New Estimates of Real Income and Multifactor Productivity Growth for the Canadian Business Sector, 1961-2011

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Abstract

Using new data from Statistics Canada, this article shows that the multifactor productivity (MFP) performance of the Canadian business sector has been reasonably satisfactory over the past half century. In particular, traditional gross income MFP growth averaged 1.03 per cent per year over the 1961-2011 period. This compares with the official Statistics Canada estimate of 0.28 per cent. The difference was mostly due to significantly higher capital input growth recorded by Statistics Canada. The study finds that quality adjusted labour input growth was the main driver of real income growth, followed by MFP growth, capital input growth, and finally by falling real import prices. The study encountered many data problems which should be addressed in future work on Canadian business sector productivity performance.

Résumé

Utilisant de nouvelles données de Statistique Canada, cet article montre que la performance de la productivité multifactorielle (PMF) des entreprises canadiennes a été raisonnablement satisfaisante au cours du dernier demi-siècle. En particulier, la croissance traditionnelle de la PMF selon les produits bruts a été en moyenne de 1,03 % par année de 1961 à 2011, alors que l'estimation officielle de Statistique Canada est de 0,28 %. Cette différence est due surtout à la croissance beaucoup plus forte des intrants de capital enregistrée par Statistique Canada. L'étude conclut que la croissance de l'apport de travail pondérée par la qualité est le principal facteur de la croissance du revenu réel, suivie par la croissance de la PTF, la croissance des intrants de capital et, enfin, la chute du prix réel des importations. De nombreux problèmes de données qu'il faudrait résoudre dans les prochains travaux sur la performance de la productivité du secteur des entreprises canadiennes se sont présentés au cours de cette étude.

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MANY OBSERVERS HAVE NOTED that an improvement in a country's terms of trade has effects similar to an improvement in a country's productivity growth in boosting real incomes. However, it is not straightforward to work out the exact magnitude of each source of gain. A number of authors developed production theory methodologies which enable one to obtain index number estimates of the contribution of each type of gain.[2] This article applies the methodology developed in Diewert, Mizobuchi and Nomura (2005) and Diewert and Lawrence (2006) to develop estimates of the sources of real income gains in the business sector of the Canadian economy over the 1961-2011 period. Appendix 1 provides the details of the methodology and Appendix 2 describes how data for the Canadian business sector were developed from Statistics Canada sources.[3]

The first main section of the article uses data from Appendix 2 to develop conventional measures of Canadian business sector multifactor productivity (MFP) for the 1961-2011 period.[4]

MFP growth, while perhaps the most important source of growth in living standards, is not the entire story. If a country's export prices increase more rapidly than its import prices, then it is well known that this has an effect that is similar to a productivity improvement. The second section of the article measures the relative contributions of multifactor productivity improvements, changes in real export and import prices and the growth of labour and capital input to the growth of (gross) real income generated by the business sector in Canada using the methodology explained in Appendix 1.

The third section compares our estimates of MFP growth to the official MFP estimates produced by the Statistics Canada KLEMS program.[5] It should be noted that the Statistics Canada KLEMS program uses detailed industry data in order to construct MFP estimates by industry and then these industry estimates are aggregated to give total business sector estimates of MFP growth. In contrast, our approach uses aggregate estimates for the outputs produced and inputs used for the entire business sector. Thus our estimates may suffer from some aggregation bias. The final section concludes.

Output and Input Aggregates and Conventional Productivity Growth for Canada

In Appendix 2, we construct price and quantity series for 22 net outputs, 12 types of labour input and 17 types of capital input for the business sector of the Canadian economy for the years 1961-2011.[6]

The net outputs are domestic consumption (Q_1) (excluding market residential rents and the services of owner occupied housing); real sales of goods and services by the business sector to

2 See Diewert (1983), Diewert and Morrison (1986), Diewert, Mizobuchi and Nomura (2005), Diewert and Lawrence (2006), Morrison and Diewert (1990), and Kohli (1990, 2003, 2004, and 2006).

3 Appendix 1 is posted at http://www.csls.ca/ipm/24/appendix1-diewert-yu.pdf and Appendix 2 is posted at http://www.csls.ca/ipm/24/appendix2-diewert-yu.pdf.

4 Total factor productivity and multifactor productivity are the same concept. The authors have in the past used the former term. This article adopts multifactor productivity since this is the term used by Statistics Canada.

5 See Baldwin, Gu and Yan (2007) for a description of the methodology used in the KLEMS program. KLEMS stands for capital (K), labour (L), energy (E), materials (M), and services (S). For an overview of World KLEMS, see Jorgenson (2012).

6 The series are almost all chained Tornqvist indexes, not chain Fisher indexes as used by Statistics Canada. This choice is a better fit with exact index number results (Diewert and Morrison, 1986). However, the differences between the chained Fisher and Tornqvist are negligible so this is not a source of difference with KLEMS estimates.

the nonmarket sector less real sales of goods and services from the nonmarket sector to the business sector (Q_2), four types of investment goods (Q_3-Q_6), inventory change (Q_7), eight types of exports (Q_8-Q_{15}), and seven types of imports (Q_{16}-Q_{21}).[7]

The price indexes that correspond to the above quantity indexes Q_n^t are denoted as P_n^t for n = 1,..., 22 and t = 1961,..., 2011 and are listed in Appendix 2. We define the price of our consumption aggregate as $P_C^t \equiv P_1^t$.

We form a domestic output aggregate Q_D^t with corresponding price P_D^t by aggregating Q_1^t-Q_7^t.[8] Similarly, we form an export aggregate Q_X^t with corresponding price P_X^t by aggregating Q_8^t-Q_{15}^t and an import aggregate Q_M^t with corresponding price P_M^t by aggregating Q_{16}^t-Q_{22}^t.[9] Once these indexes have been constructed, a business sector aggregate output or real value added index Q_Y^t is constructed as an aggregate of Q_D^t, Q_X^t and $-Q_M^t$. The corresponding aggregate output price index is P_Y^t.[10] The price indexes P_C^t, P_D^t, P_X^t, P_M^t and P_Y^t for the 1961-2011 period are given in Table 1 and the corresponding quantity indexes Q_D^t, Q_X^t, Q_M^t and Q_Y^t are given in Table 2.

Statistics Canada has constructed detailed labour input data for the Canadian business sector for 36 types of labour for the 1961-2010 period in CANSIM Table 3830024 which we will make use of in this study. Labour input is organized according to a four way classification:

- By *education level* E. There are 3 categories in this classification: E=1 corresponds to primary or secondary education; E=2 corresponds to some or completed post-secondary education below university and E=3 corresponds to university degrees or above.
- By *age of worker* A. There are 3 categories in this classification: A=1 corresponds to 15-34 years old; A=2 corresponds to 35-54 years old and A=3 corresponds to 55 years old and over.
- By *sex* S. There are 2 categories in this classification: S=1 corresponds to a male worker and S=2 corresponds to a female worker.
- By *type of employment* T. There are 2 categories in this classification: T=1 corresponds to a paid worker and T=2 corresponds to a self employed worker.

Estimates of annual hours and total compensation are thus provided for 36 types of workers (3x3x2x2). We aggregate over the age groups using Fisher chained indexes in order to form 12 price and quantity series for labour, P_{L1}-P_{L12}

7 The 22 net outputs are: domestic consumption (Q_1) (excluding market residential rents and the services of owner occupied housing); real sales of goods and services by the business sector to the nonmarket sector less real sales of goods and services from the nonmarket sector to the business sector (Q_2) government investment (Q_3); business sector investment in residential structures (Q_4); business sector investment in machinery and equipment (Q_5); business sector investment in nonresidential structures (Q_6); inventory change (Q_7); exports of agricultural and fish products (Q_8); exports of energy products (Q_9); exports of forest products (Q_{10}); exports of industrial goods and materials (Q_{11}) (excluding energy and forest product exports); exports of machinery and equipment (Q_{12}) (excluding automotive products); exports of automotive products (Q_{13}); exports of other consumer goods (Q_{14}) (excluding automotive products); exports of services (Q_{15}); imports of agricultural and fish products (Q_{16}); imports of energy products (Q_{17}); imports of industrial goods and materials (Q_{18}) (including imports of forest products but excluding imports of energy products); Imports of machinery and equipment (Q_{19}) (excluding automotive products); imports of automotive products (Q_{20}); imports of other consumer goods (Q_{21}); and imports of services (Q_{22}).

8 P_D^t is the Törnqvist price index of P_1^t-P_7^t and Q_D^t is the corresponding implicit quantity index.

9 P_X^t and P_M^t are constructed as Törnqvist price indexes and Q_X^t and Q_M^t are the corresponding implicit quantity indexes.

10 P_Y^t is a Törnqvist price aggregate of P_D^t,P_X^t,P_M^t (with corresponding quantities Q_D^t,Q_X^t,$-Q_M^t$) and Q_Y^t is the implicit quantity index that matches up with P_Y^t.

and Q_{L1}-Q_{L12}. These series were extended to 2011 using various Statistics Canada series as explained in Appendix 2. These 12 price and quantity series for the various types of labour were aggregated into aggregate quality adjusted business sector labour input Q_L^t with corresponding price index P_L^t.[11] P_L^t is provided in Table 1 and Q_L^t is given in Table 2.

Using information on business sector capital stocks in CANSIM Table 310003, calculated estimates for the beginning of year capital stock for the business sector for the 14 types of reproducible capital assets (Q_{K1}-$_{K14}$).[12] Using Statistics Canada balance sheet information (and other sources), we were able to construct business sector beginning of the year capital stock inputs for inventories (Q_{K15}), agricultural land (Q_{K16}) and business nonagricultural land (Q_{K17}). We also constructed estimates for the corresponding capital stock prices, P_{Kn}^t, for n = 1,...,17 and t = 1961-2011.

As explained in Appendix 2, user cost prices U_n^t for the 17 capital stock inputs were constructed, using balancing or endogenous real rates of return that made the value of net output produced by the business sector equal to the value of primary inputs used by the business sector.[13]

There is a problem with our capital input data in that the software series starts only in 1981. Our translog methodology does not work when an input is equal to 0 in one period and positive in a subsequent period. Thus we aggregated the software asset with the computer asset; i.e., we constructed a Fisher capital services aggregate of (U_8^t,U_{10}^t) and (Q_{K8}^t,Q_{K10}^t) to replace the individual services for these two assets.[14] We then constructed a business sector capital services aggregate Q_K^t by aggregating the 16 types of capital services using direct Törnqvist quantity aggregation. The corresponding capital services aggregate price is denoted as P_K^t and is listed in Table 1 while Q_K^t is listed in Table 2.

