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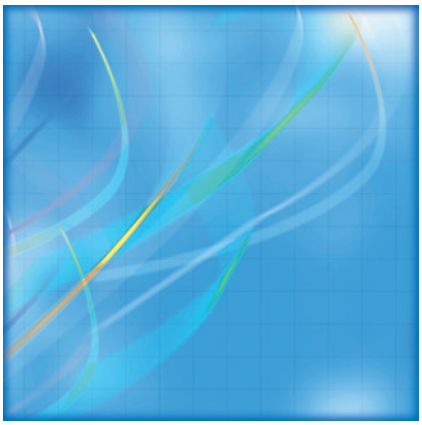
Insights on the Canadian Economy

The Output Gap Between Canada and the United States : The Role of Productivity (1994-2002)



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Introduction

Comparisons of Canada's economy to that of the United States are done for several purposes. On the one hand, analysts are interested in whether there is an output gap between the two countries—whether Canada is as well off as the United States in terms of the quantities of goods and services that are produced, taking into account the relative size of the two countries. On the other hand, analysts ask whether there is a productivity gap—whether Canada is equally efficient in transforming the resources used in the production process into goods and services.

Determining the answers to both these questions is complex because of the size and diversity of the two economies. The Canadian and U.S. economies produce a variety of goods and services and intercountry comparisons require the creation of a single (or a small) number of summary statistics that encapsulate differences between the two countries.

In this paper, we use two separate but related measures to investigate the size of the output and productivity gaps between the two countries over the period from 1994 to 2002 and ask how they are related. We do so in order not only to describe the differences between Canada and the United States but also to ask whether the two measures provide the same story. We show that they do not and explain why.

The framework

Analysis of the well-being of Canadians often involves a comparison of the quantity of goods that are available to the Canadian economy relative to its southern neighbour—the United States.[1] For this purpose, many analysts use measures of GDP as a summary statistic since it aggregates a wide range of goods and services into one value—using market prices as the aggregator. And to account for differences in the population in the two countries, GDP is divided by an estimate of population to yield GDP per capita.

In contrast, measuring the efficiency of an economy is often accomplished by using a summary statistic calculated as the size of GDP relative to the effort of labour that is used to produce the output. Labour input is most commonly measured as hours worked. The summary statistic that is then employed is GDP per hour worked, better known as labour productivity.

GDP per capita and GDP per hour worked are often used interchangeably. Some observers will use GDP per capita as an indicator of efficiency or productivity. Others will use output per hour as an indicator of our standard of living. While productivity growth rates are at the heart of changes in our standard of living, they are not the only factor at work. While the summary statistics that are used to inform discussion of these two issues are different, they are related. To understand why this is the case, note that

1. It may involve other comparisons as well—the distribution of income, the amount of specific goods such health care, etc. We restrict ourselves in this note to the measure of GDP only—a measure that brings together all of the goods and services produced by the economy.

(1) $GDP / Pop = (GDP / Hours) * (Hours / Emp) * (Emp / Pop)$

where GDP is gross domestic product
Pop is population
Hours is hours worked
Emp is jobs or employment.

This identity shows that GDP per capita is equal to the product of labour productivity (GDP/Hours), effort (the hours worked per job (or per employee)), and the per capita employment rate (the ratio of the number of employees (or jobs) to the total population). Or rewriting

(2) $GDPCAP = PROD * EFFORT * EMP$

The amount available for consumption per person in a country (GDPCAP) will be higher when productivity (PROD) is higher, when employees work longer hours (EFFORT), and when a larger proportion of the population is employed (EMP).[2] Holding productivity constant, increases in either the hours worked per worker (EFFORT) or the proportion of the population that are employed (EMP) will increase GDP per capita.

