Labour Input, Human Capital and Management Capital in Canada:

Measurement and Contribution to Economic Growth

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1 Introduction

Investment in skills and human capital is seen to be an important determinant of economic growth. More recently, the measurement of human capital has generated interest in Canada and in the other member countries of the Organisation for Economic Co-operation and Development (UNECE 2009) because of its importance to providing a full set of wealth accounts and a better understanding of sustainability.

In the late 1990s, the Canadian Productivity Accounts (CPAs) began to assess the contribution of investment in education and training to output growth and productivity growth in Canada (Gu et al. 2002). The CPAs constructed a measure of labour input that takes into account the changes in labour composition in the educational attainment and experiences of the Canadian workforce. Labour input is disaggregated by age, educational attainment and class of workers (paid and self-employed workers). Changes in the composition of workers towards more educated and more experienced workers, is found to be an important source of productivity growth. Over the last 45 years, it accounted for a quarter of the growth in labour productivity in Canada (Baldwin and Gu 2007).

The index of labour input that takes into account the effect of investment in skills and education reflects the flow of services from the stock of human capital stock. The construction of an index of labour compositional changes is an important first step towards developing a full set of economic accounts that allows us to examine the role of investment in human capital in economic performance.

To integrate human capital into the System of National Accounts and provide a more comprehensive examination of the role of human capital in economic performance, we developed a measure of the human capital derived from the lifetime earnings approach (Gu and Wong, 2010a, 2010b). The approach is developed in a series of papers by Jorgenson and Fraumeni (1989, 1992a, 1992b).

This estimate of human capital represents the value of Canada's total wealth associated with the lifetime labour related earnings of individuals that can be compared to the wealth estimates derived from produced physical capital and natural capital. The estimates of human wealth, combined with physical capital and natural capital provides a more complete picture of Canada's total wealth. The estimates of human capital are seen to be important indicators of sustainability that complement other statistics on physical capital and natural capital that have until now received more attention.

Canada has one of the most highly qualified labour forces in the world. But concern has been expressed that Canadians may lag other OECD countries in training and management talent. Canadians are less likely to participate in adult education and training than in some other OECD countries (OECD, 2005). Managers in Canada tend to have lower educational attainment overall and in business education specifically than their U.S. counterparts. Our recent work has therefore begun to focus on the role of investment in training and management capital in Canada's economic performance.

Our future research will extend the asset boundary of the System of National Accounts to include human capital. This will entail including human capital in the Production Accounts, Income and Expenditure Accounts, Capital Accumulation Accounts and Wealth Accounts. Jorgenson (2009) and Jorgenson and Landefeld (2006) have stressed that the boundaries of production, income and expenditures, accumulation and wealth accounts should be aligned in order to achieve consistency throughout the system of National Accounts.

2 Index of labour composition and its contribution to labour productivity growth

Labour input in the Canadian KLEMS database reflects the compositional shifts of workers by education, experience and class of workers (paid versus self-employed) since not all classes of workers are equally productive. To capture these compositional shifts, the overall growth of labour input (labour services) is an aggregate of the growth of hours worked by different classes of workers, weighted by the hourly wages of each class (see Gu et al. [2002] for the methodology and data sources for constructing labour input estimates in the Canadian Productivity Accounts). The estimate of compositional changes allows use to examine the contribution of investment in skills to economic and labour productivity growth.

The growth in labour input is just the sum of growth in hours worked and growth the index of labour composition. The growth in labour composition occurs when the highest-skilled workers (highest-paid) grow more rapidly than those with lower skills. The growth in labour composition reflects an increase in the skills of workers as measured by the increase in their relative wage bill associated with their education attainment and work experience.

Since 1961, the composition of the labour force has changed dramatically. From 1961 to 1979, the share of younger workers (less than 25 years) first increased dramatically and then fell continuously until the mid-1990s. As this group of post-war boomers aged, workers in the age group from 25 to 44 years increased from the 1970s to the early 1990s and then declined. This long demographic cycle led

first to a decline in the average experience of the workforce and more recently to an increase.

