Productivity Monitor*. Data in this final version are current as of September 14, 2004.

[2] According to data to be discussed in the next section, output per hour growth in Canada for 1981-2003 was 1.36 per cent per year in the total economy and 1.48 per cent per year in the business sector, a difference of only 0.12 percentage points per year. This gap was much larger for the 1989-2000 period (0.28 points per year) but negative for the 1981-1989 and 2000-2003 periods (-0.04 and -0.05 respectively). It should also be noted that the 1981-2003 experience is in sharp contrast to that in 1961-1981, during which the gap was 0.59 percentage points per year. Output per hour growth in the United States for 1981-2003 was 2.17 per cent per year in the business sector and 1.70 per cent per year in the total economy, a difference of 0.46 percentage points per year. The gap between growth rates of the two measures has been fairly consistent in the United States, at 0.35 percentage points per year in 1961-1981, 0.35 points for 1981-1989, 0.44 points for 1989-2000 and 0.87 points for 2000-2003.

Estimates to be presented in the next section show a 0.69 percentage point gap in output per hour growth in the business sector between the United States and Canada over the 1981-2003 period, but a gap of only 0.34 percentage points per year in the total economy. Thus, while Canada's labour productivity growth has lagged that in the United States according to both measures, 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.[3]

Evaluations of Canada's relative labour productivity growth performance are, as illustrated by this observation, sensitive to the choice of the business sector or the total economy as an appropriate basis for comparison of aggregate trends. Canada-U.S. productivity growth comparisons – indeed, any cross-country comparisons – are also sensitive to the choice of data sources and the cross-country methodological comparability of the chosen data.

Labour productivity is the simplest measure of productivity, requiring for its calculation only data on real output and labour input. But despite the simplicity with which labour productivity can be calculated, there is a fairly wide range of estimates of aggregate labour productivity growth that can be obtained from official published data sources, and a number of measurement issues that must be addressed if aggregate labour productivity trends are to be monitored in a meaningful way.

Gross Domestic Product (GDP) is the standard measure of output used in aggregate labour productivity analysis.[4] But labour input can be defined both in terms of the number of workers and the number of hours worked, and there are several different sources of employment and hours data in both Canada and the United States. The comparability across the two countries of these data sources may sometimes be questionable.

Also, the measurement of labour productivity is generally considered more reliable in the business sector as compared to the non-business sector. This is due to the existence of conceptual issues in measuring real output in the non-business sector, which arise because non-business sector output is non-marketed. Statistics Canada and the U.S. Bureau of Labor Statistics report official estimates of labour productivity for the business sector but not for the total economy. Consequently, trends in business sector productivity are closely monitored in both countries. But the relative importance of the business sector is not identical across countries because of the different mix of private and public activities in certain industries and different definitions of the business sector. This may have an effect on the comparability of business sector productivity

[3] Canada's productivity *level* is also below that of the United States. 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.

[4] The level difference between GDP and Gross National Product (GNP) is not significant for countries in which the proportion of production by foreign-owned companies is relatively small or where the net outflow of investment and dividend income is small. However, growth rates between the two measures may differ. For example, the level of nominal GNP in Canada in 2003 was 98.1 per cent that of GDP, and growth rates (in current dollar terms) over the 1961-2003 and 1996-2003 periods respectively were 8.40 per cent per year and 5.52 per cent for GDP, and 8.40 per cent and 5.74 per cent for GNP. Some have suggested (e.g. Spant, 2003) that Net Domestic Product (NDP) is a better measure of output than GDP because it accounts only for the sustainable portion of output (i.e. replacement of worn out capital stock is excluded), although in the case of productivity it would seem more relevant to consider total production.

trends across countries. It can also be argued that the total economy is the more appropriate unit of analysis from the perspective of labour productivity's effect on aggregate living standards.

The purpose of this paper is twofold. First, the paper provides a thorough discussion of the definitional and data issues associated with the measurement of aggregate labour productivity growth. This discussion illustrates the sensitivity of Canada-U.S. productivity growth comparisons to the total economy/business sector choice and to the choice of data sources. Second, and more importantly, the paper attempts to identify the most appropriate choices based on the methodologies underlying the data sources and on the relative merits of business sector and total economy aggregate productivity comparisons.

The paper is divided into five sections, including the introduction and conclusion. The second section of the paper introduces the official data sources in both countries for output, employment and hours, for the total economy and business sector. This section also discusses the methodologies underlying the development of these data, and presents trends in these series and the productivity series constructed with them over the past four decades. The third section addresses the question of what specific data should be employed to optimize both statistical/methodological appropriateness and comparability (or more subtly the meaningfulness of comparisons) across Canada and the United States. The fourth section attempts to answer the question of which level, the business sector or the total economy, is more appropriate for the assessment of aggregate labour productivity trends. The sources of the smaller gap between business sector and total economy productivity growth in Canada than in the United States are examined, and the advantages and disadvantages of the business sector and total economy for monitoring and comparing productivity performance are presented.

II. Data Sources, Methodological Issues and Trends

Since the focus of this paper is on official data series, it is preferable to use only the most current data series that are produced by Statistics Canada, the U.S. Bureau of Economic Analysis (BEA) and the U.S. Bureau of Labor Statistics (BLS). However, since it is also of interest to focus on long-term trends (1981-2003 in general and 1961-1981 where possible), some current series that are available for short time periods only have been extended backwards using growth rates from series that are no longer updated by statistical agencies. This has not been possible for some series though. For example, hours data from the Current Population Survey in the United States are unavailable prior to 1976, with no suitably equivalent series available before this date. Most series are available to 2003.

It should also be mentioned at this point that the focus of the paper 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. Making level comparisons is a more complex procedure, as output series must be converted to a common currency using estimates of purchasing power parity, and because employment and hours estimates must be comparable in level terms. Also, since the focus is on labour productivity exclusively there will be no discussion of capital and total factor productivity, so capital stock data sources will not be discussed.

Conceptually labour productivity series should be constructed to reflect the amount of output that is produced with a standardized unit of labour input. 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. Surveys define workers as employed whether they work 50 hours per week or only 10 hours per week, and some workers are even counted as employed but work zero hours in the reference week (i.e they are on vacation or leave). For this reason output per hour is a superior measure of labour productivity compared to output per worker or person employed, both over time and across countries.[5] Furthermore, there are no severe data constraints in moving from workers to hours, although, as will be discussed in the third section, there is still the issue of which hours data sources are the most appropriate. However, a discussion of employment data sources is still necessary since average hours data need to be combined with employment data to calculate total hours of work. This paper does briefly discuss trends in output per worker since the data are readily available, but the focus will be on output per hour.

One further issue that needs to be addressed before discussing data sources and trends is the periodization of time series for the calculation of growth rates. There are three considerations here. First, in calculating growth rates it is desirable to observe only underlying trends rather than developments due to the particular phase of the business cycle that will be offset over the course of the entire cycle. The beginning and end points of cyclically neutral periods should therefore be chosen to offset cyclical effects on productivity. Peak-to-peak periods are defined by choosing as beginning and end points the years directly before output begins to decline. For example, 1981 and 1989 were both years preceding a fall in output in Canada. Conveniently, the same is also true of the United States. The 1981-1989 period is hence considered one business cycle, and growth rates calculated over this period are cyclically neutral.[6] Of course the intensity of demand may differ between cycles, and cyclically neutral growth rates will reflect this difference.

This may suggest that there is a trade-off between monitoring recent trends and sticking to cyclically neutral periods, since the most recent peak year in Canada and the United States is 2000 and there has not been a complete business cycle since then. However, all that cyclical neutrality requires is that similar phases of the business cycle be compared, so that the 2000-2003 period can in principle be compared with past recession and early recovery years.[7] Of course, it

[5] Some economists, e.g. Jorgenson, Gollop and Fraumeni (1987) have gone further in standardizing the labour input by adjusting for the quality of individual hours of work. This is accomplished by weighting the hours of work of certain types of workers by the share of that type in the total wage bill, the assumption being that higher wages are paid to higher quality (e.g. more skilled) workers. The adjustment for quality, however, is not a well-agreed upon process, so that different analysts could in principle each be using different data on labour input based on different adjustment methods. Also, it can be argued that improvements in skills are a *source* of labour productivity growth and so should not be considered in calculating labour productivity. This paper does not discuss any data sources for quality adjusted labour input. Gu et al. (2002) examine this issue in more detail and discuss the quality adjusted hours series developed by Statistics Canada's Aggregate Productivity Measures program for mulitfactor productivity estimates.

[6] Peaks may be defined in terms of productivity as well as output. See Baldwin et al. (2001). In the late 1980s productivity declined one year before output, so that 1988 is considered the year preceding a downturn, i.e. it is the productivity peak.

[7] Sharpe (2002) presents such an analysis of productivity trends for all post-war recessions and downturns in Canada and the United States.

is also possible to calculate growth rates for the entire 1989-2003 period, although it must be recognized that a possible bias may result from comparing trends over different points of the cycle. The longer the period, the less the influence of cyclical factors on measured productivity growth.

Another consideration is the treatment of apparent structural breaks in productivity growth that occur in the middle of the business cycle. It is not necessarily of interest to look at peak-to-peak growth if there appears to be a structural break within the cycle. The growth rate will reflect trends in effect both before and after the break while only trends after the break are likely to continue. Such a break appears to have occurred in both Canada and the United States in the mid-1990s, but later in Canada than the United States.[8] Robidoux and Wong (2003) advocate dividing the 1990s at the unique breakpoints (defined as the year preceding the pick-up in productivity growth) for each country, namely 1995 for the United States and 1996 for Canada. Using 1995 as the base year for growth rate calculations for Canada will understate the extent of the structural rebound in productivity growth as the break had not yet occurred in that year and consequently 1996 was a poor year for productivity growth in Canada. However, it is also desirable to have equivalent time periods for cross-country comparisons. This paper therefore divides the 1990s at 1996 for both countries. Note that this will not understate productivity growth in the United States for the 1996-2003 period since all included years are after the structural productivity growth break.[9] However, productivity growth over the 1989-1996 period will include one year of faster growth after the break in the United States.[10]

One final consideration in choosing beginning and end years for growth rates is the reliability of output data for recent years. There is typically a four-year lag between the release of benchmark input-output estimates and the period reference year, in both Canada and the United States. For example, the preliminary input-output accounts for Canada for 2000 were released in November 2003. This means that data for more recent years are projected based on the most recent benchmark year for which data are available. The projectors used make use of recent economic indicators, but as more reliable underlying data become available revisions can sometimes be significant. This implies that caution should be used when observing growth rates that cover recent periods. This is especially true when making comparisons between Canada and the United States since in the past Canadian revisions have tended to increase output growth and U.S. revisions have tended to lower output growth. The results discussed in this paper for the 1996-2003 period will hence be compared to those for the 1996-2000 period in an attempt to ensure that conclusions are not sensitive to the preliminary nature of recent data.

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[8] See Robidoux (2003) and Macklem (2003) for two perspectives on the source of this structural break in Canada. The first cites the strong productivity gains in the service sector in the latter half of the 1990s driven by heavy investment in information and communication technology (ICT). The second places less emphasis on ICT production and use but cites an increase over the 1990s in machinery and equipment investment as a percentage of GDP and strength in other productivity drivers such as human capital and openness to trade and investment.

[9] For example, over the 1996-2003 period business sector output per hour grew at a 3.10 per cent per year average annual rate in the United States, compared to an almost identical 3.08 per cent per year for the 1995-2003 period. In Canada, however, business sector output per hour grew by 2.16 per cent per year in 1996-2003 but only 1.87 per cent per year in 1995-2003 because of slightly negative output per hour growth in 1996.

[10] An important question to be asked is what the proper treatment would be if, say, break points occurred five years apart and in different phases of the business cycle in the two countries to be compared. Clearly compromise would be called for in paying attention to all three factors, namely: structural breaks, lack of synchronization of the business cycles, and comparability of time periods.

In the interests of clarity two further points should be made regarding the calculation of growth rates. First, this paper treats the first year in a given time period as the base year for growth rate calculations; and second, all growth rates are compound average annual growth rates, rather than the simple average of annual growth rates or the slope from an Ordinary Least Squares regression on a time trend. For example, a growth rate for the 1996-2003 period is the compound average annual growth rate using 1996 as the base year and 2003 as the last year.

Summary Table 1: Output Trends in Canada and the United States, 1961-2003 (compound average annual rates of change or annual rates of change, %)

	Canada		United States	
	Total Economy	Business Sector	Total Economy	Business Sector
	NIEA	PPD	NIPA	BLS
1961-2003	3.63	3.90	3.39	3.68
1961-1973	5.34	5.74	4.50	4.83
1973-1981	3.45	3.71	2.50	2.59
1981-2003	**2.78**	**2.99**	**3.11**	**3.45**
1981-1989	3.06	3.17	3.52	3.82
1989-2003	2.62	2.88	2.87	3.24
1989-1996	1.49	1.53	2.55	2.90
1996-2003	3.76	4.24	3.20	3.58
1996-2000	4.77	5.90	4.20	4.79
2000-2003	2.42	2.08	1.88	1.98
2001	1.80	1.33	0.75	0.36
2002	3.44	3.35	1.86	1.77
2003	2.02	1.57	3.04	3.83

Source: Tables 1 and 7.

A. Output

1) Total Economy

Canada

Total economy GDP estimates are available from the National Income and Expenditure Accounts (NIEA) in Canada (1997 dollars at market prices, chained-weighted, based on a Fisher formula)[11] annually and quarterly from 1961 to 2003. Revised estimates for the 1999-2003 period were released on May 31, 2004, and have been included here. This series is shown in Table 1 and growth rates in Summary Table 1.

[11] This series is also published in 1997 fixed-weighted dollars at market prices based on a Laspeyres index for the same period. The difference in estimates between the chained and fixed-weighted methodologies is shown in Table 1a.

Also available is a series on total economy output produced by the Productivity Unit of the Analytical Studies Branch of Statistics Canada that is no longer updated.[12] This is expressed in 1992 dollars, fixed-weighted based on a Laspeyres formula, available annually from 1961 to 2001. This old total economy output series is based on the NIEA GDP series but is modified to better reflect the concept of labour productivity. Most importantly this means that imputed rents for owner-occupied dwellings are subtracted, as this part of output is not produced with a coinciding paid labour (or capital) input. As will be discussed later, however, some believe that imputed rents should be maintained in output series for calculating total economy labour productivity growth.[13]

Also, this series is based on the less preferable Laspeyres methodology and has not been revised in line with the NIEAs since August 2002. Chained-weighted GDP estimates are more accurate than fixed-weighted estimates in the sense that they utilize up-to-date weights in calculating GDP rather than constraining these weights to remain at base year values. The chained methodology affects both levels and growth rates of GDP. Data in Table 1a show that the fixed-weighted NIEA output series for Canada grew at an average annual rate of 3.71 per cent over the 1961-2003 period, while the chained series grew by 3.63 per cent per year, a difference of only 0.08 points.[14] Due to the older vintage of the alternative total economy output series and the fact that it is based on the Laspeyres fixed-weighted methodology, it will not be discussed.

Over the 1961-2003 period, total economy output according to the NIEA chained estimates grew at an average annual rate of 3.6 per cent per year (Summary Table 1). For the 1996-2003 period growth was 3.8 per cent per year, or a much stronger 4.8 per cent per year for the 1996-2000 period, which leaves out the slow-growth years of 2001 and 2003. This is a marked acceleration from the 1.5 per cent average annual growth of the 1989-1996 period, and even the 3.1 per cent average annual growth of the 1981-1989 period.

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[12] This total economy output series used to be released along with data from the Aggregate Productivity Measures program. These series, while no longer updated, are not set to be officially terminated until sometime in the Fall of 2004. This means that they will continue to be available, but that they will have been replaced by series that are regularly updated. These new series, to be discussed below, are from the Productivity Program Database, are currently available for 1997 onwards and are planned to be released in the Fall of 2004 for the period of 1961 onwards. However, no total economy output series will be available from the Productivity Program Database.

[13] Table 1a contains data on imputed rents, and shows that output series omitting imputed rents can grow either faster or slower than series including imputed rents, and that these differences in growth rates can be up to 0.5 percentage points on an annual basis. However, over longer periods of time the differences in average annual growth rates are typically quite small. For example, the series including imputed rents grew by 2.78 per cent per year in 1981-2003, compared to 2.73 per cent per year for the series excluding imputed rents.

[14] The extent of this difference also depends on the period considered, as the fixed expenditure shares differ from the current expenditure shares the further the year in question is from the base year of the series. For the 1996-2003 period the Laspeyres series grew at an average annual rate of 3.79 per cent per year, and the chained series by 3.76 per cent per year. The difference in this period was hence only 0.03 percentage points. Ahmad et al. (2003) report that measured output growth based on a fixed Laspeyres index was about 0.15 percentage points per year higher than that based on a chained index for the United States for 1987-1993.

United States

Estimates of real GDP from the National Income and Product Accounts (NIPA) produced by the Bureau of Economic Analysis (BEA)[15] are the only total economy output estimates available for the United States (Table 7). The series is expressed in 2000 dollars based on a chained-weighted Fisher formula, and is available from 1929 onwards annually and 1947 onwards quarterly. These estimates incorporate the comprehensive revisions of the NIPAs released in December 2003, as well as the regular annual revisions released at the end of July, 2004.

The NIEA methodology in Canada is more or less equivalent to the NIPA methodology in the United States, but may not be identical. It is commonly believed that the BEA, in estimating GDP, makes more adjustments to price estimates to account for quality improvements in goods and services than Statistics Canada. Quality adjustments to price indexes make for more precise estimates of real output and are done in part by incorporating hedonic or matched model pricing methods in the estimation of price deflators. Ahmad et al. (2003) estimate that a total economy real output series employing hedonic quality adjustments will grow by, at most, 0.25 percentage points faster per year than a series that does not employ hedonic methods. This effect, while not trivial, is neither of the utmost concern. The limited magnitude of this effect is due to the fact that, as Schreyer (2001:43) notes, the effect of quality adjustment on growth rates diminishes quickly at higher levels of aggregation, so that at the total economy level the effect should be small. Due to this limited impact of quality adjustment at the aggregate level, and the fact that Statistics Canada appears to make only fewer quality adjustments than the BEA rather than none at all, this factor is not likely to greatly affect the comparability of NIEA and NIPA estimates.[16]

[15] NIPA data are available to the public free of charge (unlike Canadian NIEA data) from the BEA website (www.bea.gov). The NIPA tables are found directly at www.bea.gov/bea/dn/nipaweb/index.asp.

[16] Lal (2003) discusses some further differences between the Canadian and U.S. systems of national accounts, but discusses only the effects on Canada's *level* of GDP relative to that in the United States, rather than *growth* effects. The valuation convention for defence expenditures is to count operating costs and certain capital costs as defence production. However, the United States includes more capital costs in the definition of defence production than Canada. Lal argues that with Canadian practices in the capitalization of defence, the level of U.S. GDP would be about 0.5 per cent lower than current BEA estimates. The United States used to recognize only implicit financial services to depositors (i.e. primarily consumers rather than businesses), while Canada recognizes the implicit services to both depositors and borrowers. Lal estimates that in the past this exerted an upward bias of about 1.5 per cent to the level of U.S. GDP in a given year (since services to businesses are counted as intermediate consumption and are hence subtracted from GDP). However, with the 2003 comprehensive revisions of the NIPAs, the United States revised its GDP estimates for the entire period of availability to recognize imputed financial services to both depositors and borrowers (Moulton and Seskin, 2003; Fixler, Reinsdorf and Smith, 2003). This source of incomparability between Canada and the United States hence no longer exists. Lal (2003) also mentions some other minor differences between the NIEA and NIPA methodologies, such as imputations for illegal and undocumented activities, and estimates that together they imply no more than a further 1.0 per cent upward bias to U.S. GDP levels relative to Canadian GDP levels. To the extent that these level effects are constant over time, these methodological differences will not affect the comparability of GDP growth rates. However, given that these level effects likely vary, at least to a small degree, from year to year, the comparability of growth rates is probably affected. The direction and magnitude of the growth bias cannot be determined without further detailed research, but in any case the growth bias is likely to be small.

Canadian and U.S. GDP growth comparisons may also be affected by different conventions in reporting statistical discrepancies. Total output calculated on an expenditure basis must by identity be equal to total income (Gross Domestic Income, or GDI). However, due to imperfect underlying data and sample errors, it is never the case that the total income and total expenditure estimates calculated by statistical agencies are identical. The difference between the two estimates is referred to as the statistical discrepancy, and as shown in Table 7a, this discrepancy has been as high as 2 per cent of GDP in the United States, but is usually less than 1 per cent of GDP, with GDP usually but not always greater than GDI.

In the United States, no adjustments are made to GDP, and the statistical discrepancy is reported as a component of GDI, such that the GDP and GDI measures reported by the BEA differ. In Canada, the statistical discrepancy is divided equally between GDP and GDI, so that the two measures as reported by Statistics Canada are identical. As can be seen in Table 7a, growth (in current dollar terms) is very similar between GDP and GDI in the United States over long periods of time, differing, for example, by only 0.01 percentage points per year for the 1961-2003 period and 0.04 percentage points per year for the 1981-1989 and 1989-2003 periods. But recently there has been concern expressed (e.g. *The Economist*, 2004) that GDP has been exaggerating the recent spurt in U.S. output growth. Indeed, Table 7a shows that growth of GDP (in current dollar terms) exceeded growth in GDI by 0.52 percentage points per year over the 2000-2003 period.

It seems clear that the BEA intends real output growth to be expressed in terms of GDP rather than GDI, since GDP estimates are available in both nominal and real terms but GDI estimates are available in nominal terms only. Indeed, in order to calculate real growth rates from GDI, one must apply some sort of price deflator, the most logical of which would be the implicit GDP price index from the expenditure side, which would suffer from the same alleged measurement errors as GDP itself. In any case, the concern here is not the size of the total statistical discrepancy, but rather the effect on Canada-U.S. comparisons of half of the discrepancy being included in Canadian GDP estimates but none of the discrepancy included in U.S. GDP estimates. Given the size of the discrepancy relative to GDP, the effect on comparability is likely to be small, and although the necessary data are available, no attempt has been made to adjust either Canadian or U.S. GDP data. However, given that the statistical discrepancy in the United States declined fairly sharply between 1994 and 2000 and has risen fairly sharply since then, the 1996-2000 output growth rate for the United States may be slightly understated, and that for 2000-2003 slightly overstated.[17]

As shown in Summary Table 1 and Table 7, the United States experienced real output growth of 3.4 per cent per year over the 1961-2003 period. Output growth accelerated to a 4.2 per cent average annual growth over the 1996-2000 period from 2.6 per cent per year in 1989-1996. The 3.2 per cent per year growth over the 1996-2003 period is lower because of slow growth in the recession year of 2001, with growth over the 2000-2003 period only 1.9 per cent per year.

[17] It should also be mentioned that the different base years of the national accounts in Canada (1997) and the United States (2000) can introduce incomparability if output in either country is based on a fixed-weighted index. This is described by Jackson (1996). However, since the output series discussed in this paper are based on chained indexes, the different base years do not affect Canada-U.S. output growth comparability.

2) Business Sector[18]

Canada

For Canada, business sector output data are available from the special aggregations of GDP by industry produced by the Industry Measures Division of Statistics Canada. They are available from 1981 to 2003 expressed in 1997 dollars at basic prices and fixed-weighted based on a Laspeyres formula (Table 1), and from 1997 to 2003 expressed in 1997 chained-weighted dollars based on a Fisher formula.[19] These estimates differ conceptually from the total economy NIEA estimates in that they are expressed in basic prices as opposed to market prices. Basic prices output estimates are defined as excluding taxes on intermediate inputs (but not on labour or capital) from market price estimates but including in addition intermediate input-related subsidies. While there is certainly a difference in the level of basic price estimates compared to market price estimates (i.e. basic price estimates are below market price estimates), this distinction does not have a large effect on growth rates (Table 1a). To make this business sector output series consistent with the definition used in the construction of the official productivity series, and with the United States business sector series, the value of imputed rents, also in 1997 dollars at basic prices, have been subtracted.

There is also a business sector output series for Canada maintained as part of the Productivity Program Database (PPD). This is available in index form only, and in two slightly different versions. The first version is available quarterly from 1987 currently to 2003, based on GDP at market prices and a chained Fisher formula. This series is derived from the total economy GDP at market prices series but excluding capital consumption allowances for government, labour income paid to government employees, primary input income for non-profit organizations, and gross imputed rents. The second version is available annually only for 1997-2003. However, the Statistics Canada Timeline Continuity Project will make this series available back to 1961, and should be complete sometime in the Fall of 2004. This version differs from the first in that it is measured at basic prices. For the present discussion, the first version has been converted to annual averages and extended back to 1961 using growth rates from the

[18] According to BLS (1997:chapter 10) and Baldwin and Harchaoui (2002:185), business sector output is defined by both Statistics Canada and the Bureau of Labor Statistics as total economy output excluding the output of general government, non-profit institutions and the rental value of owner-occupied real estate (and in the United States payments to employees of private households are also excluded, but this is a very small part of total output). However, a larger portion of health and education output is considered part of non-profit institutions in Canada than the United States. Baldwin, Harchaoui and Maynard (2001) discuss the comparability of the Canadian and U.S. business sectors in more detail, but some of the points of incomparability discussed by them are no longer present due to revisions to the national accounts in both countries. Chart 14 shows the relative size of the business sector in both countries over time. Note that the business sector hours share in the total economy was 82.6 per cent in 2003 in Canada, considerably above the U.S. hours share of 75.8 per cent in 2003. This share has fallen from 78.0 per cent in 1981 in the United States, and has risen from 80.7 per cent in Canada in 1981. The share of the business sector in total economy nominal output was considerably below the hours share in Canada in 2000 (the most recent year for which data are available), at 76.9 per cent, actually below the U.S. business sector nominal output share of 78.1 per cent. These issues – the substantially larger hours share of the business sector in Canada than in the United States, the growth of this share in Canada in contrast to the decline of this share in the United States, and divergence between output and hours shares in Canada and not the United States – each deserve further research.

[19] The series based on a chained Fisher formula was released for the first time by the Industry Measures Division in October 2003. Due to the short length of this series it is not included in Table 1 and will not be discussed.

corresponding Aggregate Productivity Measures business sector output series, which is no longer updated, prior to 1987. This was done for comparability with the United States, as the output series used in the calculation of the official U.S. business sector labour productivity series is currently based on market prices rather than basic prices.

The growth rates of the two business sector output series in Canada (the GDP by industry series and the PPD market prices series) are quite similar, with very minor divergences over the 1981-1989 and 1989-2000 periods (Table 1). However, the PPD series is the preferred one, since it is methodologically consistent with the output series used in the construction of the U.S. business sector labour productivity series. The business sector in Canada has shown average annual growth of 3.9 per cent per year over the 1961-2003 period. Between the 1989-1996 and 1996-2003 periods, business sector output growth in Canada accelerated from 1.5 per cent per year to 4.2 per cent per year (Summary Table 1).

United States

The NIPA tables present output by major sector of the U.S. economy based on the same estimation methodologies used for total economy output, namely at market prices based on a chained Fisher index.[20] This is the series on which the BLS Productivity and Costs program bases its output estimates for their business sector productivity series (BLS 1997:chapter 10).[21] Note that in the past the BLS has removed imputed rents from the BEA business sector output estimates. With the December 2003 comprehensive NIPA revisions the BEA has adopted the BLS definition of the business sector and removed imputed rents from its business sector estimates. The growth rates of the NIPA and BLS business sector output series shown in Table 7 are hence identical.

Output in the U.S. business sector grew by an average annual rate of 3.7 per cent over the 1961-2003 period. Growth in the first half of the 1990s (1989-1996) was 2.9 per cent per year, and picked up to 4.8 per cent per year over the 1996-2000 period (Summary Table 1). In the 2000-2003 period output growth declined to 2.0 per cent per year.

[20] Productivity trends in the non-farm business sector are generally more closely monitored than those in the business sector in the United States. Since agricultural output can fluctuate greatly from year to year because of weather conditions, it is argued that the impact of short-term fluctuations in weather on productivity should be netted out if one is concerned with true underlying productivity growth. But for long-term trends these short-term fluctuations have a trivial effect, and it is desirable to include agriculture since its contribution to aggregate productivity growth is significant. Also, productivity trends in the non-farm business sector are reported much less frequently in Canada, and indeed there is currently no up-to-date official series. The focus for the rest of this paper will therefore be on the business sector to the exclusion of the non-farm business sector. Over long periods of time the non-farm business sector tends to experience slower productivity growth than the business sector due to above average productivity growth in the agricultural sector. For example, in the United States for 1961-2003, output per hour growth in the business sector was 2.26 per cent per year and was 2.12 per cent per year in the non-farm business sector (Table 12).

[21] Unfortunately, the Productivity and Costs program does not publish data in absolute level form, only in index form, although this does not matter for discussion of growth rates.

Summary Table 2: Employment Trends in Canada and the United States, 1961-2003 (compound average annual rates of change or annual rates of change, %)

	Canada			United States			
	Total Economy		Business Sector	Total Economy			Business Sector
	LFS	PPD	PPD	CPS	CES	BLS	BLS
1961-2003		2.17	2.10	1.78	2.11	1.74	1.69
1961-1973		2.99	2.60	2.17	2.97	2.15	1.99
1973-1981		2.77	2.71	2.09	2.17	1.96	2.04
1981-2003	**1.52**	**1.51**	**1.61**	**1.45**	**1.62**	**1.43**	**1.39**
1981-1989	1.76	1.89	1.97	1.97	2.13	1.96	2.02
1989-2003	1.39	1.30	1.41	1.15	1.33	1.13	1.03
1989-1996	0.52	0.51	0.45	1.10	1.48	1.28	1.27
1996-2003	2.26	2.09	2.38	1.20	1.18	0.98	0.79
1996-2000	2.59	2.42	2.96	1.95	2.43	2.04	2.18
2000-2003	1.84	1.66	1.61	0.21	-0.47	-0.43	-1.03
2001	1.12	0.81	0.61	0.03	0.03	-0.16	-0.66
2002	2.22	2.25	2.52	-0.33	-1.13	-1.10	-2.17
2003	2.17	1.92	1.72	0.92	-0.31	-0.02	-0.26

Source: Tables 2 and 8.

B. Employment

1) Total Economy

Canada

The most widely used source for employment data for Canada is the Labour Force Survey (LFS), a household-based survey, with data available monthly and annually from 1976 onwards.[22] Data on the number of workers are also available from the Survey of Employment, Payrolls and Hours (SEPH), a monthly establishment-based survey, with estimates available from 1991 onwards.[23] However, establishment-based estimates refer only to wage and salary employees, and exclude agriculture and public administration workers. There is a PPD employment series available for the total economy, available annually from 1997 to 2003, which can be extended back to 1961 with growth rates from the corresponding Aggregate Productivity Measures series, which is no longer being updated. The PPD series will become available back to 1961 with the completion of the Timeline Continuity Project sometime in the Fall of 2004. For both the SEPH and PPD series it is the number of jobs that are counted rather than the

[22] No fully comparable historical series are officially available, although the LFS was first implemented in 1945. Estimates for the pre-1976 period based on historical definitions can be found in past issues of Statistics Canada publications such as the *Historical Labour Force Statistics* as well as the Statistics Canada volume *Historical Statistics of Canada*.