We have previously pointed out that while changes in the two measures are correlated, there can be substantial short-run deviations in one measure from the other (Wells, Baldwin and Maynard, 1999). In Wells, Baldwin and Maynard (1999), we show that productivity growth in Canada was very similar in the period 1979-1988 and the period 1988-1997, but that growth in GDP per capita varied substantially over the two periods. Despite the similarities in the growth of labour productivity in the two periods, growth in GDP per capita was much higher in the first period because there was positive growth in the variable EMP (the proportion of the population who were employed) in the former period, but a decline in the latter.

The relative levels of GDP per capita and labour productivity can also differ across countries for much the same reasons. To see this, note that the ratio of GDP per capita in Canada to GDP per capita in the United States can be divided into several components.

(3) $GDPCAP_{can} / GDPCAP_{us} = [PROD_{can} / PROD_{us}] * [EFFORT_{can} / EFFORT_{us}] * [EMP_{can} / EMP_{us}]$

Differences in GDP per capita then will exist if there are differences in productivity, in effort and in the employment rate. Only the first component captures differences in productivity. The latter two capture differences in aspects of the labour market. Differences in hours worked per employee arise because of differences in the demand for labour, differences in the inclination of the labour force to work longer hours or differences in regulations. For example, France has legislated a 35 hour work week that restricts the number of hours that can be worked per week. Differences in employment rates between two countries depend upon differences in the economic health of the two economies as well as demographic characteristics. In the latter case,

2. While we do not investigate the matter here, it should be noted that the three components may be related. Differences in labour market conditions may cause differences in productivity and vice-versa.

differences across countries in birth rates will have an impact on the relative proportion of total populations in working age groups.

The empirical evidence

In this section, we examine differences in the level of GDP per capita between Canada and the United States and differences in labour productivity in the late 1990s. We also estimate the percentage of the difference in GDP per capita between Canada and the United States that arises from differences in productivity.

For this exercise, we will examine the total economy of both countries.[3] We therefore combine both the business and the government and non-profit sectors to obtain measures of GDP.

Hours worked and numbers of jobs are obtained from an accompanying study that examines the relative level of productivity in the two countries (Baldwin, Maynard, Tanguay, Wong, and Yan, 2005).[4] The productivity programs of Statistics Canada and the Bureau of Labor Statistics make use of different methodologies when they calculate hours worked. For cross-country comparisons of productivity *growth*, these differences are not very important. But for comparisons of levels, these differences matter considerably. Therefore, for the purpose of comparing levels, we have reestimated the U.S. data on hours using the Canadian methodology.[5]

For our comparison, we divide our effort variable into hours worked per job and the number of jobs per potential member of the labour force. The potential labour force is defined as those who are 15 and over. While it might be argued that the elderly should be excluded from this definition, it is difficult to choose a particular age (i.e., 65) where we arbitrarily designate individuals as unemployable. Choosing a lower bound (15+) is facilitated by mandated education requirements.

Estimates of GDP for the total economy are taken from official estimates (Statistics Canada's System of National Accounts (SNA) and the NIPA tables of the United States Bureau of Economic Analysis). As the accompanying paper notes, both countries generally adhere to the international standards embodied in the SNA (93) manual (Baldwin, Maynard, Tanguay, Wong, and Yan, 2005). While there are some minor differences, they are not regarded as a major problem for Canada/U.S. comparisons at the level of the total economy.[6]

3. This means that the productivity estimates in this study also refer to the total economy. Statistics Canada normally only produces productivity growth estimates for the business sector because the estimation procedure followed by the National Accounts for the non-business sector (the non-market sector) essentially assumes that productivity in that sector is zero. Cross country comparisons of labour productivity therefore will be affected by the size of the non-market sector. If all countries follow the same assumption of zero productivity in the non-market sector, those countries with larger non-market sectors will have lower labour productivity because of statistical assumptions not because they are any less productive.
4. An alternate measure of labour input is number employed. The results with this numeraire rather than jobs are presented in Appendix Table A1.
5. See Appendix C and Baldwin et al., 2005.
6. There are differences in specific industries that need to be considered when detailed comparisons are made at the industry level.

