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Legislation**Tax Expenditures and Evaluations 2007 : 4**- [Table of Contents](#) - [Previous](#) - [Next](#) -**Part 2  
Research Report****Corporate Income Taxes and Investment:  
Evidence From the 2001–2004 Rate  
Reductions****Introduction**

Business investment in plant and equipment is a key driver of Canada's prosperity. It promotes innovation and growth, which generate more and better jobs at higher wages for Canadian workers. The decision to invest is sensitive to the rate of return, which is in turn affected by the taxes imposed on business investment. Business tax reductions therefore contribute to improved living standards of Canadians.

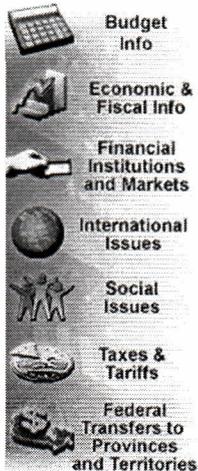
Despite the strong theoretical link between taxation and investment, and a substantial body of empirical studies supporting this link, some skepticism has been expressed about the effectiveness of corporate income tax rate reductions in stimulating business investment.<sup>[1]</sup> At the theoretical level, tax rate reductions have been criticized for not being cost-effective, since they provide financial benefits to all profitable businesses, not just those that invest. Furthermore, a cursory examination of trends in investment and taxation does not lead to a clear-cut conclusion, since there have been times when rate reductions were followed by increased investment, as well as times when investment did not increase.

This study provides a non-technical summary of empirical analysis undertaken in the Department of Finance that examined the impact of the corporate income tax rate reductions announced in the 2000 budget and implemented over the 2001 to 2004 period.<sup>[2]</sup> The results are consistent with other studies,<sup>[3]</sup> providing strong evidence that lower corporate income tax rates result in additional business investment.

The next section describes the tax reductions, providing more detail on their timing and the industries affected. This description is followed by a qualitative discussion of the determinants of investment, an explanation of the methodology used in this study and a review of the empirical results.

**The 2001–2004 Corporate Income Tax Rate  
Reductions**

The February 28, 2000 budget announced that the federal corporate income tax rate would be cut from 28 to 27 per cent effective January 1, 2001. It also



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promised further reductions over the next four years to reduce the rate to 21 per cent by 2004, but did not provide a timetable.

The October 18, 2000 *Economic Statement and Budget Update* spelled out the timing of the subsequent rate reductions as:

- 27 to 25 per cent effective January 1, 2002.
- 25 to 23 per cent effective January 1, 2003.
- 23 to 21 per cent effective January 1, 2004.

The reductions were to the "general" corporate income tax rate and did not apply to business income already eligible for special treatment.<sup>[4]</sup> Most notably, the reductions did not affect:

- Manufacturing and processing income, which already benefited from the equivalent of a 21-per-cent tax rate.
- The resource sector, which benefited from a number of special tax preferences that served to reduce its effective tax rate.
- Small businesses, which already paid a low tax rate on the first \$200,000 of taxable income. However, the full 7-percentage-point reduction was applied to taxable income between \$200,000 and \$300,000 for small businesses.

A review of resource taxation did, however, result in the sector benefiting from the tax rate reductions beginning in 2003 and receiving the full benefit by 2007.

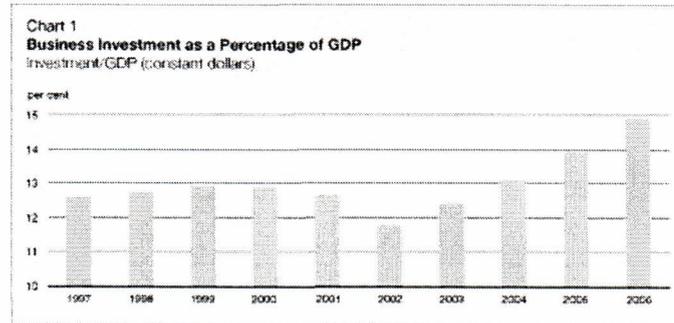
The fact that the 2001–2004 corporate income tax rate reductions were selective, applying to some industries but not to others, has important implications in terms of the statistical analysis undertaken in this study. The selective nature of the reductions provides "control" (i.e. unaffected by the tax reduction) and "treatment" (i.e. affected) groups, thereby making it easier to identify more precisely the impact of lower tax rates on business investment.

## Did the Corporate Income Tax Rate Reductions Affect Business Investment?

Business investment in plant and equipment edged down relative to gross domestic product (GDP) in 2000 and continued to decline until 2002, despite the corporate income tax rate reductions. Investment turned around subsequently and by 2006 substantially exceeded the level attained before the program of tax reductions began (Chart 1). One way of interpreting these developments is that the tax reductions succeeded in increasing investment. Investment was much higher as a per cent of GDP in 2006, with lower tax rates, than in 2000, with higher ones. An alternative view is that the tax reductions were ineffective since they coincided with a period of investment decline. Despite the tax reductions, investment stayed below its 2000 level in 2001, 2002 and 2003 and barely surpassed it in 2004. The pickup in investment in 2005 and 2006 could have been a delayed reaction to the tax reductions but could equally have been the result of other factors.