[23] Two official establishment-based series based on historical definitions are available but no longer updated. The first extends from 1983 to 2000 and the second is available monthly only from 1961 to 1983.

number of employed, the latter of which counts multiple jobholders only once.[24] The PPD series is constructed from a wide range of data sources. The LFS is the main source, although data from SEPH and unpublished employment data from other surveys are used to account for those not included in the LFS, most importantly those working in the territories.

There is not a large difference between the growth rates of the LFS and PPD employment series (Summary Table 2 and Table 2, and Chart 1). This is because the PPD growth rate is largely based on LFS data. Over the 1981-1989 period the LFS series showed growth of 1.8 per cent per year while the PPD series grew by 1.9 per cent per year. By 1996-2003 the LFS series was growing by an average annual rate of 2.3 per cent per year, compared to 2.1 per cent for the PPD series. The same is not true for the SEPH series, which has tended to grow faster than both of these series in the 1990s (Table 2).

United States

The household-based survey in the United States is the Current Population Survey (CPS), providing total economy estimates on the number of workers annually and monthly from 1947 onwards (Table 8).[25]

However, the more widely used source for employment data in the United States is the BLS establishment-based survey, called Current Employment Statistics (CES), with data available from 1947 annually and monthly. But this series covers only employees (i.e. excluding the self-employed) outside agriculture and public administration. Since the number of jobs is counted by payroll statistics, those working at multiple jobs will be counted more than once (as opposed to a binary employed/unemployed distinction regardless of the number of jobs held as in household surveys).

The CES employment series tends to show higher growth than the CPS series since the number of multiple jobholders has grown tremendously in recent years (Kitchen, 2003). When someone with one job takes on a second job, this counts as a new job based on the establishment survey but employment from the household survey remains constant. Also, Kitchen notes that there is a cyclical bias to CES employment estimates since the survey sample is made up of establishments chosen from the United States business register. This means that in a downturn the sample could contain businesses that are near closure (i.e. shedding jobs rapidly) but have not been removed from the register yet, while in an upturn the sample will exclude businesses that

[24] System of National Accounts guidelines state that it is the number of jobs that should be counted rather than the number of employed persons. However, the latter can be converted to the former by multiplying by the rate of multiple jobholding and subtracting the number of workers that were not paid and not at work (Baldwin and Maynard, 2004). Such adjustments in principle account for part of the difference between the LFS and PPD series.

[25] Official data based on earlier definitions going back to the 1920s are also available. CPS employment estimates have recently been benchmarked to 2000 census data. The CPS is a sample survey, as opposed to the population census, which surveys the entire population and hence provides more accurate estimates. The accuracy of CPS estimates is improved if these estimates are adjusted so that population estimates from the CPS sample match population estimates from the population census. CPS estimates are hence rebased approximately every ten years to the most recent population census data, and occasionally in the intervening years based on intercensal population estimates from the Bureau of the Census. Canadian LFS estimates are also benchmarked to the population census, but unlike the CPS, these benchmarks are done in a way such that the continuity of the series is preserved. See Bowler et al. (2003) for a detailed discussion on how benchmarking affects the CPS estimates.

have recently been established and are hiring rapidly but do not yet appear on the register. This is a well-known trait of the CES, and a bias-adjustment model has been in place to attempt to correct for it for several years. But Kitchen notes that such model-based approaches cannot adequately predict business births and deaths, and indeed finds that biases persist in CES estimates between benchmark revisions.[26]

The BLS also produces a total economy employment series within its Productivity and Costs program but does not officially release it. It is available on request. This series is consistent with the business sector employment series maintained by this program, and counts the number of jobs. The CES estimates are used as a base, and additions are made based on data from the CPS and other sources to account for workers excluded by the CES. However, it appears that no adjustments are possible beyond the CES bias-adjustment model to account for business births and deaths.

In addition to these three BLS employment series, the BEA publishes four aggregate employment series within the NIPA framework. These series are:

- full time plus part time employees;
- full time equivalent employees;
- persons engaged in production (which equals full time equivalent employees plus the self-employed); and
- a total employment series from the Annual State Personal Income Tables.

It is also possible to construct from BEA employment estimates a series showing the number of full-time plus part-time employees plus the self-employed. These five series are shown in Table 8. The full time equivalent and persons engaged in production series partially take account of hours of work, and so are not exactly alternative employment series, but a class in themselves somewhere between the concepts of number of workers and hours of work. The first and second of these BEA series refer to employees only, with agricultural and public administration employees included. However the third and fourth BEA series, as well as the fifth series that can be constructed, add the self-employed, which more closely coincides with the concept of total employment from the CPS. The estimates from the fourth BEA series exceed estimates from the CPS by a fairly wide margin (Table 8) so it is unclear how this series is constructed. These series are available annually only, currently to 2003 in general, but to 2002 only for the fifth series.[27]

During the 1981-2002 period the growth rates of all eight of these employment series ranged between 1.5 per cent per year and 1.8 per cent per year. By the 1996-2002 period the gap had grown, with the lowest growth rate 1.2 per cent per year and the highest 1.6 per cent per year (Table 8). As shown in Chart 7 and Table 8 there is little difference in terms of growth rates

[26] Strifas (2003) discusses how the BLS revises CES estimates at intervals of several months to make them consistent with administrative unemployment insurance records. These revisions are expected to increase in frequency in the future, so that estimates will be corrected for these cyclical biases with less of a lag. Sum et al. (2003) provide a detailed discussion of the methodologies of the CPS and CES.

[27] All of these BEA series, besides being available at the all industries level, are also available at the level of all domestic employment whereby domestic employment is equal to total employment minus U.S. citizens employed abroad plus foreign workers employed in the United States. The difference between the two employment measures in all five series is trivial, especially in terms of growth rates.

between four of the BEA counts (full time plus part time employees, full time plus part time plus self-employed, full time equivalent employees and persons engaged in production). However, this still leaves five fairly distinct employment growth stories.[28]

The largest divergence in growth rates is between the CPS and CES estimates, shown for as long a time period as possible in Chart 8. Over the 1961-2003 period the CES employment series grew by 0.33 percentage points per year faster than the CPS employment series (2.11 per cent per year compared to 1.78 per cent per year). The size of the growth gap between these two series has varied, and was as small as 0.08 percentage points over the 1973-1981 period (Summary Table 2). But since the late 1980s the growth gap has for the most part been in the 0.4 percentage point range, although between 2000 and 2003 the CES series fell much more sharply than the CPS series (1.1 per cent compared to 0.3 per cent), closing the growth gap slightly. Kitchen (2003) notes that a large part of the widening of the growth gap in the 1990s was due to the growth in multiple job holders, who are counted only once by the CPS but multiple times by the CES. The findings of Sum et al. (2003) suggest that the sharp drop in employment according to the CES for the 2000-2003 period is not reflected in the CPS estimates since the latter include a recent spurt in growth of self-employment while the former exclude the self-employed.

Clearly, the choice between employment series in calculating productivity series is far from unimportant, and given the many omissions inherent in the CES estimates this source would seem to make a poor choice. Yet the CES remains the most widely used source for monitoring the U.S. employment situation.[29] Due to their widespread use, it is important to examine the implications of using the CES estimates in productivity calculations. Chart 8 shows that the unpublished BLS jobs series, perhaps the most comprehensive in coverage due to the many sources used in its construction, tracks very closely the CPS employment series.

The CPS and BLS unpublished series both showed employment growth of 2.0 per cent per year over the 1981-1989 period, and of 1.2 and 1.1 per cent respectively between 1989 and 2003. The CES series grew faster in both the periods, by 2.1 per cent per year and 1.3 per cent per year respectively. The 1996-2000 period witnessed strong employment gains according to all three series (although the strongest growth by far was posted by the CES series), while the 2000-2003 period saw declines or only weak growth in employment (Summary Table 2). The declines were 0.5 per cent per year and 0.4 per cent per year according to the CES and BLS series respectively, while the CPS series showed growth of 0.2 per cent per year. All three series showed declines in employment between 2001 and 2002.

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[28] There is also an astonishing range in the levels of these estimates. Total employment as measured by the CPS is more than 30 million lower than total employment according to the BEA in 2002 (column 1 versus column 7 in Table 8). The CES estimate of employees is almost 7 million less than the BEA full time plus part time employees estimate, although this may partially be explained by the coverage of the agricultural sector in the latter estimate but not the former.

[29] See for example Corcoran (2003), who uses October 2003 CES estimates to make the point that although recovery in the United States had not at that point been accompanied by job growth, jobs were beginning to be created. But the CPS employment series had shown increases for several of the previous months, and showed much stronger growth in October than the CES series. This popularity may be related to the fact that the sample size is much larger for the establishment-based survey and so the estimates are considered more reliable. The CES is a survey of approximately 400,000 *establishments* (accounting for two thirds of all workers), each of varying size, while the CPS is a survey of only 60,000 *households.*

2) Business Sector

Canada

Employment by industry data based on the North American Industry Classification System (NAICS) are available from the LFS from 1987 onwards, but no estimates for the business sector aggregation are publicly available. The only employment series available for the business sector is hence a PPD jobs series, available from 1997 to 2003 annually and from 1987 to 2003 quarterly. It will be available back to 1961 once the Timeline Continuity Project is completed. Presently, the series can be extended back to 1961 with growth rates from the corresponding Aggregate Productivity Measures business sector employment series. Even if business sector employment data were available from the LFS, the PPD series would be preferred since it gives a more accurate picture of the total number of workers. Data are shown in Table 2. The business sector has shown extremely strong employment growth recently, with the number of workers growing by 3.0 per cent per year over the 1996-2000 period or 2.4 per cent per year in 1996-2003. This compares with average annual employment growth of only 0.5 per cent for the 1989-1996 period, and 2.1 per cent per year for 1961-2003 (Summary Table 2).

United States

Like Canada, employment data are not available for the business sector from the CPS or CES, nor for that matter from the BEA employment series. The BLS Productivity and Costs data set, however, contains information on the number of jobs in the business sector, but again data are only publicly available in index form. The BLS takes the CES employment estimates as the starting point, but makes adjustments using CPS data for farm employment, proprietors and unpaid family workers, and government employment. It is unclear if and how adjustments are made for the cyclical biases due to business births and deaths in the most recent CES data. Data are shown in Table 8. The 2.2 per cent per year average annual growth rate for the 1996-2000 period is higher than that in earlier periods, for example the 1.3 per cent over the 1989-1996 period and the 2.0 per cent over the 1981-1989 period. The business sector shed many jobs in 2001, 2002 and 2003 however, making the growth rate for the entire 1996-2003 period a meager 0.8 per cent per year, and for the 2000-2003 period -1.0 per cent per year (Summary Table 2).

Summary Table 3: Average and Total Hours Trends in Canada and the United States, 1961-2003 (compound average annual rates of change or annual rates of change, %)

	Canada			United States			
	Total Economy		Business Sector	Total Economy			Business Sector
	LFS	PPD	PPD	CPS	CES	BLS	BLS
	1) Average Weekly Hours						
1961-2003		-0.38	-0.37			-0.22	-0.29
1961-1973		-0.70	-0.66			-0.32	-0.34
1973-1981		-0.62	-0.65		-0.59	-0.57	-0.66
1981-2003	**-0.15**	**-0.11**	**-0.10**	**0.19**	**-0.20**	**-0.05**	**-0.14**
1981-1989	0.39	0.00	0.05	0.55	-0.25	0.16	0.04
1989-2003	-0.45	-0.18	-0.19	-0.01	-0.17	-0.16	-0.24
1989-1996	-0.36	-0.14	-0.14	0.00	-0.08	-0.12	-0.16
1996-2003	-0.54	-0.22	-0.24	-0.02	-0.25	-0.21	-0.32
1996-2000	0.21	0.10	0.08	0.36	0.00	0.06	-0.05
2000-2003	-1.54	-0.65	-0.66	-0.53	-0.59	-0.57	-0.67
2001	-1.99	-0.17	-0.22	-1.22	-0.87	-1.02	-1.40
2002	-0.87	-1.03	-1.12	0.17	-0.27	-0.21	-0.20
2003	-1.76	-0.75	-0.62	-0.53	-0.62	-0.47	-0.41
	2) Total Annual Hours						
1961-2003		1.79	1.73			1.51	1.39
1961-1973		2.27	1.92			1.83	1.65
1973-1981		2.13	2.05		1.56	1.38	1.37
1981-2003	**1.38**	**1.40**	**1.51**	**1.64**	**1.42**	**1.38**	**1.25**
1981-1989	2.15	1.89	2.01	2.53	1.87	2.12	2.06
1989-2003	0.93	1.12	1.22	1.14	1.16	0.97	0.80
1989-1996	0.17	0.37	0.31	1.10	1.40	1.16	1.13
1996-2003	1.70	1.87	2.14	1.18	0.92	0.77	0.47
1996-2000	2.77	2.52	3.04	2.32	2.43	2.11	2.15
2000-2003	0.29	1.01	0.94	-0.32	-1.05	-0.99	-1.73
2001	-0.87	0.63	0.37	-1.19	-0.84	-1.17	-2.14
2002	1.35	1.24	1.40	-0.16	-1.39	-1.31	-2.44
2003	0.41	1.15	1.05	0.38	-0.93	-0.49	-0.60

Source: Tables 3, 4, 9 and 10.

C. Average and Total Annual Hours Worked

The most appropriate measure of hours for the purpose of productivity measurement is the most complete or comprehensive. It involves: actual hours worked rather than usual hours or paid hours; hours worked at all jobs rather than just the main job; hours for all workers rather than just non-supervisory employees; and all hours worked per job including both paid and unpaid overtime.

1) Total Economy

Canada

The sources for hours data in Canada are the same as the sources for the number of workers, with a few clarifications necessary. Data from the LFS are in the form of total weekly hours, so estimates must be multiplied by 52 to obtain total hours of work per year.[30] Data from SEPH are expressed as average weekly hours paid per employee, so must be multiplied by total employees then by 52 weeks to obtain total annual hours for employees.[31]

The PPD hours estimates are available both in the form of average annual hours per job and total annual hours (the latter can also be calculated as the former multiplied by the number of jobs). The average hours series is based on LFS data, with adjustments made for public holidays and vacations, which show up as zero hours of work if they take place during the LFS reference week so cannot be assumed to hold for the rest of the year. Average weekly hours per person employed data are shown in Table 3 and total annual hours data are shown in Table 4 for Canada.

Both the PPD and LFS total hours series show strong growth in the latter half of the 1990s compared to the first half of the 1990s (Summary Table 3). The differences in growth rates between the two total hours series are not large in most periods examined, but is not negligible either. For example, in 1981-1989 the LFS series grew by 2.2 per cent per year while the PPD series grew by only 1.9 per cent per year. In 2000-2003 average hours according to the LFS fell sharply, by 1.5 per cent per year, but declined more moderately according to the PPD series, by 0.7 per cent per year.

United States

In contrast to the eight U.S. employment series available, this paper identifies only four sources for hours data for the total economy. Like the LFS Canadian data, CPS data are in terms of weekly hours and must be multiplied by 52 to obtain annual hours. All the caveats mentioned for the SEPH estimates above for Canada apply equally to the CES average weekly estimates for the United States. Namely, they are hours paid rather than hours worked, and they do not include

[30] Note that the conversion of weekly data to an annual basis does not affect growth rates since it is assumed that every year has an identical number of working days.

[31] Average hours data from SEPH are based on the concept of hours paid, rather than the preferred concept of hours worked. Also, SEPH estimates include overtime hours only to the extent that they are paid and recorded in the payrolls. Total hours of employees are calculated by multiplying SEPH average hours of employees by SEPH employees. However, data on total hours of employees are not suitable for calculation of labour productivity levels because they do not include hours of the self-employed and other workers excluded by SEPH. Total hours of all workers can be calculated by multiplying SEPH average hours of employees by the number of workers from the LFS. This implicitly assumes that all excluded workers (farmers, self-employed) work the same average weekly hours as wage and salary employees, probably an underestimate. Hence, while still a more comprehensive estimate of total hours worked in the economy than the first series, it will remain an incomplete estimate. Using total hours of employees in labour productivity growth analyses assumes that hours of employees grow at the same rate as hours of all workers.

the hours of agricultural and public administration workers nor those of the self-employed.[32] The only hours series available from the BEA is for full time plus part time employees, and data are expressed in total annual hours. There is also an unpublished total hours series constructed by the BLS Productivity and Costs program that is consistent with the business sector total hours series.

Interestingly, the patterns of growth of the CES and CPS average weekly hours series (Table 9) are directly the opposite to those for the corresponding employment series. Over the 1989-2003 period average hours fell by 0.2 per cent per year according to CES estimates and remained virtually unchanged according to CPS estimates (Chart 10). This growth differential fluctuated, but was on average in the 0.2 to 0.3 percentage point range for the sub-periods of the 1981-2003 period. In calculating total hours, therefore, the growth gap is also reversed relative to employment, although to a smaller degree (Chart 9).[33] Note also that average hours per job according to the unpublished BLS series have declined sharply over most of the 1981-2003 period, notably by 0.6 per cent per year in the 2000-2003 period. As opposed to the BLS employment series then, which tracked the CPS series closely, the BLS total hours series has advanced more slowly than both the CPS and CES series.

Total hours grew by 0.9 per cent per year according to CES estimates, 1.2 per cent per year according to CPS estimates and 0.8 per cent per year according to BLS unpublished estimates over the 1996-2003 period. This, however, masks extremely strong growth in total hours in 1996-2000 and declines in 2000-2003 according to all three series. CPS total hours increased rapidly in the 1980s, with average annual growth more than 0.6 percentage points higher per year than the CES series and 0.4 percentage points higher than the BLS series over 1981-1989 (Summary Table 3). The BEA full time plus part time hours series essentially tracks the CES series in growth rates over most of the 1981-2003 period, beginning to lag in the latter 1990s (Table 10). This is driven by faster growth (less of a decline) in average hours offset by slower growth in employment.[34]

2) Business Sector

Canada

The PPD series on total annual hours is the only source of business sector hours data publicly available in Canada. Driven by extremely weak employment growth and declining average hours, total hours showed very weak growth of 0.3 per cent per year over 1989-1996. With the large gains in employment after 1996, total hours rebounded sharply in the latter half of the 1990s though, growing by 2.1 per cent per year in 1996-2003 and 3.0 per cent per year between 1996 and 2000 (Summary Table 3).

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[32] It is also possible to combine CPS employment data with CES average hours data to arrive at an estimate for total hours of all workers that is less incomplete than a series on total hours of employees only based on CES hours and employees.

[33] The CES series is here constructed by multiplying total CES employees by CES average hours of all employees. The difference between CES and CPS total hours growth is therefore driven by *both* differences in employment growth and differences in average hours growth.

[34] The *level* of the BEA full time plus part time total hours series also corresponds closely with that of the CES series in all years, remarkable given the divergence in estimates of employment from these two sources.

United States

Likewise there is only one source of hours data for the U.S. business sector, namely total hours in index form from the BLS Productivity and Costs program. The BLS starts with CES data, making adjustments for groups not covered by the CES as is done for business sector employment, but also attempting to convert the hours paid data to hours actually worked data.[35] Total hours growth was a weak 0.8 per cent per year between 1989 and 2003, with strong growth (2.2 per cent per year) between 1996 and 2000 but weak growth in 1989-1996 (1.1 per cent per year) and large declines of 1.7 per cent per year between 2000 and 2003 (Summary Table 3). Over the entire 1961-2003 period total hours grew by only 1.4 per cent per year, reflecting a decline of 0.3 per cent per year in average hours and growth in employment of 1.7 per cent per year.

[35] See Jablonski, Kunze and Otto (1990) for a discussion of how this conversion is accomplished.

Summary Table 4: Output per Worker and Output per Hour Trends in Canada and the United States, 1961-2003 (compound average annual rates of change or annual rates of change, %)

	Canada			United States			
	Total Economy		Business Sector	Total Economy			Business Sector
	NIEA / LFS	NIEA / PPD	PPD	NIPA / CPS	NIPA / CES	NIPA / BLS	BLS
	1) Output per Worker						
1961-2003		1.43	1.76	1.58	1.26	1.62	1.96
1961-1973		2.28	3.06	2.28	1.48	2.30	2.81
1973-1981		0.66	0.97	0.40	0.33	0.53	0.53
1981-2003	**1.24**	**1.25**	**1.35**	**1.64**	**1.47**	**1.65**	**2.02**
1981-1989	1.28	1.15	1.18	1.53	1.37	1.53	1.75
1989-2003	1.21	1.30	1.45	1.70	1.53	1.73	2.18
1989-1996	0.97	0.97	1.08	1.43	1.06	1.25	1.59
1996-2003	1.46	1.63	1.82	1.97	2.00	2.20	2.78
1996-2000	2.13	2.30	2.85	2.20	1.72	2.11	2.56
2000-2003	0.57	0.74	0.46	1.67	2.36	2.32	3.06
2001	0.67	0.98	0.71	0.72	0.72	0.91	1.03
2002	1.20	1.16	0.81	2.20	3.02	3.00	4.00
2003	-0.14	0.10	-0.15	2.11	3.37	3.06	4.17
	2) Output per Hour						
1961-2003		1.81	2.15			1.85	2.26
1961-1973		3.00	3.76			2.62	3.16
1973-1981		1.29	1.62		0.93	1.11	1.19
1981-2003	**1.38**	**1.36**	**1.48**	**1.44**	**1.67**	**1.70**	**2.17**
1981-1989	0.89	1.15	1.11	0.97	1.63	1.37	1.72
1989-2003	1.67	1.48	1.69	1.72	1.70	1.89	2.42
1989-1996	1.31	1.11	1.22	1.44	1.14	1.37	1.76
1996-2003	2.02	1.85	2.16	2.00	2.25	2.41	3.10
1996-2000	1.94	2.20	2.78	1.84	1.72	2.05	2.60
2000-2003	2.12	1.40	1.34	2.21	2.97	2.90	3.77
2001	2.69	1.16	1.33	1.96	1.61	1.95	2.50
2002	2.07	2.18	2.24	2.03	3.30	3.22	4.29
2003	1.61	0.87	0.47	2.65	4.01	3.55	4.52

Source: Tables 5, 6, 11 and 12.

D. Output per Worker[36]

1) Total Economy

Canada

Two output per worker series are constructed, namely NIEA output divided by LFS employment and NIEA output divided by PPD employment (Table 5 and Chart 3).[37] Between 1989 and 2003 the NIEA/PPD output per worker series grew by 1.3 per cent per year, 0.1 percentage points faster than the 1.2 per cent per year recorded by the NIEA/LFS series. Both series showed identical growth rates for 1989-1996, but diverged by 0.1 percentage points for 1996-2003. Over the 1981-1989 period the NIEA/LFS series grew faster than the NIEA/PPD series, at 1.3 per cent per year compared to 1.2 per cent per year respectively (Summary Table 4). These differences in growth rates reflect only differences in the employment estimates between the LFS and PPD, as the NIEA output series is used for both output per worker series.

United States

As was the case for Canada, since all total economy output per worker series in the United States are based on the same output series, differences in growth rates are driven solely by differences in the growth of the underlying employment series. Data are shown in Table 11. The BLS unpublished series showed the slowest growth of all employment series, so shows the fastest output per worker growth, followed very closely by the CPS-based productivity series.

The CES-based output per worker series typically grew the slowest in all of the sub-periods of the 1961-2003 period, with the gap between it and the CPS- and BLS- based series widening significantly through the 1990s and then reversing in the 2000-2003 period (Summary Table 4). The output per worker series based on CPS employment data grew by 2.0 per cent per year over the 1996-2003 period, virtually identical to the growth shown by the output per worker series based on employment data from the CES, and 0.2 percentage points behind that of the BLS-based output per worker series.

[36] In discussing productivity trends it is important to note the reticence on the part of some analysts in placing large weight on small differences. Baldwin and Harchaoui (2001) for instance note that differences of less than 0.3 percentage points in multifactor productivity growth rates are difficult to interpret due to the measurement error inherent in the underlying data. This confidence interval might be expected to be smaller for the simpler case of labour productivity. Dean (1999) also discusses possible measurement error in labour productivity estimates although does not venture an estimate on the size of this possible error.

[37] Although the employment series used here is constructed by the Productivity Program, Statistics Canada does not provide an official output per worker series for the total economy.

2) Business Sector

Canada

The only output per worker series available for the business sector is the one based on the PPD output and employment series.[38] This series showed a 2.9 per cent average annual growth rate over 1996-2000, although including the slower productivity growth period of 2000-2003 (in which average output per worker growth was 0.5 per cent per year) leads to growth of 1.8 per cent per year from 1996 to 2003. This compares with growth of only 1.1 per cent per year in the first half of the 1990s, 1.2 per cent average annual growth throughout the 1981-1989 period and 1.0 per cent per year growth from 1973 to 1981 (Summary Table 4).

United States

Likewise there is only one business sector output per worker series for the United States, namely the BLS Productivity and Costs series. Output per worker growth was 2.2 per cent per year over the 1989-2003 period, driven by growth of 1.6 per cent per year in the first half of the 1990s and 2.8 per cent per year growth for 1996-2003. Over the entire 1961-2003 period examined, output per worker grew by an average annual rate of 2.0 per cent per year (Summary Table 4).

E. Output per Hour

1) Total Economy

Canada

As with output per worker, two total economy output per hour series are constructed for Canada, the first with NIEA output data and LFS hours data, and the second with NIEA output data and PPD hours data (Table 6 and Chart 4).[39] The growth gap for output per hour between these two series for the 1989-2003 period is slightly larger than that for output per worker due to the larger decline in LFS average hours over this period.[40] The output per hour growth gap between these two series was 0.2 percentage points per year over 1996-2003. But in 1996-2000 growth in the NIEA/PPD series actually exceeded that in the NIEA/LFS series, while in 2000-2003 the latter showed growth of 2.1 per cent per year and the former of only 1.4 per cent per year. This large gap is driven solely by the massive difference in average hours growth between

[38] The Productivity Program explicitly defines labour productivity as output per hour. Although both employment and output series are available, there is no official output per worker series available.

[39] Again, at the total economy level there is no official Statistics Canada productivity series.

[40] Growth in total hours is the sum of growth in average hours and growth in employment. Growth in output per worker is equal to growth in output minus growth in employment, and growth in output per hour is equal to growth in output minus growth in total hours. Therefore output per hour growth exceeds output per worker growth if growth in average hours is negative. LFS average hours fell by 0.45 per cent per year over 1989-2003, meaning that NIEA/LFS output per hour grew at a rate 0.45 percentage points faster than NIEA/LFS output per worker over this period. But NIEA/PPD output per hour grew by only 0.18 percentage points faster than NIEA/PPD output per worker due to the weaker 0.18 percentage point fall per year in PPD average hours for this period.

the LFS and PPD series, which declined by 1.5 per cent per year and 0.7 per cent per year respectively. According to the LFS series, output per hour growth in Canada actually accelerated mildly between 1996-2000 and 2000-2003, but according to the PPD series, Canada's productivity performance between these two periods has deteriorated substantially. The growth gap between the two series was also large in 1981-1989 but in the opposite direction, with the NIEA/LFS series growing by only 0.9 per cent per year but the NIEA/PPD series growing by 1.2 per cent per year (Summary Table 4). These differences are driven purely by differences in total hours growth rates.

United States

Four output per hour series are constructed, all based on NIPA output data, combined with CPS, CES, BLS unpublished and BEA hours data (Table 12 and Chart 12). From 1981 to 1989 the growth rate of the CPS-based series was a mere 1.0 per cent per year, but that of the CES-based series was a more robust 1.6 per cent per year, with the BLS-based series just behind at 1.4 per cent per year. These growth gaps were smaller for the 1989-2003 period, with the CPS-based and CES-based series growing by 1.7 per cent per year and the BLS-based series by 1.9 per cent per year. All three series show an improvement in the 1996-2003 period relative to earlier periods, but the extent of the improvement depends on the series. For example, the CES-based series had a growth rate 1.2 percentage points faster in 1996-2003 that in 1989-1996. But the CPS-based series showed only a 0.6 percentage point improvement, from growth of 1.4 per cent per year to 2.0 per cent per year (Summary Table 4).

2) Business Sector

Canada

Output per hour according to the PPD series (the only available) grew by 1.7 per cent per year between 1989 and 2003 and 2.2 per cent per year between 1996 and 2003 (Summary Table 4). This 2.2 per cent average annual growth rate over 1996-2003 represents an improvement relative to the 1973-1996 period, but is very close to the average growth rate for the entire 1961-2003 period considered. This is due to the 3.8 per cent per year output per hour growth over the 1961-1973 period. Output per hour growth averaged 2.8 per cent per year in the 1996-2000 period, falling to 1.3 per cent per year in the 2000-2003 period.

United States

Output per hour growth in the U.S. business sector has been very strong recently, 3.1 per cent per year for the 1996-2003 period. This is actually stronger than the 2.6 per cent per year growth over the 1996-2000 period, as productivity growth slowed only slightly in the recession year of 2001 (to 2.5 per cent) but took off in 2002 and 2003 (4.3 and 4.5 per cent respectively).[41]

[41] This strong growth since 2000 may be evidence of a post-2000 structural acceleration in labour productivity growth in the United States similar to the post-1995 acceleration in the United States and the post-1996 acceleration in Canada. The growth rate of U.S. business sector output per hour was 2.7 per cent per year in the 1995-2000 period and 3.8 per cent per year in the 2000-2003 period. This acceleration of 1.1 percentage points is just as large as the acceleration between the 1989-1995 period (1.6 per cent per year average annual growth) and the 1995-2000 period (2.7 per cent per year average annual growth). Of course, as was mentioned at the beginning of this section,

Given the weaker 1.8 per cent per year growth for the 1989-1996 period, the overall 1989-2003 period saw growth of 2.4 per cent per year. For the entire 1961-2003 period considered, output per hour in the U.S. business sector grew by 2.3 per cent per year, with 3.2 per cent average annual growth over the 1961-1973 period (Summary Table 4).

III. Appropriate Data Sources

The output, labour input and labour productivity series discussed in the previous section sometimes show markedly different trends within countries, giving conflicting evidence on Canada's aggregate labour productivity growth performance relative to the United States. Not only are relative aggregate labour productivity trends affected by the choice of data sources and choice of periods, but equally by the choice of whether to focus on the total economy or business sector. This section addresses the question of which data sources provide the most comparable and methodologically sound productivity estimates and the following section addresses the question of the appropriateness of the business sector and total economy for making aggregate productivity growth comparisons. A brief word on output is followed by a discussion of employment and total hours data. Then, once the preferred series are identified based on their methodological merits, the comparability of the preferred series is addressed.

A. Output

The choice of output data at the business sector level for both countries is straightforward because the productivity authorities in each country release on a timely basis comparable series based on the most up-to-date methodologies. Currently, the quarterly PPD business sector series in Canada is available only from 1987 onwards. The annual PPD series is slightly less comparable to the U.S. series because it is based on data expressed in basic prices. But it is this series that will eventually be available back to 1961, and the slight methodological incomparability with the U.S. data must be tolerated in the interests of long-term comparisons.