There have also been dramatic changes in the educational qualifications of the labour force. The percentage with only high school has fallen steadily while those with post-secondary degrees have increased. For example, the share of those with some or completed post-secondary education in total hours worked increased from less than 10% in 1961 to over 70% by 2009. The share of those workers with primary and secondary education declined from 90% to 30% over the period.

These changes have led to changes in the composition of the work force. Additions of relatively large portions of younger workers in the period at first led to a declining average age. Later, additions of middle-aged workers led to an increase in the average experience level. These two changes have led to quite opposite effects on the contribution to labour inputs that came from upgraded skills—what is termed in this paper, labour composition.

But the impact of changing experience in most periods is small. Far more important is the increase in the skill component that comes from increases in education levels. And since upgrading of education levels is more or less continuous during the period, this force provided most of the trend increase caught by the labour composition or quality component of labour input growth.

Table 1 summarizes the trend in growth of quantities of labour input by education. There has been a long-term shift in hours worked toward workers with university degrees or above. The labour input of worker with some or completed post-secondary education increased over time, particularly for those workers with post-secondary education below Bachelors' degree. The labour input of the workers with primary or secondary education changed little before 1989 and declined after 1989.

Table 1
Labour input growth by education in the business sector, selected periods, 1961 to 2009 (average annual growth rate-%)

	1961-1989	1989-2009	1961-2009
Labour input	2.7	1.6	2.3
primary or secondary education	0.4	-1.0	-0.2
Post-secondary education below Bachelors	11.1	2.5	7.5
University degree or above	5.7	4.6	5.3

Source: Canadian Productivity Accounts, CANSIM table 383-0021

Table 2 presents the growth of labour services, hours worked and labour composition in the business sector. The growth of labour services was higher in the 1961-to-1989 period. It was lower in the most recent period from 1989 to

2009. Over the 1961 to 2009 period, labour services rose at an annual rate of 2.3%, 1.6 percentage points of which was due to the growth in hours worked, and remaining 0.7 percentage points or 30% was due to the shifts in the composition of labour input toward more educated and more skilled workers.

Table 2
Labour services, hours worked and labour composition growth in the business sector, selected periods, 1961 to 2009 (average annual growth rate-%)

	1961-1989	1989-2009	1961-2009
Labour input	2.7	1.6	2.3
Hours worked	1.9	1.0	1.6
Labour composition	0.8	0.6	0.7

Source: Canadian Productivity Accounts, CANSIM table 383-0021

The growth of labour composition was the slowest in the 1973-to-1979 period as the baby-boom generation was entering the workforce and the declining experience level somewhat offset the increasing educational attainments of these new workers. The most rapid gains occurred in the 1961-to-1973 period and in the 1989-to-2000 period. There has been some slowing down in the growth in labour composition after 2000. For the period 2000 to 2009, labour composition increased at 0.5% per year, compared to the growth of 0.7% per year in the period 1989 to 2000.

Growth in labour productivity is determined by the growth in multifactor productivity as well as changes in capital intensity (the amount of capital per hour worked) and labour composition (percentage of the growth that comes from growth in skilled workers)

Table 3 presents a decomposition of labour productivity growth into contributions from capital deepening, changes in labour composition, and multifactor productivity growth.

For the 1961-to-2009 period, labour productivity grew at annual rate of 1.9% in the business sector. Capital deepening was the most important factor. It contributed 1.3 percentage points and 65% of the labour productivity growth.

The change in labour composition was an important source of labour productivity growth for the 1961-to-2009 period, contributing 0.4 percentage points or 22% of labour productivity growth in the business sector. A positive labour composition effect captures the increase in the average educational attainment and experience levels of workers. Investments in education and training have made a significant contribution to labour productivity growth in Canada.

