

Recent Productivity Developments in the United States and Canada: Implications for the Canada-U.S. Productivity and Income Gaps

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The second half of the 1990s saw a marked acceleration in labour productivity growth in the United States, but not in Canada.

The economic slowdown experienced by both the Canadian and American economies in 2001 reduced productivity growth in both countries. It raised a number of questions, including the sustainability or permanency of the pace of productivity growth experienced during the 1995-2000 period in the United States and the likelihood of robust U.S. productivity growth spreading to Canada.

The objective of this article is to examine recent productivity developments in the United States and Canada in light of the recent release of data for 2001.¹ The article first examines recent productivity developments in the United States to ascertain if these trends support the view that there has been a permanent upward structural shift in aggregate labour productivity growth. Second, the article analyzes aggregate labour productivity trends in Canada to determine whether there is evidence of an acceleration in labour productivity growth in this country. The final section of the article discusses the implications of the recent productivity developments for the Canada-U.S. productivity and income gaps.

Aggregate Labour Productivity Trends in the United States

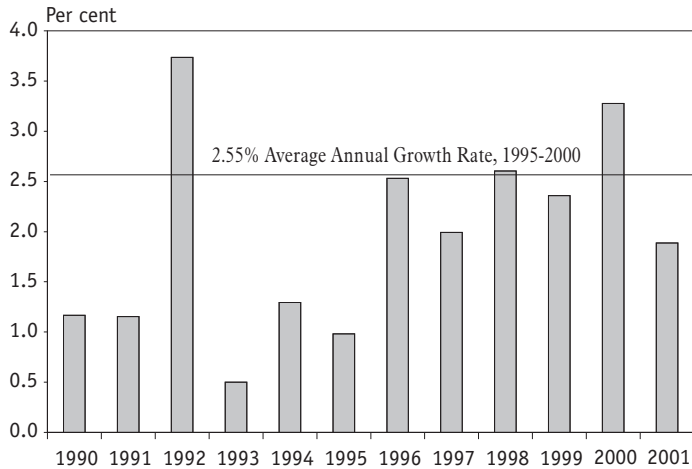
The most widely used measure of aggregate labour productivity in the United States is that for the non-farm business sector produced by the Bureau of Labor Statistics. According to this measure, output per hour advanced 1.9 per cent in 2001, a falloff of 0.7 percentage points from the 2.6 average annual per cent rate of increase in the 1995-2000 period (Chart 1).² A second measure of aggregate labour productivity — total economy GDP per hour — shows nearly identical trends.

The slowdown in output growth has been much greater in 2001 relative to the previous five year average growth rate than the slowdown in productivity growth: 3.8 percentage points from 4.7 per cent to 0.9 per cent. Because of declining demand, employers adjusted labour input very quickly. Growth in hours worked fell 3.1 percentage points from 2.2 per cent to -1.0 per cent. This explains the large rise in the unemployment rate, 0.8 percentage points from 4.0 per cent in 2000 to 4.8 per cent in 2001 (and 5.8 per cent in December 2001).

This decline in productivity growth is not surprising given the downturn in the economy.

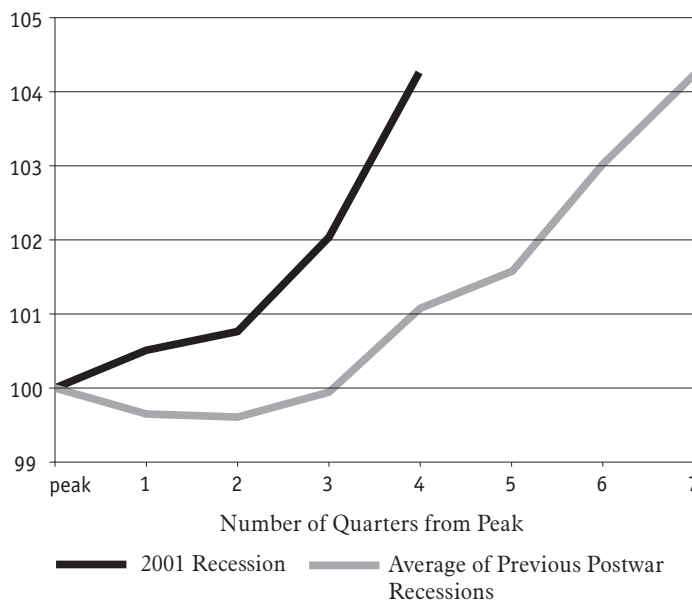
Chart 1
Aggregate Labour Productivity Trends
in the United States

Non-Farm Business Sector Output per Hour
 Per cent change from previous year



Source: BLS series PRS85006093, May 7, 2002.

Chart 2
Output per Hour in the Non-farm Business Sector
during Postwar Recessions in the United States
 (Output peak = 100)



Source: Based on BLS data. See Table 2.

Short-term productivity growth tends to behave in a pro-cyclical manner, rising during the recoveries and the early stages of economic expansions because of the existence of overhead labour and the hoarding of skilled workers and falling dur-

ing downturns and recessions. To gauge whether productivity developments in 2001 bode well or ill for the productivity acceleration story, it is necessary to compare this performance to that during previous downturns. On this score, the evidence points to a continuation of strong productivity growth.

Table 1 uses annual data on output and productivity growth in the non-farm business sector during recessions and downturns in the United States during the postwar period to shed light on current developments. Non-farm business sector output fell in absolute terms in at least one year, seven times since 1947 (1949, 1954, 1958, 1974, 1980, 1982 and 1991). The average annual decline was 1.7 per cent. Perhaps surprisingly given the cyclical nature of productivity, output per hour actually rose an average 0.9 per cent in each year of output decline. But there was a distinct difference between trends in the early postwar period and later decades. Possibly because of higher trend productivity growth before 1973, productivity growth was robust (over 2 per cent) during the first three recessions of the postwar period. In contrast, it fell during three of the four recessions in the post-1973 period.

