Discussant comments on session IPM24: Measuring productivity

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We have before us several papers that either discuss the creation of databases that can be used for the analysis of productivity comparisons or that make use of data from different countries to compare one country to another.

I will discuss these papers both as a statistician and as an economist. As a statistician, I am responsible for putting together the Canadian Productivity Accounts and I can therefore speak to issues that we have encountered as we produce productivity statistics.

Statistics Canada produces productivity statistics as part of a regular production program. It is not something done as an occasional research exercise. The production process is embedded within the National Accounts. The result is a set of data that we refer to as the Productivity Accounts.

These data consist of an integrated set of data on outputs, inputs, labour and capital contributions to the production process. Statistics Canada's Productivity Accounts are built, first, on an integrated set of production accounts – generating GDP from final demand – and, at the industry level, using one set of integrated, coherent accounts. The task of the Productivity Group is to take this integrated set of accounts and produce a set of estimates of labour services and capital services that is consistent with the output estimates. For example, on the labour side, the Productivity Group chooses amongst various source data (there are multiple sources, ie household versus employer surveys, each giving different estimates of labour inputs), makes sure the boundaries of the labour sources agree with the boundaries of the industry data, and produces a set of labour inputs in what is regarded as the best method (by estimating jobs and hours worked separately, and then multiplying them together). In the case of capital services, the Group takes investment data from a survey of investment, reconciles and modifies them to accord with National Accounts boundaries, and then estimates capital services using rates of return derived from the National Accounts estimates of profits or surplus, which in turn are taken from the Input/Output tables.

There are six dimensions that are used to determine whether statistical data are adequate for the purpose at hand – ie whether they pass a "fitness for use" test. These are: accuracy, relevance, timeliness, accessibility, interpretability and coherence. *Accuracy* refers to whether the information correctly describes the phenomenon it was designed to measure. *Coherence* reflects the degree to which data can be brought together successfully with other statistical information within a broad analytical framework.

Statistics Canada's integrated national accounts provide the foundations on which the productivity accounts are based. Because they are integrated across several dimensions – from the demand side, from the income side and from the industry accounts – along with detailed input/output tables, the productivity accounts are built on a solid foundation. For example, estimates of productivity using the demand side are reconcilable to those coming from the industry side.

The Statistics Canada Productivity Program provides quality assurance both by enhancing the accuracy of the Division's productivity estimates and by improving the overall coherence of these products. Analysis in the productivity program, as elsewhere in the National Accounts, is an extension of the particular nature of the production process. In the SNA, this process combines data from different sources. To construct official data series, the production process compares data from one source (for example industry value added) with data from another (for example, labour inputs). In the end, this comparative process serves

to bring a variety of sources into consistency with one another. Data that are generated from production surveys are subject to both response and non-response errors. By examining how one series compares to another (for example, how employment estimates from the Labour Force Survey compare with those from the Survey of Employment, Payroll and Hours), analysts can assess whether the survey error in one or the other data source is particularly large in one period.

Analysis also serves to provide consistency across different data series. Statistics Canada's Micro-economic Analysis Division (MEAD) develops and maintains a large database in support of the productivity program – what some refer to as the KLEMS (Capital, Labour, Energy, Materials and Services) database. KLEMS integrates time series data on gross output, material inputs, service inputs, energy purchases, labour, investment and capital. Each of these data series is calculated in both nominal dollars and real (constant) dollars. Price indices are collected for each of these series. Finally, KLEMS classifies these series using four different levels of aggregation – corresponding to the S, M, L, and W levels used in the Input/Output accounts. The W industry level (the most detailed of the four classifications) includes data on almost 300 industries. The period covered by the database extends from 1961 to the current reference year (2000, at present).

Productivity statistics are important indicators for those who analyse trends in the economy. These users are not only interested in knowing what the rates of productivity growth have been, but also in understanding the underlying causes behind slowdowns or accelerations in observed rates of productivity growth. Only by supporting the productivity program with large databases like KLEMS can these investigations occur. KLEMS thus serves a dual purpose. It is key to the production of productivity statistics. And its analytical capabilities are essential to many in the user community who utilise these productivity statistics.