Once the labour and capital aggregates have been constructed, we can construct a direct Törnqvist quantity *input aggregate* of Q_L^t and Q_K^t which we denote by Q_Z^t, which is listed in

11 Q_L^t is now a direct Törnqvist quantity aggregate of Q_{L1}^t-Q_{L12}^t with P_L^t defined as the corresponding implicit price index. These index number conventions are necessary in order to apply the translog methodology explained in Appendix 1.

12 Office furniture (Q_{K1}); agricultural machinery (Q_{K2}); industrial machinery (Q_{K3}); automobiles (Q_{K4}); trucks (Q_{K5}); other transport equipment (Q_{K6}); other machinery and equipment (Q_{K7}); computers (Q_{K8}); telecommunications equipment (Q_{K9}); software (Q_{K10}); industrial buildings (Q_{K11}); commercial buildings (Q_{K12}); institutional buildings (Q_{K13}); and engineering construction (Q_{K14}).

13 User costs for capital inputs are meant to approximate what it would cost a business to rent or lease the services of the asset for the accounting period under consideration. The use of user costs in multifactor productivity studies dates back to the pioneering work of Jorgenson and Griliches (1967). Basically, a user cost consists of the sum of four terms: (1) the interest that could be earned if the asset were simply sold at the beginning of the period; (2) depreciation; (3) taxes that are assessed on the use of the asset plus the appropriate business income tax rate and (4) expected capital gains (or minus losses) that the asset might accrue over the accounting period. With respect to (1) we chose the interest rate to be the balancing rate of return that makes the value of inputs equal to the value of outputs; i.e. we chose an endogenous rate of return rather than an exogenous one. With respect to (4), we chose to value beginning and end of period capital stocks at the average investment prices of the period, which eliminated the capital gains term. There are problems associated with the estimation of *expected* capital gains and so our strategy avoids these problems. Jorgenson (1989) and his coworkers estimate expected capital gains (or losses) by actual gains (of losses). This strategy tends to lead to negative user costs for land assets and hugely positive user costs for computers (when statistical agencies assign large depreciation rates to computers). Statistics Canada uses the Jorgenson methodology. The issue of how exactly to construct user costs has not been definitively resolved. For further discussion on problems with constructing user costs, see Harper, Berndt and Wood (1980), Diewert (1980) (2005a), Schreyer (2009) and Inklaar (2010).

14 Fisher (1922) aggregation can deal with 0 quantities; see Diewert (1980: 498-501).

Table 2. The corresponding implicit aggregate input price index, P_Z^t, is listed in Table 1.

Note that we have also included the price of our household consumption aggregate, P_C^t, in Table 1, which will play a role in subsequent sections. The multifactor productivity level of the Canadian business sector T^t can be defined as the aggregate output, Q_Y^t divided by aggregate input, Q_Z^t:[15]

(1) $T^t \equiv Q_Y^t/Q_Z^t$; t = 1961, ..., 2011.

Multifactor Productivity (MFP) *growth* for year t, τ^t, is defined as the productivity level in year t divided by the previous year's productivity level:

(2) $\tau^t \equiv T^t/T^{t-1}$; t = 1962, ..., 2011.

Table 2 lists the quantities that match up to the prices in Table 1 and it also lists multifactor productivity index levels and growth rates.

Our geometric or compound average rate of multifactor productivity growth over the 1961-2011 period is 1.03 per cent per year.[16] This compares with Statistics Canada's KLEMS program average multifactor productivity growth over the same years of 0.28 per cent per year, which is a rather substantial difference (0.75 percentage points per year)![17] In section three, we attempt to determine why our results are so different from the official Statistics Canada results.[18]

Over the golden years of the 1961-1973 business cycle,[19] multifactor productivity growth[20] averaged 2.67 per cent per year; over the next peak-to-peak business cycle of 1973-1981, MFP growth turned negative (-0.03 per cent per year). During the cycles of the 1980s and 1990s, MFP growth picked up, averaging 1.12 per cent per year over the 1981-1989 business cycle and 1.02 per cent over the 1989-2000 cycle. Since 2000 MFP growth has again turned slightly negative, averaging -0.04 per cent over the 2000-2008 cycle and -0.02 in the 2008-2011 period.

However, there is more to living standards growth than multifactor productivity growth: if the price of Canadian exports increases more rapidly than the price of Canadian imports, then the real income generated by the business sector should increase. This terms of trade effect is not taken into account in the above MFP productivity computations. Thus in the following section, we implement the translog real income methodology outlined in Appendix 1 to assess the contribution to Canadian living standards of improvements in Canada's terms of trade.

15 See definition (34) in Appendix 1.

16 This rate of multifactor productivity growth can be compared to the average rate of MFP growth for Australia obtained by Diewert and Lawrence (2006) using a similar methodology and over a similar period. The Diewert and Lawrence market sector average rate of MFP growth for Australia over the period 1961-2004 was 1.49 per cent per year. However, there is an upward bias in the Diewert and Lawrence results due to the fact that they used hours worked as their measure of labour input instead of a quality adjusted measure of labour input for Australia (which was not available).

17 Table 7 shows that our estimates of MFP growth exceeded those of Statistics Canada in all five peak-to-peak business cycles since 1961. The gap was greatest in the 1961-1973 period (1.47 percentage points), followed by the 1981-1989 period (0.95 points), the 1989-2000 cycle (0.56 points), the 2000-2008 cycle (0.48 points), and finally the 1973-1981 cycle (0.22 points).

18 Our measures of business sector output and capital input were different from the KLEMS measures because we excluded rental housing from our measure of value added and we excluded the residential land and residential structures inputs from our measure of capital services, whereas the KLEMS measures included rental housing in their output and capital input measures.

19 To minimize the influence of short-term cyclical factors on MFP growth, it is standard practice to calculate MFP growth rates over similar points of the business cycle, normally cyclical peaks. Peak years were 1973, 1981, 1989, 2000, and 2008.

20 All growth rates in this paragraph are average geometric growth rates over the period under consideration. The average growth rates in Table 4 are arithmetic ones (and hence are slightly higher).

Explaining Real Income Growth Generated by the Canadian Business Sector: the Gross Output Approach

The basic methodology used in this section can easily be explained in non-technical terms. The business sector faces (exogenous) domestic and international prices for the net outputs it produces: domestic outputs, exports and (minus) imports. The business sector also utilizes inputs of labour and capital in order to produce its outputs. The value of outputs produced by the business sector less the value of imports used (value added) must eventually flow back to the labour and capital primary inputs that were used to produce value added. This is the (gross) income generated by the business sector.

We divide this gross nominal income in year t by the price of consumption goods and services in year t, P_C^t, in order to turn this nominal income into *real income* ρ^t. This real income is the number of consumption bundles that *could* be purchased by the owners of the labour and capital inputs that were used in year t by the Canadian business sector. We also divide each of the prices P_D^t, P_X^t, P_M^t, P_L^t and P_K^t by the price of consumption, P_C^t, in order to form the corresponding real (that is relative to the price of consumption goods and services)[21] output and input prices facing the Canadian business sector in each year. Our estimates of the (gross) real income generated by the business sector and the corresponding real output and input prices are given in Table 3.

The gross real income generated by the Canadian business sector has grown from $29,368 million dollars worth of 1961 consumption bundles in 1961 to $182,140 million in 2011, a 6.20 fold increase. Looking at the change in real input and output prices, by 2011 the real price of domestic output had fallen to 0.972 of its starting level in 1961 (due to the fact that machinery and equipment prices have risen less rapidly than the price of consumption) and the real price of exports has risen slightly to 1.026 of the starting level. However, the real price of imports has fallen substantially to 0.653 of the starting level. The quality adjusted real wages of business sector workers have risen to 2.101 of their initial 1961 levels. The real price of capital services has risen 1.69 fold, reflecting rapidly rising prices of agricultural land and non-agricultural business land as well as upward trends in machinery and equipment depreciation rates and in real rates of return (see Appendix 2 for details).

Note that real wages, defined as the price of labour relative to the price of consumption goods and services, P_L^t/P_C^t, peaked in 1977 at 1.75 and then fell to 1.67 in 1983 (Table 3). By 2011 they had increased to 2.10, representing a 1.50 per cent average annual rate of advance since 1961. Real domestic prices, P_D^t/P_C^t, increased to 1.06 in 1974 and then dropped to 0.97 at the end of the sample period. This drop is probably due to the advent of quality adjustment of computers in the 1980s. The real price of exports, P_X^t/P_C^t, fluctuates but ends up close to unity at the end of the sample period (1.03). The real price of imports, P_M^t/P_C^t, drops substantially over the sample period, ending up at 0.63 in 2011. The real price of business sector capital services, P_K^t/P_C^t, increased to 1.52 in 1979 and then decreased to 1.09 in 1982. It stayed in the range 1.00 to 1.75 for the rest of the sample period, with large drops during recession years, which were in 1982, 1991 and 2009. This is due a decrease in the balancing real rate of return for those years.

There are six quantitative factors (α) that can be used to explain the real income ρ^t generated by the business sector in year t:

21 The series are called real because they are calculated by deflating by consumer prices.

- The price of domestic production (an aggregate of C+I+G) relative to the price of consumption in year t, P_D^t/P_C^t;
- The price of exports relative to the price of consumption in year t, P_X^t/P_C^t;
- The price of imports relative to the price of consumption in year t, P_M^t/P_C^t;
- The quantity of labour used by the business sector in year t, Q_L^t;
- The quantity of capital used by the business sector in year t, Q_K^t ;and
- The level of technology of the business sector, as proxied by multifactor productivity, in year t.

The formal model outlined in Appendix 1, based on the work of Diewert and Morrison (1986) and Kohli (1990), allows us to decompose the growth of real income from year t–1 to t, ρ^t/ρ^{t-1}, into multiplicative year to year contribution factors α_D^t, α_X^t, α_M^t, β_L^t, β_K^t and τ^t that describe the effects of changes in the six explanatory variables listed above going from year t–1 to t. The model outlined in Appendix 1 leads to the following equation which decomposes the year to year growth in real income generated by the business sector, ρ^t/ρ^{t-1}, into a product of six year to year explanatory contribution factors:[22]

(3) $\rho^t/\rho^{t-1} = \tau^t \alpha_D^t \alpha_X^t {}_M^t \beta_L^t \beta_K^t$; t = 1962, 1963,...,2011.