Non-farm business sector output did not decline in 2001 on an average annual basis so comparisons with productivity growth during postwar recessions may be moot. But 2001 did see a major downturn in output growth relative to 2000 (3.5 percentage points). It may thus be useful to compare productivity developments during downturns, defined as years in which output growth was at least 3 percentage points lower than growth in the previous year, but not negative. The average rate of output per hour growth during the five downturns of the postwar period (1952, 1956, 1960, 1967, and 1985) up to 2000 was 1.1 per cent. In contrast, output per hour advanced 1.9 per cent in 2001, well above the postwar average. In addition, the average falloff in productivity growth during postwar downturns was 2.1 per-

Table 1
Output and Output per Hour Performance in the Non-Farm Business Sector during
Recessions and Downturns in the United States, Annual Data

Recessions			Downturns				
Year of recession	Output growth in recession, %	Output per hour growth in recession, %	Year of downturn	Change in output growth between peak and downturn, percentage points	Output growth in downturn %	Change in output per hour growth between peak and downturn percentage points	Output per hour growth in downturn, %
1949	-0.94	3.45	1952	-4.98	2.81	-0.29	2.11
1954	-1.86	2.02	1956	-6.59	1.75	-5.02	-0.84
1958	-2.02	2.28	1960	-7.01	1.58	-2.89	1.17
1974	-1.53	-1.70	1967	-5.38	1.78	-1.67	1.86
1980	-0.99	-0.24	1985	-4.65	3.75	-0.72	1.36
1982	-3.07	-0.60					
1991	-1.23	1.15	2001	-3.53	0.92	-1.39	1.89
Average	-1.66	0.91	Average (excluding 2001)				
				-5.72	2.33	-2.12	1.13

Note: Based on BLS series PRS85006043 and PRS85006093, May 7, 2002. A recession year is defined as a year of negative output growth, and the peak is defined as the preceeding year. A downturn is defined as a year in which output growth was at least 3 percentage points lower than in the previous year, but not negative, and the peak is defined as the preceeding year. The year 1973 was followed by two years of negative growth: only data for 1974 is considered here.

centage points, but the falloff in 2001 was only 1.4 points. Thus, from an historical perspective, during the 2001 downturn productivity growth was stronger and the falloff in productivity growth less than the average for a postwar downturn.

Three factors may account for this situation. First, the less severe nature of the 2001 downturn may mean that the productivity growth falloff was also smaller. Second, employers may now adjust labour input to changes in output faster than in the past, reducing the cyclical of short-term productivity growth (and increasing the cyclical in labour input). This explanation implies that any cyclical rebound in productivity growth during the recovery and early stages of the expansion of the current business cycle will also be weaker. Third, trend labour productivity growth may have accelerated. This means that the normal cyclical downturn in productivity growth may have been in part offset by stronger average long-term productivity growth. More work is needed to ascertain the relative merits of these three explanations.

Table 2 compares quarterly data on output and productivity growth in the non-farm business sector during postwar recessions in the United States with developments in 2001. A recession is defined as a minimum of two quarters of declining output in the non-farm business sector. Based on this definition, nine recessions occurred over the 1947-2000 period.

The most recent output peak for the non-farm business sector was the first quarter of 2001, with output falling for two quarters and then picking up somewhat in the fourth quarter of 2001 and very strongly in the first quarter of 2002. The cumulative change in output four quarters from the output peak was 1.3 per cent, compared to an average -1.6 per cent during the nine previous postwar recessions. The 2001 recession was obviously not particularly severe by postwar standards. Output per hour by the first quarter of 2002 was 4.2 per cent above the first quarter peak (Chart 2). For the nine previous postwar recessions, output per hour was on

Table 2
Output and Output per Hour Performance in the Non-Farm Business Sector during Recessions in the United States, Quarterly Data

Output peak, or quarter preceding recession	Output growth (per cent):						
	First quarter from peak	Second quarter from peak	Third quarter from peak	Fourth quarter from peak	Fifth quarter from peak	Sixth quarter from peak	Seventh quarter from peak
1948:3	0.00	-0.94	-1.88	-0.47	-1.88	2.82	6.57
1953:2	-0.37	-2.58	-3.69	-3.69	-2.58	-0.37	3.32
1957:3	-1.67	-5.35	-5.02	-2.01	1.00	3.34	6.69
1960:1	-1.22	-1.53	-3.98	-3.06	-0.61	1.22	-3.97
1969:3	-0.80	-1.00	-0.80	0.40	-1.20	2.21	2.81
1973:2	-0.17	-0.34	-0.85	-0.85	-2.37	-3.21	-5.41
1980:1	-2.94	-3.08	-0.84	1.26			
1981:1	-1.38	-0.41	-2.07	-4.15	-3.60	-4.29	-4.29
1990:2	-0.61	-1.93	-2.74	-2.03	-1.73	-1.22	0.00
2001:1	-0.07	-0.70	-0.28	1.26			
Average (excluding 2001:1)	-1.02	-1.91	-2.43	-1.62	-1.62	0.06	0.72
Output peak, or quarter preceding recession	Output per hour growth (per cent):						
	First quarter from peak	Second quarter from peak	Third quarter from peak	Fourth quarter from peak	Fifth quarter from peak	Sixth quarter from peak	Seventh quarter from peak
1948:3	0.80	1.59	2.39	5.04	4.51	8.49	9.55
1953:2	0.67	0.00	0.22	1.12	2.91	3.81	6.05
1957:3	0.21	-1.03	0.82	2.68	4.12	4.54	5.98
1960:1	-1.52	-1.14	-2.28	-0.95	1.90	3.04	4.18
1969:3	-0.44	-0.15	1.33	3.24	2.21	5.46	5.75
1973:2	-0.91	-1.56	-1.69	-1.69	-2.99	-2.21	-1.30
1980:1	-0.97	-0.61	0.12	1.46			
1981:1	-1.08	0.00	-1.20	-2.16	-1.32	-0.96	-0.24
1990:2	0.10	-0.63	-0.21	0.94	1.26	1.99	3.87
2001:1	0.51	0.76	2.12	4.24			
Average (excluding 2001:1)	-0.35	-0.39	-0.05	1.08	1.58	3.02	4.23

Note: Based on BLS series PRS85006043 and PRS85006093, May 7, 2002. A recession is defined as two or more consecutive quarters of zero or negative growth except for 1981:2-1982:3 (treated as one recession despite intervening quarters of slightly positive growth).

average only 1.1 per cent above the output peak four quarters from the peak. This suggests that productivity growth has held up much better during the 2001 recession than in earlier recessions.

