Productivity Growth in Canada and the United States

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Since 1973, the growth of real output and productivity in Canada and the United States has slowed significantly. Understanding this slowdown is a vital concern for economists and policymakers in assessing the capacity for noninflationary growth.

FROM 1961 to 1973, real GDP grew at an average annual rate of 5.5 percent in Canada and 4.0 percent in the United States, while labor productivity rose annually by 3.3 percent in Canada and 1.7 percent in the United States. However, from 1973 to 1995, the average annual growth rates of real GDP and labor productivity declined to 2.6 percent and 1.1 percent, respectively, in Canada, and 2.3 percent and 0.8 percent, respectively, in the United States (see chart).

The slowdown of output growth is intimately related to the slowdown of labor productivity growth. Output growth comprises the growth of the number of hours worked and the growth of output per hour worked (labor productivity). Although the annual growth rate of number of hours worked decreased from 2.2 percent in 1961–73 to 1.5 percent in 1973–95 in both Canada and the United States, most of the slowdown in real output growth can be attributed to slower labor productivity growth.

Studies of the Canadian and US economies have ascribed this slowdown to several causes: a decline in the rate of capital accumulation, a shift of output and labor away from the goods sector and toward the services sector and industries with lower productivity growth, a reduction in the benefits from increasing returns to scale, a lack

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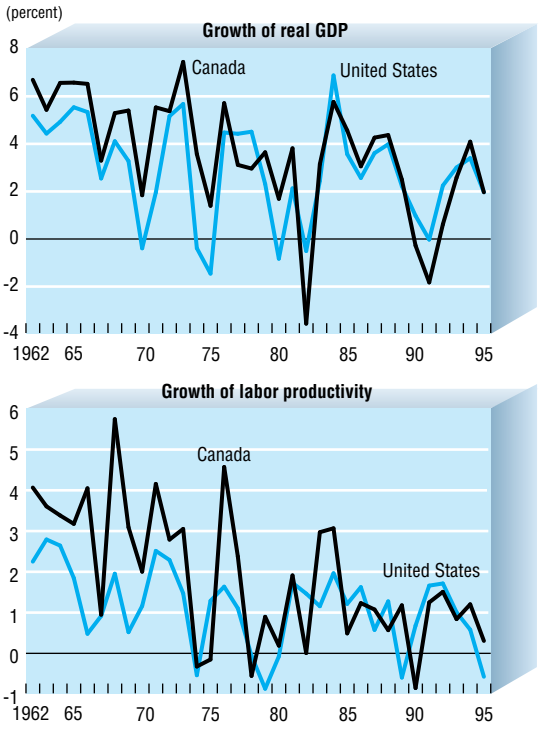
of technological progress in several mature industries, and an increase in the obsolescence of capital owing to the regulatory environment and structural changes in the economy. Several economists have argued, however, that measured output and productivity growth may be biased downward, particularly in the service industries, where output is often intangible and difficult to measure, and that the slowdown may not be as large as suggested by the data. The downward bias may have increased over time as services output (including government services) has grown from approximately one-half of GDP in the 1940s to two-thirds of GDP in recent years, and as the variety of services has increased. Moreover, in the United States, since 1993, income-based measures of output have grown more rapidly than product-based measures; the latter may therefore understate output and productivity growth. Errors in measuring productivity may, in fact, explain the surprisingly strong recent performance of the US economy, in which inflation has declined despite low levels of unemployment.

Growth of output and productivity has slowed in Canada and the United States



Sources: Statistics Canada; and United States, Department of Commerce, Bureau of Economic Analysis.

An examination of the recent growth performance in Canada and the United States across sectors and industries, and an analysis of alternative measures of productivity (including total factor productivity) suggest that the reasons for slower growth are not identical in both countries. Although a decline in the rate of capital accumulation is a factor in both—but particularly in the United States—a major reason for the slowdown in Canada appears to be diminishing benefits from increasing returns to scale, particularly in manufacturing, whereas in the United States, a major reason appears to be the rising share of the services sector in total output.

Measuring productivity

Productivity is determined by the efficiency with which resources are combined to produce a given output; it is usually measured by calculating the ratio of a weighted index of outputs to a weighted index of inputs. In a simple economy with only one type of output and one type of input, productivity is the ratio of output to input. In an economy with a variety of outputs and many different inputs, productivity can be measured in a number of ways.