Thus if α_D^t is greater than one, this means that the domestic price of output grew faster than the price of consumption going from year t–1 to t and α_D^t measures the contribution of rising real domestic output prices to the growth in real income. Similarly, if α_X^t is greater than one, this means that Canadian export prices grew faster than the price of consumption going from year t–1 to t and α_X^t measures the contribution of rising real export prices to the growth in real income generated by the Canadian business sector. However, if α_M^t is greater than one, this means that Canadian import prices did not increase as quickly as the price of consumption going from year t–1 to t and α_M^t measures the contribution of *falling* real import prices to the growth in real income generated by the Canadian business sector. If β_L^t is greater than one, then business sector labour input increased going from year t–1 to t and β_L^t measures the contribution of the increase in labour input to the growth in real income generated by the Canadian business sector. Similarly, if β_K^t is greater than one, then business sector capital services input increased going from year t–1 to t and β_K^t measures the contribution of the increase in capital input to the growth in real income generated by the Canadian business sector. Finally, if τ^t is greater than one, then the efficiency of the Canadian business sector increased from year t–1 to t and τ^t measures the contribution of the efficiency increase or multifactor productivity growth to the growth in real income generated by the Canadian business sector. These year to year contribution factors are given in Table 4 along with the (arithmetic) averages of these contribution factors over various time periods.

Looking at the (geometric) averages given for the 1961-2011 period in Table 4, it can be seen that the (gross) real income generated by the Canadian business sector over the entire sample period grew at 3.72 per cent per year. The biggest contributor to this growth was the increase in quality adjusted labour input at 1.24 percentage points per year, responsible for 33.3 per cent of real income growth. Next was capital services growth (1.08 percentage points per year or 29.1 per cent). This was followed by MFP growth, τ^t, which contributed on average 1.03 percentage points per year (or 27.6 per cent) and declines in real import prices (0.40 percentage points per year or 10.7 per cent). Declines in real domestic

22 See the equations in Appendix 1 in order to derive this equation. All of the variables in equation (3) can be identified using the data in Appendix 2.

output prices and real export prices gave rise to negative average contribution factors, –0.051 and –0.002 percentage points per year respectively. The last column in Table 4 gives the product of the real export and real import price contribution factors, α_{XM}^t, defined as:

(4) $\alpha_{XM}^t \equiv \alpha_X^t \alpha_M^t$.

Roughly speaking, α_{XM}^t is a *terms of trade contribution factor*; it gives the contribution to real income growth of the combined effects of real changes in the international prices facing the Canadian business sector.[23] It can be seen that the effects of changing real international prices are not negligible for Canada: on average, changing real export and import prices contributed 0.39 percentage points per year or 10.2 per cent to real income growth over the entire period.[24]

However, for shorter periods, the effects of changing real international prices can be far more important in explaining changes in the real income generated by the market sector of an economy. Thus if we restrict our attention to the period 2000-2011, it can be seen by looking at Table 4 that the effects of improvements in Canada's terms of trade are the most important explanatory factor. Thus during this period, the average annual growth in the real income generated by the Canadian business sector was 2.39 per cent per year and the following factors explained this growth rate: decreases in the real price of imports (1.23), increases in quality adjusted labour input (0.78), increases in capital services input (0.74) and increases in real domestic prices (0.03). There were negative contributors to business sector real income growth during the 2000s: decreases in MFP (-0.03) and decreases in the real price of exports (–0.36).

Thus decreases in the real price of imports proved to be the most important factor in explaining the growth in real income generated by the business sector during this period, accounting for over half (51.5 per cent) of the growth. Overall, the joint effects of changes in real export and import prices contributed about 0.86 percentage points per year on average to the growth of business sector real income during the 2000s, which was greater than the contribution of capital input over this period (which was 0.74 percentage points per year on average).[25] Thus improvements in the terms of trade largely compensated for the poor multifactor productivity performance during the 2000s, leading to an overall reasonable rate of growth for the real income generated by the Canadian business sector.

The annual change information in Table 4 can be easily converted into levels.[26] Thus let T^t, A_D^t, A_X^t, A_M^t, B_L^t, B_K^t and A_{XM}^t be the cumulated products of the annual link factors τ^t, α_D^t, α_X^t, α_M^t, β_L^t, β_K^t and α_{XM}^t respectively. Using these definitions and cumulating equations (3) leads to the following equation, which explains the cumulative growth in real gross income generated by the Canadian business sector relative to the base year 1961:

(5) $\rho^t/\rho^{1961} = T^t A_D^t A_X^t A_M^t B_L^t B_K^t$;
$t = 1962, 1963, \ldots, 2011$.

The cumulated variables that appear in (5) above are reported in Table 5 along with the cumulated terms of trade contribution factor, A_{XM}^t defined to be the product of the two cumulated international price factors, A_X^t and A_M^t.

23 Ulrich Kohli has pointed out that this is a slight abuse of terminology. Strictly speaking, the terms of trade is the price of exports over the price of imports and hence involves only two prices. Our definition of aXMt involves three prices: the price of exports, the price of imports and the price of domestic consumption. Our terms of trade contribution factor is the rate of change counterpart to Kohli's (2006: 50) *trading gains factor*.

24 Thus the contribution of falling real import prices outweighs the effects of falling real export prices.

25 These results are very similar to the results obtained for Australia using a similar framework by Diewert and Lawrence (2006). Both Australia and Canada have had very favourable changes in their terms of trade in recent years which contributed greatly to real income growth during the 2000s.

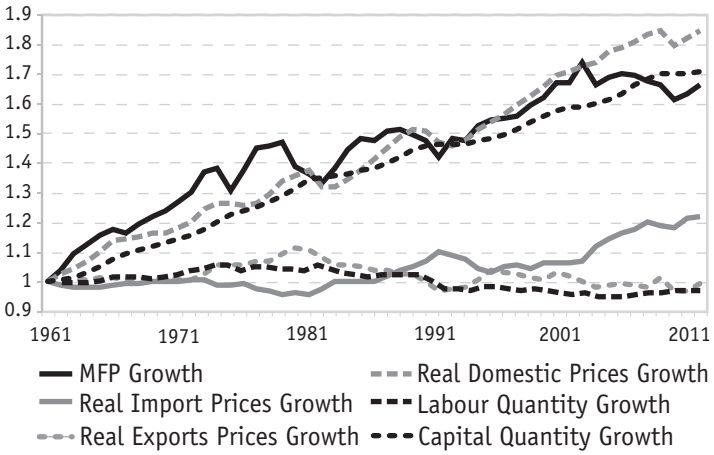
26 See equations (38) in Appendix 1 (with obvious extensions to multiple inputs and outputs).

Table 5 present the various growth factors for 6 sub-periods, including five peak-to-peak business cycles:

- The 12 golden years for the Canadian economy were 1961-1973, when the real income generated by the business sector grew by 6.73 per cent per year and MFP growth was a stellar 2.67 per cent per year;
- The 1973-1981 period, characterized by stagflation, oil shocks and rapidly increasing tax rates when the real income generated by the business sector fell to 3.38 per cent per year and MFP growth plummeted to -0.03 per cent per year;
- The 1981-1989 period when real income growth continued to fall, reaching 3.05 per cent, but MFP growth recovered to 1.12 per cent per year;
- The 1989-2000 period when real income growth again fell to 2.55 per cent, with MFP growth stable at 1.12 per cent per year;
- The 2000-2008 period when real income growth picked up to 3.22 per cent even though MFP growth turned negative (-0.04 per cent). Positive terms of trade effects accounts for this strong income growth despite the deterioration in productivity performance.
- In the 2008-2011 period, real income growth fell to 0.21 per cent per year due to the recession, with no effect on MFP growth (-0.02).

Table 5 shows that real income generated by the business sector grew 6.20 fold over the years 1961-2011. The main factors explaining this growth are growth of quality adjusted labour input (cumulative growth factor 1.85), growth of capital services (cumulative growth factor 1.71), MFP productivity increases (cumulative growth factor 1.67) and lower real import prices (cumulative growth factor 1.22). There were small negative contributions from declining real domestic output prices (cumulative growth factor 0.97) and declining real export prices (cumulative growth factor .99). [27]

Chart 1
Cumulated Contribution Factors Accounting for Real Income Growth in the Canadian Business Sector, 1961-2011
(1961=1.0)



In recent years, the real prices of Canada's raw materials exports have increased dramatically. However, these increases do not show up in the A_X^t column of Table 5; i.e., the overall real price of Canadian exports has remained relatively constant in recent years. This apparent contradiction can be explained by falling real prices for Canadian exports of manufactured goods. As already noted above, the effects of falling real import prices in recent years have been substantial. The cumulative contribution factors listed in Table 5 are plotted in Chart 1.

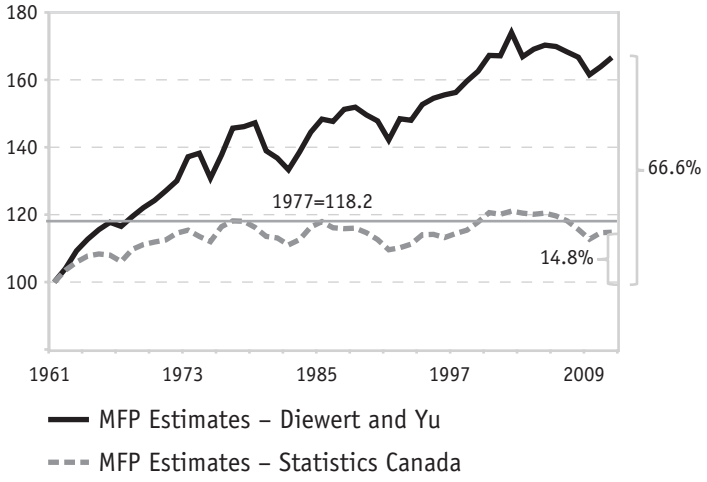
It can be seen that labour, capital and MFP growth were the main contributors to the generation of real income growth over the period 1961-2011, but that falls in import prices were an important contributory factor during the period 2002-2007.

27 This growth factor can also be expressed as compound annual growth rates, as shown in Table 5.

Chart 2

MFP Growth in the Canadian Business Sector, Comparison between Diewert and Yu and Statistics Canada, 1961-2011

(1961=100)

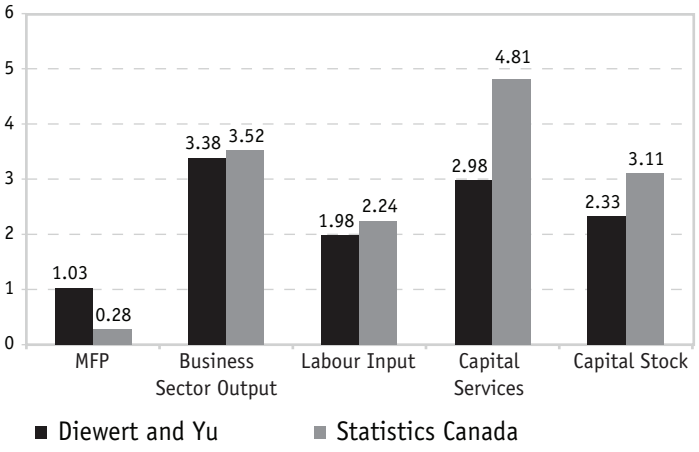


Source: Calculations by Diewert and Yu; Statistics Canada, Canadian Productivity Accounts (CANSIM Table 383-0021).