Table 1. Canada/United States relatives (%)

Year	Gross domestic product per capita	Labour productivity	Hours worked per job	Jobs to population 15+	Population 15+ to population	Hours worked per capita
1994	82.2	93.1	95.3	90.9	101.9	88.3
1995	82.7	94.0	95.4	90.4	102.0	88.0
1996	81.9	93.9	95.3	89.6	102.1	87.2
1997	81.5	93.7	94.9	89.6	102.3	86.9
1998	82.4	94.4	94.7	90.0	102.4	87.3
1999	82.8	93.6	94.6	91.0	102.7	88.4
2000	84.8	95.8	93.9	91.6	102.9	88.5
2001	85.6	95.6	93.9	92.4	103.1	89.5
2002	86.2	93.8	93.5	95.3	103.2	91.9
Mean	83.3	94.2	94.6	91.2	102.5	88.5

For comparisons of GDP in Canada and the United States, a deflator must be chosen to allow us to compare estimates of GDP that are produced in different currencies. For the purpose of this paper, we use the purchasing power parity indices that are produced by Statistics Canada to compare expenditures across countries (Statistics Canada, 2002). In our accompanying study (Baldwin, Maynard, Tanguay, Wong, and Yan, 2005), we examine the appropriateness of these data for cross-country comparisons and conclude that this measure is somewhat imperfect and suggest several variants that tend to increase the value of Canada's labour productivity relative to that of the United States. For simplicity, we make use of the traditional estimate here.

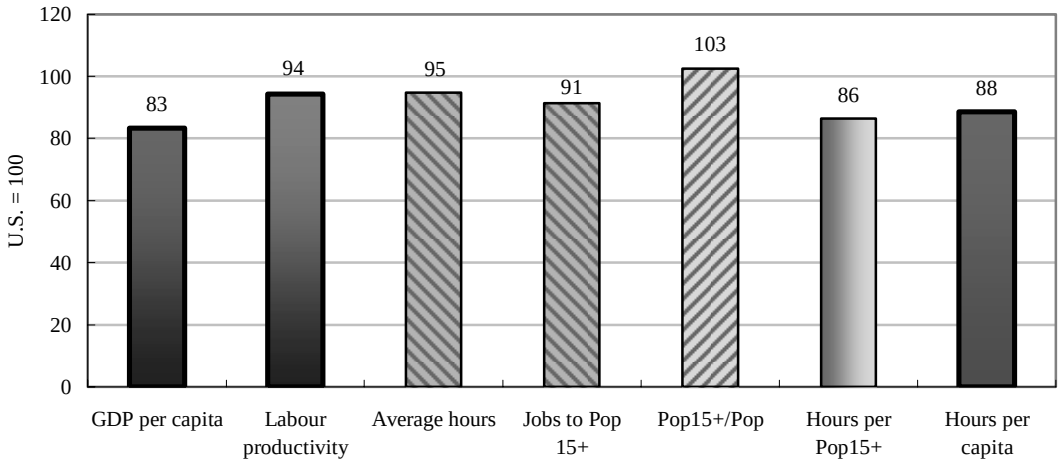
The Canada/U.S. ratios needed for equation 3 are estimated for the period 1994-2002 and presented in Table 1.[7] These include gross domestic product per capita, labour productivity, effort and employment rates for Canada relative to the United States. We divide the effort variable into two components—the number of hours per job, the number of jobs per member of the potential labour force (Population age 15 and above).

Over the period, gross domestic product per capita in Canada averaged only 83.3% of gross domestic product per capita in the United States (Figure 1). The output gap between the two countries was 17.7% of U.S. GDP per capita. But the gap between Canada and the U.S. in terms of labour productivity was much less—at only 5.8% of the U.S productivity level.

The difference in labour productivity accounted for only about 33% of the total percentage point difference in the GDP per capita of the two countries.[8] If hours worked per capita were the same in the two countries and relative productivity remained the same, two thirds of the difference in GDP per capita would disappear.