Even at the total economy level the choice appears easy since there is only one series available in each case. But as mentioned briefly before, some researchers believe that imputed rents should not be included in total economy output for productivity analyses since this component of output is not produced with a coinciding input. However, other researchers, notably Dale Jorgenson, argue that imputed rents should be included in output measures for total economy labour productivity analysis. Owner occupied dwellings are the capital stock of the household sector, and the associated imputed rents are the services available from this capital stock. From this perspective some argue that imputed rents should be included for labour productivity analysis, even though they are not produced with an associated labour input. At the

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caution is called for in examining recent trends, as statistical revisions may eventually erase part of this apparent acceleration in output per hour growth. Recent productivity trends in Canada and the United States are discussed in more detail by Sharpe (2004), who also mentions the possibility that recent U.S. performance constitutes another structural productivity growth acceleration. It should also be mentioned that this acceleration is more modest when total economy output per hour trends are considered than when business sector trends are considered. Likewise, the output per hour growth deceleration in Canada between 1996-2000 and 2000-2003 is milder according to the NIEA/PPD total economy series than according to the business sector series.

seminar on December 4, 2003 organized by Industry Canada to discuss a preliminary version of this paper, there was consensus that the expenditure-based GDP estimates from the national accounts of both the United States and Canada be used as total economy output series for labour productivity growth analyses, and hence that imputed rents be included. For those wishing to exclude imputed rents, data on rents are available within both the U.S. and Canadian national accounts, so it is possible to subtract rents from total GDP and use the resulting series in constructing labour productivity series.[42]

In the previous section, several points of incomparability between the U.S. and Canadian national accounts were identified, but the conclusion was that the effect of these on the comparability of growth rates is likely to be small. Nonetheless, it should be reiterated that the apparently more widespread use of quality adjustment in the United States than in Canada; the various methodological differences affecting level estimates, which can affect growth rates through composition effects; and the treatment of the statistical discrepancy mean that the comparability between output growth estimates across the two countries is not perfect. These points of incomparability apply in principle to both the total economy and business sector output series. However, the next section returns to this issue of the comparability of output estimates, and finds that the degree of incomparability may be substantially larger at the total economy level than at the business sector level.

B. Employment and Hours

The much stickier issue is of course the choice of total hours data, or equivalently of the employment and average hours data that are combined to calculate total hours. In Canada the most appropriate source for the total economy is the PPD series since it is fine-tuned by Statistics Canada officials to measure total hours in the most appropriate way for productivity and in a way that is consistent with System of National Account definitions. Since this series is currently available only for the 1997-2003 period, there is the issue of how these series should be extended back before 1997, given that the historical series may not be available for some months yet. The obvious path, the one followed here, is to use growth rates from the corresponding Aggregate Productivity Measures series, which is no longer updated, since this is based on broadly the same methodology as the current PPD series. Indeed, trends in the years for which the two series overlap are similar.

The only other feasible choice that combines recent data with availability over a long time period is the LFS series, as the SEPH series is not comprehensive enough. But this is not a bad alternative, since asking members of a household how many hours they actually worked the

[42] It is in fact not necessarily as simple a matter as subtracting imputed rents from total output. This is because, first of all, data on imputed rents are only available back to 1981 in Canada on a comparable basis with data on total output, which are available back to 1961. Also, both total output and imputed rent series are expressed in chained dollars, which are not additive. Liu, Hamalainen and Wong (2003) discuss several available techniques for approximating the growth rate of an aggregate series based on its subcomponents expressed in chained dollars, one of which has been applied in Table 1a to approximate a total economy GDP series in chained dollars excluding imputed rents. In any case, the differences appear small enough that the choice of whether to remove imputed rents or not should not affect the broader productivity growth picture nor the differential between countries to a large degree.

previous week is likely to yield fairly accurate results.[43] And since the growth rate of the PPD total hours series is largely based on the LFS growth rate, neither series is necessarily more statistically reliable than the other. The problem here is the availability only as far back as 1976.

Therefore the preferred hours and employment series for the total economy in Canada for years in which the PPD series are not available are the PPD series extended backwards using the earlier-vintage Aggregate Productivity Measures series. Since the PPD series are currently only updated twice annually (preliminary estimates in April, and revised estimates in December), there is also the issue of having data for the most recent year possible. This paper recommends extending the PPD series forward using growth rates from the LFS series, since annual estimates are available from the LFS in January (and output estimates for the preceding year are available in February), three months before the release of the preliminary annual PPD estimates.[44]

For the United States, although the CES employment and average hours series remain the favoured indicators of employment and hours trends in the media and for financial analysts, they make very poor estimates of labour input for the purposes of productivity growth. The OECD Productivity Manual (OECD, 2001, summarized by Schreyer, 2001) considers a simple headcount of employee jobs, and by extension the hours worked in those jobs (such as the CES estimates) as seriously lacking indicators of labour input due to the omission of the self-employed. The question that naturally should follow is, what is so wrong with the CPS estimates that such seriously lacking CES estimates are often used in their place? The answer given by BLS officials is that the CPS hours estimates are considered upwardly biased due to the over-reporting by individuals of unpaid work (van Ark, 1998; Eldridge et al., 2001). There are also breaks in the CPS series due to population benchmarking in various years. However, since the concern here is growth rates, the real question is if these population benchmarks affect growth rates and if the over-reporting of unpaid work has been changing.

Using a terminated CPS series with data for 2000-2002 not updated for the new population benchmarks,[45] growth in the number of workers over the 1961-2002 period is 1.8 per cent per year, identical to the average annual growth of the series with the new population benchmarks over the same period. However, for the 1996-2002 period the series based on the older population benchmarks grew by 1.0 per cent per year, compared to 1.3 per cent per year for the series with the new benchmarks. The population benchmarks do not affect average hours estimates, but do affect total hours through employment. Therefore the recent CPS population benchmarks cause output per hour growth based on CPS total hours to be slightly underestimated in the second half of the 1990s relative to what it would have been if the population benchmarks had been applied to every year rather than just 2000, hence causing a break in that year.

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[43] The accuracy of responses in the LFS is not the motivation for the adjustments made for the PPD and Aggregate Productivity Measures series. Rather, the adjustments are meant to address factors peculiar to the reference week and workers not covered by the LFS. As shown in Table 4, these adjustments can be significant in level terms. The growth differentials between the two series have historically not been particularly substantial, but as shown in Summary Table 4, the discrepancy in growth rates between the series has become quite large since 2000.

[44] Note once again, however, that there are sometimes large divergences between annual growth rates of the LFS and PPD employment and hours series. Such was the case in 2003, when PPD hours grew by 1.2 per cent but LFS hours grew by only 0.4 per cent. As always, there is a trade-off between accuracy and timeliness of data – but when timeliness is chosen, the LFS estimates are the only reasonable option available.

[45] This series is still provided by the BLS as series number LFN11000000, although is not available beyond March 2003.

The question of whether the degree of over-reporting of unpaid hours has trended upwards over time is much more difficult to address quantitatively. But in level terms at least, it is hard to believe that this over-reporting could upwardly bias the CPS hours estimates as much as the omission of agricultural and self-employed workers (who, anecdotally at least, tend to work longer hours than production workers) downwardly bias the CES hours estimates. For CPS hours estimates to be more biased than the CES estimates in terms of growth rates, then, year-to-year changes in over-reporting of unpaid hours must be greater than fluctuations in the composition of agricultural and public administration workers, and the self-employed in the total workforce.

It is also possible to include the issue of sample size in deciding which employment and hours source is more appropriate. Since CES estimates are based on such a large sample size they are more statistically reliable than the CPS estimates (the standard errors of the estimates are smaller). However, more than just sample size matters in terms of reliability. The CES sample, although large, is biased from the perspective of the total economy due to the categories of workers it omits. Non-sampling errors (such as over-reporting or careless responses), on the other hand, are likely to be greater in the CPS since individual responses are probably more subjective than payroll information. One further note may be helpful in evaluating this ambiguity in terms of apparent statistical reliability: the BLS has the confidence to express average hours data only to one decimal place *for both data sources*, implying that the statistical properties of the estimates are not extremely different.[46]

The unpublished BLS total hours and employment series are regarded as methodologically superior to both CES and CPS estimates since they are based on the CES estimates and hence are only marginally affected by the alleged shortcomings of the CPS estimates, but use the CPS and other sources to make up for the exclusions of the CES data. These series, however, remain unpublished, although they are available on request. BLS officials say that these estimates are as reliable as the published business sector estimates with which they are consistent, but are not published because the BLS does not publish total economy productivity series. Total economy series are not produced because there are elements of the total economy whose output is not measured independently of labour input and because there are other elements, such as imputed rents, for which there is no corresponding labour input.[47]

[46] See BLS (1997:chapters 1 and 2) for a more precise discussion of the statistical reliability of the CPS and CES estimates.

[47] Mention should also be made of the BEA employment series, although methodological notes on their construction seem not to be publicly available. Even though it is growth rates we are concerned about here, it is difficult to place much trust in the growth of series that show such implausibly high levels. The total employment figure for 2002, taken from Table 8 and the Annual State Personal Income Tables produced by the BEA, along with the total population figure from the same source, implies an employment/total population ratio of 59 per cent, exceeding by about 10 percentage points the employment/total population ratio of all OECD countries (including the U.S. ratio calculated using OECD data). The hours estimates for full time and part time employees, on the other hand, are too low since, like the CES estimates, only refer to employees.

Overall, it seems clear that the unpublished BLS series should be the preferred choice for total economy hours and employment. Indeed, this was the conclusion reached at the December 2003 inter-departmental seminar on this paper organized by Industry Canada.[48]

The choice for business sector hours data is made automatically based on data availability. Neither country provides publicly available employment and average hours estimates for the business sector aggregation, either from the household-based or establishment-based surveys. Fortunately the methodologies of the PPD series in Canada and the BLS series in the United States are designed to result in the most comprehensive estimates possible, and are consistent with those already recommended for the total economy level. Although the BLS estimates start from CES estimates, the adjustments made are intended to address the most serious weaknesses.

Summary Table 5: Recommended Output and Hours Series for Canada-U.S. Labour Productivity Growth Comparisons

	Canada		United States	
	Total Economy	Business Sector	Total Economy	Business Sector
Output	NIEA	PPD Quarterly (extended backwards with APM until annual series is released for 1961 onwards)	NIPA	Productivity and Costs
Total Hours	PPD (extended backwards with APM until released for 1961 onwards)	PPD (extended backwards with APM until released for 1961 onwards)	BLS Unpublished (or CPS in case of unavailability)	Productivity and Costs

[48] As a second best, this paper recommends the use of the CPS as the source both for average hours estimates and estimates of total employment for the total economy in the United States. This recommendation is made despite the fact that, as seen in the previous section, the growth of the unpublished hours series tends to follow that of the CES series closely. The BLS has recently switched to the CPS growth rate for total hours of all non-production and supervisory workers for productivity estimates (Eldridge, Manser and Otto, 2004), although this had only a marginal effect on growth rates.

C. Data Comparability

The output series available for productivity analysis in Canada and the United States are fairly methodologically consistent across the two countries and across the total economy and business sector levels. All are measured at market prices (except the annual PPD business sector series in Canada) and utilize the chained Fisher formula. In terms of the recommended employment and hours series, the BLS methodology differs from the PPD methodology in that the former starts from establishment data and makes adjustments using other sources while the latter starts with household data and makes adjustments using other sources. However, both are considered by their developers to be the most comprehensive estimates available, and inconsistencies across countries would seem to be slight. The series recommendations made by this paper, shown in Summary Table 5, are thus meant to optimize both methodological appropriateness and cross-country comparability.

IV. Business Sector and Total Economy Perspectives on Aggregate Productivity Growth

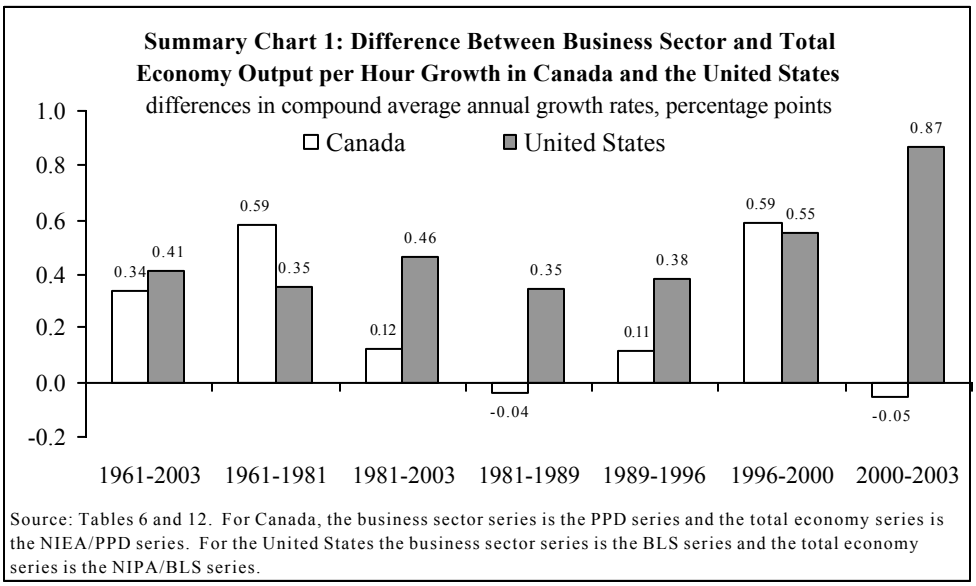
A. Explaining the Smaller Business Sector-Total Economy Productivity Growth Differential in Canada than in the United States

The trends discussed in the second section for the total economy and business sector highlight a surprising difference between Canada and the United States. Canada's productivity growth has been moderately slower than that of the United States at the total economy level over the past two decades (output per hour grew at an average annual rate of 1.36 per cent per year in Canada over the 1981-2003 period and 1.70 per cent per year in the United States, a difference of 0.34 percentage points). But the U.S. business sector has outperformed the Canadian business sector in terms of productivity growth over the same period to a much larger degree. Output per hour grew at an average annual rate of 1.48 per cent per year in Canada and 2.17 per cent per year in the United States between 1981 and 2003. This 0.69 percentage point growth gap between the United States and Canada is double the size of the growth differential at the total economy level for the same period. This suggests a large divergence between business sector and total economy output per hour growth in the United States, confirmed in Summary Chart 1.

This chart demonstrates two important and perplexing points.[49] First, the gap between business sector and total economy output per hour growth in Canada has, since 1981, generally been small in *absolute* size. The gap even became negative in the 1981-1989 period (-0.04 points), increasing to 0.11 points per year in 1989-1996 and to 0.59 points in 1996-2000, but declining markedly to -0.05 points in 2000-2003. The small gap (0.12 points) for the overall 1981-2003 period is a reversal from the 1961-1981 period, when the gap was large (0.59 points).

[49] It should be noted that Summary Chart 1 is based only on the output and labour input series recommended in the previous section. However, output per hour data from other data sources, shown in Tables 6 and 12, show that the overall patterns illustrated by the chart are not greatly affected by the choice of data sources.

As has been mentioned previously, the small gap after 1981 is an unexpected result since low measured productivity growth in the non-business sector due to the widespread use of labour input as a proxy for output is thought to exert downward pressure on measured productivity growth in the total economy. Second, this gap has generally been small *relative* to that for the United States. This gap has been steadily increasing since the early 1980s in the United States.[50]



Source: Tables 6 and 12. For Canada, the business sector series is the PPD series and the total economy series is the NIEA/PPD series. For the United States the business sector series is the BLS series and the total economy series is the NIPA/BLS series.

Total economy labour productivity growth in a given country can be calculated approximately as the sum of three terms: labour productivity growth in the business sector multiplied by the share of the business sector in total economy output in the first period of the growth rate; the same for the non-business sector; and a compositional shift term.[51] The compositional shift term is positive when the sector with an above-average level of labour productivity experiences an increasing share of hours worked in total economy hours worked over the period considered (or equivalently, if the sector with a below-average level experiences a

[50] On an annual basis the growth gap between output per hour in the business sector and total economy fluctuates greatly for both countries (Chart 15). This is likely due to different responses to the business cycle in terms of hiring workers, cutting hours, etc. in the business sector versus the total economy, which would imply different productivity behaviour during recessions and expansions in the two sectors. Note also that the growth gap changes differently in each country over time, suggesting different cyclical responses in the two countries, perhaps driven by differing industry compositions. Since about 1986 the gap, based on overlapping compound average annual growth rates over the preceding five years, has been larger in the United States for most years, and indeed has been increasing sharply in the latter half of the 1990s while the gap in Canada has been falling and was substantially negative for a prolonged period in the early 1990s. Nicoletti and Reichlin (1993) examine cyclical trends in business sector labour productivity in G-7 countries, and the evidence they present implies both that business sector productivity is more variable in Canada than the United States over the business cycle, and responds differently to the business cycle in each country.

[51] This calculation is only approximate because it requires that the levels of output and hours in the business sector and non-business sector sum identically to output and hours respectively in the total economy. This is not the case due to the use of chained dollar output series, which are not additive. Tang and Wang (2004) provide a mathematically exact decomposition of total economy productivity growth into the growth of productivity in individual sectors or industries that is robust to the index type of output estimates. The general message remains the same though: an individual industry (or sector) affects total economy labour productivity growth not just through its labour productivity growth rate but also through changes in its relative size over the period examined.

falling hours share). It is negative if the sector with an above-average level experiences a falling hours share. The compositional shift term is larger in absolute value the larger the change in the hours share and the larger the divergence in productivity levels between the two sectors.

According to this approximate decomposition of total economy labour productivity growth, the growth gap between business sector and total economy output per hour growth will be smaller the slower is business sector output per hour growth; the larger (or less negative) is the compositional effect; and the faster is non-business sector output per hour growth. Likewise, differences across countries in these three factors affect differences across countries in the size of the business sector-total economy productivity growth gap. These three factors will each be examined in turn.

1) Faster Business Sector Output per Hour Growth in the United States than in Canada

The smaller gap between output per hour growth in the business sector and total economy in Canada than in the United States is partially driven by faster business sector output per hour growth in the United States than in Canada. Estimates presented in the second section of this paper show that business sector output per hour growth in 1981-2003 was 2.17 per cent per year in the United States and 1.48 per cent per year in Canada, a difference of 0.69 percentage points per year.

Much of this growth gap appears to be driven by a substantially poorer productivity growth performance in the Canadian manufacturing industry relative to its U.S. counterpart.[52] Bernstein, Harris and Sharpe (2002) document Canadian and U.S. manufacturing productivity trends, and find substantially higher growth in the United States than in Canada, especially so since 1994. They also suggest some possible causes of this manufacturing productivity growth divergence, including much slower growth in investment per hour worked in Canadian manufacturing relative to U.S. manufacturing.

Wölfl (2004) mentions the possibility that, despite conceptual problems in measuring output in several service industries, it is actually service sector output that is correctly measured, and that the output growth of other industries such as manufacturing could actually be over-estimated. To the extent that this is true to a larger degree in the United States than in Canada, this could also account partially for the large measured gap between Canada and the United States in terms of manufacturing productivity growth. Rao, Sharpe and Tang (2003) mention that low manufacturing productivity growth in Canada relative to the United States could also be due to statistical conventions, in that certain low-productivity growth service industries may be classified as within manufacturing in Canada but within the service sector in the United States.

[52] The business sector comprises manufacturing, construction, natural resources, private utilities and several service industries, so the large U.S.-Canada productivity growth gap at the business sector level could be driven by poorer performance in any of these industries in Canada relative to the United States. But Rao, Sharpe and Tang (2003) find that labour productivity growth in several Canadian service industries has outpaced that in their U.S. counterparts, at least in the 1990s. Further, the remaining industries in the business sector account for a small share of business sector output relative to manufacturing and services. Therefore, the extremely poor manufacturing productivity growth in Canada relative to the United States must be the most important driver of the poorer Canadian business sector productivity growth relative to that in the United States.

2) Compositional Effects

In both Canada and the United States changes in the hours share of the business and non-business sectors in the total economy have made a negative contribution to total economy productivity growth, due to the different levels of output per hour in these two sectors. But in terms of explaining the business sector-total economy productivity growth gap, compositional shift effects are negligible in each country. Nonetheless, this issue deserves some further attention, as it highlights some interesting differences between Canada and the United States.

In Canada, the hours share of the business sector in the total economy in 1981 was 80.7 per cent, and rose almost two percentage points by 2003 to 82.6 per cent. In the United States, the hours share of the business sector fell by more than two percentage points over the same period, from 78.0 per cent to 75.8 per cent. As was mentioned briefly previously, these issues deserve further research. It is perplexing both that there is such a large difference in the hours share of the business sector between the two countries, and that growth in the hours share has diverged so much across the two countries over the past two decades.

Along with an increasing hours share, the Canadian business sector has a below-average level of output per hour.[53] This is to be expected, since imputed rents are included in the non-business sector and have no associated labour input. It is therefore typically the case that the non-business sector has a high level of output per hour relative to the business sector. But this is not the case in the United States, where the level of business sector output per hour is higher than total economy (and therefore non-business sector) output per hour.[54] Again, this issue deserves further research.

Thus in Canada, the sector with a below-average productivity level (the business sector) experienced an increasing hours share over the 1981-2003 period. The compositional effect term is hence negative for Canada for this period. In the United States, the sector with an above-average productivity level (the business sector) experienced a falling hours share in the total economy over this period. The compositional effect term was therefore also negative for the United States. The size of the compositional effect was roughly similar across countries though, so that this factor did not contribute to the divergent business sector-total economy labour productivity growth gaps across countries, at least for the overall 1981-2003 period.

[53] To calculate a level of business sector output per hour in Canada, output data from the GDP by industry accounts have been used, as data from the Productivity Program Database are only published in index form. But the GDP by industry business sector output series includes imputed rents. Imputed rents have therefore been removed from the GDP by industry series, for consistency with the PPD definition of the business sector. Output per hour estimates calculated from this output series are in basic prices, and are based on a Laspeyres index. They are therefore compared with total economy productivity levels based on the same methodology.

[54] As with Canada, business sector levels of output per hour for the United States are calculated using output estimates from the national accounts. However, unlike in Canada, the national accounts definition of the business sector is identical to that for the purposes of productivity analysis. Therefore, imputed rents have not been subtracted from business sector output in the United States, as the BEA does not include them in the first place.

3) Faster Non-Business Sector Output per Hour Growth in Canada than in the United States

The most important source of the smaller gap between business sector and total economy output per hour growth in Canada than in the United States since 1981 is much faster non-business sector output per hour growth in Canada than in the United States. Summary Chart 2 illustrates Canada's superior non-business sector productivity growth performance, showing output per hour growth of 1.12 per cent per year in the Canadian non-business sector for 1981-2003 compared to only 0.13 per cent per year in the U.S. non-business sector, a difference of 0.99 percentage points per year.[55] This gap has remained fairly constant since 1981. Interestingly, this marks an acceleration in Canadian non-business sector output per hour growth from the 1961-1981 period, and a deceleration in U.S. non-business sector output per hour growth.[56]

As has been mentioned previously, it is expected that output per hour growth in the non-business sector be close to zero due to the use of labour input in the measurement of the output of sectors whose production is non-marketed (i.e. education, health and government). The growth rates for Canada therefore seem quite high, while the growth rates for the United States appear more consistent with input-based output measurement. The higher non-business sector output per hour growth in Canada may be explained by higher growth of imputed rents in Canada than in the United States; more quality adjustment of labour used in non-business sector output measurement in Canada; or more generally, differing statistical practices between countries.

Imputed rental value of owner-occupied dwellings is included in non-business sector output in both Canada and the United States as it has been defined here. 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 3.4 per cent per

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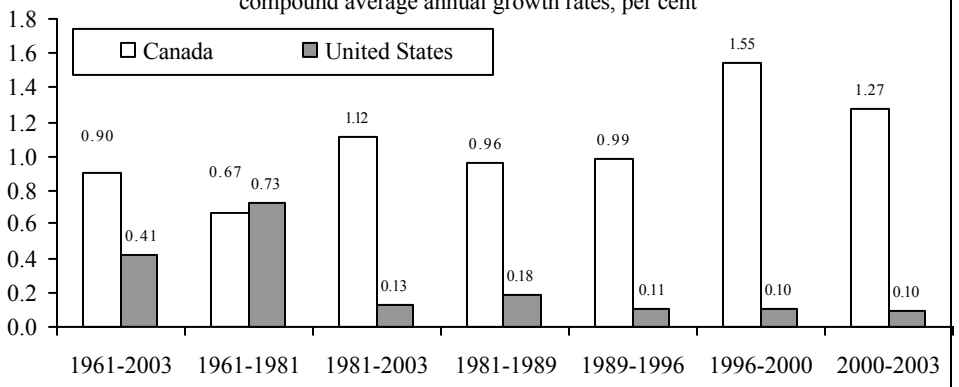
[55] Non-business sector output for the United States has been calculated from level estimates of business sector and total economy output from the BEA. Since these data are in chained dollars, which are non-additive, a method of approximating a chained dollar series as described by Liu, Hamalainen and Wong (2003) has been used. U.S. non-business sector hours have been calculated by subtracting the BLS business sector series (only published in index form but available in level form on request) from the unpublished BLS total economy series (in level form). For Canada, non-business sector output is available from the GDP by industry accounts. Since it is expressed in basic prices based on a Laspeyres index, it is not fully consistent with the business sector and total economy series used. Also, since the GDP by industry definition of the business sector includes imputed rents, unlike the PPD definition of the business sector, imputed rents have been added to the Canadian non-business sector output series. This ensures greater consistency with the Canadian business sector and total economy output series as well as the U.S. non-business sector output series. Canadian non-business sector hours are available from the Productivity Program Database. Data are shown in Tables 6a and 12a.

[56] This break in 1981 in Canada may be explained by a change in measurement techniques over time. The GDP by industry non-business sector output series begins in 1981 only, so a series of earlier vintage has been used to extend the more recent series back to 1961. This series of earlier vintage shows much slower growth than the more recent series for the period in which they are both available, for example growing by 1.17 per cent per year in 1981-2000 compared to 1.98 per cent per year for the more recent series (Table 6a). The source of the U.S. deceleration after 1981 does not appear to be related to measurement techniques though, as the non-business sector output series shown in Table 12a is derived from total economy and business sector series that are consistent for the entire 1961-2003 period.

year in Canada between 1981 and 2003, but only by 2.6 per cent per year in the United States.[57] This gap of 0.8 percentage points per year between Canadian and U.S. growth in real imputed rents could account for nearly three fifths of the non-business sector output per hour growth differential for 1981-2003.[58] The sources of this significant divergence in growth in imputed rents deserve further research attention.

Summary Chart 2: Output per Hour Growth in the Non-Business Sector in Canada and the United States

compound average annual growth rates, per cent



Source: Tables 6a and 12a. For Canada, data are expressed in fixed-weighted Laspeyres dollars. For the United States, data are expressed in chained Fisher dollars, based on a Laspeyres approximation of chained Fisher growth rates.

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

[57] Data on real imputed rents are taken from the National Income and Product Account tables on personal consumption expenditures by detailed type of product for the United States. Data are available in quantity index form for the 1981-2003 period, and rents for farm and non-farm owner-occupied dwellings are shown separately. The growth rate of overall imputed rents is based on a weighted average of farm and non-farm imputed rents, with weights calculated from nominal shares in total imputed rents. Data on imputed rents in Canada are taken from the personal consumption expenditure estimates from the Canadian expenditure-based national accounts, and are only available on a consistent basis from 1981 onwards. Data on rents in Canada are also available from the GDP by Industry series, in basic prices rather than market prices, and in fixed-weighted rather than chained dollars.

[58] 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. 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 33 per cent on average in the two countries (slightly lower in Canada and slightly higher in the United States), and non-business sector hours grew by 0.9 per cent per year in Canada in 1981-2003 and by 1.8 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 1981-2003 is hence approximately 0.56 percentage points, accounting for 57 per cent of the 0.99 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 0.8 per cent per year imply that productivity growth in the U.S. non-business sector excluding imputed rents was actually slightly negative for the 1981-2003 period. Further research would be required to determine the reasons behind this negative measured productivity growth.

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) have also noted 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 currently 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.[59] This is precisely what is observed for Canada and the United States. The growth of the non-business sector implicit price deflator was 3.4 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 3.0 per cent per year in both the United States and 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 two fifths or more 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). It would be interesting for further research to examine if this situation in the European Union is, like in Canada, related to differences in growth in imputed rents and in non-business sector measurement practices.

[59] 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.

4) Implications for the Comparability of GDP Estimates

It is important to note that total economy real GDP calculated on the basis of expenditure and income must by definition equal total economy real GDP calculated on an industry basis. This implies that if non-business sector output is mis-measured in terms of not reflecting true productivity gains, this mis-measurement is 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 mis-measured, one must accept in turn that the expenditure-based GDP estimates that are such a ubiquitous part of economic and financial analysis may also be mis-measured, 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.[60]

However, it does not follow that levels of GDP 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 made 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.

In light of the differences in non-business sector measurement techniques in Canada and the United States, there are three possible implications for Canada-U.S. productivity growth comparisons:

- It is possible that non-business sector output and productivity growth are overestimated in Canada relative to the United States, leading to an upward bias in total economy output and productivity growth and accounting in part for the observed narrow gap between total economy and business sector productivity growth in Canada as compared to the United States. However, this would imply that expenditure-based GDP estimates are overestimated in Canada relative to the United States as well, since GDP on an expenditure basis must equal GDP on an industry basis.
- Alternatively, it is possible that non-business sector output and productivity growth are overestimated in Canada (and not in the United States) but business sector output and productivity growth are underestimated in Canada (and not the United States), implying that the expenditure-based GDP estimates are comparable across countries. The underestimation

[60] 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. Also, it remains of interest to know the sources of the differing growth rates of imputed rents, as differing measurement techniques could be an issue in this respect as well.

of business sector output and productivity growth is plausible, as there are also service sector industries within the business sector whose output is conventionally measured with labour input.

- A final possibility is that expenditure-based GDP is measured accurately in both countries and the out-performance of the Canadian non-business sector relative to the U.S. non-business sector in terms of labour productivity growth is a real phenomenon. In other words, even though non-business sector measurement techniques differ across the two countries, the measured gap in non-business sector productivity growth between the two countries reflects the growth differential that would actually exist if non-business sector output were perfectly reflective of true productivity growth in both countries. A more productive non-business sector in Canada than in the United States could perhaps be driven by more innovative non-business sector industries in Canada.

Of these three possibilities, the first appears most likely. However, it is impossible to state this with certainty without a much more in-depth study of the non-business sector in both Canada and the United States.

B. Advantages and Disadvantages of the Business Sector and Total Economy for Assessing Aggregate Productivity Trends

1) Advantages of the Business Sector

The main argument for focusing on the business sector for the purposes of monitoring aggregate productivity growth, as has been mentioned previously, 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.[61]

Another 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,

[61] 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.

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. However, the business sector also contains some industries whose output is largely non-traded (e.g. residential construction), and likewise, the output of some non-business sector service industries can in principle be traded (e.g. non-profit research institutions). Nonetheless, it is almost certainly the case that 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.

2) Disadvantages of the Business Sector

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 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.[62]

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

[62] As has been mentioned previously, the definition of the business sector is broadly the same in both Canada and the United States. However, the size of the business sector relative to the total economy is surprisingly 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 75.8 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.

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, although no such ideal productivity measure is yet available given the measurement problems of the real output of these sectors.

3) Advantages of the Total Economy

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.[63]

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 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 (van Ark, 2002). 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

[63] Statistics Canada has begun to make special aggregations of GDP by industry available at the provincial level. Data are available in CANSIM Table 379-0026, but there is presently no business sector aggregation available.

productivity trends in the business sector give only a partial and fluctuating idea of the potential for improving aggregate living standards.[64]

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.

4) Disadvantages of the Total Economy

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 data base 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*.