Chart 3

MFP, Output, and Input Growth in the Canadian Business Sector, 1961-2011

(compound annual growth rates, per cent)



Source: Calculations by Diewert and Yu; Statistics Canada, Canadian Productivity Accounts (CANSIM Table 383-0021).

Comparison with the KLEMS Program Multifactor Productivity Estimates

As was mentioned earlier, the Statistics Canada KLEMS program produces on a regular basis estimates of multifactor productivity growth for the Canadian business sector.[28] Earlier in the article we noted that our level of business sector MFP using our user cost framework was 1.666 in 2011 from its starting value of 1.000 in 1961 whereas the KLEMS multifactor business sector productivity was 1.148 in 2011. This implies a significant difference of 0.75 percentage points in MFP growth over half a century between the two series (1.03 per cent versus 0.28 per cent) (see Chart 2 and Table 7). It is particularly interesting to note that the level of MFP in the Statistics Canada series in 2011 was below that of 1977, indicating negative MFP growth for the last one third of a century, a period of rapid technological change (Chart 2). In this section, we will try to determine why our estimates are so different from the corresponding KLEMS program estimates.

Our measures of real business sector output, labour and capital services input are Q_Y^t, Q_L^t and Q_K^t and our measure of the capital stock used by the business sector is Q_{KW}^t. These estimates are found in Table 6. The KLEMS program provides index counterparts to our measures for the years 1961-2011.[29] The KLEMS program also provides nominal estimates for business sector output, labour input and capital services input for the years 1961-2008.[30] We use the initial 1961 values for the KLEMS value of business sector output, labour and capital input and scale or convert the KLEMS constant dollar estimates for all years into a constant dollar series expressed in terms

28 See Baldwin, Gu and Yan (2007) and Baldwin and Gu (2007) for a description of the methods used in this program.

29 See CANSIM Table 3830021, series V41712932, V41712949, V41713051 and V41713068 respectively.

30 See CANSIM Table 3830021, series V41713153, V41713170 and V41713228 respectively.

of 1961 dollars. These official KLEMS series are given as Q_{YO}^t, Q_{LO}^t and Q_{KO}^t in Table 6.

Table 6 and Chart 3 show that our compound average annual rate of output growth over the 1961-2011, 3.38 per cent, is slightly smaller than the KLEMS estimate of average rate of output growth, which was 3.52 per cent. This relatively small difference does not explain the large difference in rates of multifactor productivity growth (and the difference goes in the wrong direction).

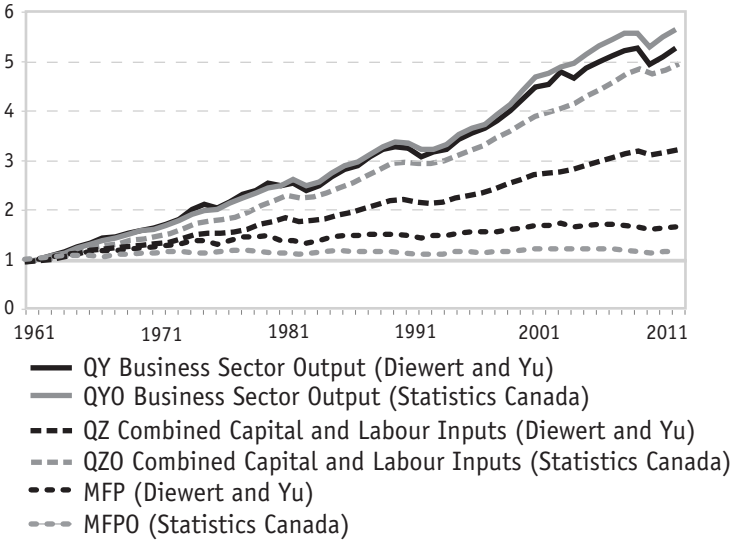
As noted earlier, our business sector output concept differs from the corresponding KLEMS concept in two ways:

- We exclude the services of both owned and rented residential housing from our output concept whereas the KLEMS program excludes only owned residential housing services; and
- We measure real inventory change as a difference in real inventory stocks whereas the KLEMS program follows national income accounting conventions and measures inventory change in a different manner.

The effect of the above two differences on output growth rates is obviously not large, resulting in our average output growth rate being fairly close to the corresponding official rate.[31]

In order to better identify sources of the differences between our multifactor productivity estimates and the official estimates, we plot our productivity level estimates (MFP) and the corresponding official ones normalized to equal one in 1961 (MFPO) in Chart 4. It can be seen that the official estimates have been essentially flat since 1972. The top two series are the output series, QY and QYO, and they are not too different. The two middle series are the total input series showing that the official aggregate input series (QZO), lies far above our counterpart series, QZ.

Chart 4
Statistics Canada and Diewert and Yu Estimates of Output, Input and Multifactor Productivity in the Canadian Business Sector, 1961-2011
(1961=1.0)

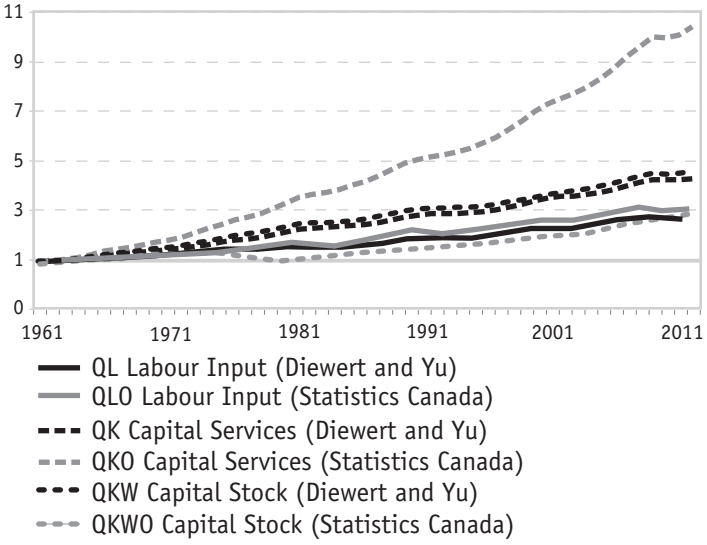


In order to identify the sources of the difference in the growth rate for aggregate input, our labour and capital services series (normalized to equal one in 1961), QL and QK, are plotted in Chart 5 with the official (normalized) series, QLO and QKO. We also plot our normalized wealth (real) capital stock, QKW, along with the counterpart official normalized wealth stock, QKWO. It can be seen that QL and QLO are reasonably close, but the official capital services series, QKO, is far above our normalized capital services series QK. It can be seen that the KLEMS capital stock series, QKWO, is also above our series QKW, but the differences in the wealth series are far smaller than the differences in the capital services series.

Our measure of quality adjusted labour grew on average at 1.98 per cent per year between 1961 and 2011, which is somewhat slower than the corresponding KLEMS rate, which was 2.24 per cent per year (Chart 3). This difference does

31 See the last column in Table 6 which lists real paid rents for the Canadian economy. They are small relative to the size of the business sector.

Chart 5
Statistics Canada and Diewert and Yu Estimates of Labour, Capital Services and Capital Stock in the Canadian Business Sector, 1961-2011
(1961=1.0)



help to explain the difference in multifactor productivity growth rates. We believe that our estimates for quality adjusted labour growth are just as credible as the KLEMS program estimates due to the difficulties in measuring the experience variable in an objective manner (which the KLEMS program uses and we do not).

However, the big explanatory factor lies in the differences in the growth of capital services: our capital services aggregate grew at the geometric rate of 2.98 per cent per year whereas the KLEMS capital services aggregate grew at 4.81 per cent per year, a massive difference of 1.83 percentage points per year! Our capital stock aggregate grew at 2.33 per cent per year and the KLEMS capital stock grew at 3.11 per cent per year, a difference of 0.78 percentage points. It is understandable why our capital stock aggregate grew more slowly than the corresponding KLEMS capital stock aggregate. Our estimates for the price of business land are likely much higher than the KLEMS estimates and we assumed no business land growth. Both factors will lead to a much lower rate of growth of the aggregate capital stock.[32]

It is possible to explain why the average growth rate of capital *services* should be faster than the average growth rate of capital *stock* components. The faster growing components of the capital stock (M&E, and especially the ICT component) have larger user costs of capital relative to the slower growing components of the capital stock (agricultural land and nonagricultural land) compared to their stock prices. Thus aggregate capital services will tend to grow faster than the corresponding aggregate capital stock.[33]

In order to obtain a rough estimate for how much of a difference in growth rates between capital stocks and services should be expected, we calculated average rates of growth over our sample period for each of our 17 capital stock components. We also calculated sample average shares for each type of capital service and for each component of the wealth stock. We calculated a share weighted average of the average rates of asset growth using average capital service shares and found that the resulting average rate of growth of capital services was 3.03 per cent per year. We then calculated a share weighted average of the average rates of asset growth using average capital stock shares and found that the resulting average rate of growth of capital stocks was 2.38 per cent per year. Thus we expect the difference between

32 It is interesting to compare these two sets of estimates of capital input and multifactor productivity growth for Canada with estimates for the United States from the Bureau of Labor Statistics. US multifactor productivity growth over the 1961-2011 was 1.15 per cent per year, similar to the estimate of Diewert and Yu for Canada (1.03 per cent) and four times the Statistics Canada estimate (0.28 per cent). US capital input growth was 3.91 per cent, mid-way between the Statistics Canada estimate (4.81 per cent) and the Diewert-Yu estimate (2.98 per cent) .

33 This observation dates back to Jorgenson and Griliches (1967) at least.

the average capital services rates of growth and the corresponding stock rates of growth to be 0.65 percentage points per year (3.03 per cent -2.38 per cent).

Recall that our average geometric rate of growth of capital services was 2.98 per cent and our average geometric rate of growth of the capital stock was 2.33 per cent per year for a difference of 0.65 percentage points per year. Thus we think that our difference between the rates of growth in the capital stock and the corresponding capital services is very reasonable. In contrast, we find the differences in the KLEMS estimates to be far too big to be credible.[34]

Part of the problem is that the KLEMS program does not provide enough detailed data for researchers outside Statistics Canada to determine the exact source of differences. Some of the differences may be due to the following factors:

- The inclusion of ex post capital gains terms in the KLEMS user cost formula. This will give high tech assets an enormous user cost (due to their rapidly declining prices) as compared to our weights.[35]
- We are using a sector wide balancing rate of return whereas the KLEMS program uses sector specific rates that could be very variable and volatile.
- The KLEMS program has access to more detailed data and so our estimates may be subject to some aggregation bias.