Table 3
Sources of labour productivity growth in the business sector, selected periods, 1961 to 2009 (average annual growth rate-%)

	1961-1989	1989-2009	1961-2009
Labour productivity growth	2.4	1.3	1.9
Contribution of capital deepening	1.4	1.0	1.3
Contribution of labour composition	0.5	0.4	0.4
MFP growth	0.5	-0.1	0.2

Source: Canadian Productivity Accounts, CANSIM table 383-0021

Over the last five decades, investment in physical and human capital together accounted for more than most of labour productivity growth in the business sector. The key to rising productivity growth has been investment—both in machines and in the education of workers.

Multifactor productivity growth contributed the remaining 0.2 percentage points or 12% of labour productivity growth. MFP growth is often associated with technological change, organizational change, scale economies or changes in utilization rates. While contributing substantially to labour productivity growth, its importance is nevertheless, in this framework, only third behind investment in general.

3 Investment in Human Capital and Stock of Human Capital

It is common to measure the capital embedded in physical and natural resource assets and include these in wealth accounts. The capital value of an asset and the flow of services at any point in time differ. The net present value of the stream of earnings over a lifetime of an asset such as physical capital represents the ‘value’ of this capital stock. The net present value of the stream of earnings of resource deposits are taken to be the value of these resources in the Wealth Accounts.

Similarly, each individual has a lifetime earnings profile that can be thought of as the potential amount that can be transformed into consumption, contributions to the government in support of needed programs, and savings that can be transformed into financial wealth in order to support retirement or contingencies that short-run earnings will not cover. The net present value of these earnings then also can be thought of as the embedded capital of an individual—what is sometimes referred to in the economics literature as human capital.

The instantaneous value of flows from an asset and its capital value measure different concepts. An individual near the end of life may have a higher yearly

income than someone just starting out their working career as a result of the accumulation of experience or education. But to the extent that they have fewer remaining earning years, the net present value of the remaining earnings and therefore the value of their human capital will be lower. The individual may be just as productive over the course of the year as he has always been but the inexorable passage of time and the finiteness of life mean that his embedded human capital diminishes with age. Just as firms are not sustainable if their assets all are at the end of their working life and no replacement has occurred, if populations consist largely of the elderly, the flow of earnings from that population will not be sustainable as death brings about a decline in population numbers. More recently, birth rates have fallen dramatically in some countries to levels that will eventually lead to decline in their population. For this reason, estimates of human capital are seen to be important indicators of sustainability that complement other statistics that have until now received more attention (Diewert, 2005, Schreyer, 2001 and 2008).

Estimates of the amount of capital, its quality, and its age have been at the heart of investigations into economic growth and sustainability in Canada and in the other member countries of the Organisation for Economic Co-operation and Development (Skills Research Initiative 2008). Attention originally focused on measures of physical capital. But more recently, experimental estimates have been produced of the amount of human capital.

Table 4 presents annual growth rates of aggregate human capital stock estimated using a variant of the Jorgenson and Fraumeni methodology. Over the period from 1970 to 2007, aggregate human capital rose at an annual rate of 1.7% in Canada. Most of the growth in human capital was due to the increase in the number of individuals in the working-age population. Of the 1.7% growth in human capital, 1.5 percentage points were due to the growth in the working-age population, and the remaining 0.2 percentage point was due to the effect of the compositional shift or the growth in human capital per capita.

The growth of aggregate human capital was highest in the 1970s, a period that coincided with the entry of baby boomers to the working-age population and a rapid increase in the education levels of the Canadian population. The growth of aggregate human capital was lower after 1980 because of the slower population growth and the compositional effects of aging of the working-age population. The compositional effects of aging of the working-age population had a negative effect on the growth of human capital per capita as a result of a shift of the population towards older individuals with lower lifetime income because of fewer remaining years of work.

The evolution of human capital per capita is sometimes used as an indicator of whether an economy is on a path of sustainable development. According to some, an economy is on a sustainable development path if total capital (including

produced capital, natural capital and human capital) per capita does not decline (UNECE, 2009).

The growth of human capital stock per capita can be decomposed into the contributions of changes in population characteristics such as age, gender and education. The relative effect of age, gender and education on the growth of human capital per capita is presented in the bottom half of Table 4.

