

Catalogue no. 11-626-X — No. 016

ISSN 1927-503X

ISBN 978-1-100-21253-1

Analytical Paper

Economic Insights

The Impact of R&D Capitalization on GDP and Productivity Growth in Canada

by Wulong Gu, Berouk Terefe and Weimin Wang

Economic Analysis Division and Income and Expenditure Accounts Division



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Published by authority of the Minister responsible for
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.	not available for any reference period
..	not available for a specific reference period
...	not applicable
0	true zero or a value rounded to zero
0 ^s	value rounded to 0 (zero) where there is a meaningful distinction between true zero and the value that was rounded
P	preliminary
r	revised
X	suppressed to meet the confidentiality requirements of the <i>Statistics Act</i>
E	use with caution
F	too unreliable to be published
*	significantly different from reference category ($p < 0.05$)

The Impact of R&D Capitalization on GDP and Productivity Growth in Canada

By Wulong Gu, Berouk Terefe and Weimin Wang

This article in the *Economic Insights* series discusses the impact of the capitalization of research and development (R&D) expenditures on gross domestic product (GDP) and labour productivity growth. Capitalizing R&D expenditures increases the scope of investment, and hence, the level of measured capital and GDP. Because R&D expenditures are relatively small in relation to other capital expenditures, R&D capitalization has only a small impact on GDP and labour productivity growth.

Research and development (R&D) is recognized as an important contributor to both business innovation and labour productivity growth. Many of the outputs associated with R&D activities are intangible, and can take a variety of forms, including the stock of knowledge that firms accumulate concerning production techniques, along with their ability to acquire, assimilate, and apply new knowledge for competitive advantage. R&D outputs are often safeguarded via copyrights, trademarks, patents, and other forms of intellectual property protection. Like tangible capital assets such as machinery and equipment, R&D outputs can be used repeatedly, and can generate income flows over a long period. Therefore, R&D expenditures have more in common with investment expenditures than with the intermediate expenditures that firms make to support their production processes.

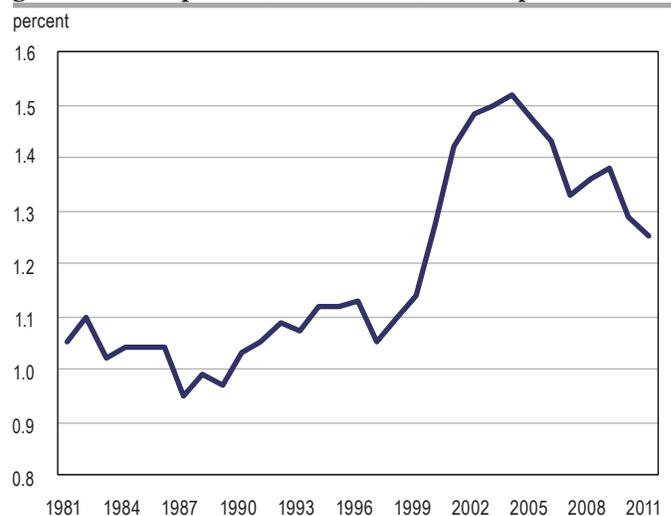
The 2012 historical revision of the Canadian System of National Accounts (CSNA12) now classifies R&D expenditures as investments and capitalizes them in estimates of gross domestic product.¹ These new data make it possible to assess the contribution of R&D activities to economic and labour productivity growth.²

R&D capitalization broadens the scope of measured GDP in the national accounts. However, whether it will lead to an increase in GDP growth or labour productivity growth depends both on the size of these R&D investments and their growth relative to other components of GDP. This article examines the impact of R&D capitalization on GDP and labour productivity growth in Canada since 1981.

Trends in R&D expenditure

From 1981 to 2011, Canada's nominal gross R&D expenditures increased by almost five fold from \$3.8 billion to \$22.1 billion. At the same time, nominal gross domestic product (GDP) measured at market prices increased by close to four-fold. As a result, the economy's R&D intensity, the nominal share of gross R&D expenditures as a percentage of GDP, increased from 1.0% to 1.3% (Chart 1).

Chart 1
Research and development in Canada, as a percentage of gross domestic product, 1981 to 2011, market prices



Source: Statistics Canada. Authors' compilation based on data from CANSIM tables 380-0063 and 380-0068.

1. For background, see Statistics Canada (2011).

2. In CSNA12, R&D is grouped together with software and mineral exploration and evaluation into an investment category called Intellectual property products. This paper only considers R&D.



Prior to 1997, annual R&D intensity averaged 1.1%, with little variability from year-to-year. After 1997, R&D intensity averaged 1.3% and was more volatile, increasing from 1.1% in 1997 to 1.5% in 2004, and then declining to 1.3% in 2011.

