

Estimation :

Statistics Canada publishes several sets of productivity measures for the Canadian business sector and its major constituent subsectors (goods producing, services subsectors Canada's Canada's Canada's Canada's and manufacturing industries) and industries. Each set of measures involves a comparison of the growth in output and input measures, but each relies on a different methodology. The concept of business sector excludes public administration, non-profit organizations and the Canadian System of National Accounts (CSNA) imputation of the rental value of owner-occupied dwellings. The business sector thereby excludes activities where it is difficult to draw inferences on productivity from the CSNA output measures. Essentially such inferences would be questionable because the CSNA output measures in these areas are based largely on labour inputs in constant prices.

The traditional measure of labour productivity - output per hour worked - constitutes the first measure of productivity introduced by Statistics Canada in the early sixties. Output, measured in constant prices, is compared to labour input, measured as hours worked in the corresponding sector or industry.

The second set of measures covers multifactor productivity. In these measures, output is again measured net of price changes, but the input measure is an aggregate of hours worked and capital service flows. Multifactor productivity estimates have been developed in recognition of the role capital growth plays in output growth.

Statistics Canada's productivity estimates are based on a bottom-up approach. Productivity indices are estimated with the most disaggregated data available. Productivity indices for 147 industries in the case of labour productivity and 123 industries in the case of multifactor productivity are then aggregated step by step to the total business sector. This approach, which takes advantage of homogenous information available at a detailed level, proves to be superior to the aggregated approach as it significantly improves the quality of the measured aggregate productivity indices.

Additional industrial detail (203 industries from 1961 to 1980 and 243 industries from 1981 on) is produced and disseminated for the number of jobs and hours worked series for both the business sector and the non-commercial sector.

In order to produce productivity growth estimates, various data sources from survey areas and the system of national accounts divisions are integrated. In particular, the productivity program requires data from:

- 1) The Input-Output Division, which provides information on the structure of the economy (in terms of industries, commodities produced and used as intermediate inputs in both current and constant prices and the primary inputs compensation for each calendar year). Please refer to Survey ID *1401*.
- 2) The Labour Statistics Division, which provides employment numbers, labour compensation and hours worked to estimate the labour input; please refer to Survey ID *3701, 2612*.

- 3) The Investment and Capital Stock Division, which provides estimates of end-year net capital stock to estimate capital input; please refer to Survey ID 2803, 2805, 2812, 2820.
- 4) The Industry Measures and Analysis Division, which produces current estimates of GDP in constant prices. Please refer to Survey ID 1303.
- 5) The Income and Expenditure Accounts Division, which provides current data on labour compensation. Please refer to Survey ID 1901.

Data that come from these different sources are conceptually adjusted to the CSNA framework and reconciled for accuracy and consistency in the estimates of inputs and outputs. As such, the production of productivity measures serves as an important source of quality control on the various data series that are used in the productivity program. [Appendix 1 – Please refer to the link in Documentation section above].

The Fisher indices of value added, capital and labour inputs are not available for the most recent years; however, Laspeyres indices are available for these three variables. A regression model, based on these Laspeyres indices, is used to project the Fisher indices for the most recent two or three years.

Formula:

The productivity program makes use of the concept of the chain Fisher indice in order to calculate growth rates of output, inputs and multifactor productivity. In the case of labour productivity, a chain Fisher indice is only used to estimate the real value added. The chain Fisher indice is defined as the square root of the product of the chain Laspeyres and the chain Paasche indices. Chain indices are calculated for consecutive periods to determine variation of quantities from one period to another. The chain indices offer the advantage of reducing the variation in the values recorded by the various fixed-base indices.

Labour Productivity is defined as real value-added per hour worked.

Unit Labour Cost equals total compensation for all jobs divided by real value-added. It is also equivalent to the ratio of hourly compensation to labour productivity.

Hourly Compensation is the ratio of the total compensation to the total number of hours worked.

For a given industry, value added is equal to its gross output less its intermediate inputs (energy, raw materials and services) produced by other industries. A double-deflation procedure is used to measure real value added: real intermediate inputs are then subtracted from real gross output. For productivity measurement, a real value added Fisher chain indice is used.

Multifactor Productivity is the growth rate of real output minus the combined growth rate of the inputs. Four categories of multifactor productivity are available - each is based on a different measure of output and therefore serves a different analytical need:

- multifactor productivity based on gross output;
- multifactor productivity based on gross output net of intra-industry transactions;
- multifactor productivity based on value-added; and multifactor productivity based on gross output net of all inter-industry transactions.