It is therefore clear that the important question, "do reductions in corporate income tax rates stimulate business investment?" cannot be answered by a simple procedure, such as examining the aggregate data portrayed in Chart 1. The process by which businesses choose how much to invest is complex.

Many influences other than taxes affect investment decisions, and these must be taken into account in order to isolate the impact of tax changes, as is discussed in the next section.



## Impact of Corporate Income Tax Rate Reductions on Investment: Theory

According to standard economic theory, firms make decisions by comparing the additional revenues anticipated from a contemplated action, such as an investment, to the expected additional costs. If firms foresee a positive gap between the extra revenue and the additional costs, they will take that action. If they are comparing a number of options, they will choose the one that promises the greatest positive margin between incremental revenue and costs, i.e. the action that maximizes the contribution to the firm's profit.

A firm's decision to invest in new structures, engineering projects or machinery and equipment is an example of a situation in which this profit-seeking behaviour is assumed to apply. Key factors affecting the prospective profitability of investment are the expected demand for the firm's output and the relative cost of investment goods. If firms expect sustained higher demand for their product, it will be profitable to undertake capacity-expanding investment in plant and equipment. On the cost side, the more affordable an investment is, the more profitable a business will find it to invest. Assessing the affordability of a particular investment involves comparing the cost of acquiring and using the capital good to the price of the products it will be used to produce. If the cost of the capital good falls relative to the price of a firm's output, increasing the capital intensity of existing production will enhance profits. In addition, projects previously judged unprofitable will become viable.

Economists have developed the user cost of capital (UCC) concept to determine the ongoing cost of using capital goods. Two key elements of this ongoing cost are:

- The cost of depreciation—Capital goods lose value as they wear out with usage or as they become relatively less productive in comparison with newer, better equipment that becomes available.
- The cost of financing the investment—Depending on the method chosen, financing costs can involve interest payments on borrowing, dilution of equity if new shares are issued, and the opportunity cost of using internal funds to purchase capital goods rather than distributing them to shareholders or investing them to earn a financial return.

Taxes are another important factor in determining the UCC since in most situations they play a major role in projections of a firm's profits.

- Corporate income taxes directly reduce the expected after-tax return from investments, diminishing the payoff for businesses making the capital expenditure. The higher the corporate income tax rate, the more it impinges on profitability.
- Less obviously, investments trigger various corporate income tax provisions, such as interest expense deductions, capital cost allowances (CCA) and investment tax credits, all of which permit businesses to reduce the amount of their profits that are subject to tax and so increase their return from investment.
- Corporate income taxes aren't the only levies that potential investors take into account. They also factor in the effect of federal and provincial capital taxes and of the provincial sales taxes that apply to investment goods.

These tax and non-tax elements influence the UCC directly and indirectly through interaction effects. For example, the difference between CCA and actual depreciation rates affects the UCC: if CCA is more than adequate to compensate for the actual depreciation of capital, the excess deduction puts downward pressure on the UCC. A corporate income tax rate reduction will reduce the value of this excess deduction. Since the gap between CCA and actual depreciation rates varies by industry, a change in the common statutory tax rate has different effects by industry. As a result, while affected industries experienced identical 2001–2004 tax rate reductions, these reductions translated into different UCC impacts by industry, which would be expected to have led to different investment responses.

#### **The User Cost of Capital and Marginal Effective Tax Rates**

Marginal effective tax rates (METRs) provide a summary indicator of the tax burden on new investment. They measure the extra return on an investment required to pay all corporate-level taxes, expressed as a percentage of the total pre-tax return to shareholders. A firm's user cost of capital is the sum of the total pre-tax return to shareholders plus economic depreciation. A lower statutory corporate income tax rate reduces the METR, causing the required pre-tax return to decline, which then puts downward pressure on the user cost of capital.

### **Impact of Corporate Income Tax Rate Reductions on Investment: Methodology and Evidence**

Natural scientists often conduct controlled experiments to test their theories. Such methods apply a treatment to one part of a sample but not to the remainder, taking care that influences other than the treatment affect all sample members in a uniform fashion. Divergent outcomes for "treatment" and "control" groups are interpreted as demonstrating that the treatment made a difference.

Economists are not able to carry out such controlled experiments. They cannot, as a rule, arrange to have a policy apply to some members of the population but not to others, simply in the interests of research. With the 2001–2004 corporate income tax reductions, however, a natural version of a controlled experiment took place. Firms in some industries were subject to the "treatment" of tax reductions, while those in others were not. Note, however, that a crucial element of a controlled experiment is missing: it cannot safely be assumed that factors other than the tax reductions affected both groups in the same way.