Rising educational attainment in the Canadian population makes a positive contribution to the growth in aggregate human capital. It adds 0.9% to annual growth in human capital stock over the period from 1970 to 2007. It adds 1.4% per year to human capital growth in the 1970 to 1980 period and 0.7% per year to human capital growth in the 1980 to 2007 period.

The compositional effects of aging of the Canadian population after the early 1980s made a negative contribution to the growth in human capital stock, and it lowered the annual growth in human capital by 0.5% in the 1980-to-2000 period and by 0.6% in the 2000-to-2007 period. Over the period 1980 to 2007, the aging of the Canadian population reduced human capital growth by 0.6% per year.

Table 4
Average annual growth in human capital and working-age population (%)

	1970 to 2007	1970 to 1980	1980 to 2000	2000 to 2007
		percent		
Human capital stock	1.7	3.1	1.2	1.0
Working-age population	1.5	2.1	1.2	1.3
Human capital per capita	0.2	0.9	0.0	-0.2
First-order indices of human capital per capita				
Gender	0.0	0.0	0.0	0.0
Education	0.9	1.4	0.8	0.5
Age	-0.4	-0.1	-0.5	-0.6

To examine the evolution of human capital stock over time and present an accumulation account of human capital, we decompose the changes in human capital stock into three components: investment in human capital, depreciation of human capital and the revaluation of human capital. The methodology for decomposing the change in human capital stock is similar to the one for decomposing the change in non-human capital stock and was developed by Jorgenson and Fraumeni (1989).

Investment in human capital reflects additions to population due to the rearing of children (the arrival of new members of the native born population into the workforce), formal education (skills upgrading from schooling post high school) and migration (new members of the population from outside Canada). The depreciation on human capital is the change in human capital stock because of aging, death and emigration. The revaluation of human capital represents the change in human capital over time for individuals with a given set of demographic characteristics—gender, education and age.

Table 5 presents the growth of the price and quantity index of investment, depreciation and revaluation of human capital. Gross investment in human capital in constant prices rose by 0.4% per year over the period from 1971 to 2007. Net investment (gross minus depreciation), while positive, declined over time as the growth of depreciation on human capital exceeded the growth of gross investment in human capital. From 1971 to 2007, net investment in human capital in 2002 prices declined by 3.1% per year from about 200 billion dollars in 1971 to about 60 billion dollars in 2007. Almost all of the overall increase occurs because of the revaluation component. This is not surprising as most of the growth in human capital stock is due to the increase in the number of individuals in the working-age population. The growth in the volume index of the revaluation term measures the increases in the number of individuals in the working-age population, holding their characteristics constant.

Table 5
Average annual growth of investment, depreciation and reevaluation of human capital (%)

	1971 to 2007	1971 to 1980	1980 to 2000	2000 to 2007
		percent		
Nominal value				
Gross investment	4.7	8.0	3.8	3.3
Depreciation	5.8	8.9	5.0	4.2
Revaluation	4.3	10.2	0.3	8.0
Net investment	2.7	7.0	1.6	0.6
Price index				
Gross investment	4.3	7.7	3.6	2.0
Depreciation	4.1	6.9	3.6	2.1
Revaluation	1.6	7.0	-2.7	6.8
Net investment	5.9	8.9	5.5	3.0
Volume index				
Gross investment	0.4	0.3	0.2	1.2
Depreciation	1.7	2.0	1.4	2.1
Revaluation	2.7	3.2	3.0	1.2
Net investment	-3.1	-1.9	-3.9	-2.5