Conclusion

There are three major conclusions that we can draw from the above results.

First, using recent Statistics Canada data sources and a top down approach, we have shown that the MFP performance of the business sector of the Canadian economy has been reasonably satisfactory over the past 50 years. In particular, traditional gross income multifactor productivity growth averaged 1.03 percent per year over the period 1961-2011 (compared to only 0.28 per cent per year according to Statistics Canada official MFP measure). However, there have been two cyclically neutral periods (1981-1989 and 2000-2008) where the MFP productivity performance of the Canadian business sector was decidedly unsatisfactory, indeed negative.

Second, the results presented here show that over short periods of time, changes in the external price environment facing an economy can have substantial effects on living standards. Thus during the years 2000-2011, the real income generated by the Canadian business sector grew at an average rate of 2.39 percent per year and declines in real import prices contributed 1.23 percentage points to this increase, which was greater than the effects of quality adjusted labour input growth (0.78 percentage points per year), capital input (0.74 percentage points per year) and real domestic prices growth (0.03 percentage points per year).

Finally, the study uncovered many data problems which should be addressed in future work on Canadian productivity performance. In particular, the treatment of capital services by Statistics Canada needs additional documentation and experimentation, particularly with respect to the measurement of land services, the form of the user cost formula, the treatment of taxes, the determination of depreciation rates and the choice of a reference rate of return.

34 The difference between capital services and capital stock growth in the KLEMS estimates is of 1.70 percentage points, based on a capital stock growth of 3.11 per cent per year and a capital services growth of 4.81 per cent per year during the 1961-2011 period.

35 Statistics Canada's depreciation rates are not necessarily incorrect. This is a topic that requires further research.

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Table 1
Price Indexes for Canadian Business Sector Output and Input Aggregates, 1961-2011

	P_C	P_D	P_X	P_M	P_L	P_K	P_y	P_Z
	Consumption	Domestic Output	Exports	Imports	Labour	Capital Services	Business Sector Output	Combined Labour and Capital Inputs
Year	(index, 1961=1.000)							
1961	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1962	1.006	1.007	1.030	1.058	1.038	1.039	0.999	1.038
1963	1.020	1.021	1.041	1.096	1.072	1.155	1.007	1.100
1964	1.023	1.032	1.057	1.105	1.114	1.213	1.019	1.148
1965	1.036	1.056	1.080	1.102	1.188	1.261	1.049	1.213
1966	1.074	1.096	1.125	1.119	1.266	1.340	1.097	1.292
1967	1.107	1.129	1.154	1.144	1.348	1.264	1.131	1.318
1968	1.148	1.164	1.201	1.167	1.435	1.340	1.173	1.401
1969	1.185	1.205	1.231	1.196	1.548	1.366	1.214	1.482
1970	1.215	1.242	1.267	1.220	1.645	1.409	1.256	1.560
1971	1.242	1.288	1.286	1.248	1.763	1.452	1.298	1.649
1972	1.293	1.348	1.333	1.275	1.915	1.535	1.366	1.776
1973	1.384	1.459	1.515	1.360	2.096	2.014	1.509	2.070
1974	1.582	1.674	1.913	1.646	2.424	2.404	1.752	2.422
1975	1.820	1.891	2.167	1.890	2.805	2.206	1.970	2.577
1976	1.904	1.998	2.297	1.929	3.229	2.390	2.111	2.907
1977	2.028	2.125	2.502	2.172	3.541	2.717	2.216	3.228
1978	2.190	2.291	2.738	2.417	3.711	3.052	2.374	3.467
1979	2.403	2.511	3.208	2.730	3.977	3.660	2.633	3.877
1980	2.691	2.794	3.735	2.980	4.384	3.791	3.003	4.172
1981	2.898	3.059	3.998	3.266	4.928	3.711	3.259	4.457
1982	3.166	3.316	4.089	3.439	5.470	3.460	3.494	4.657
1983	3.407	3.510	4.151	3.423	5.676	4.305	3.721	5.158
1984	3.564	3.647	4.297	3.582	5.978	4.823	3.851	5.562
1985	3.676	3.756	4.381	3.677	6.295	5.100	3.956	5.867
1986	3.756	3.844	4.371	3.744	6.487	4.992	4.015	5.929
1987	3.852	3.953	4.458	3.692	6.727	5.593	4.186	6.331
1988	3.958	4.061	4.471	3.601	7.199	5.588	4.348	6.602
1989	4.071	4.176	4.560	3.594	7.541	5.468	4.511	6.747
1990	4.302	4.335	4.529	3.644	7.853	5.342	4.647	6.870
1991	4.540	4.460	4.371	3.580	8.225	4.635	4.752	6.756
1992	4.599	4.503	4.496	3.726	8.410	5.118	4.773	7.085
1993	4.689	4.585	4.694	3.925	8.400	5.293	4.839	7.162
1994	4.718	4.659	4.973	4.161	8.331	6.119	4.915	7.503
1995	4.735	4.692	5.291	4.277	8.498	6.549	5.044	7.794
1996	4.833	4.748	5.321	4.222	8.612	6.890	5.152	8.013
1997	4.913	4.806	5.327	4.237	8.916	6.780	5.207	8.136
1998	4.978	4.872	5.316	4.380	9.196	6.687	5.170	8.252
1999	5.069	4.936	5.379	4.360	9.439	7.132	5.288	8.593
2000	5.207	5.050	5.710	4.442	9.915	8.062	5.553	9.287
2001	5.365	5.167	5.803	4.584	10.205	7.973	5.631	9.410
2002	5.434	5.248	5.689	4.615	10.375	8.594	5.625	9.789
2003	5.571	5.325	5.648	4.315	10.585	8.393	5.884	9.817
2004	5.652	5.415	5.786	4.206	10.897	9.245	6.139	10.380
2005	5.777	5.531	5.952	4.156	11.373	9.792	6.401	10.899
2006	5.880	5.662	5.975	4.117	11.913	9.778	6.590	11.196
2007	5.989	5.798	6.031	4.014	12.306	10.056	6.861	11.544
2008	6.156	5.975	6.644	4.244	12.622	10.728	7.219	12.035
2009	6.183	6.044	5.991	4.283	12.847	8.710	6.935	11.198
2010	6.255	6.094	6.123	4.103	13.034	9.764	7.202	11.804
2011	6.392	6.215	6.559	4.175	13.431	10.821	7.516	12.523
Compound Annual Growth Rates, per cent								
1961-2011	3.78	3.72	3.83	2.90	5.33	4.88	4.12	5.19
2000-2011	1.88	1.91	1.27	-0.56	2.80	2.71	2.79	2.76
1961-1973	2.74	3.20	3.52	2.59	6.36	6.01	3.49	6.25
1973-1981	9.68	9.70	12.90	11.58	11.28	7.94	10.10	10.06
1981-1989	4.34	3.97	1.66	1.20	5.46	4.97	4.15	5.32
1989-2000	2.26	1.74	2.07	1.95	2.52	3.59	1.91	2.95
2000-2008	2.12	2.13	1.91	-0.57	3.06	3.64	3.33	3.29
2008-2011	1.26	1.33	-0.43	-0.54	2.09	0.29	1.35	1.34

Table 2

Canadian Business Sector Real Output, Real Input Aggregates, and MFP Growth, 1961-2011