V. Conclusion

This paper has addressed the question of which output and labour input data sources in Canada and the United States are the most comparable for cross-country productivity growth comparisons. Statistics Canada and the U.S. Bureau of Labor Statistics are responsible for

[64] This fact is not usually recognized in popular discussion of productivity trends. For example, both Corcoran (2003) and Watson (2003) cite the widening gap in business sector productivity between Canada and the United States in commenting on Canada's overall relative economic prospects. Cooper and Madigan (2003) do not even mention that the productivity data they refer to is for the business sector, and further, directly link business sector productivity growth to improvements in overall living standards. This situation is likely driven by the fact that statistical agencies produce and highlight productivity estimates for the business sector only.

official labour productivity estimates for the Canadian and U.S. economies, and the estimates these agencies produce should be used where possible. This is the case for the business sector, as official series are produced for both countries. However, these agencies produce productivity estimates for the business sector only, and not for the total economy. Despite the measurement problems in the non-business sector, this paper has documented reasons for which it may be desirable to have productivity estimates for the total economy in addition to those for the business sector.

This paper recommends for the total economy that:

- Productivity analysts use NIEA total economy output and PPD total economy labour input series for the construction of total economy productivity estimates for Canada;
- Until the Timeline Continuity Project is completed and PPD data become available back to 1961, the corresponding Aggregate Productivity Measures series should be used to extend backwards the present PPD series, which currently only go back to 1997; and
- NIPA output and BLS unpublished labour input for the total economy in the United States be used to construct total economy productivity series for the United States.

The other question addressed by this paper is whether total economy or business sector productivity trends are more appropriate for cross-country comparisons. Unfortunately, no fully satisfactory solution to this problem 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. 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 paper 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 the break may be accounted for by an acceleration in the growth of imputed rents after 1981 and a difference in the measurement of non-business sector output between the pre-1981 series and the post-1981 series, 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. More generally, it would be useful to more thoroughly understand the methodological differences in non-business sector output measurement between Canada and the United States.

This paper 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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Table 1: Estimates of Real GDP in Canada, 1961-2003

	Total Economy	**Business Sector**		**Non-Farm Business Sector**
	National Income and Expenditure Accounts Real GDP at market prices (millions of 1997$, chained-weighted, Fisher index)	GDP by Industry Real GDP at basic prices (millions of 1997$, fixed-weighted, Laspeyres index, with imputed rents removed)	Productivity Program Database Index of Real GDP at market prices, 1997=100 (based on 1997$, chained-weighted, Fisher index)	Old Aggregate Productivity Measures Real GDP at market prices (millions of 1992$, fixed-weighted, Laspeyres index)
	(1)	(2)	(3)	(4)
1961	245,230		25.29	140,300
1962	262,382		27.02	148,571
1963	276,306		28.61	156,555
1964	294,196		30.62	169,358
1965	312,930		32.87	182,074
1966	333,724		35.21	194,641
1967	343,454		35.96	201,152
1968	360,214		37.99	212,353
1969	378,344		39.83	222,451
1970	389,809		40.78	229,274
1971	405,860		42.85	240,168
1972	427,962		45.55	257,656
1973	457,766		49.38	279,368
1974	474,663		50.75	289,082
1975	483,316		50.87	286,793
1976	508,445		54.30	304,931
1977	526,028		56.01	315,309
1978	546,825		57.86	326,526
1979	567,631		60.41	342,710
1980	579,907		61.66	349,235
1981	600,253	404,873	66.06	366,636
1982	583,089	387,906	62.81	348,863
1983	598,941	398,763	64.75	360,974
1984	633,756	424,814	69.72	384,428
1985	664,059	449,968	73.27	407,280
1986	680,144	463,008	75.12	415,163
1987	709,058	484,341	78.95	435,218
1988	744,333	508,109	82.93	459,772
1989	763,837	519,716	84.83	469,828
1990	765,311	518,244	83.65	463,099
1991	749,294	502,731	79.93	448,133
1992	755,848	504,829	80.30	450,326
1993	773,528	519,067	82.70	464,336
1994	810,695	549,363	88.65	491,426
1995	833,456	566,481	92.15	506,351
1996	846,952	578,892	94.35	514,211
1997	882,733	612,118	100.00	543,946
1998	918,910	641,281	104.50	564,280
1999	969,750	682,571	111.68	592,481
2000	1,020,488	726,089	118.65	623,895
2001	1,038,845	735,889	120.23	
2002	1,074,621	760,442	124.25	
2003	1,096,359	776,445	126.20	

Table 1: Estimates of Real GDP in Canada, 1961-2003

	Total Economy	**Business Sector**		**Non-Farm Business Sector**	
	National Income and Expenditure Accounts Real GDP at market prices (millions of 1997$, chained-weighted, Fisher index)	GDP by Industry Real GDP at basic prices (millions of 1997$, fixed-weighted, Laspeyres index, with imputed rents removed)	Productivity Program Database Index of Real GDP at market prices, 1997=100 (based on 1997$, chained-weighted, Fisher index)	Old Aggregate Productivity Measures Real GDP at market prices (millions of 1992$, fixed-weighted, Laspeyres index)	
	(1)	(2)	(3)	(4)	
(cont.)					**Differences**
compound average annual growth rates					(3)-(2)
1961-2003	3.63		3.90		
1961-2000	3.72		4.04	3.90	
1961-1973	5.34		5.74	5.91	
1973-2003	2.95		3.18		
1973-2000	3.01		3.30	3.02	
1973-1981	3.45		3.71	3.46	
1981-2003	2.78	3.00	2.99		-0.02
1981-2000	2.83	3.12	3.13	2.84	0.01
1981-1989	3.06	3.17	3.17	3.15	0.00
1989-2003	2.62	2.91	2.88		-0.03
1989-2000	2.67	3.09	3.10	2.61	0.01
1989-1995	1.46	1.45	1.39	1.26	-0.06
1989-1996	1.49	1.55	1.53	1.30	-0.02
1995-2003	3.49	4.02	4.01		-0.01
1995-2000	4.13	5.09	5.19	4.26	0.10
1996-2003	3.76	4.28	4.24		-0.04
1996-2000	4.77	5.83	5.90	4.95	0.07
2000-2003	2.42	2.26	2.08		-0.18

Sources (current as of September 14, 2004):
(1): CANSIM v3860085.
(2): CANSIM v2044291 - v2035164.
(3): CANSIM v1409154 converted to annual averages for 1987-2003, taking growth rates from CANSIM v716156 for 1961-1987.
(4): CANSIM v716153.

Table 1a: Total Economy Real GDP in Canada, Alternative Estimates, 1961-2003

Total Economy

	National Income and Expenditure Accounts Real GDP at market prices (millions of 1997$, chained weighted, Fisher index)	National Income and Expenditure Accounts Real GDP at market prices (millions of 1997$, fixed-weighted, Laspeyres index)	GDP by Industry Real GDP at basic prices (millions of 1997$, fixed-weighted, Laspeyres index)	NIEA Real GDP at market prices excluding Imputed Rents (millions of 1997$, Laspeyres Approximation of a chained Fisher index)
	(1)	(2)	(3)	(4)
1961	245,230	237,899		
1962	262,382	254,151		
1963	276,306	267,126		
1964	294,196	284,612		
1965	312,930	303,008		
1966	333,724	322,875		
1967	343,454	332,517		
1968	360,214	350,302		
1969	378,344	368,963		
1970	389,809	378,623		
1971	405,860	399,551		
1972	427,962	420,929		
1973	457,766	451,197		
1974	474,663	469,894		
1975	483,316	480,304		
1976	508,445	506,675		
1977	526,028	524,205		
1978	546,825	545,592		
1979	567,631	568,529		
1980	579,907	576,398		
1981	600,253	594,082	556,452	557,212
1982	583,089	576,744	541,930	539,245
1983	598,941	592,684	556,457	554,039
1984	633,756	626,378	586,802	587,391
1985	664,059	660,318	616,536	616,216
1986	680,144	677,802	633,521	630,716
1987	709,058	705,701	658,425	657,283
1988	744,333	740,592	687,559	689,752
1989	763,837	759,821	703,946	706,548
1990	765,311	762,381	707,670	705,271
1991	749,294	747,857	697,540	686,934
1992	755,848	754,835	703,485	691,346
1993	773,528	772,498	720,700	706,888
1994	810,695	810,016	753,118	741,914
1995	833,456	832,138	772,843	762,832
1996	846,952	845,157	783,810	774,712
1997	882,733	882,734	816,763	808,653
1998	918,910	919,000	848,963	842,965
1999	969,750	969,242	896,490	892,024
2000	1,020,488	1,020,258	945,783	940,551
2001	1,038,845	1,036,017	961,522	956,558
2002	1,074,621	1,071,815	992,319	989,321
2003	1,096,359	1,096,437	1,013,846	1,007,840

Table 1a: Total Economy Real GDP in Canada, Alternative Estimates, 1961-2003

Total Economy

	National Income and Expenditure Accounts Real GDP at market prices (millions of 1997$, chained weighted, Fisher index)	National Income and Expenditure Accounts Real GDP at market prices (millions of 1997$, fixed-weighted, Laspeyres index)	GDP by Industry Real GDP at basic prices (millions of 1997$, fixed-weighted, Laspeyres index)	NIEA Real GDP at market prices excluding Imputed Rents (millions of 1997$, Laspeyres Approximation of a chained Fisher index)			
	(1)	(2)	(3)	(4)			
(cont.)					**Differences**		
compound average annual growth rates					(2)-(1)	(3)-(2)	(4)-(1)
1961-2003	3.63	3.71			0.08		
1961-2000	3.72	3.80			0.08		
1961-1973	5.34	5.48			0.14		
1973-2003	2.95	3.00			0.05		
1973-2000	3.01	3.07			0.05		
1973-1981	3.45	3.50			0.05		
1981-2003	2.78	2.82	2.76	2.73	0.05	-0.06	-0.05
1981-2000	2.83	2.89	2.83	2.79	0.05	-0.06	-0.04
1981-1989	3.06	3.12	2.98	3.01	0.07	-0.14	-0.05
1989-2003	2.62	2.65	2.64	2.57	0.04	-0.01	-0.05
1989-2000	2.67	2.72	2.72	2.63	0.05	0.01	-0.03
1989-1995	1.46	1.53	1.57	1.29	0.06	0.04	-0.18
1989-1996	1.49	1.53	1.55	1.32	0.05	0.01	-0.16
1995-2003	3.49	3.51	3.45	3.54	0.02	-0.06	0.06
1995-2000	4.13	4.16	4.12	4.28	0.03	-0.04	0.15
1996-2003	3.76	3.79	3.74	3.83	0.03	-0.04	0.07
1996-2000	4.77	4.82	4.81	4.97	0.05	-0.01	0.20
2000-2003	2.42	2.43	2.34	2.33	0.01	-0.09	-0.09

Sources (current as of September 14, 2004):
(1): CANSIM v3860085.
(2): CANSIM v3862685.
(3): CANSIM v2034894.
(4): calculated by CSLS from CANSIM v3860101 and v3860085 (imputed rents and GDP in chained dollars) and CANSIM v647396 and v646937 (imputed rents and GDP in current dollars).
The Laspeyres approximation of GDP excluding imputed rents annual growth rate is calculated as the difference between the growth rate of total economy GDP and the growth rate of imputed rents (weighted by the lagged share of nominal imputed rents in nominal total economy GDP), divided by the lagged share of nominal GDP excluding imputed rents in total economy nominal GDP, where nominal GDP excluding imputed rents is calculated as the difference between total economy nominal GDP and nominal imputed rents. These approximated annual growth rates are then applied to the base year (1997) level of nominal GDP excluding imputed rents to calculate real GDP excluding imputed rents. See the Canadian Department of Finance Working Paper number 2003-13 (Economic Analysis and Modelling Using Fisher Chain Data by Yanjun Liu, Nell Hamalainen and Bing-Sun Wong).

Table 2: Estimates of the Number of Workers in Canada, 1961-2003

	Total Economy			Business Sector	Non-Farm Business Sector
	Labour Force Survey, employment (thousands)	Survey of Employment, Payrolls and Hours, total employees, industrial aggregate including unclassified, jobs (thousands)	Productivity Program Database, jobs (thousands)	Productivity Program Database, jobs (thousands)	Old Aggregate Productivity Measures, jobs (thousands)
	(1)	(2)	(3)	(4)	(5)
1961			6,480.9	5,403.0	4,683.8
1962			6,678.2	5,536.3	4,828.0
1963			6,842.7	5,660.1	4,954.1
1964			7,092.1	5,854.5	5,160.7
1965			7,355.6	6,092.3	5,431.4
1966			7,750.6	6,422.1	5,772.2
1967			7,978.3	6,540.8	5,878.7
1968			8,115.2	6,582.9	5,933.3
1969			8,352.4	6,740.8	6,104.5
1970			8,419.6	6,723.6	6,118.1
1971			8,590.8	6,839.1	6,236.7
1972			8,819.5	6,991.3	6,418.8
1973			9,230.8	7,349.1	6,777.4
1974			9,592.6	7,636.6	7,069.7
1975			9,740.3	7,690.3	7,126.4
1976	9,776.2		9,879.3	7,786.6	7,227.6
1977	9,914.7		10,052.8	7,883.0	7,323.1
1978	10,212.2		10,338.2	8,106.4	7,525.6
1979	10,657.7		10,796.1	8,511.9	7,909.5
1980	10,970.1		11,142.3	8,788.4	8,176.0
1981	11,296.8		11,484.3	9,105.2	8,430.8
1982	10,947.0		11,122.8	8,731.6	8,071.4
1983	11,027.0		11,213.0	8,744.5	8,078.0
1984	11,300.0		11,488.4	8,996.6	8,320.6
1985	11,617.3		11,846.5	9,337.2	8,641.0
1986	11,979.0		12,208.6	9,653.6	8,954.3
1987	12,320.7		12,589.3	9,986.5	9,286.7
1988	12,710.3		13,028.0	10,372.2	9,668.4
1989	12,986.4		13,337.0	10,640.0	9,943.5
1990	13,084.0		13,419.9	10,648.1	9,956.2
1991	12,850.7	11,133.4	13,180.7	10,337.5	9,680.4
1992	12,760.0	10,812.2	13,087.8	10,202.7	9,541.9
1993	12,857.5	10,830.3	13,232.4	10,308.8	9,635.5
1994	13,111.7	10,993.3	13,473.3	10,544.8	9,865.8
1995	13,356.9	11,227.2	13,696.3	10,762.7	10,086.0
1996	13,462.6	11,309.4	13,819.5	10,977.7	10,288.0
1997	13,774.4	11,641.5	14,109.8	11,296.8	10,611.5
1998	14,140.4	11,901.9	14,442.8	11,623.7	10,957.2
1999	14,531.2	12,072.8	14,850.7	12,013.8	11,397.8
2000	14,909.7	12,479.8	15,203.7	12,337.8	11,758.4
2001	15,076.8	12,775.6	15,327.4	12,413.6	
2002	15,411.8	13,077.8	15,672.9	12,725.9	
2003	15,746.0	13,342.4	15,974.5	12,944.8	

Table 2: Estimates of the Number of Workers in Canada, 1961-2003

	Total Economy			Business Sector	Non-Farm Business Sector	
	Labour Force Survey, employment (thousands)	Survey of Employment, Payrolls and Hours, total employees, industrial aggregate including unclassified, jobs (thousands)	Productivity Program Database, jobs (thousands)	Productivity Program Database, jobs (thousands)	Old Aggregate Productivity Measures, jobs (thousands)	
	(1)	(2)	(3)	(4)	(5)	
(cont.)						**Differences**
compound average annual growth rates						(4)-(3)
1961-2003			2.17	2.10		-0.07
1961-2000			2.21	2.14	2.39	-0.07
1961-1973			2.99	2.60	3.13	-0.39
1973-2003			1.84	1.90		0.06
1973-2000			1.87	1.94	2.06	0.07
1973-1981			2.77	2.71	2.77	-0.05
1981-2003	1.52		1.51	1.61		0.10
1981-2000	1.47		1.49	1.61	1.77	0.12
1981-1989	1.76		1.89	1.97	2.08	0.08
1989-2003	1.39		1.30	1.41		0.11
1989-2000	1.26		1.20	1.35	1.54	0.16
1989-1995	0.47		0.44	0.19	0.24	-0.25
1989-1996	0.52		0.51	0.45	0.49	-0.06
1995-2003	2.08	2.18	1.94	2.33		0.39
1995-2000	2.22	2.14	2.11	2.77	3.12	0.66
1996-2003	2.26	2.39	2.09	2.38		0.29
1996-2000	2.59	2.49	2.42	2.96	3.40	0.55
2000-2003	1.84	2.25	1.66	1.61		-0.05

Sources (current as of September 14, 2004).
(1): CANSIM v2461119.
(2): CANSIM v1695625.
(3): CANSIM v15900147 for 1997-2002, taking growth rates from CANSIM v716374 for 1961-1997.
(4): CANSIM v15900939 for 1997-2002, taking growth rates from CANSIM v716378 for 1961-1997.
(5): CANSIM v716375.

Table 3: Average Weekly Hours in Canada, 1961-2003

	Total Economy			Business Sector	Non-Farm Business Sector
	Labour Force Survey, per employed person	Survey of Employment, Payrolls and Hours, industrial aggregate excluding unclassified, per job	Productivity Program Database, per job	Productivity Program Database, per job	Old Aggregate Productivity Measures, per job
	(1)	(2)	(3)	(4)	(5)
1961			38.74	39.27	38.72
1962			38.76	39.34	38.91
1963			38.44	39.03	38.69
1964			38.28	38.86	38.67
1965			37.97	38.54	38.53
1966			37.69	38.28	38.23
1967			37.53	38.07	38.07
1968			36.87	37.51	37.56
1969			36.56	37.19	37.24
1970			36.21	36.83	36.93
1971			35.92	36.63	36.73
1972			35.74	36.45	36.68
1973			35.60	36.28	36.51
1974			35.43	36.09	36.30
1975			35.06	35.73	35.93
1976	35.3		34.88	35.52	35.74
1977	35.3		34.53	35.19	35.51
1978	35.7		34.59	35.28	35.66
1979	35.7		34.45	35.14	35.57
1980	35.1		33.90	34.55	35.06
1981	34.6		33.87	34.45	34.95
1982	34.4		33.55	34.10	34.51
1983	34.5		33.48	34.06	34.54
1984	34.5		33.52	34.14	34.67
1985	34.7		33.67	34.30	34.81
1986	34.7		33.64	34.27	34.82
1987	34.6		33.81	34.49	35.09
1988	35.2		33.99	34.66	35.33
1989	35.7		33.88	34.58	35.22
1990	35.2		33.63	34.35	34.97
1991	34.5	33.79	33.24	33.88	34.49
1992	33.9	33.69	33.09	33.70	34.27
1993	34.4	33.69	33.15	33.85	34.43
1994	34.8	33.76	33.48	34.21	34.84
1995	34.6	33.43	33.38	34.06	34.68
1996	34.8	33.47	33.56	34.24	34.88
1997	34.9	33.76	33.67	34.38	35.01
1998	34.5	33.72	33.71	34.42	34.96
1999	34.8	33.75	33.83	34.50	35.08
2000	35.1	33.94	33.69	34.35	35.13
2001	34.4	34.14	33.63	34.27	
2002	34.1	34.32	33.29	33.88	
2003	33.5	34.40	33.04	33.67	

Table 3: Average Weekly Hours in Canada, 1961-2003

	Total Economy			Business Sector	Non-Farm Business Sector
	Labour Force Survey, per employed person	Survey of Employment, Payrolls and Hours, industrial aggregate excluding unclassified, per job	Productivity Program Database, per job	Productivity Program Database, per job	Old Aggregate Productivity Measures, per job
	(1)	(2)	(3)	(4)	(5)
(cont.)					
compound average annual growth rates					
1961-2003			-0.38	-0.37	
1961-2000			-0.36	-0.34	-0.25
1961-1973			-0.70	-0.66	-0.49
1973-2003			-0.25	-0.25	
1973-2000			-0.20	-0.20	-0.14
1973-1981			-0.62	-0.65	-0.55
1981-2003	-0.15		-0.11	-0.10	
1981-2000	0.08		-0.03	-0.02	0.03
1981-1989	0.39		0.00	0.05	0.10
1989-2003	-0.45		-0.18	-0.19	
1989-2000	-0.15		-0.05	-0.06	-0.02
1989-1995	-0.52		-0.25	-0.25	-0.26
1989-1996	-0.36		-0.14	-0.14	-0.14
1995-2003	-0.40	0.36	-0.13	-0.14	
1995-2000	0.29	0.30	0.19	0.17	0.26
1996-2003	-0.54	0.39	-0.22	-0.24	
1996-2000	0.21	0.35	0.10	0.08	0.18
2000-2003	-1.54	0.45	-0.65	-0.66	

Sources (current as of September 14, 2004).
Tables 2 and 4.
(1): CANSIM v2634367.
(2): Employment-weighted average of average weekly hours of salaried employees (CANSIM v1801429) and average weekly hours of hourly-paid employees (CANSIM v1802965).
(3): CANSIM series v15900279 for 1997-2003, taking growth rates of v716596 for 1961-1997, divided by 52 weeks.
(4): CANSIM series v15901071 for 1997-2003, taking growth rates of v716600 for 1961-1997, divided by 52 weeks.
(5): CANSIM series v716597 divided by 52 weeks
total annual hours = average weekly hours per employed person*number of workers*52
All estimates are for all jobs and include overtime, and those employed but not at work (i.e. working 0 hours) are included in the calculation of the average.

Table 4: Estimates of Total Annual Hours at Work in Canada, 1961-2003

	Total Economy			Business Sector	Non-Farm Business Sector
	Labour Force Survey (millions)	Survey of Employment, Payrolls and Hours (millions)	Productivity Program Database (millions)	Productivity Program Database (millions)	Old Aggregate Productivity Measures (millions)
	(1)	(2)	(3)	(4)	(5)
1961			13,053.5	11,032.6	9,429.8
1962			13,458.2	11,326.3	9,769.3
1963			13,677.0	11,487.8	9,968.3
1964			14,113.1	11,829.5	10,376.0
1965			14,520.3	12,210.5	10,880.5
1966			15,186.3	12,783.8	11,473.6
1967			15,568.4	12,947.7	11,636.3
1968			15,555.6	12,838.9	11,589.5
1969			15,876.2	13,035.1	11,820.1
1970			15,850.4	12,876.8	11,749.4
1971			16,045.1	13,027.4	11,910.6
1972			16,386.9	13,252.6	12,243.9
1973			17,084.4	13,865.7	12,868.4
1974			17,671.2	14,333.1	13,344.4
1975			17,755.5	14,286.6	13,313.9
1976	17,956.1		17,913.9	14,383.5	13,431.9
1977	18,204.5		18,045.3	14,424.8	13,522.3
1978	18,933.3		18,590.3	14,870.8	13,955.1
1979	19,766.0		19,338.2	15,555.8	14,627.5
1980	20,028.1		19,635.2	15,788.0	14,907.4
1981	20,312.5		20,222.7	16,309.7	15,321.5
1982	19,601.6		19,401.6	15,482.6	14,483.7
1983	19,768.8		19,519.2	15,484.9	14,510.6
1984	20,291.1		20,023.3	15,972.7	14,999.7
1985	20,992.4		20,739.4	16,653.0	15,642.0
1986	21,633.1		21,353.8	17,201.9	16,212.9
1987	22,178.5		22,127.7	17,908.2	16,944.6
1988	23,264.3		23,020.8	18,696.0	17,763.1
1989	24,083.6		23,490.8	19,131.2	18,212.1
1990	23,923.2		23,463.3	19,020.3	18,106.8
1991	23,036.7	19,560.2	22,778.3	18,212.8	17,362.0
1992	22,513.7	18,939.7	22,515.0	17,878.9	17,004.6
1993	22,995.7	18,973.9	22,809.3	18,145.6	17,253.4
1994	23,746.5	19,296.7	23,451.5	18,760.3	17,873.6
1995	24,020.0	19,517.8	23,770.5	19,059.3	18,189.1
1996	24,373.9	19,684.7	24,111.8	19,546.8	18,657.6
1997	24,963.6	20,436.8	24,702.6	20,199.0	19,320.3
1998	25,389.8	20,871.8	25,316.6	20,812.1	19,920.5
1999	26,311.6	21,185.5	26,125.9	21,554.1	20,794.4
2000	27,193.3	22,026.3	26,632.9	22,038.2	21,479.1
2001	26,957.8	22,683.6	26,801.8	22,119.5	
2002	27,320.6	23,338.0	27,133.7	22,428.6	
2003	27,431.9	23,864.8	27,444.7	22,664.4	

Table 4: Estimates of Total Annual Hours at Work in Canada, 1961-2003

	Total Economy			Business Sector	Non-Farm Business Sector
	Labour Force Survey (millions)	Survey of Employment, Payrolls and Hours (millions)	Productivity Program Database (millions)	Productivity Program Database (millions)	Old Aggregate Productivity Measures (millions)
	(1)	(2)	(3)	(4)	(5)
(cont.)					
compound average annual growth rates					
1961-2003			1.79	1.73	
1961-2000			1.85	1.79	2.13
1961-1973			2.27	1.92	2.62
1973-2003			1.59	1.65	
1973-2000			1.66	1.73	1.92
1973-1981			2.13	2.05	2.20
1981-2003	1.38		1.40	1.51	
1981-2000	1.55		1.46	1.60	1.79
1981-1989	2.15		1.89	2.01	2.18
1989-2003	0.93		1.12	1.22	
1989-2000	1.11		1.15	1.29	1.51
1989-1995	-0.04		0.20	-0.06	-0.02
1989-1996	0.17		0.37	0.31	0.35
1995-2003	1.67	2.55	1.81	2.19	
1995-2000	2.51	2.45	2.30	2.95	3.38
1996-2003	1.70	2.79	1.87	2.14	
1996-2000	2.77	2.85	2.52	3.04	3.58
2000-2003	0.29	2.71	1.01	0.94	

Sources (current as of September 14, 2004).
(1): CANSIM v2634366 (multiplied by 52 weeks).
(3): CANSIM v15900411 for 1997-2003, taking growth rates from CANSIM v716818 for 1961-1997.
(4): CANSIM v15901203 for 1997-2003, taking growth rates from CANSIM v716822 for 1961-1997.
(5): CANSIM v716819.
total annual hours = average weekly hours per employed person*number of workers*52
All estimates are for all jobs and include overtime.

Table 5: Estimates of Output per Worker in Canada, 1961-2003

	Total Economy		**Business Sector**	**Non-Farm Business Sector**
	NIEA Real GDP (1997$, chained-weighted, Fisher index) / LFS employment	NIEA Real GDP (1997$, chained-weighted, Fisher index) / PPD jobs	PPD Index of Real GDP (based on 1997$, chained-weighted, Fisher index) / PPD jobs, 1997=100	Old APM Real GDP (1992$, fixed-weighted, Laspeyres index) / Old APM jobs
	(1)	(2)	(3)	(4)
1961		37,839	52.87	29,954
1962		39,290	55.14	30,773
1963		40,380	57.11	31,601
1964		41,482	59.08	32,817
1965		42,543	60.95	33,523
1966		43,058	61.94	33,720
1967		43,049	62.11	34,217
1968		44,388	65.19	35,790
1969		45,298	66.75	36,441
1970		46,298	68.51	37,474
1971		47,244	70.78	38,509
1972		48,524	73.60	40,141
1973		49,591	75.90	41,220
1974		49,482	75.07	40,890
1975		49,620	74.72	40,244
1976	52,008	51,465	78.79	42,190
1977	53,055	52,327	80.26	43,057
1978	53,546	52,894	80.62	43,389
1979	53,260	52,577	80.17	43,329
1980	52,863	52,045	79.26	42,715
1981	53,135	52,267	81.97	43,488
1982	53,265	52,423	81.26	43,222
1983	54,316	53,415	83.65	44,686
1984	56,085	55,165	87.54	46,202
1985	57,161	56,055	88.65	47,133
1986	56,778	55,710	87.90	46,365
1987	57,550	56,322	89.31	46,865
1988	58,561	57,133	90.32	47,554
1989	58,818	57,272	90.06	47,250
1990	58,492	57,028	88.75	46,513
1991	58,308	56,848	87.34	46,293
1992	59,236	57,752	88.91	47,195
1993	60,162	58,457	90.63	48,190
1994	61,830	60,171	94.97	49,811
1995	62,399	60,853	96.72	50,203
1996	62,911	61,287	97.09	49,982
1997	64,085	62,562	100.00	51,260
1998	64,985	63,624	101.56	51,498
1999	66,736	65,300	105.01	51,982
2000	68,445	67,121	108.64	53,060
2001	68,904	67,777	109.41	
2002	69,727	68,566	110.30	
2003	69,628	68,632	110.13	

Table 5: Estimates of Output per Worker in Canada, 1961-2003

	Total Economy		Business Sector	Non-Farm Business Sector		
	NIEA Real GDP (1997$, chained-weighted, Fisher index) / LFS employment	NIEA Real GDP (1997$, chained-weighted, Fisher index) / PPD jobs	PPD Index of Real GDP (based on 1997$, chained-weighted, Fisher index) / PPD jobs, 1997=100	Old APM Real GDP (1992$, fixed-weighted, Laspeyres index) / Old APM jobs		
	(1)	(2)	(3)	(4)		
(cont.)					**Differences**	
compound average annual growth rates					(2)-(1)	(3)-(2)
1961-2003		1.43	1.76			0.33
1961-2000		1.48	1.86	1.48		0.38
1961-1973		2.28	3.06	2.70		0.78
1973-2003		1.09	1.25			0.16
1973-2000		1.13	1.34	0.94		0.21
1973-1981		0.66	0.97	0.67		0.31
1981-2003	1.24	1.25	1.35		0.01	0.11
1981-2000	1.34	1.33	1.49	1.05	-0.02	0.17
1981-1989	1.28	1.15	1.18	1.04	-0.13	0.03
1989-2003	1.21	1.30	1.45		0.09	0.15
1989-2000	1.39	1.45	1.72	1.06	0.07	0.27
1989-1995	0.99	1.02	1.20	1.02	0.03	0.18
1989-1996	0.97	0.97	1.08	0.81	0.01	0.11
1995-2003	1.38	1.52	1.64		0.14	0.12
1995-2000	1.87	1.98	2.35	1.11	0.11	0.37
1996-2003	1.46	1.63	1.82		0.17	0.19
1996-2000	2.13	2.30	2.85	1.51	0.17	0.55
2000-2003	0.57	0.74	0.46		0.17	-0.29

Sources (current as of September 14, 2004).
Tables 1 and 2.