Figure 1

Ratio of nominal investment to gross domestic product in Canada

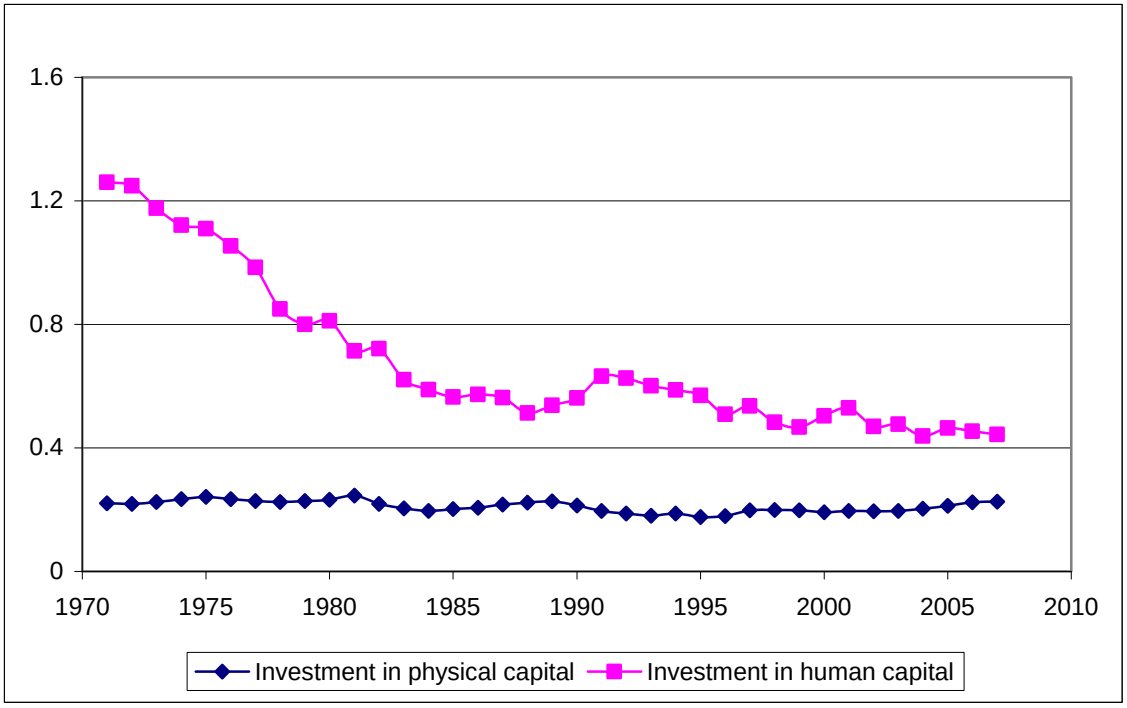


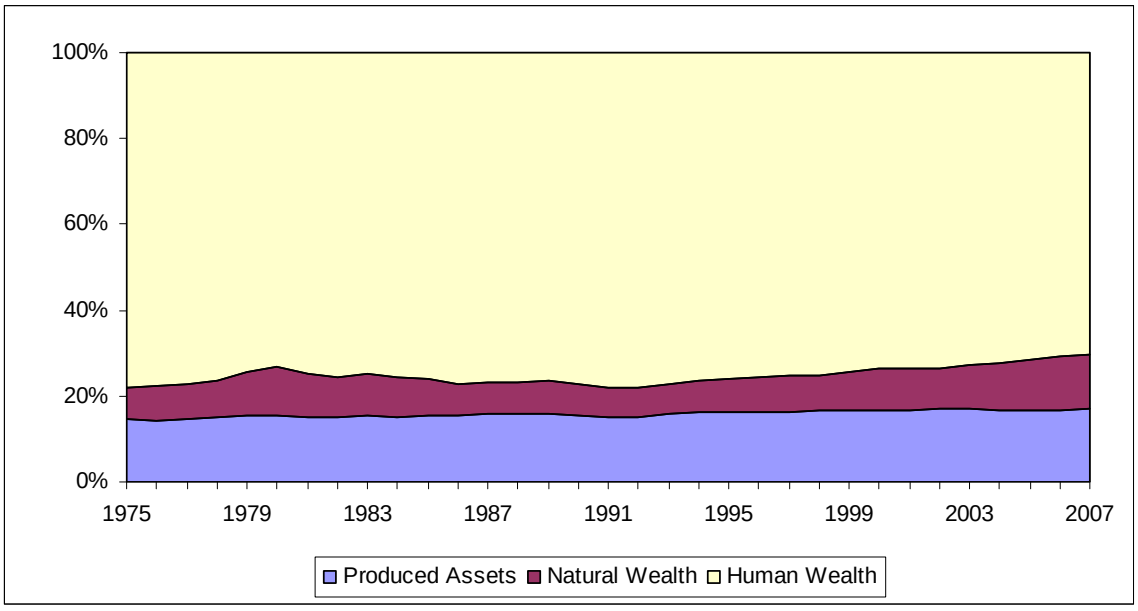
Figure 1 compares the value of investment in human capital and physical capital. The value of human capital investment and stock exceeds the value of produced physical capital investment and stock at a point in time. But the ratio of human capital investment and stock to physical capital investment and stock declined over time. In 2007, human capital stock is about four times as large as produced capital stock, and investment in human capital was about two times as large as investment in produced capital. The difference between human capital and produced capital was higher in the early 1970s. The ratio of human capital stock to produced capital stock was 5.7 to 1 in 1970, and the ratio of investment in human capital to investment in produced capital was also 5.7 to 1 in 1971.