	Q_D	Q_X	Q_M	Q_L	Q_K	Q_y	Q_Z	T	τ
	Domestic Output	Exports	Imports	Labour	Capital Services	Business Sector Output	Combined Labour and Capital Inputs	MFP	MFP Growth
	(1)	(2)	(3)	(4)	(5)	(6)=(1)+(2)+(3)	(7)=(5)+(6)	(8)=(6)/(7)	(9)
Year	(millions, 1961 dollars)							(1961=1)	(% change)
1961	30,398	6,867	-7,897	19,240	10,128	29,368	29,368	1.000	
1962	32,414	7,195	-8,033	20,049	10,326	31,585	30,375	1.040	4.0
1963	34,157	7,832	-8,031	20,506	10,613	34,008	31,120	1.093	5.1
1964	36,431	9,105	-8,989	21,372	11,091	36,591	32,466	1.127	3.1
1965	40,024	9,418	-10,180	22,321	11,655	39,269	33,983	1.156	2.5
1966	43,167	10,696	-11,579	23,452	12,450	42,286	35,917	1.177	1.9
1967	43,510	11,827	-12,306	23,822	13,105	43,046	36,941	1.165	-1.0
1968	45,235	12,910	-13,527	23,864	13,515	44,645	37,378	1.194	2.5
1969	48,343	13,802	-15,377	24,366	13,986	46,806	38,338	1.221	2.2
1970	48,289	15,211	-15,293	24,395	14,513	48,260	38,850	1.242	1.7
1971	50,936	15,929	-16,480	24,836	14,953	50,452	39,711	1.271	2.3
1972	54,541	17,257	-18,892	25,469	15,415	53,041	40,792	1.300	2.3
1973	61,382	19,008	-21,754	26,868	16,106	58,832	42,891	1.372	5.5
1974	67,244	18,347	-23,977	27,717	17,037	61,727	44,662	1.382	0.8
1975	65,767	16,951	-23,228	27,534	18,122	59,494	45,471	1.308	-5.3
1976	69,516	18,390	-24,774	27,417	18,769	63,195	45,885	1.377	5.3
1977	72,993	19,678	-24,836	27,616	19,366	67,878	46,601	1.457	5.8
1978	74,955	21,544	-26,197	28,636	20,037	70,536	48,284	1.461	0.3
1979	80,182	22,467	-28,092	30,208	20,912	74,698	50,730	1.472	0.8
1980	79,002	22,548	-28,715	31,015	22,012	73,053	52,586	1.389	-5.7
1981	82,000	23,012	-30,716	31,669	23,302	74,433	54,414	1.368	-1.5
1982	72,384	22,882	-25,710	29,737	23,850	70,175	52,644	1.333	-2.6
1983	76,539	24,326	-28,444	29,747	24,016	73,155	52,786	1.386	4.0
1984	81,657	28,444	-33,270	30,714	24,312	78,122	54,090	1.444	4.2
1985	87,008	29,938	-35,548	31,892	24,809	82,738	55,787	1.483	2.7
1986	90,012	31,456	-37,965	33,124	25,343	85,019	57,578	1.477	-0.4
1987	96,002	32,933	-39,889	34,682	26,064	90,559	59,880	1.512	2.4
1988	102,460	35,371	-45,163	36,105	27,136	94,670	62,340	1.519	0.4
1989	106,238	35,434	-47,820	36,972	28,278	96,089	64,243	1.496	-1.5
1990	104,078	37,556	-48,551	36,814	29,056	95,610	64,682	1.478	-1.2
1991	98,192	38,167	-49,281	35,445	29,504	90,121	63,394	1.422	-3.8
1992	100,685	40,921	-51,473	35,000	29,544	93,349	62,887	1.484	4.4
1993	100,614	45,382	-55,461	35,683	29,642	94,373	63,765	1.480	-0.3
1994	105,514	51,076	-60,606	37,145	30,070	100,395	65,766	1.527	3.1
1995	107,894	55,452	-64,385	38,163	30,529	103,938	67,266	1.545	1.2
1996	110,521	58,646	-67,340	39,243	31,132	107,231	68,949	1.555	0.7
1997	118,530	63,457	-77,378	40,501	32,269	111,367	71,275	1.563	0.5
1998	122,860	69,086	-81,755	41,680	33,566	117,544	73,645	1.596	2.2
1999	127,598	76,337	-88,261	43,103	34,865	123,965	76,284	1.625	1.8
2000	134,789	83,350	-95,661	44,563	35,944	131,753	78,781	1.672	2.9
2001	135,351	80,654	-90,649	45,096	36,583	133,537	79,903	1.671	-0.1
2002	143,444	81,599	-92,347	45,811	36,720	140,604	80,788	1.740	4.1
2003	145,573	79,268	-96,341	46,610	37,380	137,165	82,214	1.668	-4.1
2004	154,248	83,281	-104,558	48,181	38,111	142,907	84,524	1.691	1.3
2005	163,288	84,847	-112,552	48,777	39,392	146,935	86,293	1.703	0.7
2006	171,384	85,213	-118,273	49,653	41,010	150,603	88,649	1.699	-0.2
2007	178,411	86,367	-125,533	50,817	42,360	153,232	91,066	1.683	-1.0
2008	184,343	82,650	-126,364	51,240	43,583	154,363	92,591	1.667	-0.9
2009	172,892	71,414	-108,643	49,049	43,323	145,283	89,970	1.615	-3.1
2010	183,521	76,559	-123,691	50,315	43,405	149,898	91,461	1.639	1.5
2011	191,904	80,232	-132,890	51,312	43,896	154,899	92,960	1.666	1.7
Compound Annual Growth Rates									
1961-2011	3.75	5.04	5.81	1.98	2.98	3.38	2.33	1.03	..
2000-2011	3.26	-0.35	3.03	1.29	1.83	1.48	1.52	-0.03	..
1961-1973	6.03	8.85	8.81	2.82	3.94	5.96	3.21	2.67	..
1973-1981	3.69	2.42	4.41	2.08	4.73	2.98	3.02	-0.03	..
1981-1989	3.29	5.54	5.69	1.95	2.45	3.24	2.10	1.12	..
1989-2000	2.19	8.09	6.51	1.71	2.20	2.91	1.87	1.02	..
2000-2008	3.99	-0.11	3.54	1.76	2.44	2.00	2.04	-0.04	..
2008-2011	1.35	-0.98	1.69	0.05	0.24	0.12	0.13	-0.02	..

Note: Since business sector and combined capital and labour input aggregates were calculated using Tornqvist indexes, they are not exactly additive.

Table 3
Gross Real Income Generated by the Canadian Business Sector and Real Output and Input Prices, 1961-2011

	r	P_D/P_C	P_X/P_C	P_M/P_C	P_L/P_C	P_K/P_C
	Real Income	Real Domestic Prices	Real Exports Prices	Real Imports Prices	Real Labour Prices	Real Capital Services Prices
Year	(millions, 1961 dollars)	(1961=1.000)				
1961	29,368	1.000	1.000	1.000	1.000	1.000
1962	31,346	1.000	1.024	1.051	1.032	1.033
1963	33,574	1.002	1.021	1.075	1.051	1.133
1964	36,430	1.008	1.033	1.080	1.089	1.186
1965	39,778	1.019	1.042	1.064	1.147	1.217
1966	43,178	1.020	1.047	1.042	1.179	1.248
1967	43,963	1.019	1.042	1.033	1.218	1.142
1968	45,613	1.014	1.046	1.017	1.250	1.167
1969	47,964	1.017	1.039	1.010	1.307	1.153
1970	49,880	1.022	1.043	1.004	1.354	1.160
1971	52,734	1.037	1.035	1.005	1.420	1.169
1972	56,020	1.042	1.031	0.986	1.481	1.187
1973	64,142	1.054	1.095	0.982	1.515	1.456
1974	68,360	1.058	1.209	1.041	1.532	1.519
1975	64,401	1.039	1.191	1.039	1.541	1.212
1976	70,045	1.049	1.206	1.013	1.696	1.255
1977	74,186	1.048	1.234	1.071	1.747	1.340
1978	76,445	1.046	1.250	1.103	1.695	1.394
1979	81,839	1.045	1.335	1.136	1.655	1.523
1980	81,529	1.038	1.388	1.107	1.629	1.409
1981	83,688	1.056	1.380	1.127	1.701	1.280
1982	77,448	1.048	1.292	1.086	1.728	1.093
1983	79,904	1.030	1.218	1.005	1.666	1.264
1984	84,425	1.024	1.206	1.005	1.677	1.353
1985	89,040	1.022	1.192	1.000	1.713	1.388
1986	90,893	1.024	1.164	0.997	1.727	1.329
1987	98,402	1.026	1.157	0.958	1.746	1.452
1988	103,992	1.026	1.130	0.910	1.819	1.412
1989	106,463	1.026	1.120	0.883	1.852	1.343
1990	103,284	1.008	1.053	0.847	1.825	1.242
1991	94,344	0.982	0.963	0.789	1.812	1.021
1992	96,892	0.979	0.978	0.810	1.829	1.113
1993	97,398	0.978	1.001	0.837	1.792	1.129
1994	104,594	0.988	1.054	0.882	1.766	1.297
1995	110,709	0.991	1.117	0.903	1.795	1.383
1996	114,302	0.982	1.101	0.874	1.782	1.426
1997	118,038	0.978	1.084	0.862	1.815	1.380
1998	122,079	0.979	1.068	0.880	1.847	1.343
1999	129,307	0.974	1.061	0.860	1.862	1.407
2000	140,515	0.970	1.097	0.853	1.904	1.548
2001	140,153	0.963	1.082	0.855	1.902	1.486
2002	145,551	0.966	1.047	0.849	1.909	1.582
2003	144,866	0.956	1.014	0.775	1.900	1.507
2004	155,219	0.958	1.024	0.744	1.928	1.636
2005	162,807	0.958	1.030	0.719	1.969	1.695
2006	168,802	0.963	1.016	0.700	2.026	1.663
2007	175,551	0.968	1.007	0.670	2.055	1.679
2008	180,996	0.970	1.079	0.689	2.050	1.743
2009	162,942	0.977	0.969	0.693	2.078	1.409
2010	172,597	0.974	0.979	0.656	2.084	1.561
2011	182,140	0.972	1.026	0.653	2.101	1.693
Compound Annual Growth Rates						
1961-2011	3.72	-0.06	0.05	-0.85	1.50	1.06
2000-2011	2.39	0.02	-0.60	-2.40	0.90	0.82
1961-1973	6.73	0.44	0.76	-0.15	3.52	3.18
1973-1981	3.38	0.02	2.93	1.73	1.46	-1.59
1981-1989	3.05	-0.36	-2.57	-3.01	1.07	0.60
1989-2000	2.56	-0.51	-0.19	-0.31	0.25	1.30
2000-2008	3.22	0.01	-0.20	-2.63	0.93	1.49
2008-2011	0.21	0.07	-1.67	-1.78	0.83	-0.96

Table 4
Sources of Annual Real Income Growth in the Canadian Business Sector, 1961-2011

		Contributions to Real Income Growth						
	r^t/r^{t-1}	τ	α_D	α_X	α_M	β_L	β_K	α_{XM}
	Real Income Growth	MFP Growth	Real Domestic Prices Growth	Real Exports Prices Growth	Real Import Prices Growth	Labour Quantity Growth	Capital Services Growth	Real Net Export Prices Growth
	(1)=(2)*(3)*(6)*(7)*(8)	(2)	(3)	(4)	(5)	(6)	(7)	(8)=(4)*(5)
Year	(growth factors)							
1962	1.067	1.040	1.000	1.005	0.987	1.027	1.007	0.992
1963	1.071	1.051	1.001	0.999	0.994	1.015	1.010	0.993
1964	1.085	1.031	1.007	1.003	0.999	1.027	1.016	1.002
1965	1.092	1.025	1.011	1.002	1.004	1.028	1.018	1.006
1966	1.085	1.019	1.001	1.001	1.006	1.032	1.024	1.007
1967	1.018	0.990	0.999	0.999	1.002	1.010	1.018	1.001
1968	1.038	1.025	0.994	1.001	1.005	1.001	1.011	1.006
1969	1.052	1.022	1.003	0.998	1.002	1.014	1.012	1.000
1970	1.040	1.018	1.006	1.001	1.002	1.001	1.013	1.003
1971	1.057	1.023	1.014	0.998	1.000	1.012	1.010	0.997
1972	1.062	1.023	1.006	0.999	1.006	1.017	1.010	1.005
1973	1.145	1.055	1.011	1.019	1.001	1.036	1.015	1.021
1974	1.066	1.008	1.004	1.033	0.980	1.020	1.021	1.012
1975	0.942	0.947	0.982	0.995	1.001	0.996	1.022	0.996
1976	1.088	1.053	1.010	1.004	1.009	0.997	1.012	1.013
1977	1.059	1.058	0.999	1.007	0.980	1.005	1.011	0.987
1978	1.030	1.003	0.998	1.004	0.989	1.024	1.012	0.994
1979	1.071	1.008	0.999	1.024	0.989	1.034	1.016	1.012
1980	0.996	0.943	0.994	1.015	1.010	1.016	1.020	1.025
1981	1.027	0.985	1.017	0.998	0.993	1.013	1.021	0.991
1982	0.925	0.974	0.992	0.975	1.014	0.960	1.008	0.989
1983	1.032	1.040	0.984	0.978	1.028	1.000	1.002	1.006
1984	1.057	1.042	0.994	0.996	1.000	1.020	1.005	0.996
1985	1.055	1.027	0.999	0.995	1.002	1.023	1.008	0.997
1986	1.021	0.996	1.002	0.990	1.001	1.024	1.008	0.992
1987	1.083	1.024	1.003	0.998	1.016	1.029	1.011	1.014
1988	1.057	1.004	1.000	0.991	1.021	1.025	1.015	1.011
1989	1.024	0.985	1.000	0.997	1.012	1.015	1.015	1.009
1990	0.970	0.988	0.982	0.977	1.017	0.997	1.010	0.993
1991	0.913	0.962	0.974	0.966	1.029	0.975	1.005	0.995
1992	1.027	1.044	0.997	1.006	0.989	0.992	1.000	0.995
1993	1.005	0.997	0.999	1.011	0.985	1.013	1.001	0.996
1994	1.074	1.031	1.010	1.026	0.975	1.026	1.005	1.000
1995	1.058	1.012	1.003	1.032	0.988	1.017	1.006	1.019
1996	1.032	1.007	0.992	0.992	1.018	1.017	1.008	1.009
1997	1.033	1.005	0.996	0.991	1.007	1.020	1.014	0.998
1998	1.034	1.022	1.000	0.991	0.989	1.018	1.015	0.980
1999	1.059	1.018	0.995	0.996	1.013	1.021	1.014	1.009
2000	1.087	1.029	0.996	1.021	1.005	1.021	1.012	1.026
2001	0.997	0.999	0.994	0.991	0.999	1.007	1.007	0.990
2002	1.039	1.041	1.003	0.980	1.003	1.010	1.001	0.984
2003	0.995	0.959	0.990	0.982	1.050	1.011	1.007	1.031
2004	1.071	1.013	1.002	1.005	1.021	1.020	1.008	1.026
2005	1.049	1.007	0.999	1.004	1.017	1.007	1.014	1.021
2006	1.037	0.998	1.005	0.993	1.013	1.011	1.017	1.006
2007	1.040	0.990	1.005	0.995	1.021	1.014	1.013	1.017
2008	1.031	0.991	1.002	1.035	0.987	1.005	1.012	1.021
2009	0.900	0.969	1.007	0.952	0.998	0.974	0.998	0.950
2010	1.059	1.015	0.997	1.004	1.026	1.016	1.001	1.030
2011	1.055	1.017	0.998	1.021	1.002	1.012	1.005	1.023