A key driver of the productivity acceleration in the United States in the second half of the

1990s has been the manufacturing sector. In 2001, the growth rate of manufacturing productivity fell to 1.1 per cent from an average of 4.8 per cent per year in the 1995-2000 period (Chart 3). This 3.7 percentage point falloff, reflecting the massive downturn in high-tech manufacturing industries, was responsible for all of the 0.7

percentage points deceleration in non-farm business sector output per hour growth. Indeed, the non-manufacturing component of the non-farm business sector actually experienced a slight acceleration in labour productivity growth in 2001 relative to the second half of the 1990s, with growth in output per hour increasing to 2.2 per cent in 2001 from an average 2.0 per cent per year in 1995-2000.

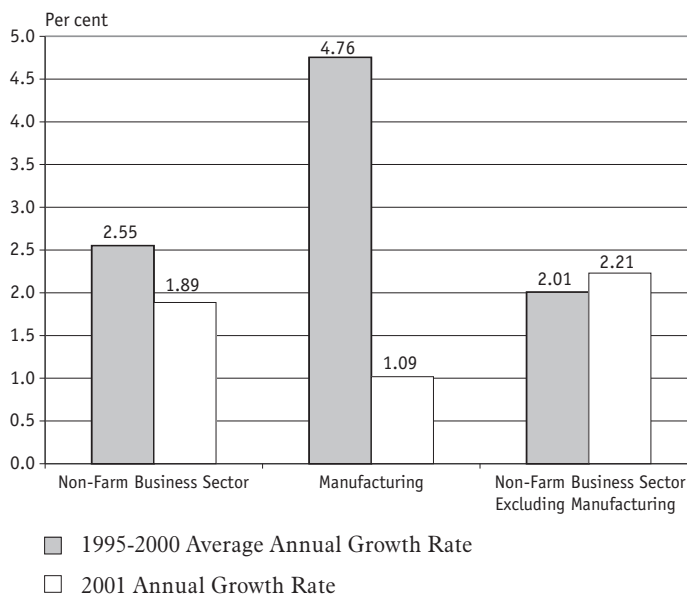
Thus, despite the economic downturn, the service sector, which constitutes the lion's share of the non-manufacturing, non-farm business sector, continued to register reasonably strong productivity gains in 2001. The large investments made in information and communication technologies in the 1990s appear to be boosting productivity growth in service industries. With the rebound in economic activity expected into the medium term, these service sector productivity gains should continue if not strengthen. In addition, the expected recovery of manufacturing should revive productivity growth in this sector, adding to aggregate productivity growth. These developments provide strong support for the view that the trend labour productivity growth of around 2.5 per cent experienced in the second half of the 1990s will continue into the medium term.

Aggregate Labour Productivity Trends in Canada

The most widely used measure of aggregate labour productivity in Canada is that for the business sector produced by Statistics Canada as part of the official Aggregate Productivity Measures (APM) series. According to this measure output per hour advanced 1.2 per cent in 2001,³ a falloff of 0.5 percentage points from the 1.7 average annual per cent rate of increase in the 1995-2000 period (Chart 4).⁴

As in the United States, the slowdown in business sector output growth in Canada was much

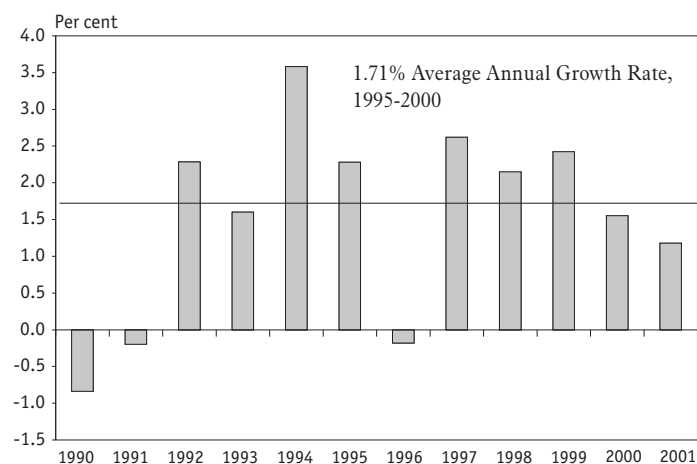
Chart 3
Decomposition of Output per Hour Growth for the Non-farm Business Sector in the United States



Source: based on BLS series PRS85006093 and PRS30006093, May 7, 2002, and nominal output shares from the Economic Report of the President 2002, tables B-10 and B-12.

Chart 4
Aggregate Labour Productivity Trends in Canada Business Sector Output per Hour

Per cent change from previous year



Source: Aggregate Productivity Measures, quarterly, Statistics Canada, April 18, 2002.

greater in 2001 relative to the previous five year average growth rate than the slowdown in productivity growth: 3.7 percentage points from 4.9 per cent in 1995-2000 to 1.2 per cent in 2001. It was again the drastic fallout in growth in hours worked — 3.2 percentage points from 3.2 per cent

Table 3
Output and Output per Hour Performance in the Business Sector during
Recessions and Downturns in Canada, Annual

Recessions			Downturns				
Year of recession	Output growth in recession, %	Output per hour growth in recession, %	Year of downturn	Change in output growth between peak and downturn, percentage points	Output growth in downturn %	Change in output per hour growth between peak and downturn percentage points	Output per hour growth in downturn, %
1954	-2.07	-1.03	1953	-3.53	3.88	-3.69	3.48
1982	-3.97	1.13	1957	-8.81	0.35	-5.40	-0.22
1990	-1.35	-0.84	1967	-4.72	2.25	-1.50	0.80
			1974	-5.45	2.88	-4.22	-0.62
			1977	-3.79	3.06	-3.28	2.81
			1995	-3.08	3.95	-1.30	2.28
			2001	-4.03	1.20	-0.38	1.18
Average	-2.47	-0.25	Average (excluding 2001)				
				-4.90	2.73	-3.23	1.42

Note: Based on Statistics Canada, Aggregate Productivity Measures data, April 18, 2002. A recession year is defined as a year of negative output growth, and the peak is defined as the preceding year. A downturn is defined as a year in which output growth was at least 3 percentage points lower than growth in the previous year but not negative, and the peak is defined as the preceding year. The year 1989 was followed by two years of negative growth: only data for 1990 is considered here.

to 0 per cent — that accounted for the lion's share (87 per cent) of the fall in output growth.

