Comment on "Estimating Capital Input for Measuring Business Sector Multifactor Productivity Growth in Canada"

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ABSTRACT

This article shows that the large difference of 0.8 per cent percentage points per year between top-down estimates of capital input growth obtained by Diewert and Yu and the bottom-up estimates produced by Statistics Canada for the Canadian business sector over the 1961-2011 period can be interpreted as an reallocation effect due either to inefficiencies in production and or a measurement issue. It is also noted that although user costs of capital are officially recognized in the System of National Accounts, there is no single recommendation on the details of implementation and that moving towards such a recommendation is an objective worth pursuing.

RÉSUMÉ

Cet article montre que la grosse différence de 0,8 points de pourcentage par année entre les estimations descendantes de la croissance des intrants de capital obtenues par Diewert et Yu et les estimations ascendantes produites par Statistique Canada pour le secteur des entreprises canadiennes pendant la période 1961 à 2011 peut être interprétée comme un effet de redistribution dû à des pratiques de production inefficaces. On fait remarquer aussi que, bien que les coûts de l'utilisation du capital soient officiellement reconnus dans le Système de comptabilité nationale, il n'y a pas une seule recommandation sur les détails de la mise en œuvre, et qu'en arriver à formuler ce genre de recommandation est un objectif qu'il vaut la peine d'essayer d'atteindre.

GU (2012) IN THIS SYMPOSIUM examines the differences in capital input estimates between the Canadian Productivity Program of Statistics Canada and Diewert and Yu (2012). He finds that the difference in aggregate capital input estimates (and therefore the differences in multifactor productivity (MFP) growth) is largely explained by three factors. First, whereas the Canadian Productivity Program aggregates capital services across industries to derive the capital input measure at the level of the business sector, Diewert and Yu (2012) use a top-down approach and directly compute capital and labour input series at the business sector level. Second, there are differences in the way the price of capital services is computed. Third, the Canadian Productivity Program bases its capital measures on a more detailed list of assets than Diewert and Yu (2012). This note provides some additional comments on the first and second source of differences.

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Top-down and Bottom-up Computations of MFP

It is intuitively appealing to start productivity measurement at the industry level by positing the existence of an industry-specific technology and an associated production or cost function. The industry-level approach allows for industry-specific prices of inputs and thus for possible rigidities in factor markets. When, in a second step, growth rates of inputs and outputs are constructed at the level of the business sector, aggregation proceeds using industry-specific prices of inputs (and outputs). This is essentially the approach chosen by the Canadian Productivity Program.

Alternatively, (or rather in addition as I will argue below) an economy-wide MFP measure can be established directly, via Jorgenson's (1966) production possibility frontier (PPF). The PPF relates an economy's output to the set of inputs available in the economy under efficient allocation. MFP growth is measured as the shift of the PPF over time. A key feature of the PPF is that it assumes a single price for each type of input that applies across all uses in different industries. Thus, the PPF constitutes a benchmark, achievable under full mobility of factors in competitive markets. Its exogenous time shift is the top-down productivity computation that corresponds to Diewert and Yu's (2012) measures of Canadian business sector MFP productivity.

Jorgenson, Ho and Stiroh (2005) and Jorgenson and Schreyer (forthcoming) show how the PPF-based productivity measure links up with industry-specific measures. The link is simple and intuitively appealing and has been referred to by Gu (2012) in his comments but is worth spelling out explicitly. Letting ρ be the PPF-based, business sector-wide measure of MFP growth and letting π_j stand for MFP growth in industry j, the following relation holds:

$$\rho = \sum_j w_j \pi_j + \text{REALL}$$

The difference between top-down MFP growth ρ and a weighted average of industry-specific MFP productivity growth (with w_j being each industry's share in total nominal value added) is a 'reallocation' term. REALL quantifies the departure from the assumptions on efficient input markets required for the PPF. It can be shown that the reallocation term is exactly the difference between the input aggregates constructed with industry-specific input prices and the input aggregates constructed with a single input price across industries. REALL will be positive and allocation inefficient if inputs grow more rapidly in those industries that pay relatively higher prices for these inputs than other industries.

But should ρ or $\Sigma w_j \pi_j$ be considered the 'correct' measure of aggregate MFP growth? There is no simple answer here. Rather, each measure provides an answer to a different question. Whereas $\Sigma w_j \pi_j$ is best described as *effective* productivity growth, 'adding up' industry productivity growth, ρ captures *underlying* productivity growth in the sense of a shift of the economy's production possibilities if allocation operates efficiently. As the difference between the two measures has a clear interpretation (and possible policy implications if there are large potential efficiency gains from reallocation) both measures are clearly useful.

That said, the empirical evidence for instance in Jorgenson, Ho, and Samuels (2012) points to reallocation effects that tend to be small, at least for the United States. The significant size of the reallocation effect in the Canadian case (valued by Gu (2012) at 0.8 percentage points per year for capital input over the 1961-2011 period) is worth examining because it either points to significant productivity gains that could be realized in the Canadian economy through reallocation of resources between industries or it reflects a measurement issue associated with large variances of industry-specific input prices.

In the case of capital, input prices correspond to user costs.

User Cost Calculations

Because many capital goods are both owned and used by a particular firm, there is only a limited number of market transactions for the purchase of capital services as would be the case when capital goods are rented out. Absent a market transaction, a price has to be imputed and as is frequently the case, there are several possibilities for imputation. The *OECD Measuring Capital Manual* (Schreyer, 2009) discusses at length the advantages and drawbacks of various approaches and the sensitivity of the resulting aggregates to these choices.

Country practices and practices among researchers vary. While agencies such as the US Bureau of Labor Statistics and the Australian Bureau of Statistics follow a similar approach towards calculating user cost as the Canadian Productivity Program, this is, for instance, not the case for the Netherlands, Korea and for the OECD's MFP measurement work. In the end, the choice is often made on pragmatic grounds, including the ease with which results can be communicated to users.[2]

At this stage, there is no single method that constitutes an international recommendation or standard. The current debate shows that it may be worth pursuing this objective and to go beyond the recent achievement of having capital services officially recognized as part of the UN System of National Accounts. The OECD would certainly be willing to contribute to this objective.

Debates such as the one at hand are welcome and important as they sharpen our understanding of issues and bring out new evidence. More often than not, there is no single correct answer to one question but several answers to several questions. This is the nature of the beast 'productivity measurement' and if questions and answers can be clarified through constructive debate, much will have been achieved.

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2 In the course of a recent study on Korea (Cho, Kim and Schreyer, 2012) we examined the various possibilities for deriving user cost measures. In the end, the choice fell on using a real balancing rate, akin to the approach adopted by Diewert and Yu (2012). The single most important reason for this choice was the fact that the new Korean dataset includes capital services from land whose real price showed a strong upward trend over an extended period. Explicit inclusion of these real price changes in the user cost formula for land would have led to negative prices for capital services from land in a significant number of years which is a result that is difficult to interpret. Consequently, the real balance rate method which is a simplified user cost approach (also discussed in OECD, 2009) was selected. A similar result would have been achieved by selecting an exogenous real rate of return that is equal across assets. In both cases, the assumption is made that the best guess for the expected price change of an asset is the overall rate of inflation.