Table 4
Continued

	Real Income Growth	MFP Growth	Real Domestic Prices Growth	Real Exports Prices Growth	Real Import Prices Growth	Labour Quantity Growth	Capital Services Growth	Real Net Export Prices Growth
Average Contributions to Real Income Growth								
1961-2011	1.0372	1.0103	0.9995	0.9998	1.0040	1.0124	1.0108	1.0038
2000-2011	1.0239	0.9997	1.0003	0.9964	1.0123	1.0078	1.0074	1.0086
1961-1973	1.0673	1.0267	1.0044	1.0021	1.0006	1.0183	1.0135	1.0028
1973-1981	1.0338	0.9997	1.0001	1.0099	0.9938	1.0130	1.0170	1.0037
1981-1989	1.0305	1.0112	0.9965	0.9900	1.0118	1.0118	1.0090	1.0017
1989-2000	1.0255	1.0102	0.9949	1.0006	1.0011	1.0105	1.0081	1.0017
2000-2008	1.0322	0.9996	1.0001	0.9980	1.0138	1.0105	1.0098	1.0118
2008-2011	1.0021	0.9998	1.0006	0.9920	1.0084	1.0004	1.0010	1.0003
Average Contributions to Real Income Growth, per cent								
1961-2011	100.0	27.6	-1.5	-0.5	10.7	33.3	29.1	10.2
2000-2011	100.0	-1.4	1.1	-15.1	51.5	32.5	30.8	36.2
1961-1973	100.0	39.7	6.6	3.2	0.9	27.2	20.1	4.1
1973-1981	100.0	-1.0	0.4	29.4	-18.2	38.4	50.2	11.0
1981-1989	100.0	36.8	-11.5	-32.6	38.5	38.8	29.6	5.5
1989-2000	100.0	39.9	-20.0	2.2	4.2	41.1	31.8	6.5
2000-2008	100.0	-1.2	0.4	-6.1	42.8	32.8	30.4	36.7
2008-2011	100.0	-8.1	30.6	-382.1	399.6	17.8	45.4	14.3

Note: Percentage point contributions do not sum up exactly to real income growth because they are multiplicative.

Table 5
Cumulated Growth in Real Income and Contribution Factors in the Canadian Business Sector, 1961-2011

	r^t/r^{1961}	Cumulative Contributions to Real Income Growth						
		T	A_D	A_X	A_M	B_L	B_K	A_{XM}
	Cumulative Real Income Growth	MFP Growth	Real Domestic Prices Growth	Real Exports Prices Growth	Real Import Prices Growth	Labour Quantity Growth	Capital Quantity Growth	Real Net Exports Prices Growth
	(1)=(2)*(3)*(6)*(7)*(8)	(2)	(3)	(4)	(5)	(6)	(7)	(8)=(4)*(5)
Year	(index, 1961=1.000)							
1961	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1962	1.067	1.040	1.000	1.005	0.987	1.027	1.007	0.992
1963	1.143	1.093	1.002	1.005	0.981	1.043	1.016	0.985
1964	1.240	1.127	1.008	1.008	0.980	1.071	1.033	0.987
1965	1.354	1.156	1.020	1.010	0.984	1.101	1.051	0.994
1966	1.470	1.177	1.021	1.011	0.989	1.136	1.076	1.000
1967	1.497	1.165	1.020	1.010	0.992	1.148	1.096	1.002
1968	1.553	1.194	1.014	1.011	0.996	1.149	1.107	1.007
1969	1.633	1.221	1.017	1.009	0.999	1.165	1.120	1.008
1970	1.698	1.242	1.023	1.010	1.000	1.166	1.134	1.011
1971	1.796	1.271	1.037	1.008	1.000	1.180	1.146	1.008
1972	1.908	1.300	1.043	1.007	1.006	1.200	1.157	1.013
1973	2.184	1.372	1.055	1.026	1.007	1.243	1.175	1.034
1974	2.328	1.382	1.058	1.060	0.987	1.267	1.200	1.046
1975	2.193	1.308	1.039	1.055	0.988	1.262	1.227	1.042
1976	2.385	1.377	1.050	1.059	0.997	1.259	1.242	1.056
1977	2.526	1.457	1.048	1.067	0.977	1.264	1.255	1.043
1978	2.603	1.461	1.046	1.071	0.967	1.294	1.270	1.036
1979	2.787	1.472	1.045	1.097	0.956	1.338	1.291	1.049
1980	2.776	1.389	1.038	1.113	0.966	1.360	1.317	1.075
1981	2.850	1.368	1.056	1.111	0.959	1.378	1.345	1.065
1982	2.637	1.333	1.048	1.083	0.973	1.323	1.355	1.053
1983	2.721	1.386	1.031	1.059	1.000	1.323	1.359	1.060
1984	2.875	1.444	1.024	1.055	1.000	1.349	1.365	1.055
1985	3.032	1.483	1.023	1.050	1.002	1.381	1.376	1.052
1986	3.095	1.477	1.024	1.040	1.003	1.413	1.387	1.044
1987	3.351	1.512	1.027	1.038	1.020	1.454	1.402	1.058
1988	3.541	1.519	1.027	1.028	1.040	1.491	1.423	1.070
1989	3.625	1.496	1.027	1.025	1.053	1.514	1.445	1.079
1990	3.517	1.478	1.008	1.001	1.070	1.510	1.459	1.072
1991	3.212	1.422	0.982	0.967	1.102	1.472	1.466	1.066
1992	3.299	1.484	0.979	0.973	1.089	1.460	1.467	1.060
1993	3.316	1.480	0.978	0.984	1.073	1.479	1.469	1.056
1994	3.562	1.527	0.987	1.009	1.046	1.517	1.476	1.055
1995	3.770	1.545	0.990	1.041	1.033	1.543	1.485	1.075
1996	3.892	1.555	0.982	1.032	1.051	1.570	1.496	1.085
1997	4.019	1.563	0.978	1.023	1.059	1.600	1.516	1.083
1998	4.157	1.596	0.979	1.014	1.047	1.630	1.539	1.061
1999	4.403	1.625	0.974	1.010	1.060	1.664	1.561	1.071
2000	4.785	1.672	0.970	1.032	1.066	1.698	1.579	1.099
2001	4.772	1.671	0.964	1.023	1.065	1.711	1.590	1.089
2002	4.956	1.740	0.967	1.003	1.068	1.727	1.593	1.071
2003	4.933	1.668	0.957	0.984	1.121	1.745	1.604	1.104
2004	5.285	1.691	0.959	0.990	1.144	1.781	1.616	1.132
2005	5.544	1.703	0.959	0.993	1.164	1.794	1.638	1.156
2006	5.748	1.699	0.964	0.986	1.179	1.813	1.665	1.163
2007	5.978	1.683	0.969	0.981	1.205	1.838	1.687	1.182
2008	6.163	1.667	0.971	1.016	1.189	1.847	1.707	1.207
2009	5.548	1.615	0.978	0.967	1.186	1.799	1.703	1.146
2010	5.877	1.639	0.975	0.971	1.216	1.827	1.704	1.181
2011	6.202	1.666	0.973	0.991	1.219	1.849	1.712	1.208
Compound Annual Growth Rates								
1961-2011	3.72	1.03	-0.05	-0.02	0.40	1.24	1.08	0.38
2000-2011	2.39	-0.03	0.03	-0.36	1.23	0.78	0.74	0.86
1961-1973	6.73	2.67	0.44	0.21	0.06	1.83	1.35	0.28
1973-1981	3.38	-0.03	0.01	0.99	-0.62	1.30	1.70	0.37
1981-1989	3.05	1.12	-0.35	-1.00	1.18	1.18	0.90	0.17
1989-2000	2.56	1.02	-0.51	0.06	0.11	1.05	0.81	0.17
2000-2008	3.22	-0.04	0.01	-0.20	1.38	1.05	0.98	1.18
2008-2011	0.21	-0.02	0.06	-0.80	0.84	0.04	0.10	0.03

Table 6
Comparison between Diewert and Yu and Statistics Canada Estimates of Real Output and Real Input Series, 1961-2011