Annual data on business sector output per hour in Canada are available from 1946. Over the last half century there were only three years when business sector output actually declined in at least one year (1954, 1982, and 1990). The average decline in output was 2.5 per cent and in output per hour 0.3 per cent (Table 3). As neither business sector output nor output per hour fell in 2001, this historical comparison to past recessions may be of limited value.

While years of falling business sector output were relatively rare, economic downturns or slowdowns, defined as a year of a minimum of a 3 percentage point drop in output growth from the previous year, were more frequent (1953, 1957, 1967, 1974, 1977, and 1995). Canada's past productivity performance during downturns may be more relevant than during recessions for the interpretation of current trends given that 2001 was a downturn and not a recession.

The average magnitude of the six postwar downturns (excluding 2001) was 4.9 percentage points, slightly greater than the 4.0 percentage point output growth falloff in 2001. But the average falloff in productivity growth was 3.2 points, nearly ten times that of the 0.4 point falloff in 2001, suggesting productivity growth held up well in 2001 despite the deterioration in economic conditions.

The average output growth during the six postwar downturns was still a relatively strong 2.7 per cent, compared to 1.2 per cent in 2001. Output per hour growth averaged 1.4 per cent during the downturns, compared to 1.2 per cent in 2001. The slightly weaker productivity growth in 2001 may reflect the weaker output growth. However, relative to output growth, productivity growth in 2001 was surprisingly strong, which bodes well for future productivity growth as the economy returns to a strong growth path.

Unfortunately, quarterly estimates of business sector output per hour are only produced by

Table 4
Output and Output per Worker Performance in the Total Economy during Recessions
in Canada, Quarterly Data

Output peak, or quarter preceeding recession	Output growth (per cent)						
	First quarter from peak	Second quarter from peak	Third quarter from peak	Fourth quarter from peak	Fifth quarter from peak	Sixth quarter from peak	Seventh quarter from peak
1951:2	-2.22	-4.20	3.42	4.73	6.87	8.86	9.02
1953:4	-3.83	-4.25	-3.21	-2.33	1.32	4.80	6.81
1956:4	-0.40	-1.07	-0.15	-1.65	-1.19	0.16	1.01
1980:1	-0.44	-1.38	-0.17	2.64	3.61		
1981:2	-0.68	-1.18	-1.91	-3.26	-4.12	-5.01	-3.49
1990:1	-0.27	-0.82	-1.74	-3.05	-2.87	-2.48	-2.15
2000:4	-0.04	0.33	0.03	0.56			
Average (excluding 2000:4)	-1.31	-2.15	-0.63	-0.49	0.60	1.27	2.24

Output peak, or quarter preceeding recession	Output per worker growth (per cent)						
	First quarter from peak	Second quarter from peak	Third quarter from peak	Fourth quarter from peak	Fifth quarter from peak	Sixth quarter from peak	Seventh quarter from peak
1951:2							
1953:4	-4.54	-4.47	-3.77	-3.57	0.00	2.21	3.18
1956:4	-1.30	-2.21	-1.67	-2.82	-1.16	-0.62	0.04
1980:1	-0.63	-2.08	-1.96	-0.45	-0.39		
1981:2	-0.67	-0.71	-0.50	-0.39	0.25	-0.15	0.93
1990:1	-0.43	-0.67	-0.68	-0.99	-0.90	-0.55	0.02
2000:4	-0.20	-0.02	-0.26	0.14			
Average (excluding 2000:4)	-1.51	-2.03	-1.72	-1.64	-0.44	0.22	1.04

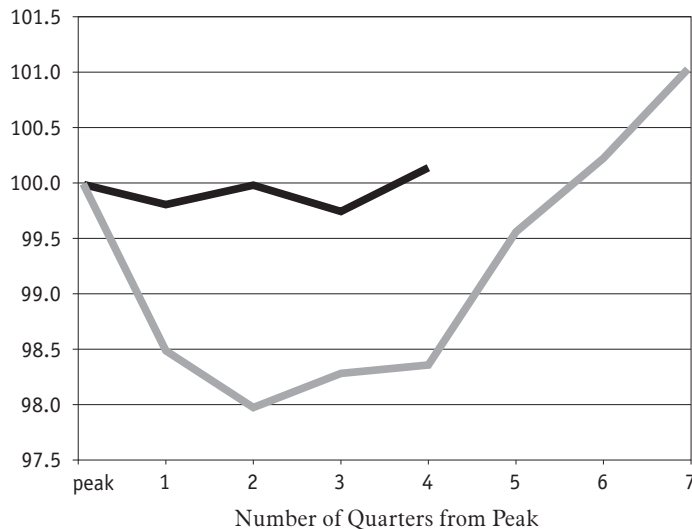
Note: Output data based on expenditure-based GDP data from the National Accounts, CANSIM II v1992259, April 23 2002, and *National Accounts, Income and Expenditure by Quarters, 1947-1961*, Statistics Canada, cat. No. 13-519. Employment data based on the Labour Force Historical Review 2001(R) CD-ROM, Statistics Canada, cat. No. 710004XCB, and *Historical Labour Force Statistics 1974 and 1993*, Statistics Canada, cat. No. 71-201. A recession is defined as two consecutive quarters of zero or negative growth except for 2000:4 (treated as a recession despite the first and third quarters from the peak being separated by a quarter of positive growth).

Statistics Canada for the post-1987 period. A quarterly series on total economy real GDP per worker for the postwar recessions (defined as two consecutive quarters of falling output growth) has been constructed from employment data from the Labour Force Survey (Table 4). It shows that real GDP peaked in the fourth quarter of 2000, then fell in the first quarter of 2001, rebounded in the second quarter only to fall in the third quarter and then pick up in the final quarter of the year.⁵ Four quarters after the out-

put peak, output was up 0.6 per cent. In contrast, during six postwar recessions, real output was still on average 0.5 per cent below the output peak four quarters after the peak.