7. The underlying data for Table 1 are presented in Appendix C, along with a description of sources.
8. And as the accompanying paper (Baldwin et al., 2005) indicates, the actual difference in productivity levels is probably less than the estimate used here.

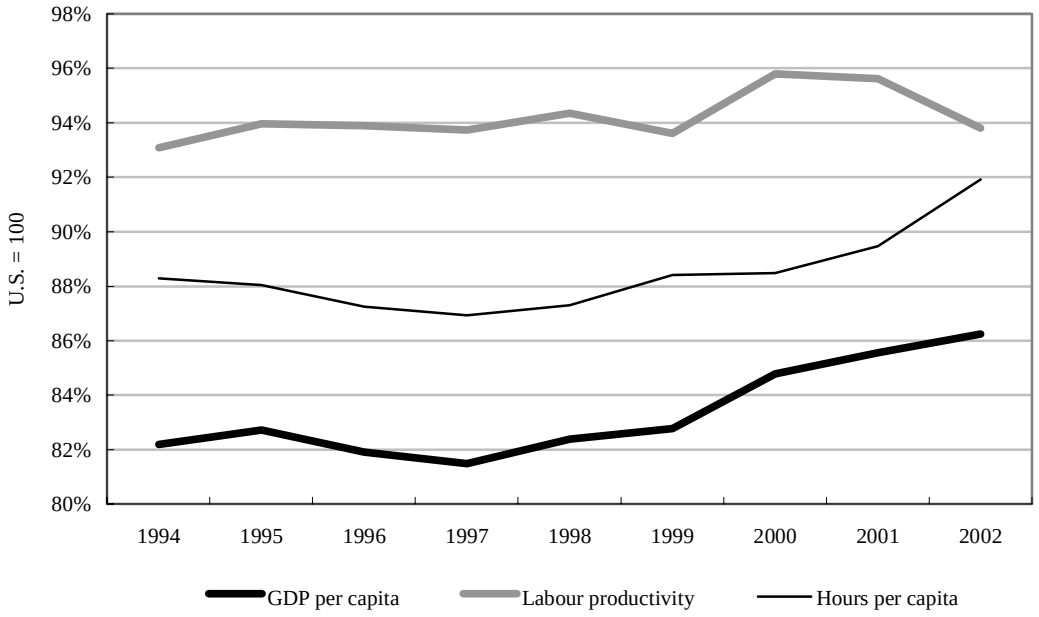
Figure 1. Decomposition of GDP per capita (average ratio Canada/U.S. —1994-2002)



Most of the Canada/U.S. difference in GDP per capita comes from differences in the labour input (hours worked per capita in the two countries). Hours worked per capita in Canada were only 88.5% of the hours worked per capita in the United States. This variable can be decomposed into three components—the differences in hours worked per job, the difference in jobs per potential member of the labour force (Population age 15 and above) and the ratio of the potential labour force (Population age 15 and above) to total population.

Substantial differences between Canada and the United States exist in each of the former two areas. Hours worked per job in Canada are only 95% of those in the United States. Jobs per potential member of the labour force are 91% of the United States. Thus the primary reason that Canada has a lower GDP per capita than the United States is that those who work put in fewer hours per job and because Canadians are less likely to work at a job. It is not primarily because Canada is less productive.

Figure 2. Most of the growth in relative Canadian GDP per capita from 1994 to 2002 originates from the growth in relative hours worked per capita



The course of relative Canada/U.S. GDP per capita, labour productivity and hours worked per capita over the period 1994-2002 is plotted in Figure 2. GDP per capita increased over the period from 82% to 86%. But relative Canadian labour productivity was about the same at the beginning and end of the period, starting at 93% and ending at close to 94% that of the United States. The increase in Canadian GDP per capita relative to the United States owed itself to increases in hours worked per capita in Canada relative to hours worked per capita in the United States. The Canada/U.S. ratio of the number of hours worked per capita increased from 87% in 1997 to 92% in 2002. This was due mainly to an increase in the extent to which the Canadian economy was providing jobs. The Canada/U.S. ratio of the number of jobs worked by the population age 15 and above increased from 91% to 95% over the same period.