Output. The usual way to handle the heterogeneity of output is to construct an index that weights the physical units of output by their "real value"—that is, their market prices, adjusted for inflation. However, in a diverse modern economy, it is difficult to keep track of the prices of all products because of changes in product quality, product innovation, and product and outlet substitution. Therefore, various price indices are used to deflate nominal prices. The consumer price index (CPI) and its components, for example, are used to deflate the final purchases of consumer goods and services, which are a large component of GDP. However, a number of economists, particularly in the United States, have argued that the CPI and other price indices overstate inflation because of the difficulty of tracking prices, and that real output is therefore improperly measured.

A second difficulty is presented by products that do not have market prices—for example, goods and services produced by governments and nonprofit institutions, services of owner-occupied dwellings, and goods produced for own consumption. In general, the prices for these products are computed based on the cost of their inputs or are imputed from prices of similar products. For example, services of owner-occupied dwellings are valued at their estimated rental prices. However, using the cost of inputs to measure real output—which is how government output is generally measured—implies that productivity growth is zero.

Input. There are several ways to handle the variety of inputs. Productivity can be measured as labor productivity, which is defined as output per employee or hour worked. In this case, labor (assumed to be homogeneous) is the only input. Although this measure is relatively easy to calculate and may be useful for studying real wage or per capita income growth, it has a major limitation: namely, it measures output per unit of labor instead of output per unit of all inputs combined and thus misleadingly includes the part of output growth that is due to more efficient use of all inputs (including labor) or to increased use of other productive inputs relative to labor. In other words, labor productivity measured in this way becomes a function not only of efficiency (which includes technology, and the organization and management of the production process) but also of inputs such as land and other natural resources, and physical and human capital.

An alternative measure is total factor productivity (TFP), which, in principle, takes all inputs into account. In general, however, aggregate measures of TFP include only the contributions of labor and physical capital (although some measures of TFP include other factors, such as energy inputs). One problem in computing TFP has to do with the difficulty of measuring inputs. Generally, labor is considered homogeneous, while physical capital is valued at its deflated book or constant-dollar replacement value. When labor is not differentiated by skill level, TFP measurements implicitly include relative growth in human capital in estimates of productivity growth. When physical capital is valued by deflating book or replacement values, biases from mismeasured price indices can creep into estimates of productivity. Furthermore, during a recession, if firms do not adjust factors immediately (because of the fixed nature of capital, labor hoarding, or work effort effects), some of the change in productivity growth should be attributed to underemployed resources (although this issue is of less concern when examining productivity growth over longer periods).

Table 1
Growth in labor productivity
(annual averages, in percent)

Sectors	1961–92	1961–73	1973–92	1973–81	1981–92
Canada	**1.88**	**3.34**	**1.13**	**1.11**	**1.14**
Goods [1]	2.94	4.90	1.70	1.55	1.81
Services [2]	1.72	2.57	1.18	1.20	1.16
Government	0.61	1.30	0.17	0.21	0.15
United States	**1.14**	**1.74**	**0.89**	**0.53**	**1.16**
Goods [3]	1.73	2.22	1.41	-0.10	2.52
Services [4]	1.13	1.82	0.70	0.89	0.57
Government	0.43	0.27	0.52	0.71	0.38

Sources: Statistics Canada; United States, Department of Commerce, Bureau of Economic Analysis; and author's estimates.
[1] Agriculture and related industries; fishing and trapping; logging and forestry; mining, quarrying, and oil wells; manufacturing; construction; and other utilities.
[2] Transportation and storage; communication; wholesale trade; retail trade; finance, insurance, and real estate; and community, business, and personal services.
[3] Agriculture, forestry, and fishing; mining; manufacturing; construction; and electricity, gas, and sanitary services.
[4] Wholesale and retail trade; hotels and other lodging places; transportation; communication; finance, insurance, and real estate; and community, social, business, and personal services.