Table 6: Estimates of Output per Hour in Canada, 1961-2003

	Total Economy		**Business Sector**	**Non-Farm Business Sector**
	NIEA Real GDP (1997$, chained-weighted, Fisher index) / LFS hours	NIEA Real GDP (1997$, chained-weighted, Fisher index) / PPD hours	PPD Index of Real GDP (based on 1997$, chained-weighted, Fisher index) / PPD hours, 1997=100	Old APM Real GDP (1992$, fixed-weighted, Laspeyres index) / Old APM hours
	(1)	(2)	(3)	(4)
1961		18.79	46.33	14.9
1962		19.50	48.45	15.2
1963		20.20	50.57	15.7
1964		20.85	52.34	16.3
1965		21.55	54.46	16.7
1966		21.98	55.88	17.0
1967		22.06	56.23	17.3
1968		23.16	59.77	18.3
1969		23.83	61.89	18.8
1970		24.59	64.01	19.5
1971		25.30	66.49	20.2
1972		26.12	69.67	21.0
1973		26.79	72.15	21.7
1974		26.86	71.79	21.7
1975		27.22	72.15	21.5
1976	28.32	28.38	76.39	22.7
1977	28.90	29.15	78.51	23.3
1978	28.88	29.41	78.87	23.4
1979	28.72	29.35	78.51	23.4
1980	28.95	29.53	79.22	23.4
1981	29.55	29.68	82.05	23.9
1982	29.75	30.05	82.05	24.1
1983	30.30	30.68	84.52	24.9
1984	31.23	31.65	88.41	25.6
1985	31.63	32.02	89.12	26.0
1986	31.44	31.85	88.41	25.6
1987	31.97	32.04	89.12	25.7
1988	31.99	32.33	89.67	25.9
1989	31.72	32.52	89.60	25.8
1990	31.99	32.62	88.87	25.6
1991	32.53	32.90	88.72	25.8
1992	33.57	33.57	90.72	26.5
1993	33.64	33.91	92.10	26.9
1994	34.14	34.57	95.47	27.5
1995	34.70	35.06	97.70	27.8
1996	34.75	35.13	97.55	27.6
1997	35.36	35.73	100.00	28.2
1998	36.19	36.30	101.45	28.4
1999	36.86	37.12	104.68	28.7
2000	37.53	38.32	108.88	29.0
2001	38.54	38.76	110.33	
2002	39.33	39.60	112.80	
2003	39.97	39.95	113.33	

Table 6: Estimates of Output per Hour in Canada, 1961-2003

	Total Economy		Business Sector	Non-Farm Business Sector		
	NIEA Real GDP (1997$, chained-weighted, Fisher index) / LFS hours	NIEA Real GDP (1997$, chained-weighted, Fisher index) / PPD hours	PPD Index of Real GDP (based on 1997$, chained-weighted, Fisher index) / PPD hours, 1997=100	Old APM Real GDP (1992$, fixed-weighted, Laspeyres index) / Old APM hours		
	(1)	(2)	(3)	(4)		
(cont.)					Differences	
compound average annual growth rates					(2)-(1)	(3)-(2)
1961-2003		1.81	2.15			0.34
1961-2000		1.84	2.22	1.72		0.37
1961-1973		3.00	3.76	3.18		0.76
1973-2003		1.34	1.52			0.18
1973-2000		1.33	1.54	1.08		0.20
1973-1981		1.29	1.62	1.21		0.33
1981-2003	1.38	1.36	1.48		-0.02	0.12
1981-2000	1.27	1.35	1.50	1.02	0.09	0.15
1981-1989	0.89	1.15	1.11	0.96	0.26	-0.04
1989-2003	1.67	1.48	1.69		-0.18	0.21
1989-2000	1.54	1.50	1.79	1.07	-0.04	0.28
1989-1995	1.51	1.26	1.45	1.25	-0.24	0.19
1989-1996	1.31	1.11	1.22	0.97	-0.20	0.11
1995-2003	1.78	1.64	1.87		-0.14	0.23
1995-2000	1.58	1.79	2.19	0.85	0.21	0.40
1996-2003	2.02	1.85	2.16		-0.16	0.31
1996-2000	1.94	2.20	2.78	1.24	0.26	0.59
2000-2003	2.12	1.40	1.34		-0.72	-0.05

Sources (current as of September 14, 2004).
Tables 1 and 4.
(3): CANSIM v1409153 for 1987-2003 (quarterly converted to annual averages), taking growth rates from v717266 for 1961-1987.
(4): CANSIM v717263.

Table 6a: Non-Business Sector Output, Labour Input and Productivity Estimates, Canada, 1961-2003

Non-Business Sector

	GDP by Industry Real GDP at basic prices (millions of 1997$, fixed-weighted, Laspeyres index, with imputed rents added)	Old APM Real GDP at basic prices (1992$, fixed-weighted, Laspeyres index)	Productivity Program Database Total Hours (millions)	Old APM Real GDP (1992$, fixed-weighted, Laspeyres index) / PPD hours	GDP by Industry Real GDP at basic prices (1997$, fixed-weighted, Laspeyres index) / PPD hours
	(1)	(2)	(3)	(4)=(2)/(3)	(5)=(1)/(3)
1961	69,777	49,145	2,048.6	23.99	34.06
1962	73,525	51,785	2,156.8	24.01	34.09
1963	76,625	53,968	2,212.7	24.39	34.63
1964	79,831	56,226	2,306.0	24.38	34.62
1965	82,100	57,824	2,335.9	24.75	35.15
1966	85,950	60,536	2,430.7	24.90	35.36
1967	92,122	64,883	2,637.5	24.60	34.93
1968	97,359	68,571	2,725.9	25.16	35.72
1969	101,750	71,664	2,845.2	25.19	35.76
1970	106,735	75,175	2,967.2	25.34	35.97
1971	110,563	77,871	3,010.5	25.87	36.73
1972	114,446	80,606	3,123.0	25.81	36.65
1973	118,789	83,665	3,210.8	26.06	37.00
1974	124,322	87,562	3,329.1	26.30	37.34
1975	130,666	92,030	3,451.0	26.67	37.86
1976	134,657	94,841	3,510.0	27.02	38.36
1977	137,923	97,141	3,595.0	27.02	38.37
1978	141,803	99,874	3,694.0	27.04	38.39
1979	143,922	101,366	3,762.5	26.94	38.25
1980	148,009	104,245	3,826.5	27.24	38.68
1981	151,497	106,702	3,895.6	27.39	38.89
1982	154,706	108,647	3,889.6	27.93	39.77
1983	158,318	111,080	3,997.6	27.79	39.60
1984	162,049	113,439	4,019.7	28.22	40.31
1985	166,121	116,015	4,062.8	28.56	40.89
1986	169,902	118,270	4,131.9	28.62	41.12
1987	173,107	119,653	4,205.2	28.45	41.17
1988	178,113	121,922	4,315.0	28.26	41.28
1989	182,745	123,714	4,353.7	28.42	41.97
1990	188,149	126,435	4,430.3	28.54	42.47
1991	194,057	129,460	4,533.7	28.56	42.80
1992	197,994	131,487	4,595.1	28.61	43.09
1993	201,030	132,470	4,624.6	28.64	43.47
1994	203,302	133,108	4,659.2	28.57	43.63
1995	205,995	133,680	4,682.0	28.55	44.00
1996	204,694	131,113	4,552.0	28.80	44.97
1997	204,645	129,687	4,503.7	28.80	45.44
1998	207,682	130,770	4,504.4	29.03	46.11
1999	213,919	131,885	4,571.8	28.85	46.79
2000	219,694	133,038	4,594.7	28.95	47.81
2001	225,633	135,547	4,682.3	28.95	48.19
2002	231,877		4,705.1		49.28
2003	237,401		4,780.3		49.66

Table 6a: Non-Business Sector Output, Labour Input and Productivity Estimates, Canada, 1961-2003

Non-Business Sector

	GDP by Industry Real GDP at basic prices (millions of 1997$, fixed-weighted, Laspeyres index, with imputed rents added)	Old APM Real GDP at basic prices (1992$, fixed-weighted, Laspeyres index)	Productivity Program Database Total Hours (millions)	Old APM Real GDP (1992$, fixed-weighted, Laspeyres index) / PPD hours	GDP by Industry Real GDP at basic prices (1997$, fixed-weighted, Laspeyres index) / PPD hours
	(1)	(2)	(3)	(4)=(2)/(3)	(5)=(1)/(3)
(cont.)					
compound average annual growth rates					
1961-2003	2.96		2.04		0.90
1961-2000	2.98	2.59	2.09	0.48	0.87
1961-1973	4.53	4.53	3.82	0.69	0.69
1973-2003	2.33		1.34		0.99
1973-2000	2.30	1.73	1.34	0.39	0.95
1973-1981	3.09	3.09	2.45	0.63	0.63
1981-2003	2.06		0.93		1.12
1981-2000	1.98	1.17	0.87	0.29	1.09
1981-1989	2.37	1.87	1.40	0.46	0.96
1989-2003	1.89		0.67		1.21
1989-2000	1.69	0.66	0.49	0.17	1.19
1989-1995	2.02	1.30	1.22	0.08	0.79
1989-1996	1.63	0.83	0.64	0.19	0.99
1995-2003	1.79		0.26		1.53
1995-2000	1.30	-0.10	-0.38	0.28	1.68
1996-2003	2.14		0.70		1.43
1996-2000	1.78	0.37	0.23	0.13	1.55
2000-2003	2.62		1.33		1.27

Sources (current as of September 14, 2004):
(1): CANSIM v2044294 + v2035164, taking growth rates from (2) for 1961-1981.
(2): CANSIM v716159. Corrected series provided by Jean-Pierre Maynard of Statistics Canada.
(3): CANSIM v15901995 for 1997-2003, taking growth rates from CANSIM v716381 for 1961-1997.

Table 7: Estimates of Real GDP in the United States, 1961-2003

	Total Economy	**Business Sector**		**Non-Farm Business Sector**	
	National Income and Product Accounts Real GDP at market prices (billions of 2000$, chained-weighted, Fisher index)	National Income and Product Accounts Real GDP at market prices (billions of 2000$, chained-weighted, Fisher index)	BLS Productivity and Costs (1992=100, absolute levels unpublished, based on a chained-weighted Fisher index) *	National Income and Product Accounts Real GDP at market prices (billions of 2000$, chained-weighted, Fisher index)	BLS Productivity and Costs (1992=100, absolute levels unpublished, based on a chained-weighted Fisher index) *
	(1)	(2)	(3)	(4)	(5)
1961	2,560.0	1,782.8	32.7	1,747.8	32.4
1962	2,715.2	1,897.7	34.8	1,867.0	34.6
1963	2,834.0	1,985.4	36.4	1,954.3	36.2
1964	2,998.6	2,111.7	38.7	2,086.0	38.7
1965	3,191.1	2,260.6	41.4	2,233.5	41.4
1966	3,399.1	2,413.6	44.2	2,393.2	44.4
1967	3,484.6	2,459.5	45.1	2,434.1	45.1
1968	3,652.7	2,581.7	47.3	2,561.5	47.5
1969	3,765.4	2,660.3	48.8	2,639.1	48.9
1970	3,771.9	2,659.3	48.7	2,636.0	48.9
1971	3,898.6	2,761.5	50.6	2,736.2	50.7
1972	4,105.0	2,939.8	53.9	2,918.4	54.1
1973	4,341.5	3,145.0	57.6	3,131.5	58.0
1974	4,319.6	3,101.3	56.8	3,089.1	57.3
1975	4,311.2	3,071.2	56.3	3,037.5	56.3
1976	4,540.9	3,272.9	60.0	3,249.1	60.2
1977	4,750.5	3,456.2	63.3	3,431.1	63.6
1978	5,015.0	3,673.3	67.3	3,656.8	67.8
1979	5,173.4	3,796.7	69.6	3,774.2	70.0
1980	5,161.7	3,756.1	68.8	3,736.1	69.2
1981	5,291.7	3,859.5	70.7	3,814.7	70.7
1982	5,189.3	3,743.1	68.6	3,691.9	68.4
1983	5,423.8	3,944.3	72.3	3,932.8	72.9
1984	5,813.6	4,286.3	78.6	4,254.3	78.9
1985	6,053.7	4,484.5	82.2	4,434.2	82.2
1986	6,263.6	4,652.0	85.3	4,606.2	85.4
1987	6,475.1	4,815.5	88.3	4,769.8	88.4
1988	6,742.7	5,023.0	92.1	4,987.7	92.4
1989	6,981.4	5,206.6	95.4	5,162.3	95.7
1990	7,112.5	5,287.0	96.9	5,237.9	97.1
1991	7,100.5	5,245.4	96.1	5,194.7	96.3
1992	7,336.6	5,456.5	100.0	5,395.2	100.0
1993	7,532.7	5,625.9	103.1	5,576.0	103.4
1994	7,835.5	5,905.3	108.2	5,841.4	108.3
1995	8,031.7	6,076.8	111.4	6,030.2	111.8
1996	8,328.9	6,356.0	116.5	6,300.4	116.8
1997	8,703.5	6,693.8	122.7	6,627.2	122.8
1998	9,066.9	7,017.1	128.6	6,955.3	128.9
1999	9,470.3	7,376.8	135.2	7,314.2	135.6
2000	9,817.0	7,666.7	140.5	7,595.1	140.8
2001	9,890.7	7,691.0	141.0	7,625.7	141.3
2002	10,074.8	7,831.0	143.5	7,761.3	143.9
2003	10,381.3	8,132.1	149.0	8,059.6	149.4

Table 7: Estimates of Real GDP in the United States, 1961-2003

	Total Economy	**Business Sector**		**Non-Farm Business Sector**		
	National Income and Product Accounts Real GDP at market prices (billions of 2000$, chained-weighted, Fisher index)	National Income and Product Accounts Real GDP at market prices (billions of 2000$, chained-weighted, Fisher index)	BLS Productivity and Costs (1992=100, absolute levels unpublished, based on a chained-weighted Fisher index) *	National Income and Product Accounts Real GDP at market prices (billions of 2000$, chained-weighted, Fisher index)	BLS Productivity and Costs (1992=100, absolute levels unpublished, based on a chained-weighted Fisher index) *	
	(1)	(2)	(3)	(4)	(5)	
(cont.)						**Differences**
compound average annual growth rates						(2)-(1)
1961-2003	3.39	3.68	3.68	3.71	3.71	0.29
1961-2000	3.51	3.81	3.81	3.84	3.84	0.30
1961-1973	4.50	4.84	4.83	4.98	4.97	0.34
1973-2003	2.95	3.22	3.22	3.20	3.20	0.27
1973-2000	3.07	3.36	3.36	3.34	3.34	0.29
1973-1981	2.50	2.59	2.59	2.50	2.51	0.09
1981-2003	3.11	3.45	3.45	3.46	3.46	0.34
1981-2000	3.31	3.68	3.68	3.69	3.69	0.37
1981-1989	3.52	3.81	3.82	3.85	3.86	0.29
1989-2003	2.87	3.24	3.24	3.23	3.23	0.36
1989-2000	3.15	3.58	3.58	3.57	3.57	0.43
1989-1995	2.36	2.61	2.62	2.62	2.63	0.25
1989-1996	2.55	2.89	2.90	2.89	2.89	0.34
1995-2003	3.26	3.71	3.70	3.69	3.69	0.45
1995-2000	4.10	4.76	4.75	4.72	4.72	0.66
1996-2003	3.20	3.58	3.58	3.58	3.58	0.39
1996-2000	4.20	4.80	4.79	4.78	4.78	0.60
2000-2003	1.88	1.98	1.98	2.00	2.00	0.10

Sources (current as of September 16, 2004):
(1): Bureau of Economic Analysis NIPA Table 1.3.6, line 1.
(2): Bureau of Economic Analysis NIPA Table 1.3.6, line 2.
(3): Bureau of Labor Statistics series PRS84006043.
(4): Bureau of Economic Analysis NIPA Table 1.3.6, line 3.
(5): Bureau of Labor Statistics series PRS85006043.
* (3) and (5) are calculated by the BLS based on (2) and (4) respectively.

Table 7a: Gross Domestic Product Versus Gross Domestic Income in the United States, 1961-2003

	Gross Domestic Product (billions of current dollars)	GDP per cent change	Gross Domestic Income (billions of current dollars)	GDI per cent change	GDP - GDI (Statistical Discrepancy on the Income Side)	Statistical Discrepancy as a percentage of GDP	Cumulative Statistical Discrepancy as a percentage of GDP	GDP annual growth - GDI annual growth	Cumulative Difference in Annual Growth
	(1)	(1a)	(2)	(2a)	(3)	(4)=(3)/(1)	(4a)	(5)=(1a)-(2a)	(5a)
1961	544.7		545.3		-0.6	-0.11	-0.11		
1962	585.6	7.51	585.3	7.34	0.3	0.05	-0.06	0.17	0.17
1963	617.7	5.48	618.5	5.67	-0.8	-0.13	-0.19	-0.19	-0.02
1964	663.6	7.43	662.8	7.16	0.8	0.12	-0.07	0.27	0.25
1965	719.1	8.36	717.5	8.25	1.6	0.22	0.15	0.11	0.36
1966	787.8	9.55	781.5	8.92	6.3	0.80	0.95	0.63	1.00
1967	832.6	5.69	828.0	5.95	4.6	0.55	1.51	-0.26	0.73
1968	910.0	9.30	905.4	9.35	4.6	0.51	2.01	-0.05	0.68
1969	984.6	8.20	981.4	8.39	3.2	0.33	2.34	-0.20	0.48
1970	1,038.5	5.47	1,031.2	5.07	7.3	0.70	3.04	0.40	0.88
1971	1,127.1	8.53	1,115.5	8.17	11.6	1.03	4.07	0.36	1.24
1972	1,238.3	9.87	1,229.2	10.19	9.1	0.73	4.80	-0.33	0.91
1973	1,382.7	11.66	1,374.1	11.79	8.6	0.62	5.43	-0.13	0.79
1974	1,500.0	8.48	1,489.1	8.37	10.9	0.73	6.15	0.11	0.90
1975	1,638.3	9.22	1,620.6	8.83	17.7	1.08	7.23	0.39	1.29
1976	1,825.3	11.41	1,800.1	11.08	25.2	1.38	8.61	0.34	1.63
1977	2,030.9	11.26	2,008.7	11.59	22.2	1.09	9.71	-0.32	1.30
1978	2,294.7	12.99	2,268.1	12.91	26.6	1.16	10.87	0.08	1.38
1979	2,563.3	11.71	2,517.3	10.99	46	1.79	12.66	0.72	2.10
1980	2,789.5	8.82	2,748.1	9.17	41.4	1.48	14.14	-0.34	1.75
1981	3,128.4	12.15	3,097.5	12.71	30.9	0.99	15.13	-0.57	1.19
1982	3,255.0	4.05	3,254.7	5.08	0.3	0.01	15.14	-1.03	0.16
1983	3,536.7	8.65	3,490.9	7.26	45.8	1.29	16.44	1.40	1.56
1984	3,933.2	11.21	3,918.6	12.25	14.6	0.37	16.81	-1.04	0.52
1985	4,220.3	7.30	4,203.6	7.27	16.7	0.40	17.20	0.03	0.54
1986	4,462.8	5.75	4,415.8	5.05	47	1.05	18.26	0.70	1.24
1987	4,739.5	6.20	4,717.8	6.84	21.7	0.46	18.71	-0.64	0.60
1988	5,103.8	7.69	5,123.3	8.60	-19.5	-0.38	18.33	-0.91	-0.31
1989	5,484.4	7.46	5,444.7	6.27	39.7	0.72	19.06	1.18	0.88
1990	5,803.1	5.81	5,736.8	5.36	66.3	1.14	20.20	0.45	1.32
1991	5,995.9	3.32	5,923.4	3.25	72.5	1.21	21.41	0.07	1.39
1992	6,337.7	5.70	6,235.0	5.26	102.7	1.62	23.03	0.44	1.83
1993	6,657.4	5.04	6,517.9	4.54	139.5	2.10	25.12	0.51	2.34
1994	7,072.2	6.23	6,929.7	6.32	142.5	2.01	27.14	-0.09	2.25
1995	7,397.7	4.60	7,296.5	5.29	101.2	1.37	28.51	-0.69	1.56
1996	7,816.9	5.67	7,723.2	5.85	93.7	1.20	29.71	-0.18	1.38
1997	8,304.3	6.24	8,233.7	6.61	70.6	0.85	30.56	-0.37	1.01
1998	8,747.0	5.33	8,761.6	6.41	-14.6	-0.17	30.39	-1.08	-0.07
1999	9,268.4	5.96	9,304.1	6.19	-35.7	-0.39	30.00	-0.23	-0.31
2000	9,817.0	5.92	9,944.1	6.88	-127.1	-1.29	28.71	-0.96	-1.26
2001	10,128.0	3.17	10,217.6	2.75	-89.6	-0.88	27.82	0.42	-0.85
2002	10,487.0	3.54	10,502.3	2.79	-15.3	-0.15	27.68	0.76	-0.09
2003	11,004.0	4.93	10,978.5	4.53	25.5	0.23	27.91	0.40	0.31

Table 7a: Gross Domestic Product Versus Gross Domestic Income in the United States, 1961-2003

	Gross Domestic Product (billions of current dollars) (1)	GDP per cent change (1a)	Gross Domestic Income (billions of current dollars) (2)	GDI per cent change (2a)	GDP - GDI (Statistical Discrepancy on the Income Side) (3)	Statistical Discrepancy as a percentage of GDP (4)=(3)/(1)	Cumulative Statistical Discrepancy as a percentage of GDP (4a)	GDP annual growth - GDI annual growth (5)=(1a)-(2a)	Cumulative Difference in Annual Growth (5a)
(cont.)						**Differences**			
compound average annual growth rates						(1)-(2)			
1961-2003	7.42		7.41			0.01			
1961-2000	7.70		7.73			-0.03			
1961-1973	8.07		8.01			0.07			
1973-2003	7.16		7.17			-0.01			
1973-2000	7.53		7.61			-0.08			
1973-1981	10.75		10.69			0.05			
1981-2003	5.88		5.92			-0.04			
1981-2000	6.20		6.33			-0.13			
1981-1989	7.27		7.31			-0.04			
1989-2003	5.10		5.14			-0.04			
1989-2000	5.44		5.63			-0.19			
1989-1995	5.11		5.00			0.11			
1989-1996	5.19		5.12			0.07			
1995-2003	5.09		5.24			-0.15			
1995-2000	5.82		6.39			-0.57			
1996-2003	5.01		5.15			-0.15			
1996-2000	5.86		6.52			-0.66			
2000-2003	3.88		3.35			0.52			

Sources: (current as of September 16, 2004)
GDP (expenditure-based): NIPA Table 1.1.5, line 1.
GDI: NIPA Table 1.10, line 1.
Statistical Discrepancy also from NIPA Table 1.10, line 26.

Table 8: Estimates of the Number of Workers in the United States, 1961-2003

	Total Economy							Business Sector	Non-Farm Business Sector
	BLS Current Population Survey, household based, employment (thousands)	BLS Current Employment Statistics, establishment based, jobs (thousands)	Bureau of Economic Analysis Full Time plus Part Time Employees (thousands)	Bureau of Economic Analysis Full Time plus Part Time Employees plus Self Employed (thousands)	Bureau of Economic Analysis Full Time Equivalent Employees (thousands)	Bureau of Economic Analysis Persons Engaged in Production (equals Full Time Equivalent Employees plus Self Employed, thousands)	Bureau of Economic Analysis Total Employment (thousands)	BLS Productivity and Costs, jobs (unpublished, thousands)	BLS Productivity and Costs (1992=100, absolute levels unpublished)	BLS Productivity and Costs (1992=100, absolute levels unpublished)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1961	65,746	54,105	62,881	71,058	56,479	64,656		69,988	58.0	54.4
1962	66,702	55,659	64,573	72,582	58,034	66,043		71,491	58.8	55.5
1963	67,762	56,764	65,619	73,341	58,907	66,629		72,183	59.2	56.1
1964	69,305	58,391	67,275	74,927	60,208	67,860		73,745	60.4	57.5
1965	71,088	60,874	69,692	77,218	62,633	70,159		75,964	62.2	59.5
1966	72,895	64,020	73,516	80,787	66,071	73,342		78,983	64.2	61.9
1967	74,372	65,931	75,442	82,630	67,992	75,180		80,919	65.1	63.0
1968	75,920	68,023	77,602	84,717	69,859	76,974		82,910	66.5	64.5
1969	77,902	70,512	79,850	87,049	71,718	78,917	91,057.2	85,297	68.6	66.8
1970	78,678	71,006	79,750	86,847	71,225	78,322	91,281.6	85,162	68.4	66.8
1971	79,367	71,335	79,554	86,696	70,846	77,988	91,586.4	85,135	68.4	66.9
1972	82,153	73,798	81,583	88,817	72,674	79,908	94,317.2	87,338	70.5	69.0
1973	85,064	76,912	85,202	92,518	76,034	83,350	98,432.5	90,371	73.5	72.1
1974	86,794	78,389	86,573	94,100	77,142	84,669	100,117.8	91,865	74.7	73.3
1975	85,846	77,069	85,044	92,550	75,376	82,882	98,906.6	90,314	72.4	71.1
1976	88,752	79,502	87,402	94,897	77,712	85,207	101,597.2	92,743	74.7	73.5
1977	92,017	82,593	90,421	98,179	80,417	88,175	105,049.2	96,196	77.8	76.7
1978	96,048	86,826	94,785	102,903	84,520	92,638	109,688.6	100,850	82.1	81.1
1979	98,824	89,932	98,025	106,441	87,310	95,726	113,289.1	104,035	85.3	84.4
1980	99,303	90,528	98,379	107,037	87,231	95,889	114,231.2	104,687	85.5	84.6
1981	100,397	91,289	99,235	107,988	87,994	96,747	115,304.0	105,562	86.4	85.5
1982	99,526	89,677	97,762	106,685	86,215	95,138	114,557.3	104,210	84.9	84.1
1983	100,834	90,280	98,527	107,740	86,773	95,986	116,056.7	105,077	85.7	84.8
1984	105,005	94,530	103,119	112,531	91,202	100,614	121,091.1	109,470	90.0	89.4
1985	107,150	97,511	105,802	115,129	93,697	103,024	124,509.7	112,270	92.3	91.9
1986	109,597	99,474	107,722	117,091	95,405	104,774	126,970.3	114,216	93.9	93.6
1987	112,440	102,088	110,725	120,390	98,163	107,828	130,400.4	117,172	96.4	96.2
1988	114,968	105,345	113,885	123,841	101,039	110,995	134,506.9	120,617	99.3	99.2

Table 8: Estimates of the Number of Workers in the United States, 1961-2003

	Total Economy								Business Sector	Non-Farm Business Sector
	BLS Current Population Survey, household based, employment (thousands)	BLS Current Employment Statistics, establishment based, jobs (thousands)	Bureau of Economic Analysis Full Time plus Part Time Employees (thousands)	Bureau of Economic Analysis Full Time plus Part Time Employees plus Self Employed (thousands)	Bureau of Economic Analysis Full Time Equivalent Employees (thousands)	Bureau of Economic Analysis Persons Engaged in Production (equals Full Time Equivalent Employees plus Self Employed, thousands)	Bureau of Economic Analysis Total Employment (thousands)	BLS Productivity and Costs, jobs (unpublished, thousands)	BLS Productivity and Costs (1992=100, absolute levels unpublished)	BLS Productivity and Costs (1992=100, absolute levels unpublished)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(cont.)										
1989	117,342	108,014	116,590	126,660	103,720	113,790	137,199.8	123,333	101.4	101.5
1990	118,793	109,487	118,076	128,208	104,865	114,997	139,380.9	124,814	102.1	102.2
1991	117,718	108,374	116,567	126,940	103,306	113,679	138,605.8	123,849	100.4	100.4
1992	118,492	108,726	116,982	127,022	103,394	113,434	139,162.1	123,823	100.0	100.0
1993	120,259	110,844	118,625	129,130	104,918	115,423	141,779.4	126,098	102.2	102.4
1994	123,060	114,291	121,416	131,980	107,691	118,255	145,223.6	129,633	105.6	105.7
1995	124,900	117,298	124,306	134,820	110,708	121,222	148,982.8	132,471	108.4	108.5
1996	126,708	119,708	126,607	137,131	112,917	123,441	152,150.2	134,838	110.8	111.1
1997	129,558	122,776	129,416	139,960	115,697	126,241	155,608.2	137,889	113.8	114.2
1998	131,463	125,930	132,748	143,089	118,823	129,164	159,628.2	140,870	116.4	116.9
1999	133,488	128,993	135,833	145,954	121,656	131,777	162,955.3	143,589	118.7	119.4
2000	136,891	131,785	138,678	148,911	124,319	134,552	166,758.8	146,204	120.8	121.6
2001	136,933	131,826	138,407	148,540	124,608	134,741	166,908.2	145,968	120.0	120.9
2002	136,485	130,341	137,262	147,225	123,299	133,262	167,033.5	144,359	117.4	118.2
2003	137,736	129,931	136,852	147,181	122,792	133,121		144,335	117.1	118.0

Sources (current as of September 16, 2004).
(1): BLS series LNU02000000.
(2): BLS series CEU0000000001.
(3): BEA NIPA Tables 6.4B, 6.4C and 6.4D.
(4): (3) plus BEA NIPA Tables 6.6B, 6.6C and 6.6D. Calculated by CSLS.
(5): BEA NIPA Table 6.5B, 6.5C and 6.5D.
(6): BEA NIPA Tables 6.8B, 6.8C and 6.8D.
(7): BEA Annual State Personal Income Table SA25.
(8): BLS, unpublished, corresponding to BLS press release of September 2, 2004.
(9): BLS series PRS84006013.
(10): BLS series PRS85006013.