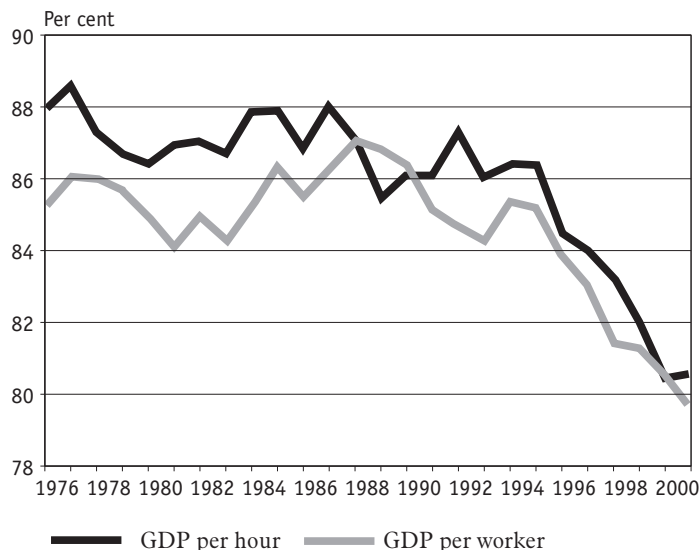
Productivity growth also performed much better in Canada in 2001 than in postwar recessions. Four quarters after the output peak, output per worker was up 0.1 per cent, compared to an average 1.6 per cent decline during postwar recessions (Chart 5). As noted earlier, one explanation for the relative strength in productivity growth during

Chart 5
Output per Worker in the Total Economy
during Recessions in Canada
 (Output peak = 100)



Source: Based on output and employment data from Statistics Canada. See Table 4.

Chart 6
Relative Aggregate Labour Productivity Trends
 (Canada as % of the United States)



2001 may be that trend productivity has picked up. An alternative explanation may be that firms now adjust employment much more quickly to changes in demand conditions, which dampens cyclical fluctuations in productivity.

While aggregate productivity growth in Canada in 2001 did somewhat better than might

have been expected given the phase of the business cycle, there is certainly no strong evidence of an acceleration in productivity growth such as the United States experienced after 1995.

The Widening Canada-U.S. Productivity and Income Gaps

Throughout the 1990s, slower aggregate productivity growth in Canada relative to that in the United States has led to a widening in the Canada-U.S. aggregate labour productivity gap (Chart 6).⁶ Current dollar GDP per worker in Canada, measured in U.S. dollars at the GDP purchasing power parity (PPP) exchange rate as estimated by Statistics Canada was \$40,613 in 1989, or 86.8 per cent of the level of \$46,779 in the United States (Appendix Table 1).⁷ By 2000, Canada's level of output per worker, now \$60,163 in PPP adjusted U.S. dollars, had fallen to 80.5 per cent of the U.S. level of \$75,573. The level of output per hour followed a similar downward trend.

With Canada's aggregate labour productivity growth performance in 2001 again inferior to that in the United States, the Canada-U.S. productivity gap continued to widen. Output per worker fell a further 0.9 percentage points to 79.6 per cent of that in the United States, falling below the 80 per cent level.

The future trends in the Canada-U.S. productivity gap depend on the relative productivity growth rates in the two countries. If U.S. productivity growth continues into the medium term at the 2.5 per cent annual pace of the second half of the 1990s, as the evidence in this article suggests, Canada will face a very difficult challenge just to prevent the gap from widening further, let alone to narrow it. Canada has not yet experienced an acceleration in productivity growth, as the United States did in the second half of the 1990s. Such a structural shift is certainly possible given Canadian access to information technologies,

which appear to be the driving force behind the U.S. productivity acceleration. Indeed, given current U.S. trends, the prerequisite for the stabilization of the Canada-U.S. productivity gap is much faster productivity growth in this country.

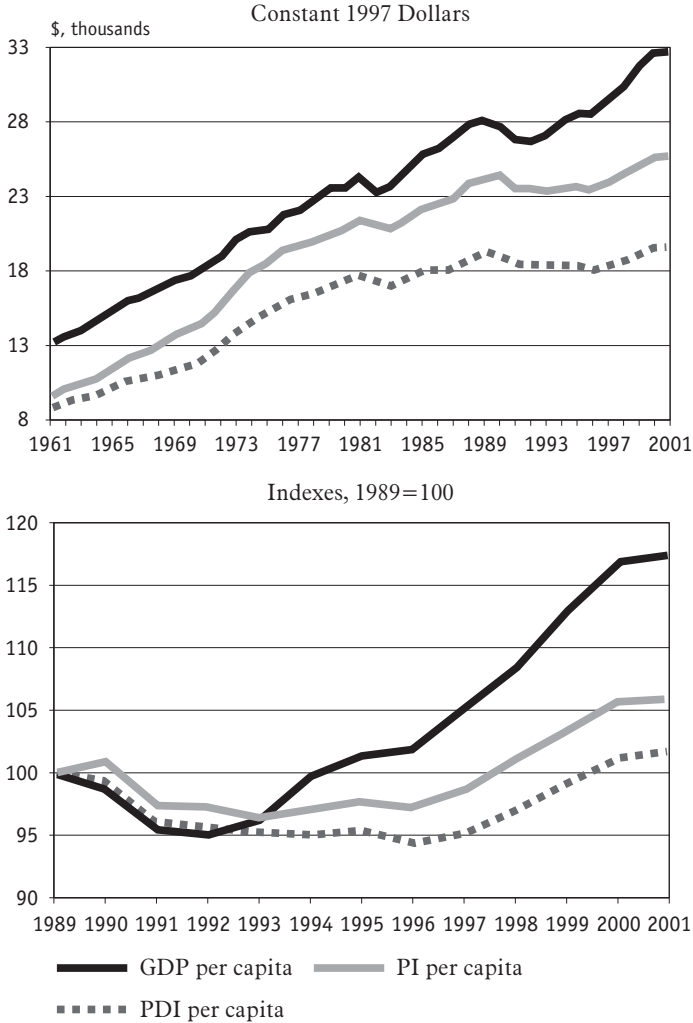
After four years of robust growth from 1997 to 2000, all three measures of aggregate real income growth in Canada fell off considerably in 2001, although growth remained positive (Chart 7). Real GDP per capita, the most widely used measure of aggregate income, advanced 0.5 per cent in 2001, down from a very robust 3.5 per cent average annual rate of increase over the 1996-2000 period. Real personal income per capita grew a meagre 0.2 per cent, down from the 2.1 per cent annual pace of the previous four years. Finally, real disposable personal income per capita increased 0.7 per cent, down from 1.7 per cent in 1996-2000.⁸

In the United States all three measures of aggregate income also registered much slower growth in 2001 than in 2000 and the second half of the 1990s. Real GDP per capita grew 0.2 per cent, real personal income per capita 1.0 per cent and real disposable personal income 1.6 per cent.