Table 2
Growth in total factor productivity [1]
(annual averages, in percent)

Sectors	1961–92	1961–73	1973–92	1973–81	1981–92
Canada	**1.31**	**2.69**	**0.43**	**0.24**	**0.58**
Goods [2]	1.80	3.59	0.67	0.02	1.15
Services [3]	1.18	2.50	0.34	0.86	-0.03
Government	0.58	1.32	0.12	0.08	0.15
United States	**0.72**	**1.00**	**0.54**	**0.01**	**0.93**
Goods [4]	0.99	1.42	0.72	-1.21	2.13
Services [5]	0.44	0.80	0.22	0.37	0.10
Government	0.33	0.11	0.46	0.66	0.32

Sources: Statistics Canada; United States, Department of Commerce, Bureau of Economic Analysis; and author's estimates.
[1] Using value-added output, net capital stock, and sectoral average income shares as weights on capital and labor.
[2] Agriculture and related industries; fishing and trapping; logging and forestry; mining, quarrying, and oil wells; manufacturing; construction; and other utilities.
[3] Transportation and storage; communication; wholesale trade; retail trade; finance, insurance, and real estate; and community, business, and personal services.
[4] Agriculture, forestry, and fishing; mining; manufacturing; construction; and electricity, gas, and sanitary services.
[5] Wholesale and retail trade; hotels and other lodging places; transportation; communication; finance, insurance, and real estate; and community, social, business, and personal services.

Determining the appropriate weights for different inputs is also a problem. If constant returns to scale and perfectly competitive markets are assumed, the weights for these aggregate factors are their shares in total factor payments. Econometric tests cannot reject these two assumptions at the aggregate level in Canada and the United States. At the sectoral level, however, the assumption of constant returns to scale can be rejected in several industries. In particular, the Canadian manufacturing sector shows evidence of increasing returns to scale.

Sectoral productivity. Productivity growth in a given sector can be computed in several ways. Output can be measured as gross output (the market value of all output for an individual industry) or as value-added output (gross output minus the purchases of goods and services used in production, sometimes referred to as intermediate consumption). Generally, sectoral labor productivity is computed using value-added output, while sectoral TFP may be computed using either method.

Productivity growth

Between 1961 and 1992, aggregate labor productivity grew faster in Canada than in the United States (Table 1), in part as a result of higher rates of capital accumulation—during this period, investment rates were substantially higher in Canada than in the United States. With relatively more capital, all other things being equal, Canadian workers became more productive. Faster TFP growth in Canada also contributed to faster labor productivity growth (Table 2). In both countries, labor productivity and TFP growth rates were higher in the goods sector than in the services and government sectors, although the figures may to some extent reflect the difficulty of measuring productivity in the services sector. (Because of the difficulty of interpreting changes in government productivity, this article focuses on the goods and services sectors, and the aggregate economy.) Furthermore, to the extent that services are the intermediate consumption of the goods sector and services sector output is underestimated, some of the productivity gains in the services sector may be incorrectly measured as productivity gains for the goods sector.

The slowdown of labor productivity and TFP growth in 1973–92, compared with 1961–73, was more severe in Canada than in the United States. During the later period, however, labor productivity grew faster in Canada than in the United States, thanks to higher investment rates, even though TFP growth rates were generally higher in the United States. The energy price shocks of the 1970s and the ensuing structural changes in the Canadian and US economies were partly responsible for the slowdown after 1973. As the real price of energy moved closer to its pre-1973 level during the 1980s and 1990s, however, labor productivity growth, particularly in Canada, did not rebound to its pre-1973 rate. One way to separate the effects of these shocks from those of other factors is to estimate productivity growth subsequent to the 1970s.

During 1981–92, productivity growth rates rose more in the United States than in Canada. In fact, the United States experienced (slightly) higher aggregate labor productivity growth and higher aggregate TFP growth. The US economy's stronger recovery can be attributed almost entirely to the performance of the goods sectors. Although the productivity of the US services sector has grown more slowly in recent years than during the 1970s, the productivity of the goods sector grew faster during 1981–92 than during 1961–73. In Canada, the recovery of the goods sector was weaker, and it therefore only partially offset the slowdown of growth in other sectors. Productivity growth in all Canadian sectors, including goods, was lower in 1981–92 than in 1961–73.

Reasons for the slowdown

Two possible explanations for the slowdown in aggregate productivity growth

Table 3
Possible explanations for the slowdown in productivity growth between 1961–73 and 1981–92
(in percentage points)

	Canada		United States	
	Labor productivity	Total factor productivity	Labor productivity	Total factor productivity
Total slowdown	2.20	2.11	0.58	0.07
Due to capital accumulation	0.09	...	0.51	...
Due to intersectoral shifts	0.23	-0.01	0.53	0.34
Of which: slow recovery of total factor productivity growth in services	0.03	0.03	0.30	0.30

Source: Author's estimates.
Note: ... indicates not applicable.

emerge from this analysis: the intersectoral shift of output and labor toward services and a slowdown in capital accumulation relative to labor force growth. The intersectoral shift toward services may have slowed aggregate productivity growth for two reasons: first, the services sector had slower productivity growth rates than the goods sector; and second, since the 1970s, measured productivity growth has recovered more slowly in the services sector than in the goods sector. The energy price shocks of the 1970s may explain part of the slowdown after 1973 but do not explain the lack of recovery in productivity growth during the 1980s and 1990s, when real energy prices declined to levels seen before 1973.