In summary, the primary reason for differences in the late 1990s between Canada and the United States in productive capacity, as measured by GDP per capita, was not a difference in labour productivity; rather it was the difference in hours worked per capita. And the progress that has been made since the mid 1990s in closing the Canada/U.S. GDP per capita gap came not from improvements in productivity. Rather progress in closing the Canada/U.S. gap in GDP per capita came from improvements in the hours worked per capita in Canada relative to the United States. And the latter came because of a relatively faster Canadian increase in the number of jobs and employment.

Appendix A: Alternate decompositions

The main body of the paper uses jobs to calculate employment rates because it is this concept that has been defined in the System of National Accounts as the appropriate labour concept to be employed in conjunction with National Income concepts. For the purposes of international comparability, we adopt this standard.

An alternate measure that is sometimes employed is the number of individuals who hold jobs—or people employed. We calculate this measure from our reconciled United States/Canada data bases. Employment is calculated as the number of jobs as produced by the Productivity Program of the Bureau of Labor Statistics less the multiple job holders estimated from the Current Population Survey (CPS) for the United States. For Canada, it is calculated as the number of persons employed from the Labour Force Survey (LFS) to which we have added the employment in Military, Indian Reserves and in the Territories to produce full coverage for Canada. The results are reported in Table A1.

Table A1. Alternate decomposition using employment Canada/United States relatives (%)

Year	Gross domestic product per capita	Labour productivity	Hours worked per employee	Employment to Population 15+	Population over 15 to population	Hours worked per capita
1994	82.2	93.1	94.3	91.9	101.9	88.3
1995	82.7	94.0	94.1	91.7	102.0	88.0
1996	81.9	93.9	94.3	90.6	102.1	87.2
1997	81.5	93.7	93.9	90.5	102.3	86.9
1998	82.4	94.4	93.9	90.8	102.4	87.3
1999	82.8	93.6	94.0	91.6	102.7	88.4
2000	84.8	95.8	93.4	92.1	102.9	88.5
2001	85.6	95.6	93.5	92.9	103.1	89.5
2002	86.2	93.6	93.3	95.4	103.2	91.9
Mean	83.3	94.2	93.9	91.9	102.5	88.5