Beginning in 1993, real R&D expenditures by both businesses and governments expanded at a faster pace (with average annual growth rates of 4.3% and 2.9%, respectively) than did GDP (2.7%) (Chart 2). Consequently, businesses now account for a larger share of total R&D spending than in decades past. The nominal share of business investment as a percentage of total R&D expenditure averaged 52% in the post-1993 period, compared to 42% from 1981 to 1992. Both business and government R&D expenditures declined after 2006. While the overall trend is similar for both sectors, business R&D investment has been more variable than government spending on R&D.

R&D capital and labour productivity growth in the business sector

During the 1981-to-2011 period, R&D capital in the business sector increased at a faster pace (an average annual growth rate of 3.9%) than physical capital (2.1%).

Labour productivity growth can be decomposed into four sources: R&D capital deepening³, non-R&D capital deepening, an increase in labour composition that comes from improvements in worker skills, and the remainder, multifactor productivity (MFP) growth, which captures the contribution of all unmeasured factors.

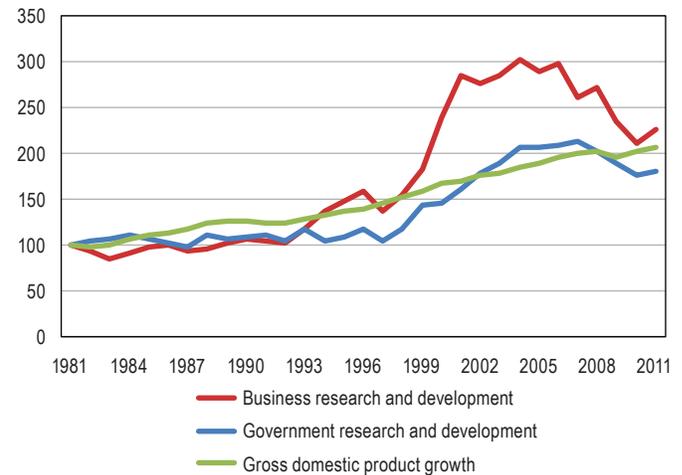
The results of this decomposition for the Canadian business sector are shown in Table 1⁴, both with R&D expenditures capitalized and without R&D capitalization.

R&D capital has a small impact on labour productivity growth. The average annual contribution of R&D capital deepening to labour productivity growth was 0.03 percentage points per year before 2000 and 0.04 percentage points per year thereafter.

On balance, the capitalization of R&D expenditures has a very small impact on business sector labour productivity growth, increasing it, on average, by 0.04 percentage points per year prior to 2000, while decreasing labour productivity by 0.01 percentage points per year after 2000. The positive effect before 2000 reflects the faster growth of real R&D expenditure in relation to the other components of GDP; conversely, the negative effect

Chart 2
Growth in research and development expenditure and gross domestic product

Index 1981 = 100



Source: Statistics Canada. Authors' compilation based on data from CANSIM tables 380-0064 and 380-0068.

after 2000 is attributable to the relatively slower growth of real R&D expenditures during this period. As a result, with R&D capitalization, the pace at which labour productivity growth decelerates after 2000 is increased by 0.04 percentage points per year.

R&D capitalization also has little impact on the estimated contribution of capital deepening and labour composition to labour productivity growth. With R&D capitalization, the contribution of capital deepening increases by 0.02 percentage points per year (from 0.76 to 0.78) before 2000, and by 0.01 percentage points per year (from 1.01 to 1.02) as well after 2000. The contribution of labour composition is basically unchanged.

The inclusion of R&D in the capital stock raises MFP growth by 0.01 percentage points per year before 2000 and decreases MFP growth by 0.02 percentage points per year after 2000. As a result, the pace at which MFP growth decelerates after 2000 increases by 0.03 percentage points per year.

3. Capital deepening is used interchangeably with capital intensity and refers to increases in the amount of capital that factors (usually labour) have at their disposal in the production process.

4. The decomposition of labour productivity growth is implemented for the business sector only. Because of data limitations, business-funded rather than business-performed R&D expenditures are capitalized and used in this decomposition exercise.



Table 1
Decomposition of annual labour productivity growth, business sector

	1981 to 2000	2000 to 2011	1981 to 2011
Including research and development capital			
Labour productivity growth (percent)	1.58	0.80	1.29
Contribution of (percentage point)			
Research and development capital deepening	0.03	0.04	0.03
Non-research and development capital deepening	0.75	0.98	0.84
Labour composition	0.37	0.27	0.33
Multifactor productivity	0.42	-0.48	0.09
Excluding research and development capital			
Labour productivity growth (percent)	1.54	0.81	1.31
Contribution of (percentage point)			
Capital deepening	0.76	1.01	0.85
Labour composition	0.37	0.27	0.33
Multifactor productivity	0.41	-0.46	0.09

Source: Statistics Canada. Authors' compilation based on data from CANSIM tables 380-0068, 383-0008 and 383-0021.

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