The relative contribution of intersectoral shifts to the slowdown can be estimated by decomposing the slowdown in measured productivity growth into the additional growth that would have taken place if the initial shares of the various sectors had remained constant at their original levels and the TFP growth rate of the services sector during 1961–73 and 1981–92 had declined only as much as the TFP growth rate in the goods sector (or, in the United States, where the TFP growth rate of the goods sector actually increased, if the TFP growth rate for the services sector had recovered to 1961–73 levels). The impact of the lagging recovery in services and the lower productivity of the services sector can be gauged by decomposing the slowdown in measured productivity growth into the additional growth that would have taken place had the initial shares of the sectors remained constant at their original levels and had the productivity of the services sector declined as suggested by the data. The relative contribution of the slowdown in the growth of the capital-to-labor ratio can be measured by calculating the difference between labor productivity and TFP growth.

These calculations show that intersectoral shifts can account for almost the entire slowdown in aggregate labor productivity growth in the United States during 1981–92, compared with 1961–73 (Table 3), with most of the slowdown attributable to the sluggish recovery of productivity in services and the remainder to slower growth of the capital-to-labor ratio. The intersectoral shift more than accounts for the slowdown in TFP growth, which is equivalent to the slowdown in aggregate labor productivity growth less the slowdown in the capital-to-labor ratio multiplied by the capital income share.

In Canada, the intersectoral shift accounts for a small, or even negligible, part of the slowdown in labor productivity and TFP growth, because growth in the goods sector slowed almost as much as growth in the services sector during 1981–92, compared with 1961–73. In addition, because the rate of capital accumulation relative to growth of the labor force declined less than in the United States between the same two periods, the reduction in the growth of the capital-to-labor ratio accounts for a smaller part of the slowdown compared with the United States. Econometric tests provide evidence that diminishing benefits from increasing scale in manufacturing may be responsible for as much as one-fourth of the slowdown in aggregate productivity growth in Canada. Other possible explanations include slower technological progress, relative changes in the average level of labor skills (or human capital accumulation), relative changes in resource utilization (particularly during business cycle troughs), and relative changes in capital equipment obsolescence.

In the United States, slower technological progress in the services sector may be the reason productivity growth recovered more slowly in this sector than in the goods sector. (It may be difficult, for example, to improve the productivity of providing haircuts.) Other factors that may have played a role include a mismeasurement of the output and inputs of different sectors, as well as different rates of capital obsolescence and human capital accumulation across sectors.

A 1996 study by Lawrence Slifman and Carol Corrado of the US Federal Reserve Board attempts to explain the relatively slow recovery of productivity growth in the services sector by examining trends in labor productivity and profitability across sectors in the United States. This study found that labor productivity growth rebounded after the early 1980s to the levels of the 1960s in all sectors except for nonfarm, noncorporate services. In this sector, although productivity growth was negative, profitability was unchanged. The study noted that measured rapid relative price increases of these services seemed to explain this discrepancy but that such increases were unlikely. The difficulty of measuring prices (and thus output and productivity) in this particular sector appears to be a likelier explanation. In other words, at least in the United States, what appears to be a slowdown in aggregate productivity could be, in large part, the result of measurement problems in the services sector.

"The energy price shocks of the 1970s . . . do not explain the lack of recovery in productivity growth."

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Suggestions for further reading:

Ranil Salgado, 1997, "Developments in Productivity Across Industries in Canada," in Canada—Selected Issues, *IMF Staff Country Report 97/20 (Washington: International Monetary Fund).*

——, 1997, "Developments in Productivity Across Industries in the United States," in United States—Selected Issues, *IMF Staff Country Report 97/97 (Washington: International Monetary Fund).*

Lawrence Slifman and Carol Corrado, 1996, "Decomposition of Productivity and Unit Costs," Federal Reserve Board Occasional Staff Studies, No. 1 (Washington: Board of Governors of the Federal Reserve System).