Table 8: Estimates of the Number of Workers in the United States, 1961-2003

	Total Economy							Business Sector	Non-Farm Business Sector	
	BLS Current Population Survey, household based, employment (thousands)	BLS Current Employment Statistics, establishment based, jobs (thousands)	Bureau of Economic Analysis Full Time plus Part Time Employees (thousands)	Bureau of Economic Analysis Full Time plus Part Time Employees plus Self Employed (thousands)	Bureau of Economic Analysis Full Time Equivalent Employees (thousands)	Bureau of Economic Analysis Persons Engaged in Production (equals Full Time Equivalent Employees plus Self Employed, thousands)	Bureau of Economic Analysis Total Employment (thousands)	BLS Productivity and Costs, jobs (unpublished, thousands)	BLS Productivity and Costs (1992=100, absolute levels unpublished)	BLS Productivity and Costs (1992=100, absolute levels unpublished)	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	
(cont.)											**Differences**
compound average annual growth rates											(2)-(1)
1961-2003	1.78	2.11	1.87	1.75	1.87	1.73		1.74	1.69	1.86	
1961-2002	1.80	2.17	1.92	1.79	1.92	1.78		1.78	1.73	1.91	0.37
1961-2000	1.90	2.31	2.05	1.92	2.04	1.90		1.91	1.90	2.08	0.41
1961-1973	2.17	2.97	2.56	2.22	2.51	2.14		2.15	1.99	2.38	0.80
1973-2003	1.62	1.76	1.59	1.56	1.61	1.57		1.57	1.56	1.66	
1973-2002	1.64	1.84	1.66	1.61	1.68	1.63	1.84	1.63	1.63	1.72	0.19
1973-2000	1.78	2.01	1.82	1.78	1.84	1.79	1.97	1.80	1.86	1.95	0.24
1973-1981	2.09	2.17	1.92	1.95	1.84	1.88	2.00	1.96	2.04	2.15	0.07
1981-2003	1.45	1.62	1.47	1.42	1.53	1.46		1.43	1.39	1.48	
1981-2002	1.47	1.71	1.56	1.49	1.62	1.54	1.78	1.50	1.47	1.55	0.24
1981-2000	1.65	1.95	1.78	1.71	1.84	1.75	1.96	1.73	1.78	1.87	0.31
1981-1989	1.97	2.13	2.04	2.01	2.08	2.05	2.20	1.96	2.02	2.17	0.16
1989-2003	1.15	1.33	1.15	1.08	1.21	1.13		1.13	1.03	1.08	
1989-2002	1.17	1.46	1.26	1.16	1.34	1.22	1.53	1.22	1.13	1.18	0.29
1989-2000	1.41	1.82	1.59	1.48	1.66	1.54	1.79	1.56	1.60	1.66	0.41
1989-1995	1.05	1.38	1.07	1.05	1.09	1.06	1.38	1.20	1.12	1.12	0.34
1989-1996	1.10	1.48	1.18	1.14	1.22	1.17	1.49	1.28	1.27	1.30	0.38
1995-2003	1.23	1.29	1.21	1.10	1.30	1.18		1.08	0.97	1.05	
1995-2002	1.28	1.52	1.43	1.27	1.55	1.36	1.65	1.24	1.15	1.23	0.24
1995-2000	1.85	2.36	2.21	2.01	2.35	2.11	2.28	1.99	2.19	2.31	0.51
1996-2003	1.20	1.18	1.12	1.02	1.20	1.08		0.98	0.79	0.86	
1996-2002	1.25	1.43	1.36	1.19	1.48	1.28	1.57	1.14	0.97	1.04	0.18
1996-2000	1.95	2.43	2.30	2.08	2.43	2.18	2.32	2.04	2.18	2.28	0.48
2000-2003	0.21	-0.47	-0.44	-0.39	-0.41	-0.36		-0.43	-1.03	-1.00	-0.68

Table 9: Average Weekly Hours in the United States, 1961-2003

	Total Economy				Business Sector	Non-Farm Business Sector
	Current Population Survey, household based, per employed person	Current Employment Statistics, establishment based, per job	Bureau of Economic Analysis Average Hours of Full Time and Part Time Employees	BLS Productivity and Costs (unpublished), per job	BLS Productivity and Costs (1992=100, absolute levels unpublished)	BLS Productivity and Costs (1992=100, absolute levels unpublished)
	(1)	(2)	(3)	(4)	(5)	(6)
1961			35.05	36.54	111.2	111.4
1962			35.17	36.68	111.7	111.7
1963			35.20	36.63	111.7	111.7
1964		38.5	35.13	36.80	112.7	113.0
1965		38.6	35.21	36.96	113.2	113.4
1966		38.5	35.05	36.81	112.6	112.8
1967		37.9	34.71	36.35	110.7	110.9
1968		37.7	34.48	36.12	110.1	110.2
1969		37.5	34.45	35.97	109.4	109.5
1970		37.0	33.96	35.40	107.5	107.7
1971		36.8	33.85	35.23	107.2	107.2
1972		36.9	33.97	35.29	107.2	107.4
1973		36.9	33.93	35.17	106.8	107.0
1974		36.4	33.44	34.74	105.2	105.4
1975		36.0	33.12	34.35	103.9	104.0
1976	36.36	36.1	33.16	34.41	104.1	104.2
1977	36.47	35.9	33.13	34.33	103.7	103.7
1978	36.74	35.8	33.08	34.28	103.3	103.3
1979	36.64	35.6	33.02	34.13	102.8	102.7
1980	36.22	35.2	32.66	33.82	101.6	101.5
1981	35.90	35.2	32.49	33.61	101.3	101.2
1982	35.82	34.7	32.34	33.54	100.7	100.6
1983	36.19	34.9	32.50	33.85	101.6	101.6
1984	36.74	35.1	32.61	34.13	102.3	102.3
1985	36.89	34.9	32.57	34.04	102.0	102.0
1986	37.05	34.7	32.34	33.82	101.1	101.1
1987	36.95	34.7	32.40	33.84	101.3	101.4
1988	37.40	34.6	32.33	33.85	101.1	101.1
1989	37.52	34.5	32.48	34.03	101.6	101.6
1990	37.36	34.3	32.26	33.71	100.4	100.5
1991	37.23	34.1	31.94	33.51	99.7	99.7
1992	36.90	34.2	31.93	33.57	100.0	100.0
1993	37.42	34.3	32.01	33.76	100.6	100.6
1994	37.41	34.5	32.10	33.84	101.0	100.9
1995	37.54	34.3	32.15	33.92	101.1	101.0
1996	37.51	34.3	31.99	33.75	100.5	100.3
1997	37.81	34.5	32.22	33.97	101.2	101.0
1998	37.63	34.5	32.27	34.00	101.0	100.8
1999	38.00	34.3	32.25	34.04	101.2	101.1
2000	38.05	34.3	32.10	33.83	100.3	100.2
2001	37.59	34.0	31.81	33.49	98.9	98.8
2002	37.65	33.9	31.73	33.42	98.7	98.5
2003	37.45	33.7	31.59	33.26	98.3	98.1

Table 9: Average Weekly Hours in the United States, 1961-2003

	Total Economy				Business Sector	Non-Farm Business Sector	
	Current Population Survey, household based, per employed person	Current Employment Statistics, establishment based, per job	Bureau of Economic Analysis Average Hours of Full Time and Part Time Employees	BLS Productivity and Costs (unpublished), per job	BLS Productivity and Costs (1992=100, absolute levels unpublished)	BLS Productivity and Costs (1992=100, absolute levels unpublished)	
	(1)	(2)	(3)	(4)	(5)	(6)	
(cont.)							**Differences**
compound average annual growth rates							(2)-(1)
1961-2003			-0.25	-0.22	-0.29	-0.30	
1961-2000			-0.22	-0.20	-0.26	-0.27	
1961-1973			-0.27	-0.32	-0.34	-0.34	
1973-2003		-0.30	-0.24	-0.19	-0.28	-0.29	
1973-2000		-0.27	-0.20	-0.14	-0.23	-0.24	
1973-1981		-0.59	-0.54	-0.57	-0.66	-0.69	
1981-2003	0.19	-0.20	-0.13	-0.05	-0.14	-0.14	-0.39
1981-2000	0.31	-0.14	-0.06	0.04	-0.05	-0.05	-0.44
1981-1989	0.55	-0.25	0.00	0.16	0.04	0.05	-0.80
1989-2003	-0.01	-0.17	-0.20	-0.16	-0.24	-0.25	-0.15
1989-2000	0.13	-0.05	-0.11	-0.05	-0.12	-0.13	-0.18
1989-1995	0.01	-0.10	-0.17	-0.05	-0.08	-0.10	-0.11
1989-1996	0.00	-0.08	-0.22	-0.12	-0.16	-0.18	-0.08
1995-2003	-0.03	-0.22	-0.22	-0.25	-0.35	-0.36	-0.19
1995-2000	0.27	0.00	-0.03	-0.05	-0.16	-0.16	-0.27
1996-2003	-0.02	-0.25	-0.18	-0.21	-0.32	-0.32	-0.23
1996-2000	0.36	0.00	0.09	0.06	-0.05	-0.02	-0.36
2000-2003	-0.53	-0.59	-0.54	-0.57	-0.67	-0.70	-0.06

Sources (current as of September 16, 2004).
Tables 8 and 10.
(2): BLS series CEU0500000005.
(5) and (6): BLS series PRS84006023 and PRS85006023.
total annual hours = average weekly hours per employed person*number of workers*52.
All estimates are for all jobs and include overtime, and those employed but not at work (i.e. working 0 hours) are included in the calculation of the average.

Table 10: Estimates of Total Hours of Work in the United States, 1961-2003

	Total Economy					Business Sector	Non-Farm Business Sector
	Current Population Survey, household based (millions)	Current Employment Statistics, establishment based (millions)	Bureau of Economic Analysis Hours of Full Time and Part Time Employees (millions)	Bureau of Economic Analysis Hours of Full Time and Part Time Employees plus Self Employed (millions)	BLS Productivity and Costs (unpublished, billions)	BLS Productivity and Costs (1992=100, absolute levels unpublished)	BLS Productivity and Costs (1992=100, absolute levels unpublished)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1961			114,607	129,510	132.975	64.5	60.6
1962			118,097	132,745	136.365	65.7	62.0
1963			120,093	134,225	137.495	66.2	62.7
1964		116,899	122,889	136,867	141.100	68.1	65.0
1965		122,186	127,604	141,384	145.989	70.4	67.5
1966		128,168	133,972	147,222	151.188	72.3	69.8
1967		129,937	136,172	149,146	152.936	72.1	69.8
1968		133,352	139,143	151,900	155.730	73.2	71.1
1969		137,498	143,024	155,919	159.539	75.1	73.1
1970		136,616	140,823	153,355	156.749	73.6	72.0
1971		136,507	140,043	152,615	155.944	73.3	71.8
1972		141,604	144,127	156,907	160.277	75.6	74.1
1973		147,579	150,314	163,221	165.295	78.5	77.1
1974		148,375	150,547	163,636	165.937	78.6	77.2
1975		144,273	146,463	159,390	161.300	75.3	73.9
1976	167,804	149,241	150,687	163,609	165.929	77.7	76.5
1977	174,516	154,185	155,780	169,146	171.734	80.7	79.6
1978	183,485	161,635	163,054	177,019	179.788	84.8	83.7
1979	188,276	166,482	168,335	182,788	184.612	87.7	86.6
1980	187,031	165,702	167,061	181,763	184.126	86.9	85.9
1981	187,437	167,095	167,650	182,438	184.473	87.5	86.5
1982	185,378	161,813	164,379	179,382	181.730	85.5	84.6
1983	189,740	163,840	166,500	182,069	184.976	87.0	86.2
1984	200,612	172,536	174,884	190,846	194.283	92.1	91.4
1985	205,560	176,963	179,215	195,014	198.700	94.2	93.8
1986	211,162	179,491	181,150	196,905	200.872	94.9	94.6
1987	216,043	184,208	186,572	202,858	206.168	97.7	97.5
1988	223,600	189,537	191,466	208,204	212.310	100.3	100.3
1989	228,925	193,777	196,933	213,942	218.220	103.0	103.1
1990	230,762	195,281	198,053	215,048	218.763	102.5	102.7
1991	227,899	192,169	193,610	210,839	215.812	100.2	100.2
1992	227,373	193,358	194,252	210,924	216.144	100.0	100.0
1993	234,010	197,701	197,474	214,962	221.339	102.8	103.0
1994	239,392	205,038	202,686	220,321	228.112	106.7	106.6
1995	243,838	209,213	207,817	225,394	233.672	109.6	109.5
1996	247,153	213,511	210,620	228,127	236.645	111.4	111.5
1997	254,702	220,260	216,830	234,496	243.603	115.1	115.4
1998	257,242	225,918	222,744	240,096	249.038	117.6	117.9
1999	263,744	230,072	227,813	244,787	254.163	120.1	120.7
2000	270,868	235,052	231,510	248,593	257.226	121.3	121.9
2001	267,648	233,068	228,925	245,685	254.204	118.7	119.4
2002	267,216	229,827	226,445	242,881	250.867	115.8	116.5
2003	268,237	227,691	224,784	241,750	249.637	115.1	115.8

Table 10: Estimates of Total Hours of Work in the United States, 1961-2003

	Total Economy					Business Sector	Non-Farm Business Sector
	Current Population Survey, household based (millions)	Current Employment Statistics, establishment based (millions)	Bureau of Economic Analysis Hours of Full Time and Part Time Employees (millions)	Bureau of Economic Analysis Hours of Full Time and Part Time Employees plus Self Employed (millions)	BLS Productivity and Costs (unpublished, billions)	BLS Productivity and Costs (1992=100, absolute levels unpublished)	BLS Productivity and Costs (1992=100, absolute levels unpublished)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
(cont.)							
compound average annual growth rates							
1961-2003			1.62	1.50	1.51	1.39	1.55
1961-2000			1.82	1.69	1.71	1.63	1.81
1961-1973			2.29	1.95	1.83	1.65	2.03
1973-2003		1.46	1.35	1.32	1.38	1.28	1.37
1973-2000		1.74	1.61	1.57	1.65	1.62	1.71
1973-1981		1.56	1.37	1.40	1.38	1.37	1.45
1981-2003	1.64	1.42	1.34	1.29	1.38	1.25	1.33
1981-2000	1.96	1.81	1.71	1.64	1.77	1.73	1.82
1981-1989	2.53	1.87	2.03	2.01	2.12	2.06	2.22
1989-2003	1.14	1.16	0.95	0.88	0.97	0.80	0.83
1989-2000	1.54	1.77	1.48	1.37	1.51	1.50	1.53
1989-1995	1.06	1.29	0.90	0.87	1.15	1.04	1.01
1989-1996	1.10	1.40	0.96	0.92	1.16	1.13	1.13
1995-2003	1.20	1.06	0.99	0.88	0.83	0.61	0.70
1995-2000	2.12	2.36	2.18	1.98	1.94	2.05	2.17
1996-2003	1.18	0.92	0.93	0.83	0.77	0.47	0.54
1996-2000	2.32	2.43	2.39	2.17	2.11	2.15	2.25
2000-2003	-0.32	-1.05	-0.98	-0.93	-0.99	-1.73	-1.70

Sources (current as of September 16, 2004).
(1): average hours for those at work on the reference week (BLS series LNU02005054)
multiplied by the number of employed at work on the reference week
(BLS series LNU02005053) multiplied by 52 weeks.
(2): average hours for private non-farm employees from Table 9
multiplied by total non-farm employees (CES) from Table 8.
(3): BEA NIPA Tables 6.9B, 6.9C and 6.9D.
(4): Calculated by multiplying the average hours of full time and part time employees by
full time plus part time employees plus self employed from Table 8 and multiplying by 52 weeks.
(5): BLS, unpublished, corresponding to BLS press release of September 2, 2004.
(6): BLS series PRS84006033.
(7): BLS series PRS85006033.
total annual hours = average weekly hours per employed person*number of workers*52
All estimates are for all jobs and include overtime.

Table 11: Estimates of Output per Worker in the United States, 1961-2003

	Total Economy								Business Sector	Non-Farm Business Sector
	NIPA Real GDP (2000$, chained-weighted, Fisher index) / CPS Employment	NIPA Real GDP (2000$, chained-weighted, Fisher index) / CES Jobs	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Full Time plus Part Time Employees	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Full Time plus Part Time Employees plus Self Employed	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Full Time Equivalent Employees	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Full Time Equivalent Employees plus Self Employed	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Total Employment	NIPA Real GDP (1996$, chained-weighted, Fisher index) / BLS Jobs (unpublished)	BLS Productivity and Costs (1992=100, absolute levels unpublished, based on a chained-weighted Fisher index)	BLS Productivity and Costs (1992=100, absolute levels unpublished, based on a chained-weighted Fisher index)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1961	38,938	47,315	40,712	36,027	45,327	39,594		36,578	56.3	59.5
1962	40,706	48,783	42,049	37,409	46,786	41,113		37,980	59.1	62.4
1963	41,823	49,926	43,189	38,641	48,110	42,534		39,261	61.4	64.6
1964	43,267	51,354	44,572	40,020	49,804	44,188		40,662	64.1	67.3
1965	44,889	52,421	45,789	41,326	50,949	45,484		42,008	66.6	69.5
1966	46,630	53,094	46,236	42,075	51,446	46,346		43,036	68.9	71.6
1967	46,854	52,852	46,189	42,171	51,250	46,350		43,063	69.2	71.6
1968	48,112	53,698	47,070	43,116	52,287	47,454		44,056	71.2	73.6
1969	48,335	53,401	47,156	43,256	52,503	47,713	41,352	44,145	71.1	73.2
1970	47,941	53,121	47,297	43,432	52,958	48,159	41,322	44,291	71.2	73.1
1971	49,121	54,652	49,006	44,969	55,029	49,990	42,567	45,793	74.0	75.8
1972	49,968	55,625	50,317	46,219	56,485	51,372	43,523	47,001	76.4	78.4
1973	51,038	56,448	50,955	46,926	57,099	52,088	44,106	48,041	78.5	80.6
1974	49,768	55,105	49,895	45,904	55,995	51,017	43,145	47,021	76.1	78.2
1975	50,220	55,939	50,694	46,582	57,196	52,016	43,589	47,736	77.7	79.2
1976	51,164	57,117	51,954	47,851	58,432	53,293	44,695	48,962	80.3	82.0
1977	51,626	57,517	52,538	48,386	59,073	53,876	45,222	49,384	81.4	82.9
1978	52,213	57,759	52,909	48,735	59,335	54,135	45,720	49,727	82.0	83.6
1979	52,350	57,526	52,776	48,603	59,253	54,044	45,665	49,727	81.6	82.9
1980	51,979	57,018	52,467	48,224	59,173	53,830	45,186	49,306	80.5	81.8
1981	52,708	57,966	53,325	49,003	60,137	54,696	45,893	50,129	81.9	82.7
1982	52,140	57,867	53,081	48,641	60,190	54,545	45,299	49,797	80.8	81.4
1983	53,789	60,078	55,049	50,342	62,506	56,506	46,734	51,617	84.4	85.9
1984	55,365	61,500	56,378	51,662	63,744	57,781	48,010	53,107	87.2	88.2
1985	56,497	62,082	57,217	52,582	64,609	58,760	48,620	53,921	89.0	89.4
1986	57,151	62,967	58,146	53,493	65,653	59,782	49,331	54,840	90.8	91.2
1987	57,587	63,427	58,479	53,784	65,963	60,050	49,656	55,261	91.6	91.9
1988	58,648	64,006	59,206	54,446	66,734	60,748	50,129	55,902	92.7	93.2
1989	59,496	64,634	59,880	55,119	67,310	61,353	50,885	56,606	94.1	94.3
1990	59,873	64,962	60,237	55,476	67,825	61,849	51,029	56,985	94.9	95.0

Table 11: Estimates of Output per Worker in the United States, 1961-2003

	Total Economy								Business Sector	Non-Farm Business Sector
	NIPA Real GDP (2000$, chained-weighted, Fisher index) / CPS Employment	NIPA Real GDP (2000$, chained-weighted, Fisher index) / CES Jobs	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Full Time plus Part Time Employees	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Full Time plus Part Time Employees plus Self Employed	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Full Time Equivalent Employees	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Full Time Equivalent Employees plus Self Employed	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Total Employment	NIPA Real GDP (1996$, chained-weighted, Fisher index) / BLS Jobs (unpublished)	BLS Productivity and Costs (1992=100, absolute levels unpublished, based on a chained-weighted Fisher index)	BLS Productivity and Costs (1992=100, absolute levels unpublished, based on a chained-weighted Fisher index)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(cont.)										
1991	60,318	65,518	60,913	55,936	68,733	62,461	51,228	57,332	95.7	95.9
1992	61,916	67,478	62,716	57,758	70,958	64,677	52,720	59,251	100.0	100.0
1993	62,637	67,958	63,500	58,334	71,796	65,262	53,130	59,737	100.9	100.9
1994	63,672	68,557	64,534	59,369	72,759	66,259	53,955	60,444	102.5	102.4
1995	64,305	68,473	64,612	59,574	72,549	66,256	53,910	60,630	102.8	103.0
1996	65,733	69,577	65,785	60,737	73,761	67,473	54,741	61,770	105.1	105.1
1997	67,178	70,889	67,252	62,186	75,227	68,944	55,932	63,120	107.8	107.5
1998	68,969	72,000	68,302	63,365	76,306	70,197	56,800	64,364	110.5	110.2
1999	70,945	73,417	69,720	64,886	77,845	71,866	58,116	65,954	113.9	113.5
2000	71,714	74,493	70,790	65,925	78,966	72,961	58,869	67,146	116.3	115.7
2001	72,230	75,028	71,461	66,586	79,375	73,405	59,258	67,759	117.5	116.9
2002	73,816	77,296	73,398	68,431	81,710	75,601	60,316	69,790	122.2	121.7
2003	75,371	79,899	75,858	70,534	84,544	77,984		71,925	127.3	126.6

Sources (current as of September 16, 2004).
Tables 7 and 8.
(9) and (10): BLS series PRS84006163 and PRS85006163.

Table 11: Estimates of Output per Worker in the United States, 1961-2003

	Total Economy								Business Sector	Non-Farm Business Sector			
	NIPA Real GDP (2000$, chained-weighted, Fisher index) / CPS Employment	NIPA Real GDP (2000$, chained-weighted, Fisher index) / CES Jobs	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Full Time plus Part Time Employees	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Full Time plus Part Time Employees plus Self Employed	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Full Time Equivalent Employees	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Full Time Equivalent Employees plus Self Employed	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Total Employment	NIPA Real GDP (1996$, chained-weighted, Fisher index) / BLS Jobs (unpublished)	BLS Productivity and Costs (1992=100, absolute levels unpublished, based on a chained-weighted Fisher index)	BLS Productivity and Costs (1992=100, absolute levels unpublished, based on a chained-weighted Fisher index)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)			
(cont.)											Differences		
compound average annual growth rates											(9)-(1)	(9)-(2)	(9)-(8)
1961-2003	1.58	1.26	1.49	1.61	1.50	1.63		1.62	1.96	1.81	0.38	0.71	0.34
1961-2002	1.57	1.20	1.45	1.58	1.45	1.59		1.59	1.91	1.76	0.34	0.70	0.32
1961-2000	1.58	1.17	1.43	1.56	1.43	1.58		1.57	1.88	1.72	0.30	0.71	0.31
1961-1973	2.28	1.48	1.89	2.23	1.94	2.31		2.30	2.81	2.56	0.53	1.33	0.51
1973-2003	1.31	1.16	1.34	1.37	1.32	1.35		1.35	1.62	1.52	0.32	0.46	0.27
1973-2002	1.28	1.09	1.27	1.31	1.24	1.29	1.09	1.30	1.54	1.43	0.26	0.45	0.24
1973-2000	1.27	1.03	1.23	1.27	1.21	1.26	1.08	1.25	1.47	1.35	0.20	0.43	0.22
1973-1981	0.40	0.33	0.57	0.54	0.65	0.61	0.50	0.53	0.53	0.32	0.13	0.20	0.00
1981-2003	1.64	1.47	1.61	1.67	1.56	1.63		1.65	2.02	1.95	0.39	0.56	0.37
1981-2002	1.62	1.38	1.53	1.60	1.47	1.55	1.31	1.59	1.92	1.86	0.31	0.54	0.34
1981-2000	1.63	1.33	1.50	1.57	1.44	1.53	1.32	1.55	1.86	1.78	0.23	0.53	0.31
1981-1989	1.53	1.37	1.46	1.48	1.42	1.45	1.30	1.53	1.75	1.65	0.22	0.38	0.22
1989-2003	1.70	1.53	1.70	1.78	1.64	1.73		1.73	2.18	2.13	0.48	0.66	0.46
1989-2002	1.67	1.39	1.58	1.68	1.50	1.62	1.32	1.62	2.03	1.98	0.36	0.64	0.41
1989-2000	1.71	1.30	1.53	1.64	1.46	1.59	1.33	1.56	1.94	1.88	0.23	0.65	0.38
1989-1995	1.30	0.97	1.28	1.30	1.26	1.29	0.97	1.15	1.48	1.48	0.18	0.52	0.33
1989-1996	1.43	1.06	1.35	1.40	1.32	1.37	1.05	1.25	1.59	1.56	0.16	0.53	0.34
1995-2003	2.00	1.95	2.03	2.13	1.93	2.06		2.16	2.71	2.61	0.70	0.76	0.55
1995-2002	1.99	1.75	1.84	2.00	1.71	1.90	1.62	2.03	2.50	2.41	0.51	0.75	0.47
1995-2000	2.20	1.70	1.84	2.05	1.71	1.95	1.78	2.06	2.50	2.35	0.29	0.80	0.44
1996-2003	1.97	2.00	2.06	2.16	1.97	2.09		2.20	2.78	2.69	0.80	0.78	0.58
1996-2002	1.95	1.77	1.84	2.01	1.72	1.91	1.63	2.06	2.54	2.47	0.59	0.78	0.49
1996-2000	2.20	1.72	1.85	2.07	1.72	1.97	1.83	2.11	2.56	2.43	0.36	0.84	0.46
2000-2003	1.67	2.36	2.33	2.28	2.30	2.24		2.32	3.06	3.05	1.39	0.70	0.74

Table 12: Estimates of Output per Hour in the United States, 1961-2003

	Total Economy					Business Sector	Non-Farm Business Sector
	NIPA Real GDP (2000$, chained-weighted, Fisher index) / CPS hours	NIPA Real GDP (2000$, chained-weighted, Fisher index) / CES hours	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Hours of Full Time and Part Time Employees	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Hours of Full Time and Part Time Employees plus Self Employed	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BLS Productivity and Costs hours (unpublished)	BLS Productivity and Costs (1992=100, absolute levels unpublished, based on a chained-weighted Fisher index)	BLS Productivity and Costs (1992=100, absolute levels unpublshed, based on a chained-weighted Fisher index)
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
1961			22.34	19.77	19.25	50.6	53.4
1962			22.99	20.45	19.91	52.9	55.8
1963			23.60	21.11	20.61	55.0	57.8
1964		25.65	24.40	21.91	21.25	56.8	59.5
1965		26.12	25.01	22.57	21.86	58.8	61.3
1966		26.52	25.37	23.09	22.48	61.2	63.5
1967		26.82	25.59	23.36	22.78	62.5	64.6
1968		27.39	26.25	24.05	23.46	64.6	66.8
1969		27.39	26.33	24.15	23.60	64.9	66.9
1970		27.61	26.78	24.60	24.06	66.2	67.9
1971		28.56	27.84	25.55	25.00	69.0	70.6
1972		28.99	28.48	26.16	25.61	71.2	73.0
1973		29.42	28.88	26.60	26.27	73.5	75.3
1974		29.11	28.69	26.40	26.03	72.3	74.2
1975		29.88	29.44	27.05	26.73	74.8	76.2
1976	27.06	30.43	30.13	27.75	27.37	77.2	78.7
1977	27.22	30.81	30.49	28.09	27.66	78.5	79.9
1978	27.33	31.03	30.76	28.33	27.89	79.3	81.0
1979	27.48	31.07	30.73	28.30	28.02	79.4	80.7
1980	27.60	31.15	30.90	28.40	28.03	79.2	80.6
1981	28.23	31.67	31.56	29.01	28.69	80.8	81.7
1982	27.99	32.07	31.57	28.93	28.55	80.2	80.9
1983	28.59	33.10	32.58	29.79	29.32	83.1	84.6
1984	28.98	33.69	33.24	30.46	29.92	85.3	86.3
1985	29.45	34.21	33.78	31.04	30.47	87.2	87.6
1986	29.66	34.90	34.58	31.81	31.18	89.9	90.3
1987	29.97	35.15	34.71	31.92	31.41	90.4	90.7
1988	30.16	35.57	35.22	32.39	31.76	91.7	92.1
1989	30.50	36.03	35.45	32.63	31.99	92.6	92.8
1990	30.82	36.42	35.91	33.07	32.51	94.5	94.6
1991	31.16	36.95	36.67	33.68	32.90	96.0	96.1
1992	32.27	37.94	37.77	34.78	33.94	100.0	100.0
1993	32.19	38.10	38.15	35.04	34.03	100.3	100.4
1994	32.73	38.21	38.66	35.56	34.35	101.5	101.5
1995	32.94	38.39	38.65	35.63	34.37	101.6	102.0
1996	33.70	39.01	39.54	36.51	35.20	104.6	104.8
1997	34.17	39.51	40.14	37.12	35.73	106.5	106.5
1998	35.25	40.13	40.71	37.76	36.41	109.4	109.3
1999	35.91	41.16	41.57	38.69	37.26	112.6	112.3
2000	36.24	41.77	42.40	39.49	38.16	115.9	115.5
2001	36.95	42.44	43.20	40.26	38.91	118.8	118.3
2002	37.70	43.84	44.49	41.48	40.16	123.9	123.5
2003	38.70	45.59	46.18	42.94	41.59	129.5	129.0

Table 12: Estimates of Output per Hour in the United States, 1961-2003

			Total Economy			Business Sector	Non-Farm Business Sector			
	NIPA Real GDP (2000$, chained-weighted, Fisher index) / CPS hours	NIPA Real GDP (2000$, chained-weighted, Fisher index) / CES hours	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Hours of Full Time and Part Time Employees	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BEA Hours of Full Time and Part Time Employees plus Self Employed	NIPA Real GDP (2000$, chained-weighted, Fisher index) / BLS Productivity and Costs hours (unpublished)	BLS Productivity and Costs (1992=100, absolute levels unpublished, based on a chained-weighted Fisher index)	BLS Productivity and Costs (1992=100, absolute levels unpublshed, based on a chained-weighted Fisher index)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)			
(cont.)								Differences		
compound average annual growth rates								(6)-(1)	(6)-(2)	(6)-(5)
1961-2003			1.74	1.86	1.85	2.26	2.12			0.41
1961-2000			1.66	1.79	1.77	2.15	2.00			0.38
1961-1973			2.16	2.50	2.62	3.16	2.91			0.54
1973-2003		1.47	1.58	1.61	1.54	1.91	1.81		0.43	0.36
1973-2000		1.31	1.43	1.47	1.39	1.70	1.60		0.39	0.31
1973-1981		0.93	1.12	1.09	1.11	1.19	1.02		0.26	0.08
1981-2003	1.44	1.67	1.75	1.80	1.70	2.17	2.10	0.72	0.50	0.46
1981-2000	1.32	1.47	1.57	1.64	1.51	1.92	1.84	0.59	0.45	0.40
1981-1989	0.97	1.63	1.46	1.48	1.37	1.72	1.61	0.75	0.09	0.35
1989-2003	1.72	1.70	1.91	1.98	1.89	2.42	2.38	0.71	0.73	0.53
1989-2000	1.58	1.35	1.64	1.75	1.62	2.06	2.01	0.48	0.71	0.44
1989-1995	1.29	1.06	1.45	1.48	1.20	1.56	1.59	0.27	0.49	0.36
1989-1996	1.44	1.14	1.57	1.62	1.37	1.76	1.75	0.32	0.61	0.38
1995-2003	2.04	2.17	2.25	2.36	2.41	3.08	2.98	1.04	0.91	0.67
1995-2000	1.93	1.70	1.87	2.08	2.12	2.67	2.52	0.74	0.97	0.55
1996-2003	2.00	2.25	2.24	2.35	2.41	3.10	3.01	1.10	0.84	0.69
1996-2000	1.84	1.72	1.76	1.98	2.05	2.60	2.46	0.76	0.88	0.55
2000-2003	2.21	2.97	2.89	2.83	2.90	3.77	3.75	1.56	0.80	0.87

Sources (current as of September 16, 2004).
Tables 7 and 10.
(6) and (7): BLS series PRS84006093 and PRS85006093.