The productivity accounts serve to improve data accuracy or suitability by contributing to the production of time series that are consistent over time. National Accounts data, if they are to be useful, need to have consistency over time. These data are used primarily for time series analysis. But, by their nature, the survey systems that provide data to the SNA are often not 'time-series' consistent. Industry classification systems have changed from being SIC-based to being NAICS-based. Surveys (such as the Annual Survey of Manufactures) change their coverage. Other surveys are re-stratified. Each of these changes may improve survey estimates at a given point in time, but render analysis over time less consistent. While rough corrections are often provided by survey programs to account for the impact of changes in coverage or classification, the survey programs rarely provide all of the changes that are required for time-series consistency. This is accomplished by using the data for analysis and then communicating the results of this analysis to production divisions.

It is important to note that data that may be fit for one purpose – that meet acceptable quality standards in this area – may not be for others. *Relevance* reflects the degree to which this information meets the needs of users. *Interpretability* reflects the availability of supplementary information necessary to interpret and utilise the appropriate data. And statistics may be developed for one purpose, while outside demand may begin to use them for other purposes, for which they were not designed and for which they may be less than ideal.

The evolution of the productivity statistics program provides an example of just such a transition. Statistics Canada's productivity accounts were originally developed to provide information on productivity *growth rates* in Canada, with regard to labour productivity and to multifactor – what academics often refer to as total factor – productivity. In a world of increasing globalisation, users' demands for international comparisons have increased. But providing estimates that meet acceptable quality standards poses particular challenges.

(a) The first challenge has been to develop data that are conceptually equivalent. Here the United Nations *System of National Accounts* has provided a foundation, and the

OECD's work on developing manuals on productivity estimation have been invaluable for setting standards.

(b) The second is to develop an idea of the quality of the statistics produced by different countries. There are two ways in which this can be done.

(1) First, statistical agencies can devote resources to cross-country studies that attempt to adjust for differences in source data and methodology. In Canada, users have requested guidance on the quality of Canada/U.S. productivity comparisons. Statistics Canada has long provided information products that compare Canada/U.S. productivity *growth* rates, choosing U.S. data sources that are closest to Canadian ones. Despite differences between the two countries, these differences are sufficiently small and sufficiently constant over time that they do not pose a major problem. More recently, Statistics Canada commenced a set of studies that examined alternatives that can be used to estimate the level of relative productivity – both labour and multifactor productivity. Statistics Canada found that despite the relative similarity in the statistical systems of the two countries, harmonisation of data sources and methodology was important. For example, differences existed in the way that labour input was calculated in the official productivity programs of both countries, which led to substantial downward bias in the relative Canadian level of labour productivity.

(2) The second method of ascertaining the quality of the product is to have third parties – such as the OECD and EU/KLEMS – take the initiative. Such efforts will develop estimates for multilateral comparisons, which, if they differ substantially from the national estimates that statistical agencies produce, will force the latter to reconsider their own programs.

(c) The third challenge is to provide guidance on the quality of the resulting estimates. Productivity estimates are essentially analytical concepts. They are derived from underlying data on GDP, labour and capital services that are imperfect. Most of the estimates from these series are usually reported as single points. Yet they all have distributions. Providing some estimates of the confidence intervals is a challenge to the profession. Yet it is an important one. Small differences in rates of growth lead to very large differences in cumulative growth over large periods of time. If the confidence interval around intercountry differences in our productivity estimates is large enough to prevent our being able to say whether large cumulative differences are real, we are doing a disservice to users. Quality of product, as emphasised, involves guidance on interpretability. If those providing estimates of productivity growth rates do not provide this guidance, the quality of their program will be brought into question.

Providing high quality products involves more than simply choosing similar parameters for all countries. As Solow argued, it is not clear that the standard assumptions about well functioning markets (prices equal to marginal costs or constant returns to scale) are equally appropriate across all countries. Nor is it obvious that choosing similar depreciation rates across all countries is equally correct. Or, for that matter, applying similar price indices. Careful examination of price changes in Canada relative to the United States have shown that some prices have very different cycles in the two countries, as a result of oligopolistic price discrimination across exchange rate cycles.

What is required is to gain the interest of the analytical community in many of these areas. And here, there is a need to partner the academic and statistical communities. Naturally, the former will pose many questions that the present data were not created to answer. The latter group will find itself trying to react to new demands and will possess uncodified information on data peculiarities that need to be understood in order to assess the value of the international comparisons being made.

I personally welcome the OECD productivity and EU/KLEMS productivity-related program initiatives, as a start toward providing the impetus for national programs that examine where country data can appropriately be used. To the extent that this expands demand for the product, it will lead to improvements that enhance the quality of the estimates.

Finally, I should like to point to the need to expand the quality of the estimates we provide.