The slower growth of personal income and personal disposable income in Canada relative to the United States in 2001 meant that these measures of the Canada-U.S. income gap increased, taking relative levels of income back to that of the early 1970s (Chart 8 and Appendix Table 2). Indeed, personal income per capita in Canada fell to 76.2 per cent of that in the United States in 2001 from 76.8 per cent in 2000 and 88.6 per cent in 1990. Personal disposable income per capita fell to 68.4 per cent of the U.S. level in 2001 from 69.0 per cent in 2000 and 78.4 per cent in 1989. The relative level of real GDP per capita was unchanged in 2001 over 2000 at 79.5 per cent of the U.S. level.

The widening in the Canada-U.S. income gap in 2001, as has been the case throughout the 1990s, is primarily due to the increased productivity gap. Productivity gains fuel real income

Chart 7
Real Income in Canada



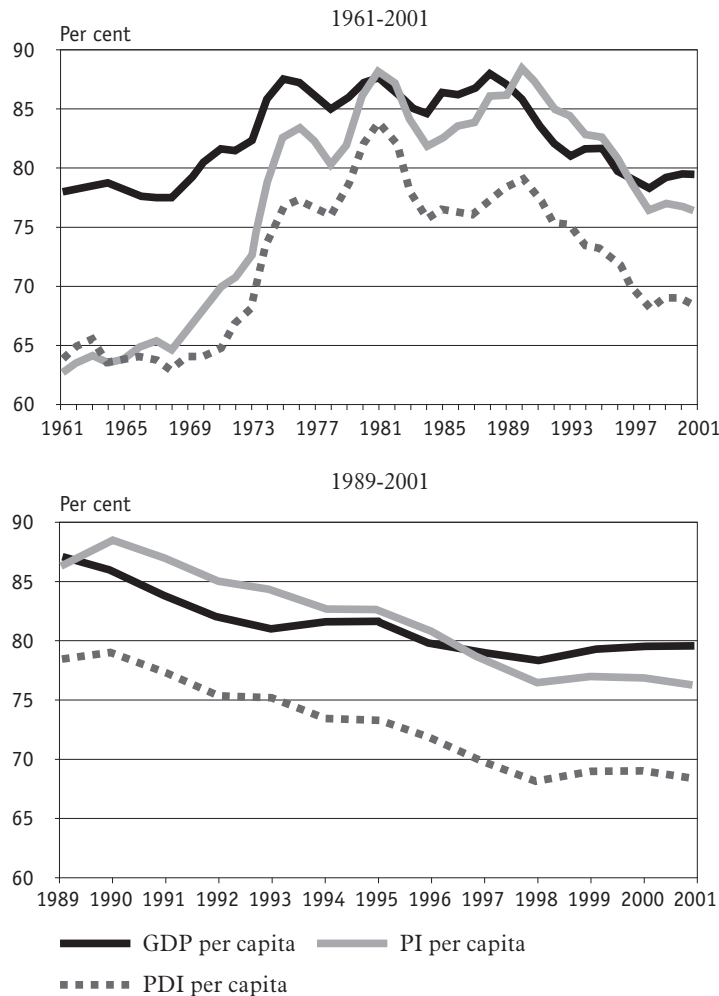
Source: CCLS Income and Productivity database, based on National Accounts data, March 5, 2002. See Appendix Table 1.

gains so slower productivity growth in Canada relative to the United States translates into slower income growth. Without arresting the widening of the productivity gap there is little chance of stemming the growth in the income gap.⁹

Conclusion

Productivity developments in the United States in 2001 and early 2002 support the view that the upward shift in trend productivity growth experienced in the second half of the 1990s will continue into the medium-term.

Chart 8
Relative Income Trends
 (Canada as a % of the United States)



Source: CSLS Income and Productivity database, based on Canadian National Accounts and U.S. BEA data, March 5, 2002, and PPP exchange rates from Statistics Canada. See Appendix Table 1.

Despite the large output growth slowdown, aggregate labour productivity growth faltered little, and even accelerated outside manufacturing. With a solid recovery, the United States could enjoy annual productivity growth of around 2.5 per cent for the rest of the decade.

Canada's aggregate labour productivity performance in 2001 was respectable given the economic downturn, but it certainly showed no sign of the acceleration the U.S. economy experienced after 1995. Without such an acceleration, and with the likely continuation of the current U.S. productivity trend, the Canada-U.S. pro-

ductivity and income gaps will continue to widen, a development with important implications for the Canadian economy and society.

Notes

- * The author would like to thank Someshwar Rao for comments on earlier drafts of this article and Jeremy Smith for research assistance. Email: csls@csls.ca
- 1 The Canadian national accounts for 2001 and earlier years will be revised in June 2002 and the U.S. national accounts will be revised in the summer of 2002. There may be major revisions, as was the case in 2001, particularly for the United States. All tables and charts in this paper will be revised in the summer of 2002 after the release of the revised U.S. accounts. These revised tables will be posted with the electronic version of this article at www.csls.ca under the *International Productivity Monitor*.
- 2 Unless otherwise noted, labour productivity or just the term productivity refers to output per hour.
- 3 A second measure of aggregate labour productivity — total economy GDP per hour — shows a somewhat different trend, increasing 2.4 per cent in 2001. The difference is largely accounted for by divergences in trends in average hours. According to published Labour Force Survey (LFS) data, the source for hours in the total economy GDP per hour series, average weekly hours for all workers dropped 2.0 per cent in 2001 (from 34.46 to 33.77). In contrast, the Aggregate Productivity Measures (APM) series, also based on the LFS, found only a 0.8 per cent drop in average hours worked in the business sector in 2001. The difference reflects divergences between trends in average hours in the business sector and total economy and a possible overestimation of hours in 2000 in the LFS due to technical problems with the survey in October 2000. The overestimate of hours in 2000 results in a large fall in hours in 2001. The APM measure is in principle more accurate and will be the focus of discussion in this article.
- 4 Over the 1996-2000 period, output per hour advanced 2.2 per cent per year, suggesting considerably stronger productivity growth. A case could be made that this period, not 1995-2000, which includes the fall in productivity growth in 1995, should be the reference for measuring whether Canada has experienced an acceleration in productivity growth. By this definition, productivity growth has picked up 1.0 percentage points between the 1989-96 and 1996-2000 periods. However, to maintain consistency with the U.S. analysis, the 1995-2000 period will be retained.
- 5 Based on the definition of two consecutive quarters of falling output, the year 2001 does not qualify as a recession.
- 6 The gap refers to the total economy, although the business sector is the most widely used level of analysis for aggregate productivity trend growth. Long-term trends in total economy and business sector productivity growth are very similar.