Table 12a: Non-Business Sector Output, Labour Input and Productivity Estimates, United States, 1961-2003

Non-Business Sector

	Real GDP at market prices (billions of 2000$, Laspeyres Approximation of a chained Fisher index)	Total Hours, BLS Productivity and Costs (unpublished, billions)	Real GDP at market prices (2000$, chained-weighted, Fisher index) / BLS hours
	(1)	(2)	(3)=(1)/(2)
1961	842.2	26.885	31.32
1962	880.9	28.354	31.07
1963	911.1	28.710	31.73
1964	944.9	29.142	32.42
1965	982.9	30.202	32.54
1966	1037.4	32.334	32.08
1967	1088.0	34.374	31.65
1968	1134.7	35.376	32.07
1969	1171.4	36.105	32.44
1970	1182.3	35.772	33.05
1971	1202.4	35.402	33.96
1972	1218.8	35.932	33.92
1973	1238.0	36.281	34.12
1974	1270.7	36.684	34.64
1975	1302.8	37.565	34.68
1976	1316.8	38.108	34.56
1977	1331.6	39.002	34.14
1978	1371.2	40.286	34.04
1979	1404.1	40.440	34.72
1980	1446.3	41.220	35.09
1981	1470.3	40.610	36.21
1982	1500.3	41.131	36.48
1983	1524.0	41.935	36.34
1984	1554.8	42.881	36.26
1985	1591.6	43.802	36.34
1986	1631.7	44.872	36.36
1987	1679.0	45.597	36.82
1988	1738.2	47.319	36.73
1989	1792.9	48.806	36.74
1990	1847.0	50.180	36.81
1991	1881.9	51.112	36.82
1992	1902.3	51.723	36.78
1993	1926.6	52.359	36.80
1994	1944.6	52.752	36.86
1995	1967.2	53.494	36.78
1996	1980.9	53.522	37.01
1997	2014.3	54.281	37.11
1998	2051.9	55.741	36.81
1999	2093.8	56.695	36.93
2000	2150.3	57.862	37.16
2001	2199.7	59.064	37.24
2002	2243.7	60.393	37.15
2003	2252.3	60.431	37.27

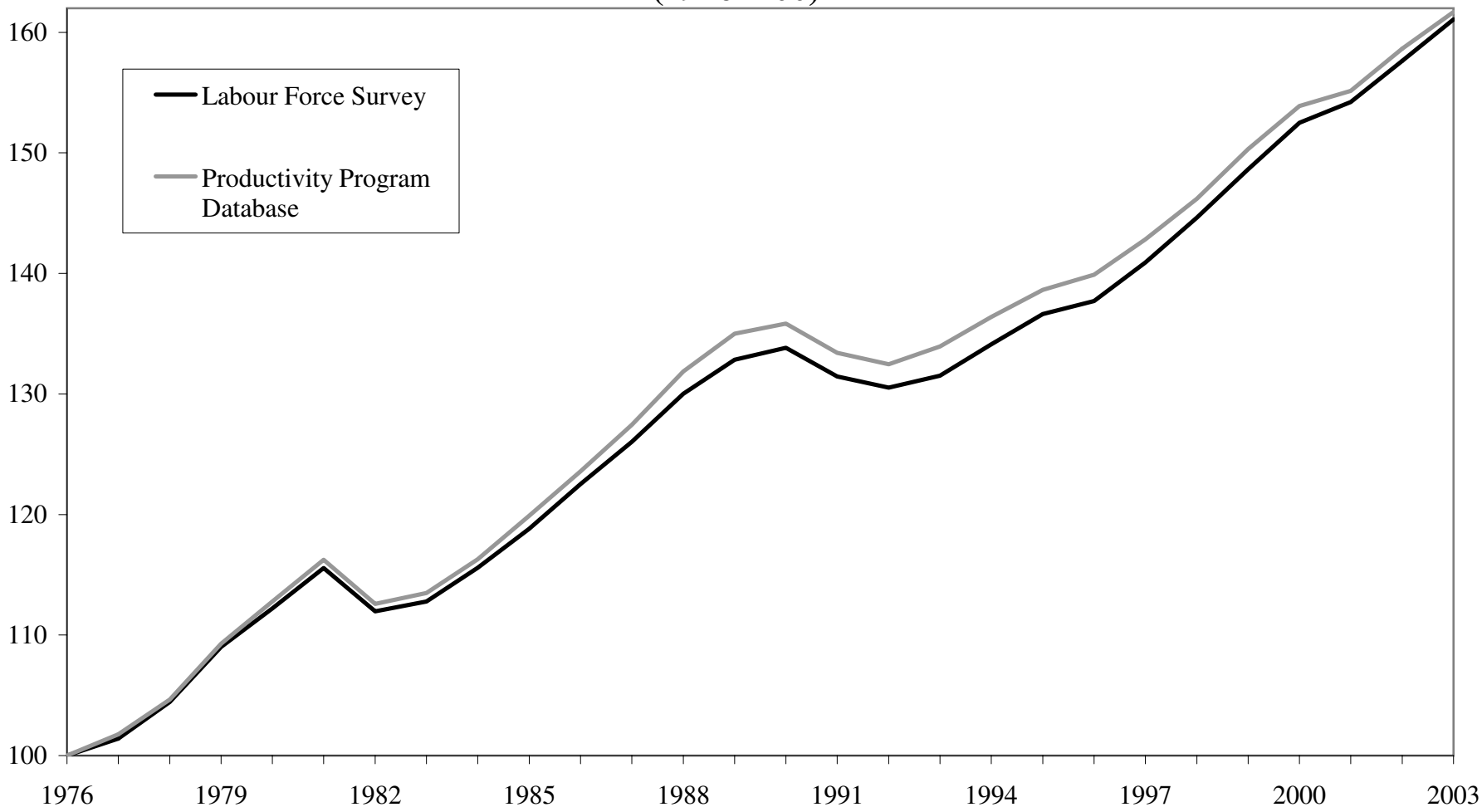
Table 12a: Non-Business Sector Output, Labour Input and Productivity Estimates, United States, 1961-2003

Non-Business Sector

	Real GDP at market prices (billions of 2000$, Laspeyres Approximation of a chained Fisher index)	Total Hours, BLS Productivity and Costs (unpublished, billions)	Real GDP at market prices (2000$, chained-weighted, Fisher index) / BLS hours
	(1)	(2)	(3)=(1)/(2)
(cont.)			
compound average annual growth rates			
1961-2003	2.37	1.95	0.41
1961-2000	2.43	1.98	0.44
1961-1973	3.26	2.53	0.72
1973-2003	2.01	1.72	0.29
1973-2000	2.07	1.74	0.32
1973-1981	2.17	1.42	0.74
1981-2003	1.96	1.82	0.13
1981-2000	2.02	1.88	0.14
1981-1989	2.51	2.32	0.18
1989-2003	1.64	1.54	0.10
1989-2000	1.67	1.56	0.11
1989-1995	1.56	1.54	0.02
1989-1996	1.43	1.33	0.11
1995-2003	1.71	1.54	0.17
1995-2000	1.80	1.58	0.21
1996-2003	1.85	1.75	0.10
1996-2000	2.07	1.97	0.10
2000-2003	1.56	1.46	0.10

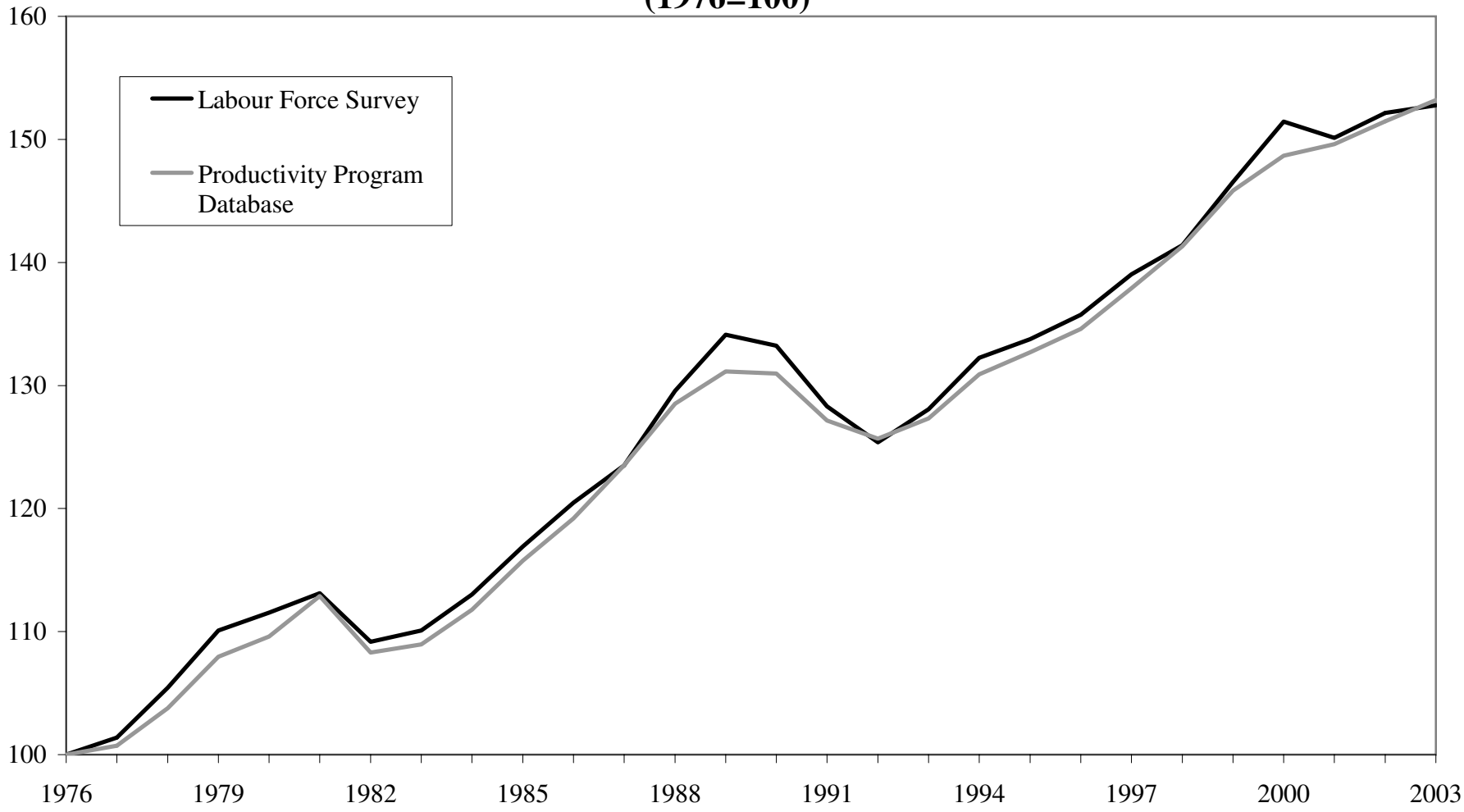
Sources (current as of September 16, 2004):
(1): Calculated by CSLS from data in NIPA Tables 1.3.5 and 1.3.6.
The Laspeyres approximation of the non-business sector GDP annual growth rate is calculated as the difference between the growth rate of total economy GDP and the growth rate of business sector GDP (weighted by the lagged share of nominal business sector GDP in nominal total economy GDP), divided by the lagged share of non-business sector nominal GDP in total economy nominal GDP, where non-business sector nominal GDP is calculated as the difference between total economy and business sector nominal GDP. These approximated annual growth rates are then applied to the base year (2000) level of nominal non-business sector GDP to calculate real non-business sector GDP. See the Canadian Department of Finance Working Paper number 2003-13 (Economic Analysis and Modelling Using Fisher Chain Data by Yanjun Liu, Nell Hamalainen and Bing-Sun Wong).
(2): Unpublished data in level form for the business sector subtracted from the total economy series in Table 10.

Chart 1 - Canada: Labour Force Survey Employment vs. Productivity Program Database Jobs, 1976-2003
(1976=100)



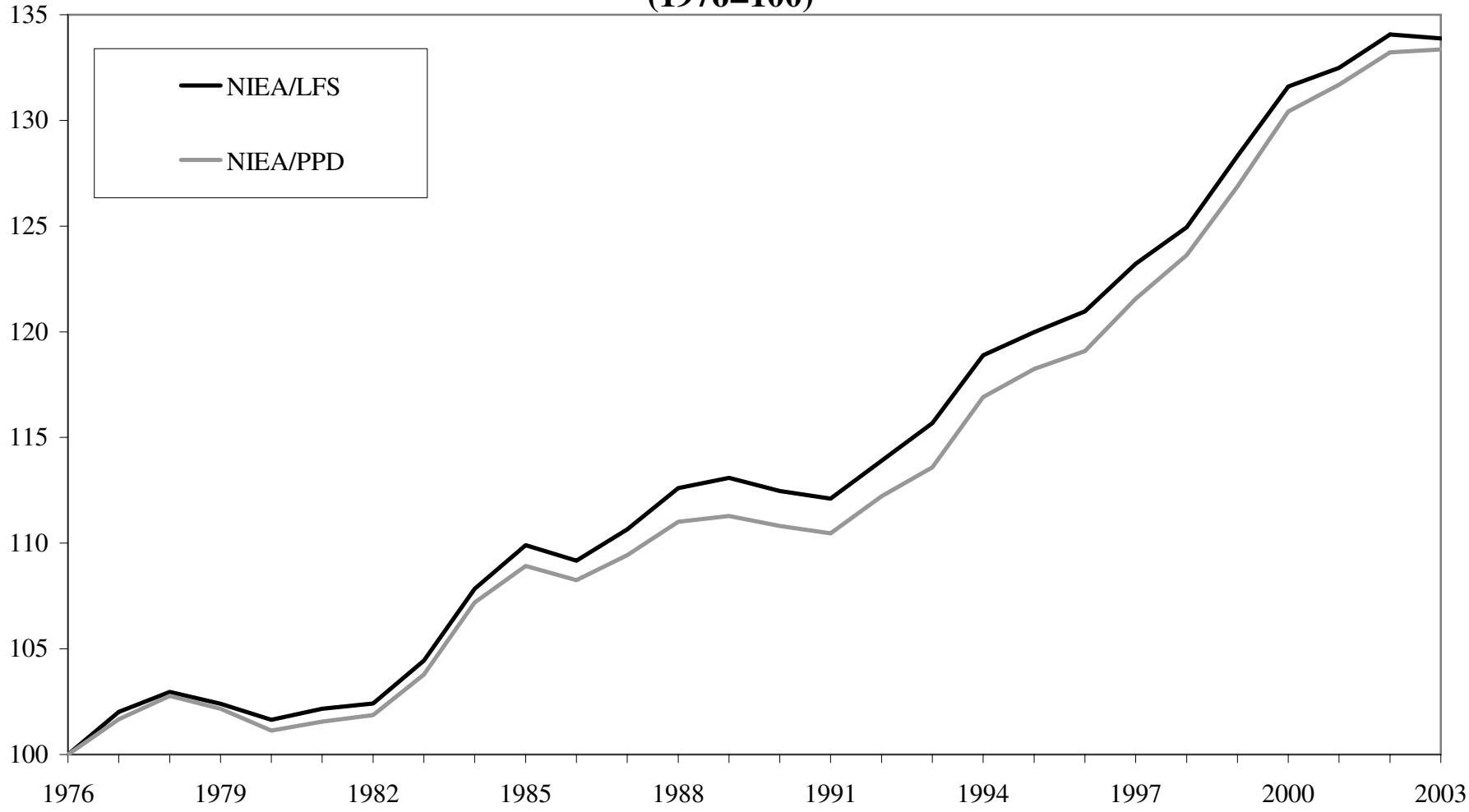
Source: Statistics Canada. Calculated from Table 2.

Chart 2 - Canada: Labour Force Survey vs. Productivity Program Database
Total Hours Worked in the Total Economy, 1976-2003
(1976=100)



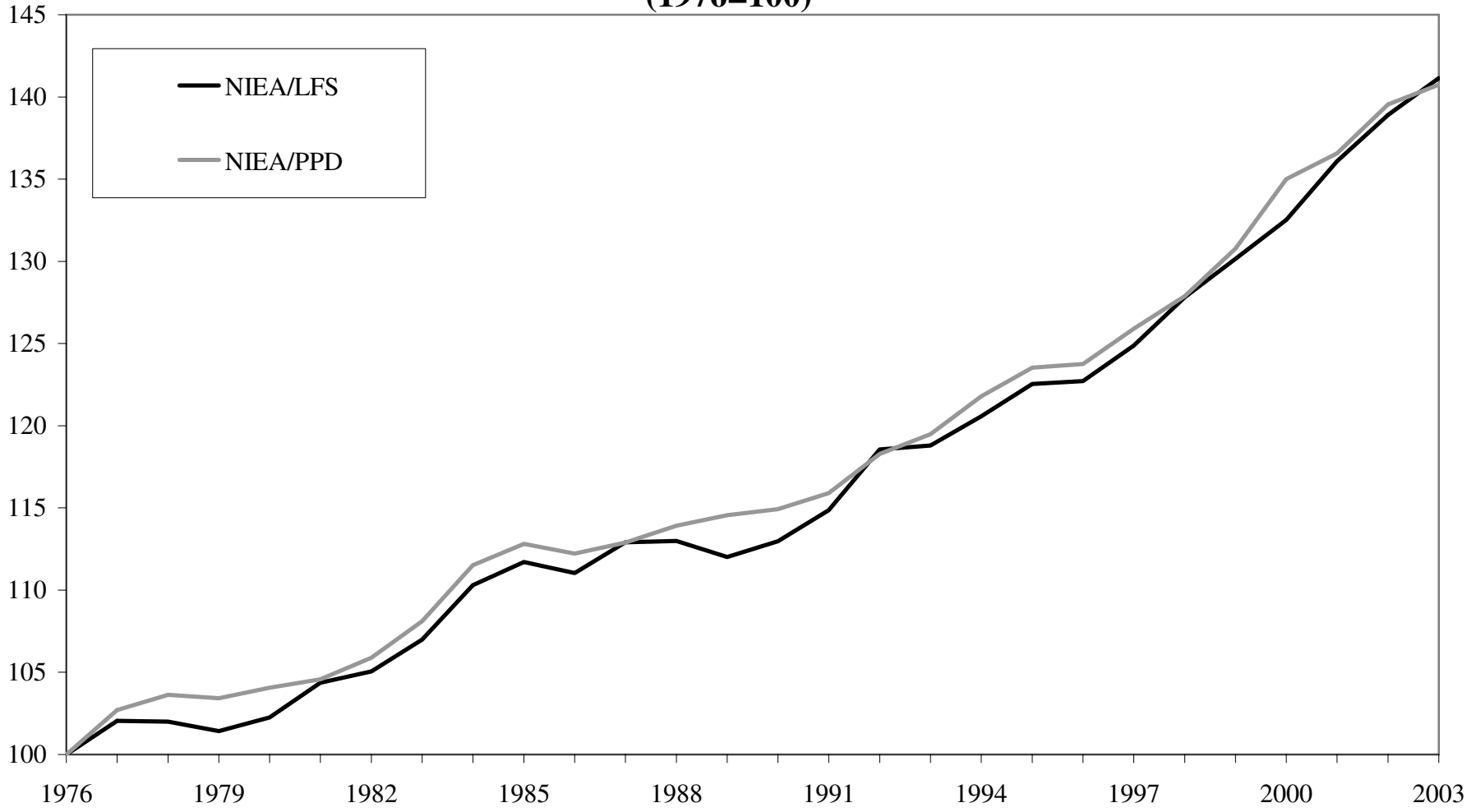
Source: Statistics Canada. Calculated from Table 4.

Chart 3 - Canada: NIEA/LFS vs. NIEA/PPD Output per Worker in the Total Economy, 1976-2003
(1976=100)



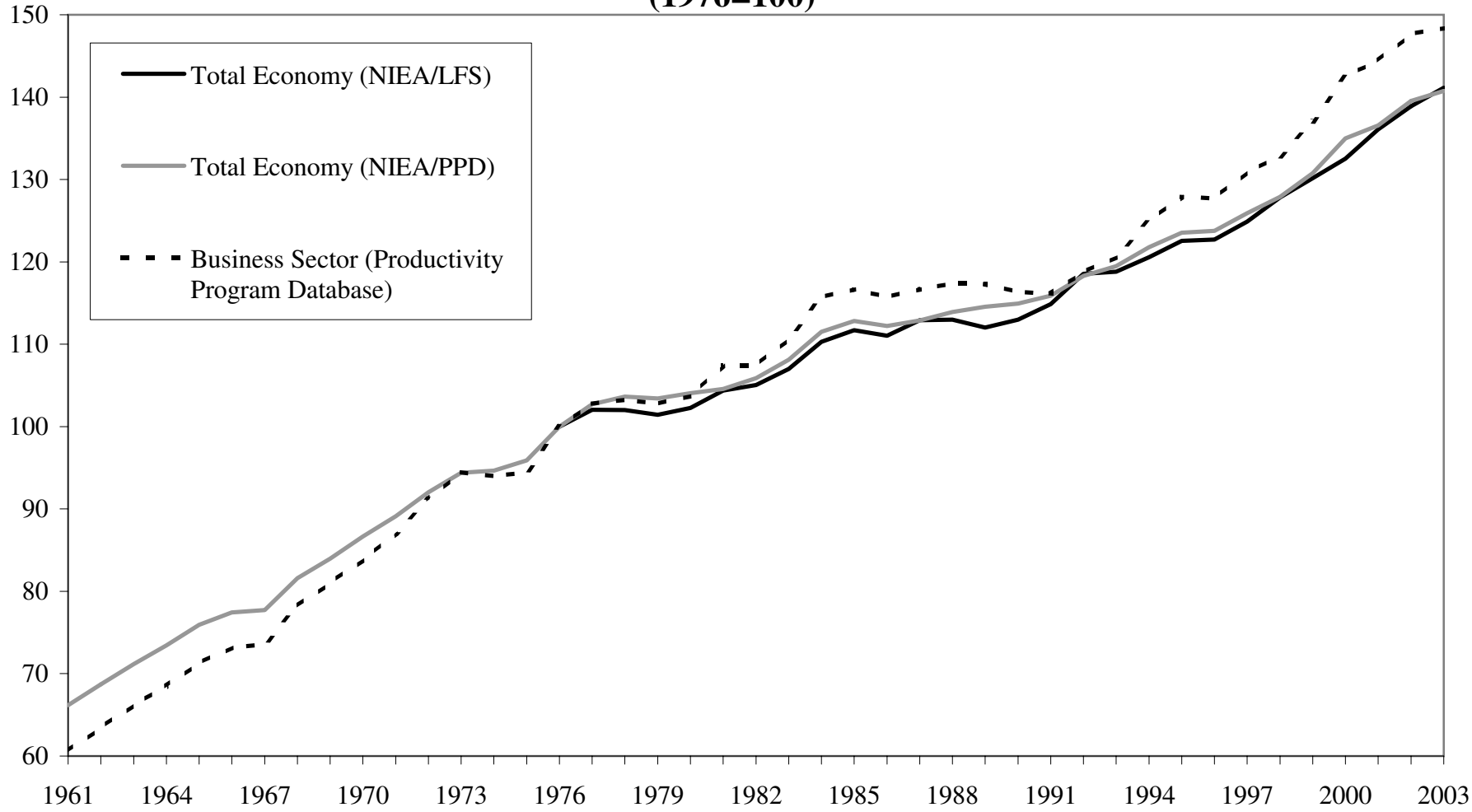
Source: Statistics Canada. Calculated from Table 5.

Chart 4 - Canada: NIEA/LFS vs. NIEA/PPD Output per Hour in the Total Economy, 1976-2003
(1976=100)



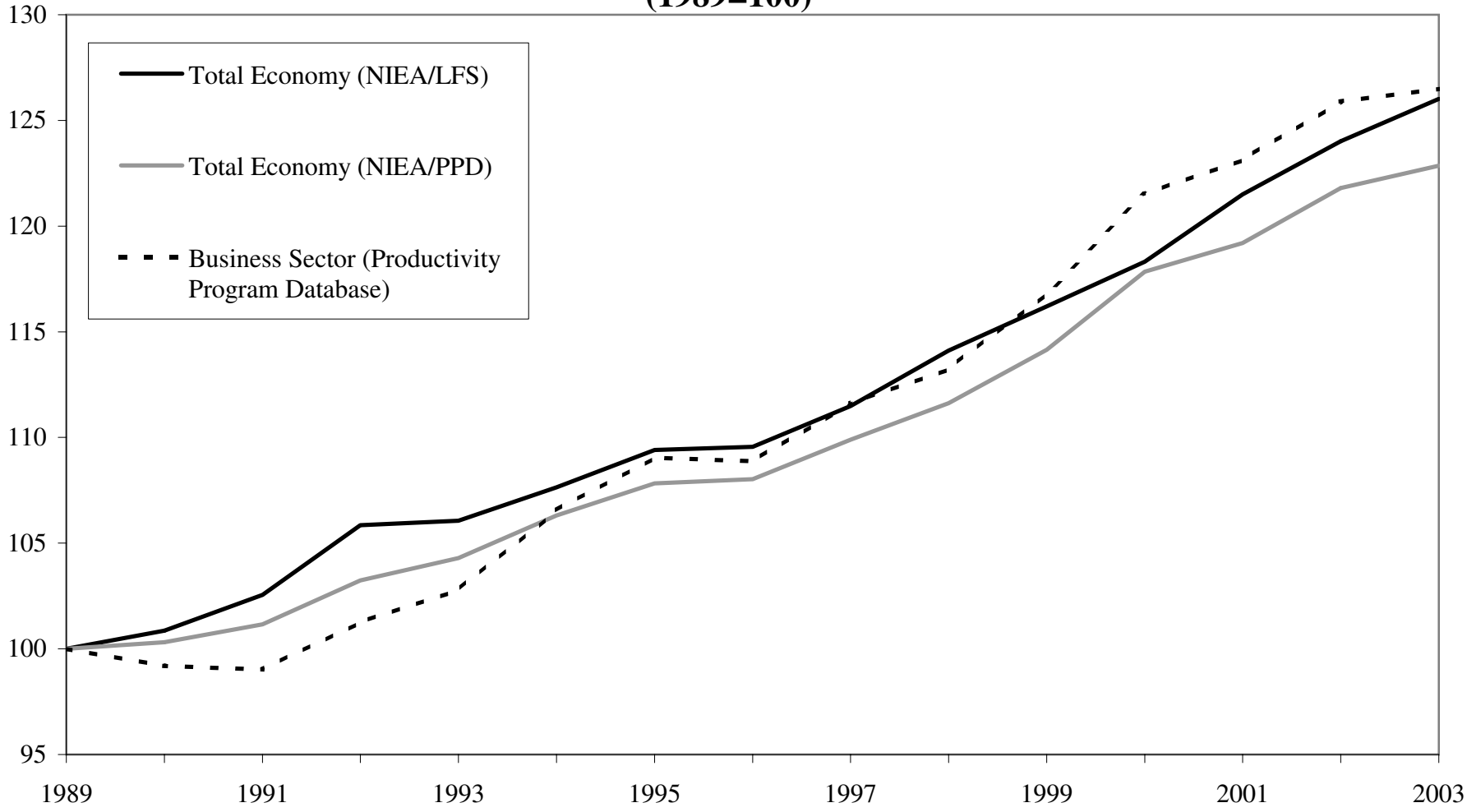
Source: Statistics Canada. Calculated from Table 6.

Chart 5 - Canada: Output per Hour in the Business Sector vs. the Total Economy, 1961-2003
(1976=100)



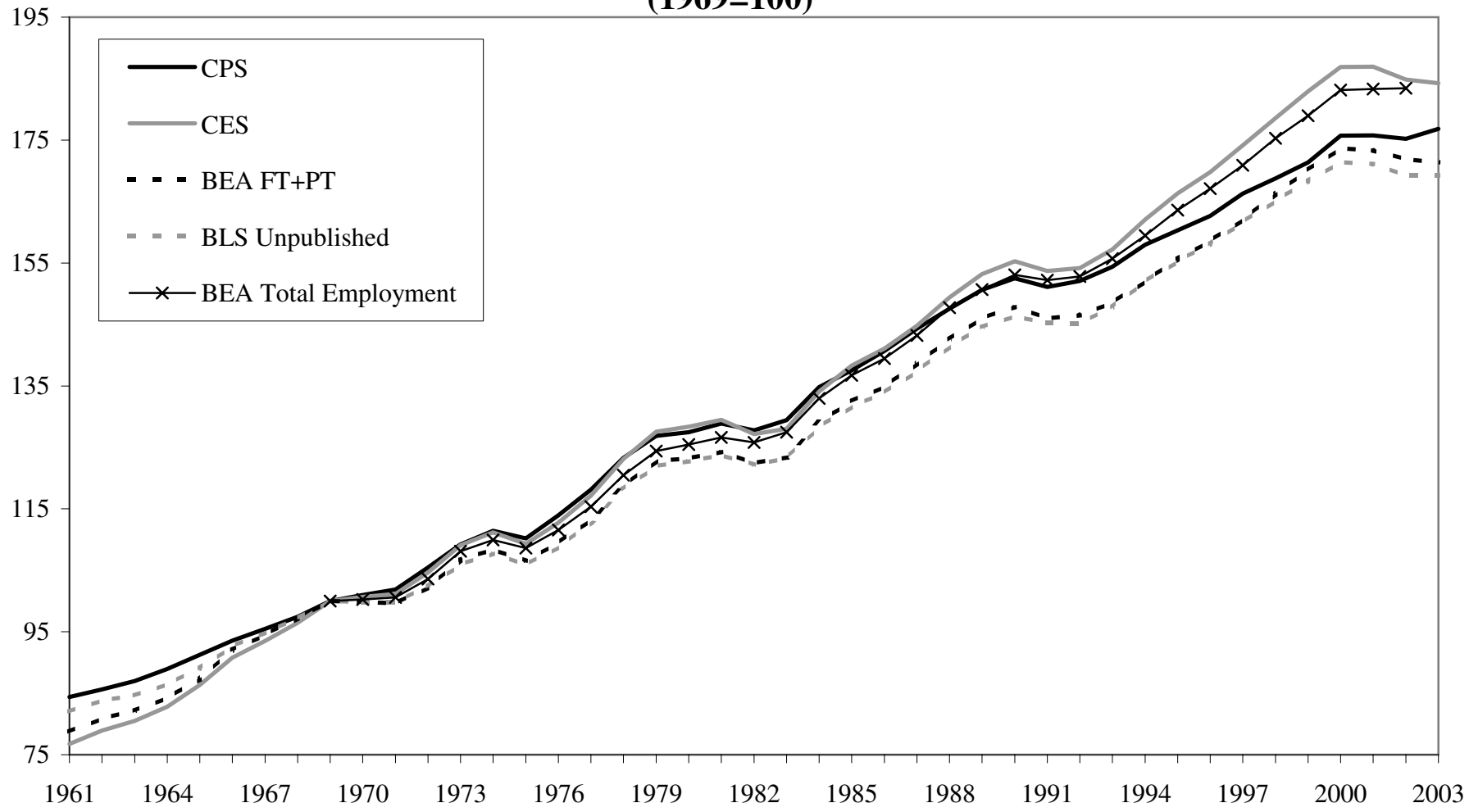
Source: Statistics Canada. Calculated from Table 6.