The growth of human capital investment and stock was slower than the growth of produced capital investment and stock. Over the period from 1970 to 2007, the volume of human capital stock increased 1.7% per year, while produced capital stock rose at 2.8% per year. From 1971 to 2007, human capital investment in constant dollars grew at 0.4% per year, while real investment in produced capital rose at 3.9% per year.

We present the share of human wealth, produced physical capital and natural wealth in Figure 2. The largest component of a full wealth Accounts in Canada is human wealth, followed by produced capital and natural capital. Human wealth accounted for 70% of full wealth in 2007, while produced capital and natural capital accounted for 17% and 13%, respectively, in that year.

Over the last 40 years, the share of human capital in full wealth declined slightly, and the share of produced capital and natural capital increased. From 1975 to 2007, the share of human capital declined from 78% to 70%, the share of produced capital increased from 15% to 17%, and the share of natural capital increased from 8% to 13%.

Figure 2. Distribution of total wealth in nominal dollars in Canada



4 Investment in Training and Management Capital

Canada has one of the most highly qualified labour forces in the world. But Canadians are less likely to participate in adult education and training than in some other OECD countries (OECD, 2006).

Managers in Canada tend to have lower educational attainment overall and in business education specifically than their U.S. counterparts. Only 31 percent of managers in Canada possess a university degree versus 50 percent of the managers in the United States (Martin and Milway 2005, OECD, 2006). Martin and Milway (2005) argue that the more educated managers are, the more likely they are to think innovatively and strategically and to operate more effectively.

Owners and managers of Canadian firms set the pace of innovation within their companies, and if they pursue an explicit or implicit business strategy that does not require innovation, then it will not happen.

Our recent work investigated the role of investment in training and management capital in economic performance in Canada (Baldwin et al, 2010). We followed the methodologies of Corrado, Hulten and Sichel (2005, 2009) to construct a measure of investment in training and management capital, along with other types of intangible capital, which include computerized information (software and computerized database), innovative property (scientific R&D and non-scientific R&D), and economic competencies (brand equity, training and management capital). A departure here is we use the expenditure data related to training and management capital to measure investment in those areas. This differs from the measure of investment in education that is derived from the income side of the investment activities.

Table 6
Intangible investment as percent of GDP in the Canadian business sector

	1976	1990	2000	2008
Total intangible	4.9	8.6	12.6	13.2
Computerized information	0.2	0.8	1.2	1.5
Innovative property	1.9	2.7	4.2	4.1
Scientific and engineering R&D	0.5	1.1	1.6	1.4
Mineral exploration and evaluation	0.3	0.3	0.9	1.0
Development costs in financial industry	0.2	0.3	0.3	0.3
New architecture and engineering design	0.7	0.9	1.1	1.1
Own-account other science and engineering services	0.1	0.1	0.0	0.1
Purchased other science and engineering services	0.1	0.1	0.1	0.2
Economic competencies	2.7	5.0	7.1	7.6
Advertising	1.2	1.6	1.7	1.5
Training	0.2	0.4	0.4	0.3
Purchased organizational capital	0.4	1.0	3.1	3.6
Own account organizational capital	1.0	2.1	2.0	2.2

Table 6 shows the investment in intangible capital as a percentage of total GDP in the business sector for selected years. The Canadian businesses invested 13.2 percent of GDP in intangible assets in 2008. The share increased for all types of intangible assets for the period from 1976 to 2008, except for own-account other science and engineering expenditures. Investment in that category changed little over the period.