	Q_Y	Q_{YO}	Q_L	Q_{LO}	Q_K	Q_{KO}	Q_{KW}	Q_{KWO}	Q_{PR}
	Business Sector Output		Labour Input		Capital Services		Capital Stock		
	Diewert and Yu	Statistics Canada	Diewert and Yu	Statistics Canada	Diewert and Yu	Statistics Canada	Diewert and Yu	Statistics Canada	Paid Rents
Year	(millions, 1961 dollars)								
1961	29,368	30,805	19,240	19,201	10,128	11,604	65,074	65,074	1,107
1962	31,585	33,059	20,049	20,025	10,326	12,054	66,186	66,820	1,149
1963	34,008	35,013	20,506	20,540	10,613	12,593	67,985	68,814	1,170
1964	36,591	37,567	21,372	21,466	11,091	13,493	70,874	72,554	1,221
1965	39,269	40,122	22,321	22,444	11,655	14,752	73,925	76,793	1,278
1966	42,286	42,827	23,452	23,577	12,450	16,281	78,410	82,029	1,337
1967	43,046	43,728	23,822	24,040	13,105	17,451	82,234	86,766	1,390
1968	44,645	46,133	23,864	24,143	13,515	18,350	84,583	90,256	1,420
1969	46,806	48,537	24,366	24,658	13,986	19,430	87,164	94,495	1,476
1970	48,260	49,889	24,395	24,761	14,513	20,599	90,627	98,733	1,530
1971	50,452	51,843	24,836	25,276	14,953	21,588	92,937	102,723	1,551
1972	53,041	54,998	25,469	26,048	15,415	23,028	94,972	107,460	1,584
1973	58,832	59,206	26,868	27,541	16,106	25,007	98,134	112,945	1,566
1974	61,727	61,310	27,717	28,519	17,037	26,986	103,385	119,677	1,558
1975	59,494	62,061	27,534	28,467	18,122	28,785	110,211	126,159	1,544
1976	63,195	66,118	27,417	28,467	18,769	30,764	112,964	132,642	1,482
1977	67,878	68,823	27,616	28,776	19,366	32,383	115,949	138,127	1,384
1978	70,536	71,979	28,636	29,960	20,037	34,092	119,537	143,363	1,322
1979	74,698	75,134	30,208	31,710	20,912	36,341	123,921	149,845	1,295
1980	73,053	76,938	31,015	32,740	22,012	38,949	130,218	156,079	1,313
1981	74,433	80,244	31,669	33,615	23,302	41,828	135,275	163,309	1,359
1982	70,175	77,088	29,737	31,968	23,850	42,817	138,323	165,802	1,410
1983	73,155	79,192	29,747	32,174	24,016	43,897	136,998	167,298	1,444
1984	78,122	84,752	30,714	33,358	24,312	45,246	137,639	169,044	1,471
1985	82,738	89,260	31,892	34,748	24,809	47,045	140,493	172,285	1,500
1986	85,019	91,514	33,124	36,241	25,343	48,844	142,988	176,523	1,539
1987	90,559	96,022	34,682	38,042	26,064	51,453	145,848	182,258	1,599
1988	94,670	100,981	36,105	39,793	27,136	54,331	150,432	189,738	1,662
1989	96,089	103,685	36,972	40,874	28,278	57,389	155,302	197,218	1,726
1990	95,610	103,235	36,814	40,874	29,056	59,368	158,744	202,703	1,798
1991	90,121	99,027	35,445	39,587	29,504	60,538	160,238	205,445	1,853
1992	93,349	99,628	35,000	39,123	29,544	61,527	158,327	205,695	1,899
1993	94,373	102,483	35,683	39,998	29,642	62,517	157,980	206,443	1,943
1994	100,395	108,795	37,145	41,543	30,070	64,496	158,425	208,437	1,982
1995	103,938	112,401	38,163	42,727	30,529	66,834	159,699	210,681	2,016
1996	107,231	114,956	39,243	43,962	31,132	69,353	162,378	213,673	2,049
1997	111,367	121,417	40,501	45,404	32,269	73,401	166,742	220,904	2,097
1998	117,544	127,127	41,680	46,845	33,566	77,269	170,681	227,386	2,139
1999	123,965	135,542	43,103	48,389	34,865	81,676	174,830	234,118	2,187
2000	131,753	144,108	44,563	50,088	35,944	85,454	178,130	241,598	2,231
2001	133,537	146,362	45,096	50,706	36,583	87,793	181,277	245,338	2,279
2002	140,604	150,269	45,811	51,478	36,720	89,952	180,822	249,327	2,341
2003	137,165	153,124	46,610	52,405	37,380	92,830	183,931	254,812	2,413
2004	142,907	158,383	48,181	54,206	38,111	96,698	185,502	261,544	2,487
2005	146,935	163,492	48,777	54,927	39,392	101,646	189,852	270,021	2,560
2006	150,603	167,850	49,653	55,905	41,010	107,223	195,631	279,994	2,638
2007	153,232	171,306	50,817	57,295	42,360	111,990	200,440	288,720	2,715
2008	154,363	171,306	51,240	57,758	43,583	116,398	205,062	295,702	2,797
2009	145,283	163,042	49,049	55,493	43,323	115,948	205,338	294,455	2,881
2010	149,898	169,203	50,315	56,935	43,405	117,477	204,637	295,452	2,966
2011	154,899	173,861	51,312	58,119	43,896	121,435	205,655	300,439	3,054
Compound Annual Growth Rates									
1961-2011	3.38	3.52	1.98	2.24	2.98	4.81	2.33	3.11	2.05
2000-2011	1.48	1.72	1.29	1.36	1.83	3.25	1.31	2.00	2.90
1961-1973	5.96	5.60	2.82	3.05	3.94	6.61	3.48	4.70	2.93
1973-1981	2.98	3.87	2.08	2.52	4.73	6.64	4.09	4.72	-1.76
1981-1989	3.24	3.26	1.95	2.47	2.45	4.03	1.74	2.39	3.03
1989-2000	2.91	3.04	1.71	1.87	2.20	3.69	1.25	1.86	2.36
2000-2008	2.00	2.18	1.76	1.80	2.44	3.94	1.78	2.56	2.87
2008-2011	0.12	0.49	0.05	0.21	0.24	1.42	0.10	0.53	2.97

Source: Calculations by Diewert and Yu; Statistics Canada, Canadian Productivity Accounts, CANSIM Table 383-0021.

Table 7

Comparison between Diewert and Yu and Statistics Canada Estimates for MFP, Labour Compensation and Capital Cost Shares in the Canadian Business Sector, 1961-2011

	Multifactor Productivity		Labour Compensation Share		Capital Cost Share	
	Diewert and Yu	Statistics Canada	Diewert and Yu	Statistics Canada	Diewert and Yu	Statistics Canada
Year	(index, 1961=1.000)		(% of business sector GDP)			
1961	1.000	1.000	66.0	62.3	34.0	37.7
1962	1.040	1.035	66.0	62.5	34.0	37.5
1963	1.093	1.059	64.0	61.5	36.0	38.5
1964	1.127	1.077	64.0	61.2	36.0	38.8
1965	1.156	1.084	64.0	61.8	36.0	38.2
1966	1.177	1.080	64.0	62.0	36.0	38.0
1967	1.165	1.061	66.0	63.5	34.0	36.5
1968	1.194	1.097	65.0	62.3	35.0	37.7
1969	1.221	1.111	66.0	63.0	34.0	37.0
1970	1.242	1.119	66.0	62.8	34.0	37.2
1971	1.271	1.125	67.0	63.1	33.0	36.9
1972	1.300	1.145	67.0	63.1	33.0	36.9
1973	1.372	1.154	63.0	61.1	37.0	38.9
1974	1.382	1.136	62.0	60.9	38.0	39.1
1975	1.308	1.120	66.0	61.6	34.0	38.4
1976	1.377	1.165	66.0	62.2	34.0	37.9
1977	1.457	1.182	65.0	62.4	35.0	37.6
1978	1.461	1.180	63.0	60.9	37.0	39.1
1979	1.472	1.162	61.0	59.4	39.0	40.6
1980	1.389	1.136	62.0	58.8	38.0	41.2
1981	1.368	1.131	64.0	60.1	36.0	39.9
1982	1.333	1.110	66.0	60.6	34.0	39.4
1983	1.386	1.126	62.0	58.2	38.0	41.8
1984	1.444	1.163	61.0	57.5	39.0	42.5
1985	1.483	1.179	61.0	58.1	39.0	41.9
1986	1.477	1.161	63.0	59.7	37.0	40.3
1987	1.512	1.159	62.0	59.4	38.0	40.6
1988	1.519	1.160	63.0	60.3	37.0	39.7
1989	1.496	1.146	64.0	60.8	36.0	39.2
1990	1.478	1.126	65.0	61.9	35.0	38.1
1991	1.422	1.096	68.0	63.5	32.0	36.5
1992	1.484	1.102	66.0	63.6	34.0	36.4
1993	1.480	1.113	66.0	62.3	34.0	37.7
1994	1.527	1.140	63.0	59.8	37.0	40.2
1995	1.545	1.142	62.0	58.9	38.0	41.1
1996	1.555	1.132	61.0	58.8	39.0	41.2
1997	1.563	1.144	62.0	59.0	38.0	41.0
1998	1.596	1.154	63.0	60.2	37.0	39.8
1999	1.625	1.178	62.0	58.8	38.0	41.2
2000	1.672	1.206	60.0	57.4	40.0	42.6
2001	1.671	1.201	61.0	58.0	39.0	42.0
2002	1.740	1.211	60.0	58.3	40.0	41.7
2003	1.668	1.205	61.0	57.1	39.0	42.9
2004	1.691	1.201	60.0	56.7	40.0	43.3
2005	1.703	1.205	59.0	56.1	41.0	43.9
2006	1.699	1.196	60.0	56.7	40.0	43.3
2007	1.683	1.182	59.0	56.8	41.0	43.2
2008	1.667	1.156	58.0	55.6	42.0	44.4
2009	1.615	1.127	63.0	..	37.0	..
2010	1.639	1.146	61.0	..	39.0	..
2011	1.666	1.148	59.0	..	41.0	..
	Compound Annual Growth Rates		Period Average			
1961-2011	1.03	0.28	63.2	60.2	36.8	39.8
2000-2011	-0.03	-0.45	59.8	56.9	40.3	43.1
1961-1973	2.67	1.20	65.2	62.3	34.8	37.7
1973-1981	-0.03	-0.25	63.6	60.8	36.4	39.2
1981-1989	1.12	0.17	62.8	59.3	37.3	40.7
1989-2000	1.02	0.46	63.5	60.4	36.5	39.6
2000-2008	-0.04	-0.52	59.8	56.9	40.3	43.1
2008-2011	-0.02	-0.24	..	..	..	..

Note: Period averages for labour compensation and capital cost shares were calculated without taking into account the last year of the previous business cycle. Furthermore, average shares were calculated for the 1961-2008 period only, since official estimates for the 2009-2011 period were not available.

Source: Calculations by Diewert and Yu; Statistics Canada, Canadian Productivity Accounts, CANSIM Table 383-0021.