Chart 6 - Canada: Output per Hour in the Business Sector vs. the Total Economy, 1989-2003
(1989=100)



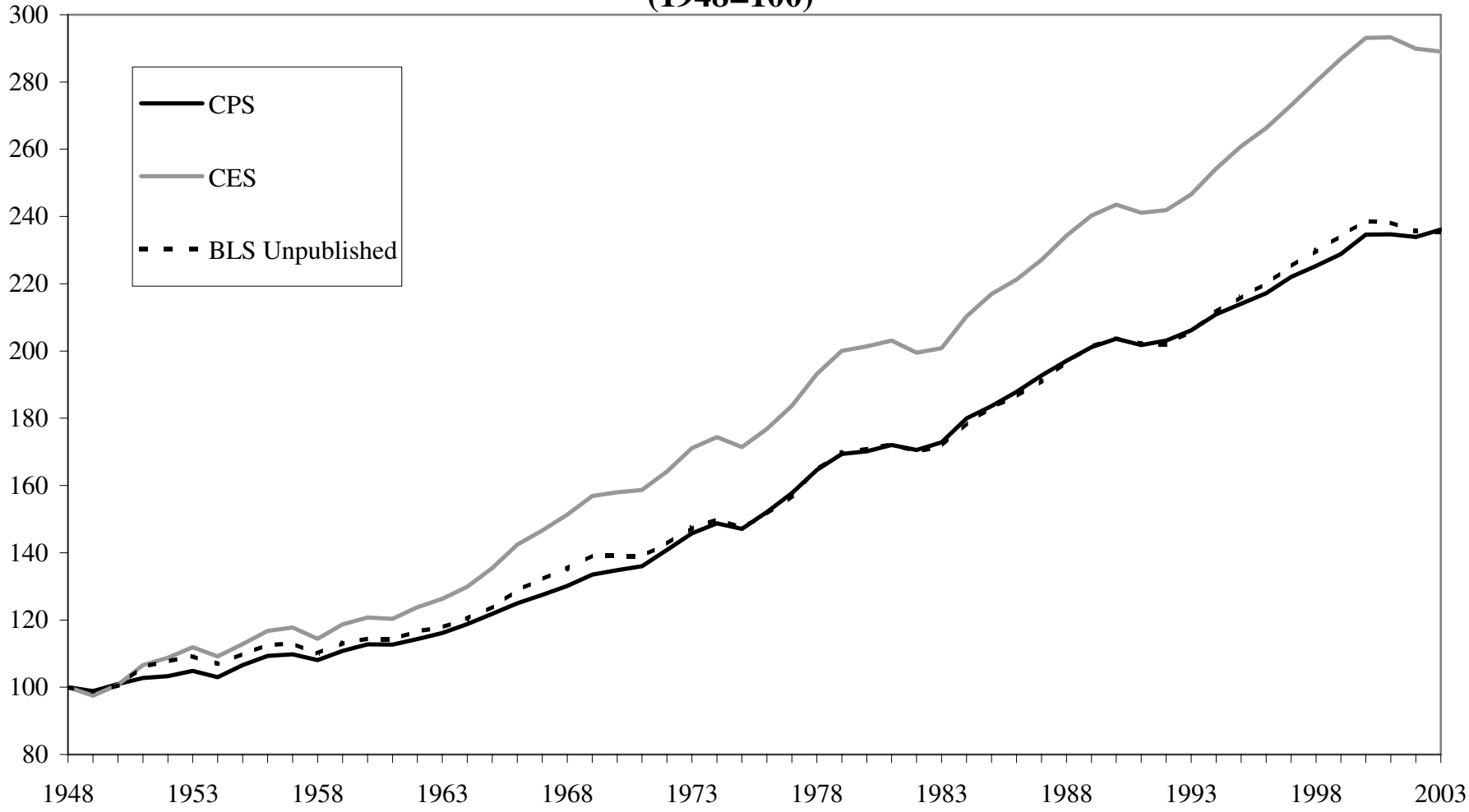
Source: Statistics Canada. Calculated from Table 6.

Chart 7 - United States: Household, Establishment and Adjusted/Derived Number of Workers in the Total Economy, 1961-2003 (1969=100)



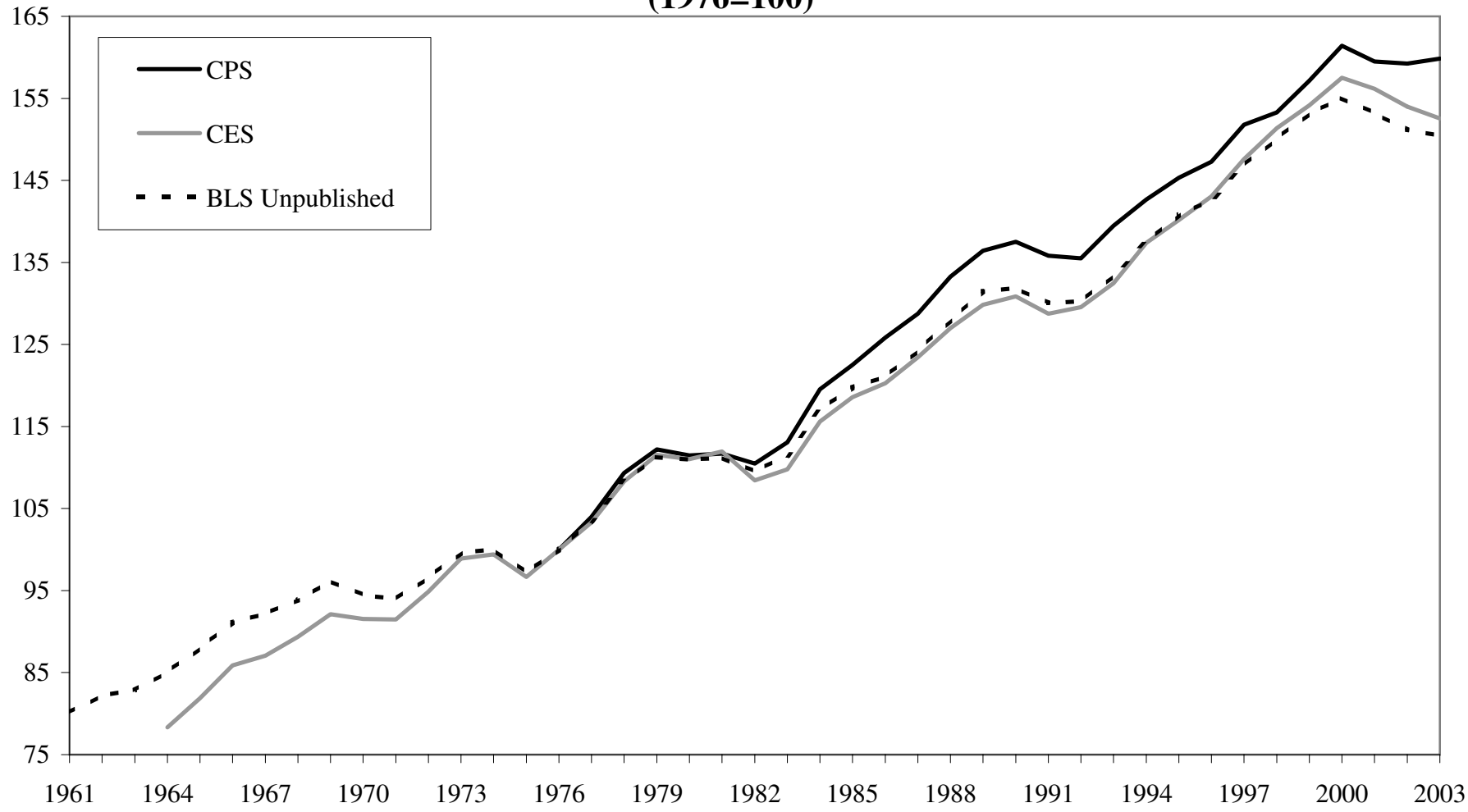
Source: Bureau of Labor Statistics, Bureau of Economic Analysis. Calculated from Table 8.

Chart 8 - United States: CPS vs. CES Employment in the Total Economy, 1948-2003
(1948=100)



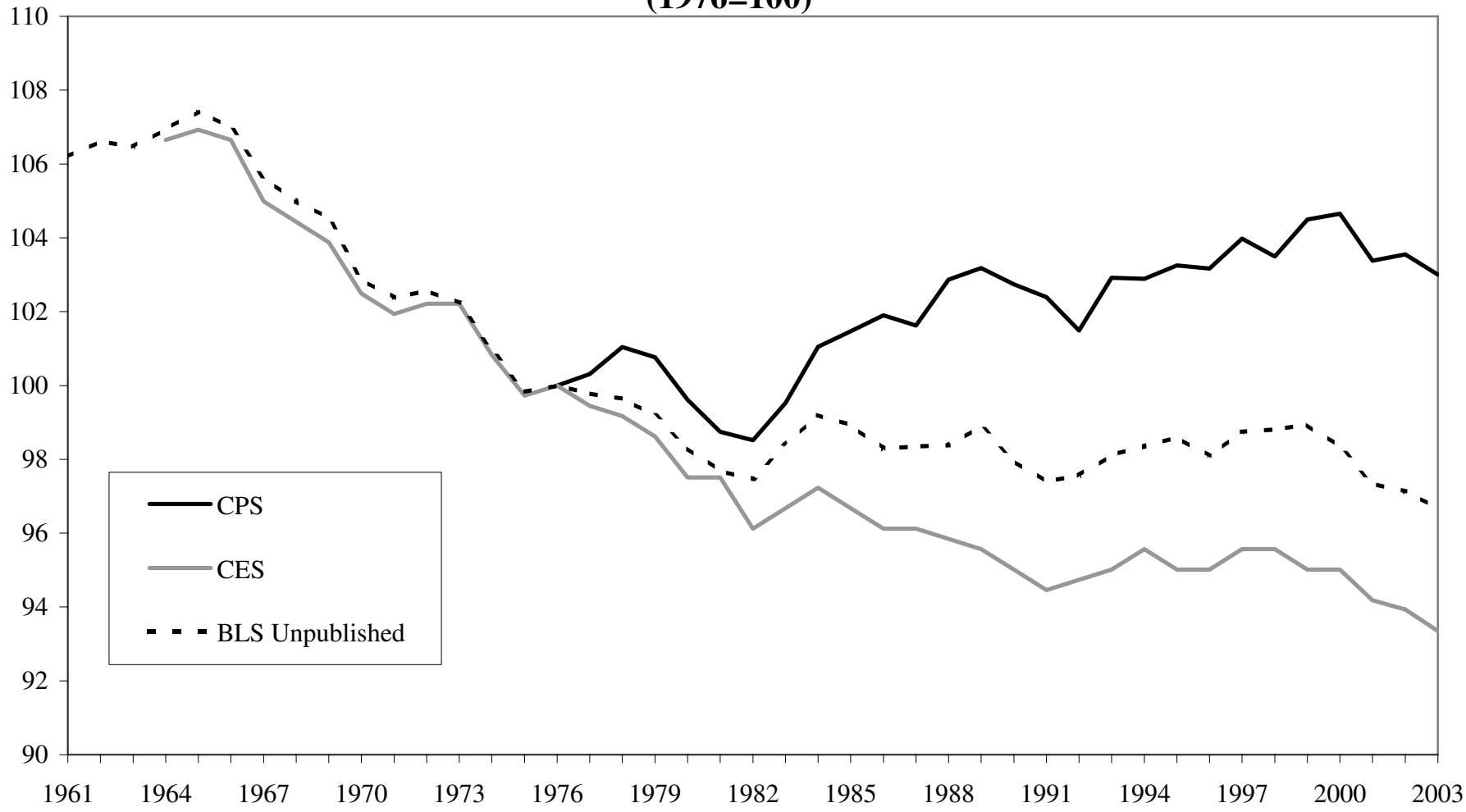
Source: Bureau of Labor Statistics. Calculated from Table 8.

Chart 9 - United States: Household, Establishment and Adjusted/Derived Total Hours Worked in the Total Economy, 1961-2003 (1976=100)



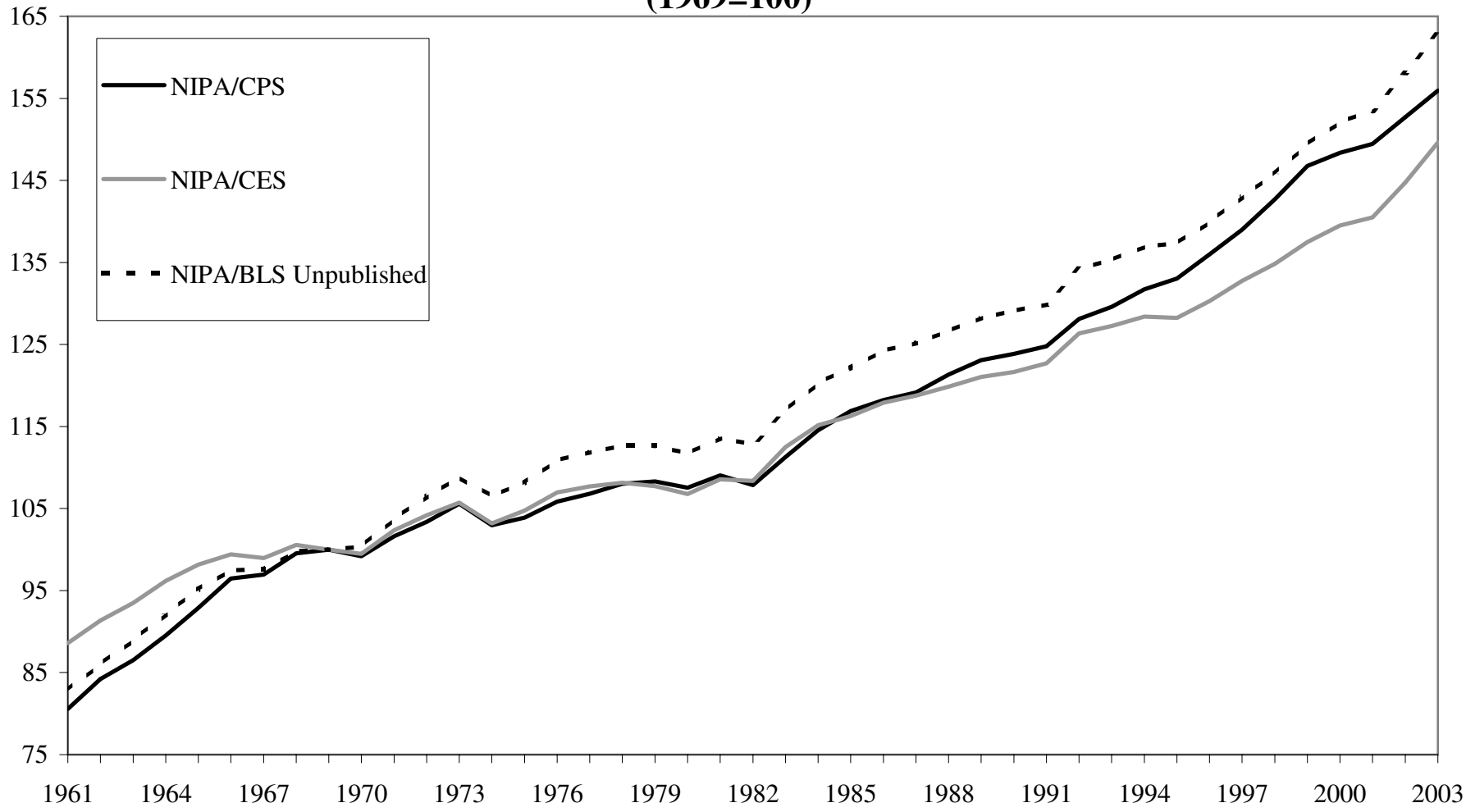
Source: Bureau of Labor Statistics and Bureau of Economic Analysis. Calculated from Table 10.

Chart 10 - United States: Household, Establishment and Adjusted/Derived Average Weekly Hours Worked in the Total Economy, 1961-2003 (1976=100)



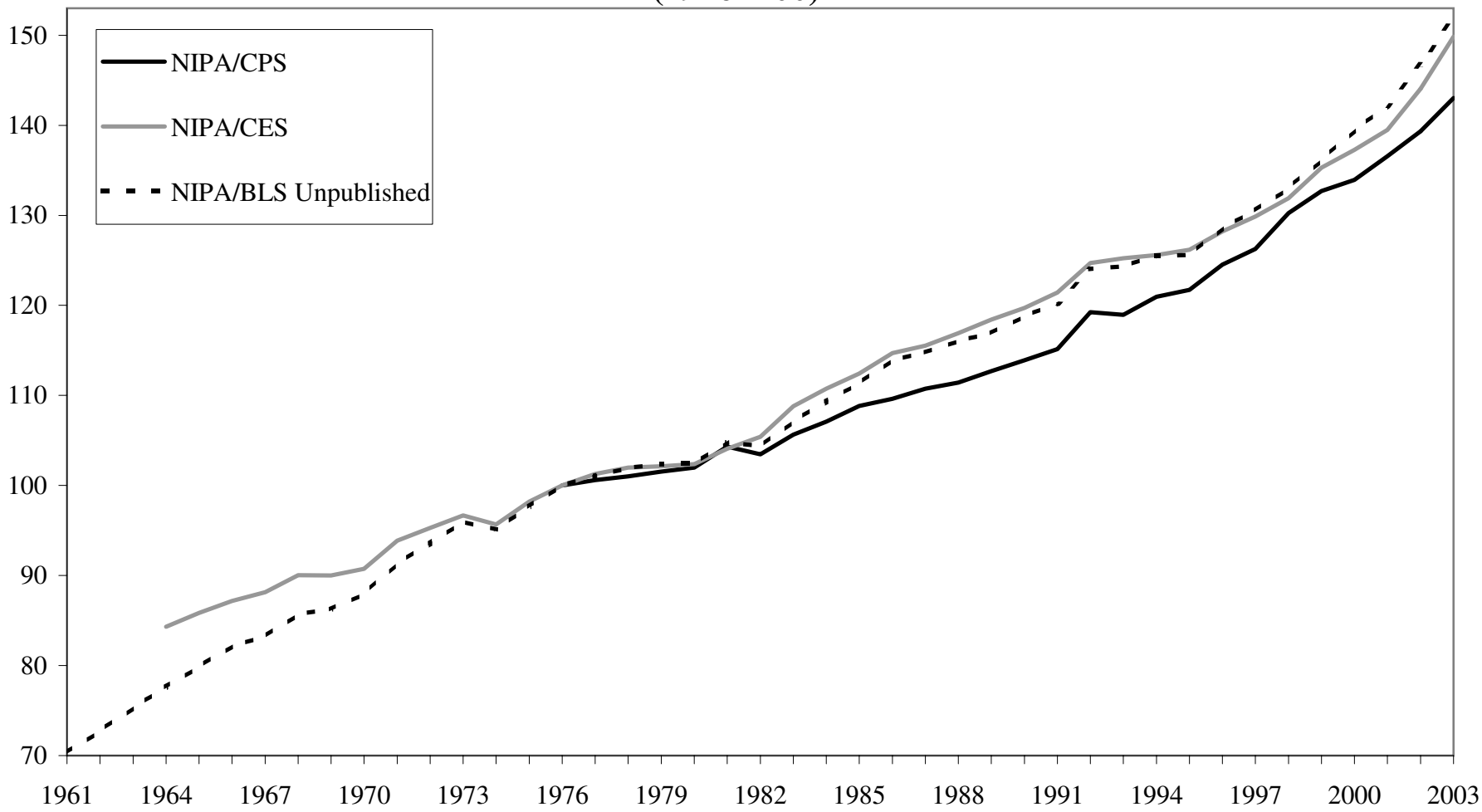
Source: Bureau of Labor Statistics and Bureau of Economic Analysis. Calculated from Table 9.

Chart 11 - United States: Household, Establishment and Adjusted/Derived Employment-Based Output per Worker in the Total Economy, 1961-2003 (1969=100)



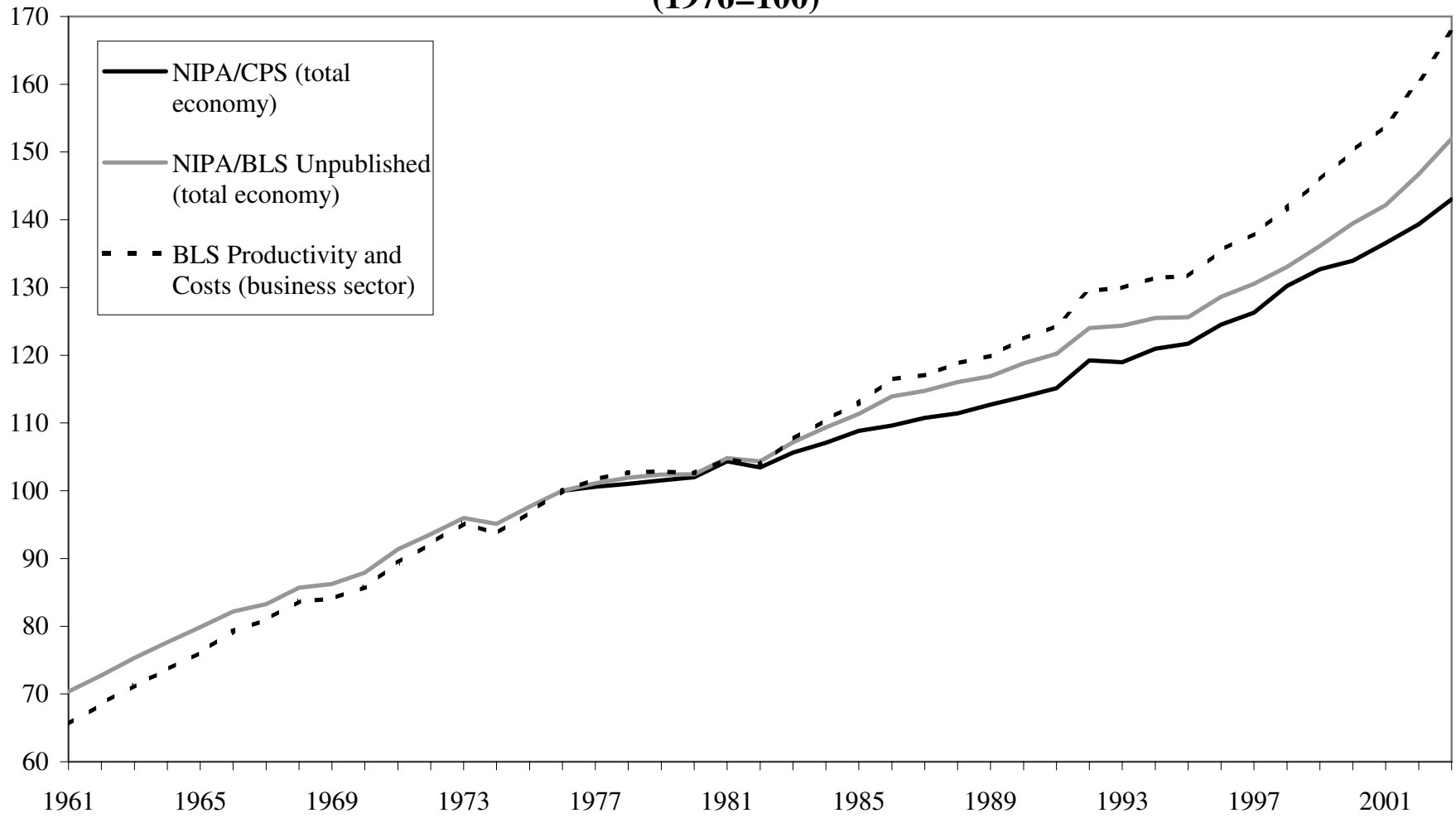
Source: Bureau of Labor Statistics, Bureau of Economic Analysis. Calculated from Table 11.

Chart 12 - United States: Household, Establishment and Adjusted/Derived Hours-Based Output per Hour in the Total Economy, 1961-2003 (1976=100)



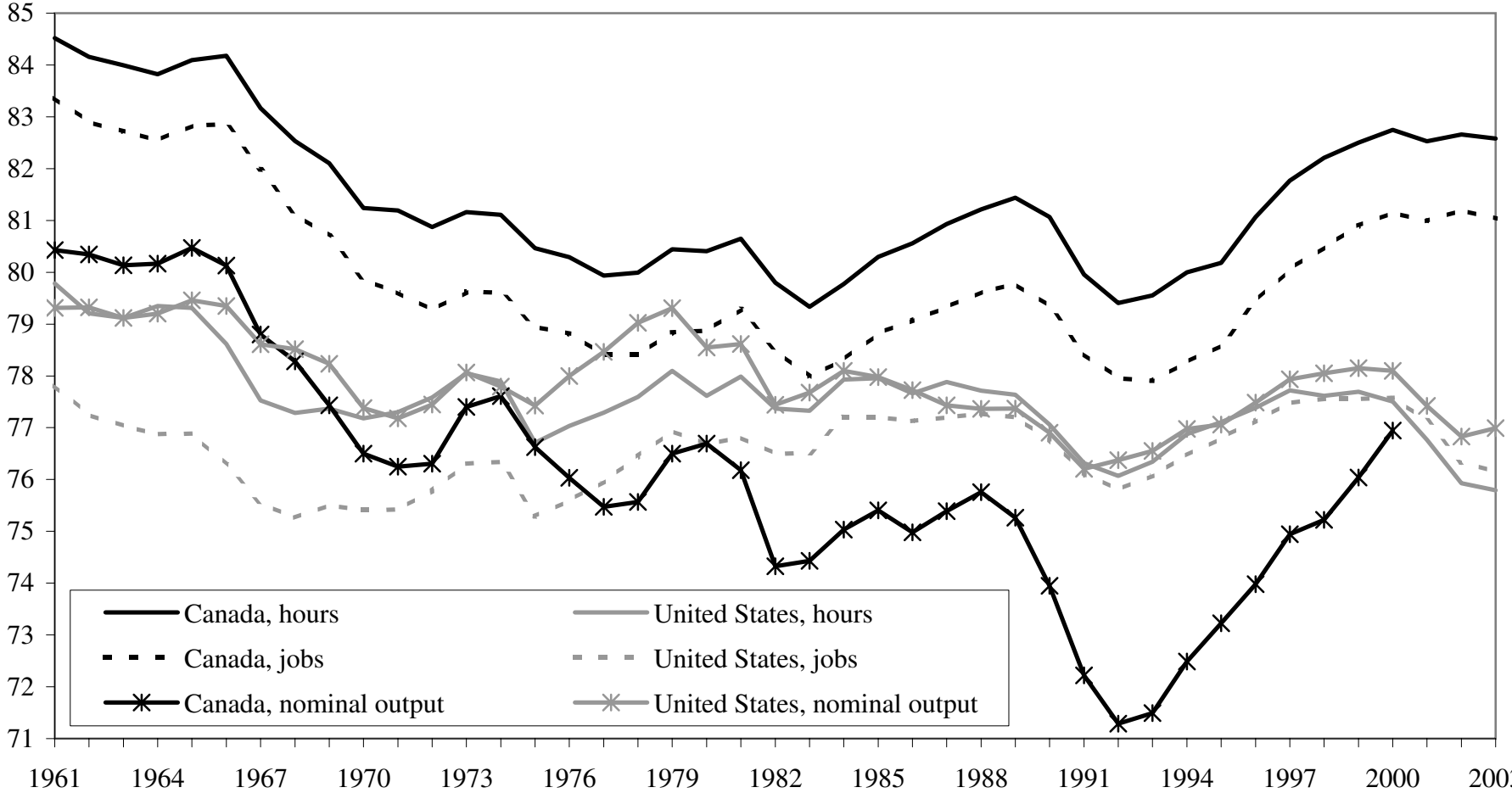
Source: Bureau of Labor Statistics, Bureau of Economic Analysis. Calculated from Table 12.

Chart 13 - United States: Output per Hour in the Total Economy vs. the Business Sector, 1961-2003
(1976=100)



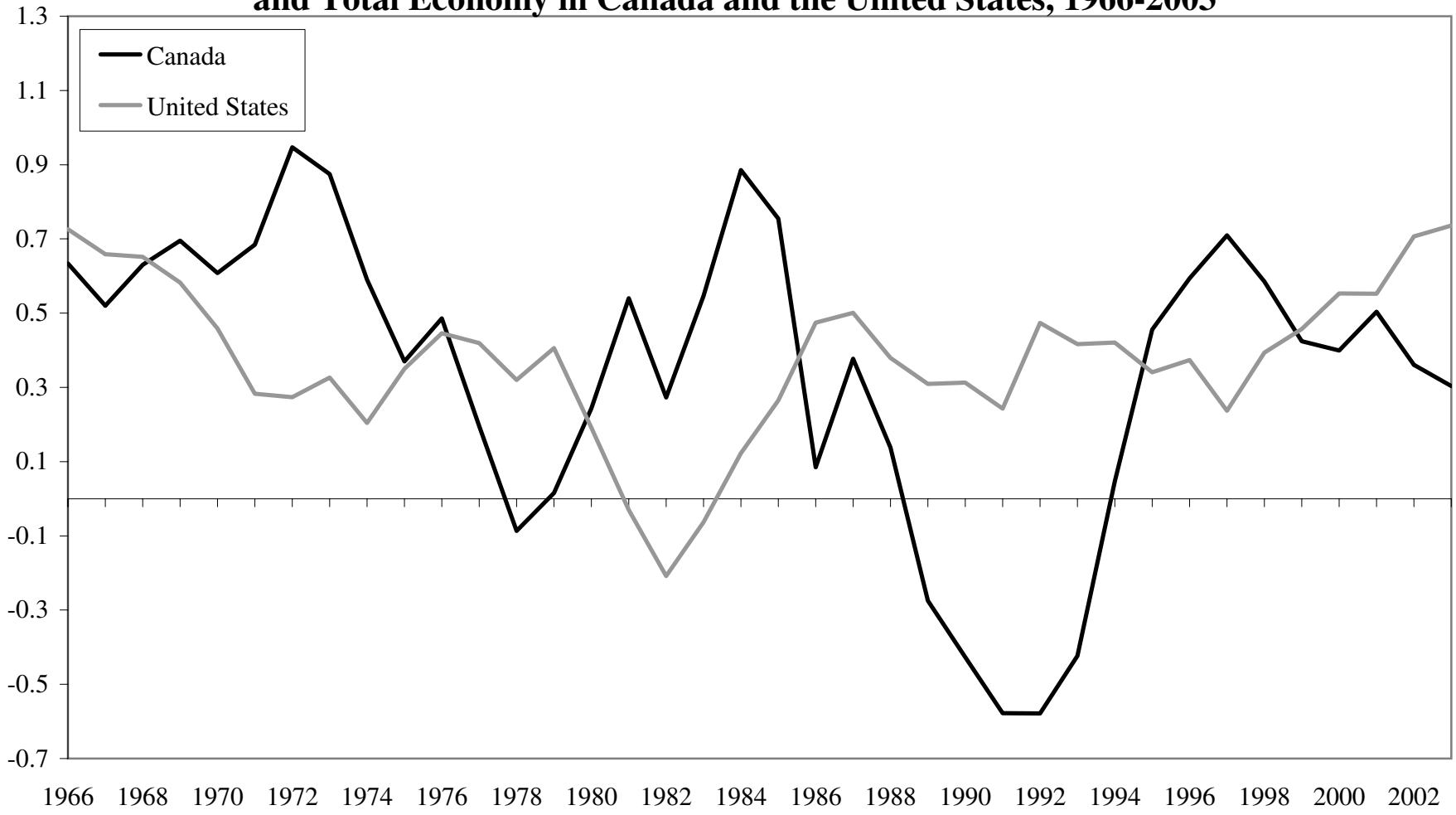
Source: Bureau of Labor Statistics, Bureau of Economic Analysis. Calculated from Table 12.

Chart 14 - Business Sector Share of Total Hours Worked, Number of Jobs and Nominal Output in the Total Economy in Canada and the United States, 1961-2003



Sources: Canada: Productivity Program Database, Tables 2 and 4; United States: Bureau of Labor Statistics Productivity and Costs unpublished data. Output shares from NIPA Table 1.3.5 for the United States, and from input-output benchmark estimates for Canada, CANSIM series v3860036, v3860037, and v3859751, September 14, 2004.

Chart 15 - Output per Hour Growth Differentials Between the Business Sector and Total Economy in Canada and the United States, 1966-2003



Source: Calculated from Tables 6 and 12.

Note: the plotted trend for each country is the compound average annual growth rate of output per hour in the business sector over the preceding five years minus the same for the total economy.