- 7 Because productivity levels and gaps are measured in current dollars and with different purchasing power parity estimates for each year, changes in the gap in a given year may be slightly different than changes in aggregate productivity growth between the two countries.
- 8 The growth rate of real GDP per capita and real personal income per capita may differ because of different growth rates in the components of nominal GDP (labour income, profits, capital consumption allowances, unincorporated business income) and the components of nominal personal income (labour income, investment income, transfers, and unincorporated business income) and because of differences in the growth of the GDP deflator, used to deflate nominal GDP, and the Consumer Price Index, used to deflate nominal personal income. Differences in the rates of growth between real personal income per capita and real disposable personal income per capita are accounted for by changes in the tax share of personal income.
- 9 The relative weight attached to absolute and relative income levels is crucial in the debate about the widening Canada-U.S. income gap. Is Canada better off in a scenario where U.S. productivity and income growth forge ahead at a 2.5 per cent rate, compared to 2.0 per cent in this country, with a 5 percentage point rise in the gap over a decade, but strong income growth; or in a scenario where Canada experiences productivity growth of 1.5 per cent compared to 1.0 per cent in the United States resulting in a reduction in the gap, but a slower rate of increase in living standards for Canadians? There is no one answer to this question.

Appendix Table 1
Relative Productivity Trends in Canada and the United States

Year	GDP per worker, current CAD\$	GDP per hour, current CAD\$	Canada GDP PPP exchange rate, U.S.\$/CAD\$	GDP per worker, current U.S.\$	GDP per hour, current U.S.\$	United States GDP per worker, current U.S.\$	GDP per hour, current U.S.\$	Canada as % of U.S.	
	A	B	C	D=A*C	E=B*C	F	G	H=F/D*100	I=G/E*100
1976	20,488	11.26	0.854	17,498	9.62	20,551	10.94	85.15	87.90
1977	22,326	12.29	0.851	19,001	10.46	22,076	11.80	86.07	88.63
1978	24,042	13.10	0.855	20,561	11.20	23,904	12.83	86.02	87.29
1979	26,301	14.35	0.846	22,245	12.14	25,969	14.01	85.66	86.65
1980	28,737	15.94	0.832	23,913	13.26	28,152	15.35	84.94	86.42
1981	31,987	18.03	0.82	26,230	14.79	31,189	17.01	84.10	86.95
1982	34,785	19.67	0.80	27,828	15.74	32,747	18.09	84.98	87.02
1983	37,398	21.14	0.79	29,544	16.70	35,057	19.27	84.28	86.68
1984	39,888	22.51	0.80	31,910	18.01	37,453	20.49	85.20	87.87
1985	41,907	23.50	0.81	33,945	19.04	39,319	21.66	86.33	87.91
1986	42,892	24.08	0.81	34,743	19.51	40,630	22.47	85.51	86.83
1987	45,484	25.65	0.80	36,387	20.52	42,178	23.32	86.27	88.01
1988	48,349	26.85	0.80	38,679	21.48	44,432	24.68	87.05	87.03
1989	50,766	27.83	0.80	40,613	22.26	46,779	26.06	86.82	85.45
1990	52,099	29.00	0.81	42,200	23.49	48,851	27.28	86.38	86.10
1991	53,458	30.35	0.81	43,301	24.58	50,852	28.55	85.15	86.10
1992	55,046	31.76	0.82	45,138	26.04	53,328	29.83	84.64	87.29
1993	56,744	32.31	0.82	46,530	26.49	55,233	30.79	84.24	86.05
1994	58,942	33.13	0.83	48,922	27.50	57,324	31.84	85.34	86.38
1995	60,827	34.45	0.83	50,486	28.59	59,251	33.10	85.21	86.37
1996	62,326	35.08	0.83	51,730	29.11	61,663	34.45	83.89	84.52
1997	64,251	36.13	0.83	53,329	29.99	64,206	35.69	83.06	84.04
1998	64,769	36.74	0.84	54,406	30.86	66,798	37.10	81.45	83.19
1999	67,115	37.74	0.841	56,431	31.73	69,434	38.70	81.27	81.98
2000	70,827	39.53	0.830	58,807	32.82	73,020	40.79	80.54	80.46
2001	71,906	40.95	0.837	60,163	34.26	75,573	42.53	79.61	80.56

Note: The GDP PPP exchange rates for 1999-2001 were calculated by multiplying the PPP rate in 1998 by the index value (1998=1.00) of the U.S. GDP deflator as a percentage of the Canadian GDP deflator in each year. The GDP PPP exchange rates for 1976-1980 were calculated by multiplying the PPP rate in 1981 by the index value (1981=1.00) of the U.S. GDP deflator as a percentage of the Canadian GDP deflator in each year. PPP estimates for 1981-1998 are only published to 2 decimal places.

Source: CCLS Income and Productivity database, based on data from Canadian National Accounts and Labour Force Survey, and U.S. BEA and BLS, Current Population Survey, March 5, 2002. PPP exchange rates from Statistics Canada *National Income and Expenditure Accounts, Third Quarter 1999*, Cat. No. 13-001-XPB.