Investment in management capital was large and increased over time. The share of investment in management capital increased from 1.4% in 1976 to 5.8% of GDP in 2008 in the Canadian business sector. Investment in training is also significant. It accounted for 0.4% of GDP in 2008.

Table 7 presents a decomposition of labour productivity growth in the Canadian business sector for the period 1976 to 2008. Intangible capital made a significant contribution to labour productivity growth and it accounted for about 40 percent of the total capital deepening effects in both 1976-2000 and 2000-2008 periods. Innovative property and economic competencies made similar contribution, accounting for about 0.2 to 0.3 percentage points of the annual labour productivity growth in the business sector.

Table 7. Contributions of intangible capital to labour productivity growth in Canada

	1976-2000	2000-2008
Labour productivity growth	1.7	0.8
Contributions of:		
Capital deepening	1.3	1.4
Tangible	0.8	0.8
ICT excluding software	0.3	0.3
Non-ICT excluding mineral exploration	0.4	0.5
Intangible	0.5	0.6
Computerized information	0.1	0.1
Innovative property	0.2	0.2
Economic competencies	0.3	0.2
Labour composition	0.4	0.3
Multifactor productivity growth	0.1	-0.8

We have also compared our results for Canada with those for the United States from Corrado, Hulten and Sichel (2005, 2009). We find that investment in intangibles was lower in Canada than in the U.S., especially in more recent years. This was due to Canada's lower investment in R&D and computer software. The business investment in other intangibles assets was similar in the two countries.

The overall contribution of intangibles to labour productivity growth is found to be similar in the two countries from the mid-1970s to 1995. After 1995, the contribution of intangibles was lower in Canada than in the United States, due to Canada's lower investment in software and R&D capital.

We find that that investment in management capital was similar between Canada and the United States. Investment in management capital made similar contributions to labour productivity growth in the two countries.

5 Conclusions and Future Research

This paper summarizes the measurement of labour input, investment in human capital and management capital in Canada and their contributions to the economic performance in Canada.

Future research will be aimed at expanding the asset boundary of the system of national accounts to include human capital and to integrate human capital into the production account, income and expenditure account, accumulation account and wealth account. This system of accounts was designed to facilitate the analysis of macro economic process from the creation of income via production through changes in wealth and to provide detailed information on the evolution of economies in terms of the structure of production and the spending and the uses of primary factors of the production (Wilson, 2006). The integration of human capital in the national accounts will provide a more comprehensive examination of the role of human capital in economic performance. It will also provide new perspectives into the underlying determinants of the performance of various aspects of the macro economy.

References

Baldwin, John, Wulong Gu and Ryan MacDonld. 2010. Innovation, Intangible Capital and Productivity Growth: A Canada – U.S. Comparison. Economic Analysis Division, Statistics Canada.

Corrado, C.A., Hulten, C.R, and D.E. Sichel. 2005. "Measuring Capital and Technology: An Expanded Framework." In C. Corrado, J. Haltiwanger and D. Sichel (eds) Measuring Capital in the New Economy. NBER Studies in Income and Wealth. Volume 65. Chicago and London: University of Chicago Press.

Corrado, Carol, Charles Hulten, and Daniel Sichel, "Intangible Capital and U.S. Economic Growth," *Review of Income and Wealth*, 55, 661–85, 2009.

Diewert, W.E. (1976), "Exact and Superlative Index Numbers", *Journal of Econometrics*, 4:115-45

Diewert, W.E. (2005), "Issues in the Measurement of Capital Service, Depreciation, Asset Price Changes, and Interest Rates", in C. Carrado, J. Haltiwanger, and D. Sichel (eds.) *Measuring Capital in the New Economy.* Chicago: University of Chicago Press.