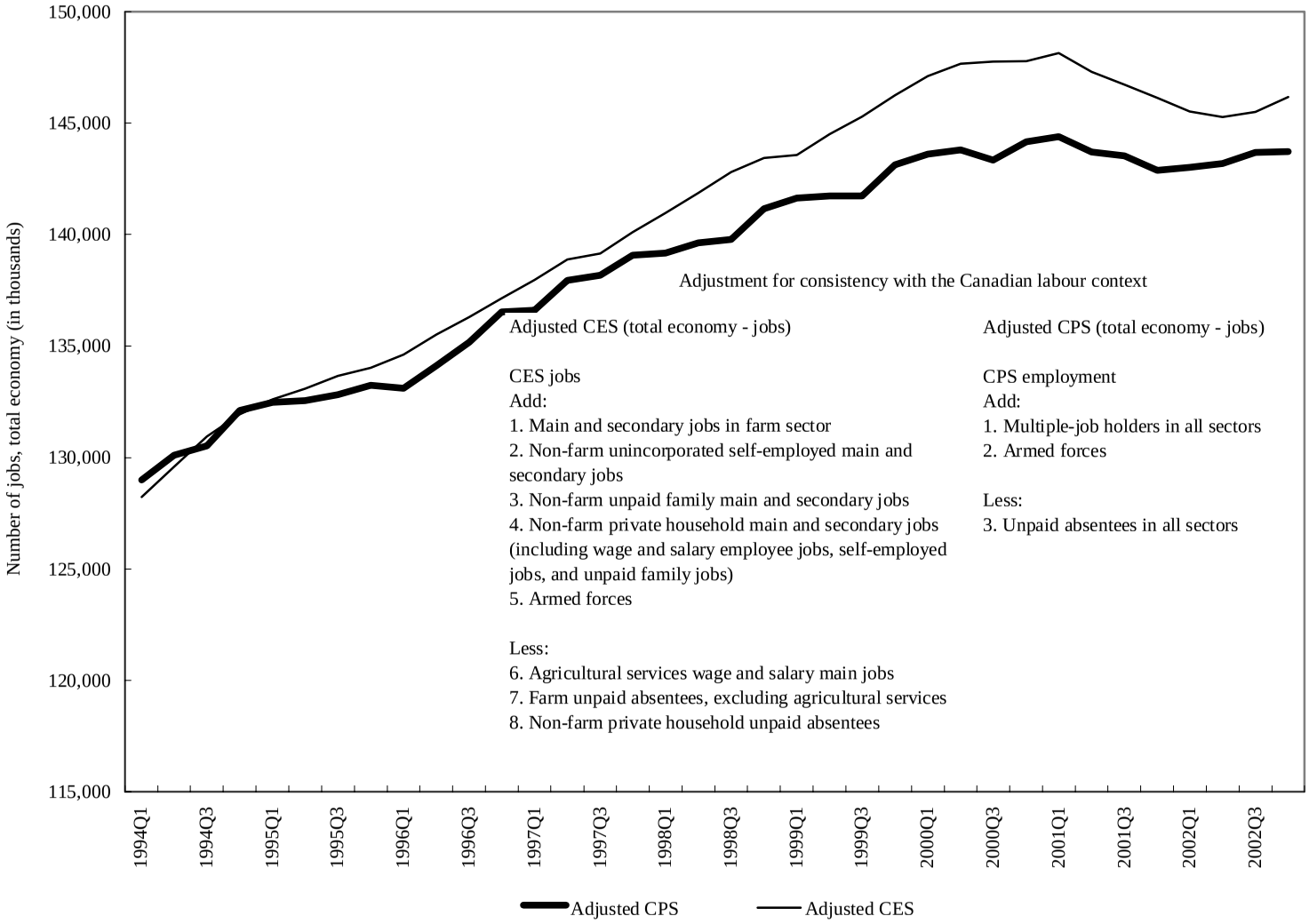
Appendix B: The relative Canadian/U.S. employment rate

The data used in this study indicate that Canadian employment rates (defined as jobs per population 15+) are lower than those of the United States. Others have not found the same disadvantage—because they used sources that were neither comprehensive nor comparable.

We derive the results reported here because we calculate jobs using the Labour Force Survey (LFS) for Canada, and we use essentially the Current Employment Statistics (CES) data that are produced by the United States. Other studies sometimes make use of jobs estimates from the United States Current Population Survey (CPS).

An accompanying paper (Baldwin et al., 2005) provides more detail on the differences between the United States CES and the CPS. We believe that for deriving comparable jobs estimates, it is best to use the Canadian LFS estimates and the U.S. CES estimates adjusted by some estimates derived from the CPS estimates of categories not covered by the CES. The Canadian LFS provides the most comprehensive estimate for jobs in Canada and is regarded as the best source for total jobs by the Canadian statistical authorities. The same is not true in the United States. The CPS has been late in benchmarking to population estimates throughout the 1990s and is consistently lower than the CES estimates (see Figure B1).