Appendix Table 2

Relative Aggregate Income Trends in Canada and the United States

Year	Canada								United States			Canada as % of U.S.		
	GDP per capita, current CAD\$	PI per capita, current CAD\$	PDI per capita, current CAD\$	GDP PPP exchange rate, U.S.\$/CAD\$	Household Consumption PPP exchange rate, U.S.\$/CAD\$	GDP per capita, current U.S.\$	PI per capita, current U.S.\$	PDI per capita, current U.S.\$	GDP per capita, current U.S.\$	PI per capita, current U.S.\$	PDI per capita, current U.S.\$	GDP per capita	PI per capita	PDI per capita
	A	B	C	D	E	F=A*D	G=B*E	H=C*E	I	J	K	L=I/F*100	M=J/G*100	N=K/H*100
1961	2,241	1,661	1,503	1.033	0.881	2,315	1,463	1,324	2,971	2,343	2,082	77.93	62.45	63.58
1970	4,204	3,160	2,607	0.971	0.883	4,082	2,790	2,302	5,070	4,102	3,592	80.50	68.03	64.09
1971	4,491	3,399	2,790	0.987	0.896	4,434	3,045	2,499	5,435	4,359	3,861	81.58	69.86	64.74
1972	4,956	3,804	3,138	0.971	0.882	4,811	3,356	2,768	5,910	4,737	4,138	81.41	70.84	66.89
1973	5,744	4,388	3,620	0.937	0.870	5,382	3,819	3,151	6,538	5,254	4,620	82.31	72.68	68.20
1974	6,765	5,180	4,240	0.890	0.873	6,023	4,522	3,702	7,019	5,731	5,014	85.82	78.91	73.84
1975	7,514	5,930	4,882	0.882	0.859	6,630	5,093	4,193	7,571	6,166	5,470	87.57	82.60	76.66
1976	8,541	6,683	5,462	0.854	0.845	7,295	5,645	4,614	8,365	6,767	5,962	87.21	83.42	77.39
1977	9,330	7,320	5,988	0.851	0.834	7,940	6,108	4,997	9,224	7,433	6,520	86.08	82.17	76.63
1978	10,246	8,093	6,699	0.855	0.824	8,762	6,666	5,517	10,315	8,304	7,255	84.95	80.28	76.05
1979	11,582	9,024	7,488	0.846	0.840	9,796	7,580	6,290	11,403	9,249	8,034	85.90	81.96	78.29
1980	12,859	10,147	8,413	0.832	0.866	10,700	8,788	7,287	12,276	10,205	8,869	87.16	86.12	82.16
1981	14,559	11,721	9,641	0.82	0.85	11,938	9,962	8,195	13,616	11,303	9,775	87.68	88.14	83.83
1982	15,161	12,816	10,518	0.80	0.81	12,128	10,381	8,519	14,037	11,923	10,366	86.40	87.06	82.19
1983	16,257	13,371	10,894	0.79	0.79	12,843	10,563	8,606	15,087	12,577	11,037	85.13	83.99	77.97
1984	17,601	14,352	11,718	0.80	0.79	14,081	11,338	9,257	16,639	13,856	12,218	84.63	81.83	75.77
1985	18,839	15,402	12,533	0.81	0.79	15,260	12,168	9,901	17,667	14,740	12,943	86.37	82.55	76.50
1986	19,686	16,322	13,080	0.81	0.79	15,945	12,894	10,333	18,504	15,426	13,557	86.17	83.58	76.22
1987	21,187	17,317	13,738	0.80	0.79	16,949	13,680	10,853	19,532	16,320	14,248	86.78	83.83	76.17
1988	22,932	18,762	14,792	0.80	0.80	18,345	15,009	11,834	20,848	17,436	15,315	87.99	86.08	77.27
1989	24,161	20,031	15,908	0.80	0.80	19,329	16,025	12,727	22,192	18,597	16,238	87.10	86.17	78.38
1990	24,608	21,186	16,567	0.81	0.82	19,932	17,373	13,585	23,215	19,615	17,176	85.86	88.57	79.09
1991	24,508	21,599	16,907	0.81	0.81	19,851	17,495	13,695	23,692	20,127	17,710	83.79	86.92	77.33
1992	24,753	21,885	17,097	0.82	0.82	20,297	17,946	14,019	24,740	21,105	18,616	82.04	85.03	75.31
1993	25,418	22,081	17,323	0.82	0.83	20,843	18,327	14,378	25,733	21,734	19,120	81.00	84.32	75.20
1994	26,616	22,273	17,340	0.83	0.84	22,091	18,709	14,566	27,066	22,591	19,818	81.62	82.82	73.50
1995	27,678	22,908	17,764	0.83	0.85	22,973	19,472	15,099	28,130	23,570	20,612	81.67	82.61	73.26
1996	28,278	23,178	17,856	0.83	0.86	23,471	19,933	15,356	29,428	24,660	21,385	79.76	80.83	71.81
1997	29,513	23,877	18,286	0.83	0.85	24,496	20,295	15,543	31,033	25,880	22,265	78.93	78.42	69.81
1998	30,278	24,702	18,825	0.84	0.85	25,434	20,996	16,001	32,463	27,452	23,495	78.35	76.48	68.10
1999	31,977	25,683	19,598	0.841	0.854	26,886	21,929	16,733	33,958	28,494	24,247	79.18	76.96	69.01
2000	34,320	26,999	20,508	0.830	0.859	28,496	23,198	17,621	35,853	30,211	25,533	79.48	76.79	69.01
2001	34,879	27,756	21,168	0.837	0.862	29,183	23,916	18,239	36,712	31,382	26,683	79.49	76.21	68.36

Source: CCLS Income and Productivity database, based on data from Canadian National Accounts and U.S. BEA, March 5, 2002.

PPP exchange rates from Statistics Canada *National Income and Expenditure Accounts, Third Quarter 1999*, Cat. No. 13-001-XPB.

Note: the GDP PPP exchange rates for 1999-2001 were calculated by multiplying the PPP rate in 1998 by the index value (1998=1.00) of the U.S. GDP deflator as a percentage of the Canadian GDP deflator in each year. The household consumption PPP exchange rates for 1999-2001 were calculated by multiplying the PPP rate in 1998 by the index value (1998=1.00) of the U.S. CPI deflator as a percentage of the Canadian CPI deflator in each year. The GDP PPP exchange rates for 1961-1980 were calculated by multiplying the PPP rate in 1981 by the index value (1981=1.00) of the U.S. GDP deflator as a percentage of the Canadian GDP deflator in each year. The household consumption PPP exchange rates for 1961-1980 were calculated by multiplying the PPP rate in 1981 by the index value (1981=1.00) of the U.S. CPI deflator as a percentage of the Canadian CPI deflator in each year. PPP estimates for 1981-1998 are only published to 2 decimal places.