Gu, W., M. Kaci, J.-P., Maynard and M. Sillamaa. 2002. "The Changing Composition of the Canadian Workforce and its Impact on Productivity Growth." Chapter 3 in *Productivity Growth in Canada*. J.R. Baldwin and T.M. Harchaoui (eds.). Catalogue no. 15-204-XIE. Ottawa: Statistics Canada.

Gu, W. and A. Wong. 2010a. "Estimates of Human Capital in Canada: The Lifetim Income Approach." Economic Analysis Research Paper no. 062. Statistics Canada.

Gu, W. and A. Wong. 2010b. "Investment in Human Capital and the Output of the Education Sector in Canada." Paper for the IARIW 2010 Conference, http://www.iariw.org, Economic Analysis Division, Statistics Canada.

Jorgenson, D.W. 2009. "A New Architecture for the U.S. National Accouts." *Review of Income and Wealth*, 55(1): 1:42.

Jorgenson, D.W., F.M. Gollop and B.M. Fraumeni. 1987. "Productivity and U.S. Economic Growth." Cambridge, M.A.: Harvard University Press.

Jorgenson, D. W. and B.M. Fraumeni. 1989. "The Accumulation of Human and Nonhuman Capital." In *The Measurement of Saving, Investment and*

Wealth, eds. Robert E. Lipsey and Helen Stone Tice. Chicago: University of Chicago Press, 227-281.

Jorgenson, D. W. and B.M. Fraumeni. 1996a. “Investment in Education and U.S. Economic Growth” in Jorgenson, D. W., Productivity, Volume 1: Postwar Economic Growth, The MIT Press.

Jorgenson, D. W. and B.M. Fraumeni. 1992b. “The Output of the Education Sector.” In *Output Measurement in the Service Sector*, Zvi Griliches, ed. Chicago: University of Chicago Press, 303-338

Jorgenson, D.W., M. Ho and K. Stiroh. 2005. *Information Technology and the American Growth Resurgence*. The MIT Press.

Jorgenson, Dale W. and J. Steven Landefeld. 2006. “Blueprint for Expanded and Integrated U.S. Accounts: Review, Assessment, and Next Steps,” in Dale W. Jorgenson, J. Steven Landefeld, and William D. Nordhaus (eds), *A New Architecture for the U.S. National Accounts*, University of Chicago Press, Chicago, 13–112.

Martin, R. and J. Milway, “Commmercialization and the Canadian Business Environment: A Systems Perspective”, 4 July, 2005

Organization for Economic Cooperation and Development 2006. *OECD Economic Surveys: Canada* OECD Publications. Paris, France.

Schreyer, Paul. 2001. *Productivity Manual: A Guide to the Measurement of Industry Level and Aggregate Productivity Growth*, Organisation for Economic Cooperation and Development, Paris.

Schreyer, Paul. 2008. *OECD Manual: Measuring Capital*, Organisation for Economic Cooperation and Development, Paris.

Skills Research Initiative. 2008. *Skills for Innovation and Growth – Overview of Key Findings and Policy Implications of the Skills Research Initiative*. Ottawa. Human Resources and Social Development Canada, Industry Canada, and Social Sciences and Humanities Research Council of Canada. Catalogue no. Iu4-127/1-2008E-PDF.

United Nations Economic Commission for Europe (UNECE). 2009. *Measuring Sustainable Development*. Geneva and New York. United Nations. Prepared in cooperation with the Organisation for Economic Co-operation and Development and the Statistical Office of the European Communities.

Wilson, Karen. 2006. “The Architecture of the System of National Accounts: A Three-Way Comparison of Canada, Australia, and the United Kingdom,” in

Dale W. Jorgenson, J. Steven Landefeld, and William D. Nordhaus (eds), *A New Architecture for the U.S. National Accounts*, University of Chicago Press, Chicago, 113–42.