Figure B1. U.S. jobs—estimates from the CPS and CES adjusted for consistency with the Canadian Estimation Framework, total economy, seasonally adjusted, 1994-2002



Appendix C: Data

Table C1. Canadian data

Year	Gross domestic product in millions	GDP adjusted to PPP - millions	Hours worked (thousands)	Jobs (thousands)	Population over age 15 (thousands)	Population (thousands)
1994	770,873	639,825	23,776,037	13,445	23,041	28,999
1995	810,426	672,654	24,146,454	13,669	23,329	29,302
1996	836,864	702,966	24,531,308	13,790	23,625	29,611
1997	882,733	741,496	24,999,791	14,086	23,930	29,907
1998	914,973	786,877	25,573,865	14,416	24,199	30,157
1999	982,441	835,075	26,342,270	14,823	24,485	30,404
2000	1,076,577	903,475	26,923,953	15,181	24,805	30,689
2001	1,108,200	941,340	26,984,331	15,314	25,167	31,021
2002	1,157,968	981,707	27,314,229	15,653	25,534	31,362

Table C2. United States data

Year	Gross domestic Product in millions	PPP (Can$/ U.S.$)	Hours worked (thousands)	Jobs (thousands)	Population over age 15 (thousands)	Population (thousands)
1994	7,072,228	0.83	244,638,264	131,779	205,323	263,455
1995	7,397,651	0.83	249,508,991	134,807	208,007	266,588
1996	7,816,861	0.84	256,115,882	137,266	210,690	269,714
1997	8,304,344	0.84	262,442,719	140,342	213,560	272,958
1998	8,746,997	0.86	268,240,752	143,185	216,374	276,154
1999	9,268,412	0.85	273,697,883	145,736	219,085	279,328
2000	9,816,972	0.84	279,992,850	148,205	221,894	282,425
2001	10,127,976	0.85	277,413,917	147,852	224,614	285,358
2002	10,487,011	0.85	273,012,867	146,211	227,357	288,240

The period from 1994 to 2002 that is covered in this study is chosen because comparable Canada-U.S. data on hours worked can be constructed for this period. Total hours worked used in this analysis have been estimated in two steps. The first step estimates the number of jobs; the second estimates the hours worked per job. More details can be found in Baldwin et al. (2005).

For Canada, the best source for population employed and number of jobs is the Labour Force Survey (LFS). In the United States, the best source is the Current Employment Statistics (CES) survey. Since the coverage of this survey only includes the Civilian Non farm wage earner jobs, it has to be supplemented by their Current Population Survey to add the farm jobs and the self-employed jobs as well as administrative data for the military. With the exception just noted, the estimates of the number of jobs used in this report correspond essentially to the official estimates produced in the estimates used in the Productivity Accounts of Canada and the United States.[9]

9. In Canada, the Canadian Productivity Accounts are under the responsibility of the Micro-economic Analysis Division, National Accounts and Analytical Studies field. In the United States, the Productivity Program is run by the Bureau of Labor Statistics.

In the case of hours worked per job, we produce adjusted hours actually worked using the labour market household surveys in the two countries—the LFS in Canada and the CPS in the United States. Since 1994, the surveys of both countries have used a similar set of questions to measure actual hours worked. Because these surveys are conducted for one specific week every month, the hours worked obtained from this survey need to be adjusted to produce appropriate annual data. These adjustments were done based on the Canadian methodology developed in the Canadian Productivity Accounts.[10] More detail on the adjustments is contained in Baldwin et al. (2005).

The Gross Domestic Product used for this analysis is calculated at market prices. It can be found in NIPA table 1.1.5 on the website of the Bureau of Economic Analysis for the United States and in CANSIM, table 380-0016 (v646925) for Canada. The purchasing power parities (PPP) were taken from CANSIM table 380-0058, v13930490 up to 2001. The PPP for 2002 was, at the time of writing, not available and was chosen as the level for 2001.

The total population estimates are obtained from the Estimates of Population by Age and Sex for Canada (CANSIM table 050-0001, v466668), while they come from NIPA Table 7.1 (Population at mid-period). The population of 15 and over is obtained residually for both countries. In Canada, we remove from the total population, the population of 0 to 14 years old extracted from CANSIM table 050-0001, v466956). In the United States the population 0 to 14 is obtained from the Intercensal population estimates from the Bureau of the Census website (Table titled Resident Plus Armed Forces Overseas Population by Age Group and Sex).

10. For more information about this methodology, see Maynard (2004).

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