This study uses two methodologies to take advantage of this "natural experiment." Both approaches make use of regression analysis to test the linkage between the tax reductions and investment.<sup>[5]</sup> The first approach captures the impact of tax reductions by examining year-to-year changes in investment by industry, while the second compares investment by industry in two periods, before and after the "treatment" of lower taxes. In both cases, additional variables are included in the regression equations to capture the impact of other influences on investment by the treatment and control groups.

## Standard Regression Using Annual Data

This approach analyzes annual investment in 43 industries over the seven-year period 1998 to 2004.<sup>[6]</sup> The period examined starts well before the corporate income tax rate reductions were announced, thereby permitting the regression model to assign values to the coefficients that reflect the underlying investment process both with and without tax reductions.

The explanatory variable of primary interest is changes in the UCC. In order to identify the contribution of taxes more precisely, the industry-specific UCCs were decomposed into tax and non-tax components. Both components are expressed relative to the price of industry output. The UCCs were computed at the Department of Finance as described in Annex 1.

As indicated earlier, firms react more to the expected than the current value of the UCC. Since it cannot be observed, determining the expected value of the tax component of the UCC requires some judgement. In this study, it is assumed that firms viewed the 1-percentage-point rate reduction announced in Budget 2000 as credible but remained skeptical about the remaining 6-percentage-point reduction until the schedule was set out in legislation in the October 2000 *Economic Statement and Budget Update*. The expected value of the tax component was calculated by factoring in the present value of announced tax reductions. As a result, the biggest change to the tax component occurs in late 2000. A change in the expected value of the tax component should, in principle, affect investment in both current and subsequent periods, in part because projects take time to get underway and to complete.

The expected level of output is another key explanatory variable that is difficult to specify accurately in a regression equation. For example, when assessing the need for additional capacity, a firm making steel for the auto industry will need to form a view on the demand for autos, on the steel content of autos and on its market share. Fortunately, when working with industry-level data as in this study, it is possible to simplify matters considerably by using statistical techniques<sup>[7]</sup> to capture:

- The factors that affect all industries' expectations of output in a given year, such as the episodes of economic weakness that occurred in 2001 and 2003.
- The persisting factors that affect each industry's expectations of output year after year, such as a higher trend growth rate.

While the techniques in question reduce the need to identify explicitly the factors at work, they do not capture events that affect expected output in a specific industry in a given year, such as a labour strike. Current-year

industry output is included in the regression equation to play this role.

The results from the regression model indicate that the corporate income tax rate reductions, operating through the UCC, had a significant stimulative effect on investment (see Annex 1 for detailed results.) Specifically, a 10-per-cent reduction in the UCC coming from its tax component is associated with a 3.1-per-cent increase in the real capital stock. Statistical testing confirmed that a high degree of confidence in this result was warranted, i.e. that it was very unlikely to have occurred by chance. The disadvantage of this approach is that the tax component of the UCC is assumed to affect investment only in the year it changes—there is no effect on investment in subsequent periods. Given that expectations may not have been formed as assumed and that firms may take several years to respond to the tax reductions, the regression equation may not be capturing the full effect of the changes in taxes. This issue is addressed in the second modelling approach, which examines the investment response over the entire tax reduction period.

The non-tax component of the UCC, which captures the effect of factors such as interest rates, economic depreciation and the price of investment goods, is also shown to be a statistically significant determinant of investment. In contrast, output is not statistically significant—its potential role is perhaps disguised by the industry- and year-specific variables included in the regression.

## Difference-in-Differences

The second approach takes advantage of the selective nature of the policy by comparing industries that were affected by the corporate income tax rate reductions (the "treatment group") with industries that did not benefit from the reductions (the "control group"). When used in economic analysis, this methodology is often described as the difference-in-differences (DD) approach. In this study it involves comparing two differences in investment performance.

- Between the treatment group and the control group before the tax reductions.
- Between the treatment group and the control group after the tax reductions.

In its simplest application, the calculated DD would be used to draw conclusions about the impact of the tax reduction on investment by the treatment group of industries. That is, if the gap in investment changed to the relative advantage of the treatment group after the tax reductions, this would be taken as evidence that the tax reductions worked as expected. In more sophisticated use, regression analysis is applied to quantify the impact of the various factors that had a divergent influence on the investment undertaken by members of the two groups. In this manner, the DD can be decomposed into portions attributable to tax and non-tax factors.

The DD analysis carried out in this study compares changes in the real capital stock in the treatment group of industries to changes in the control group.<sup>[8]</sup> The treatment group consists of 22 sectors strongly affected by the tax cut, while the control group is comprised of 21 sectors not affected by the tax cut. Each industry's investment is considered in the without-treatment and the with-treatment periods, delineated by the announcement of the tax reduction. The pre-announcement period includes 1997–1999 and the post-announcement period covers 2000–2004. The post-announcement

period includes the year 2000 even though the first tax cut did not come into effect until January 2001, because it is assumed that firms reacted to the announcements in 2000.

In regression terminology, the DD analysis aims to explain inter-industry and inter-period differences in a dependent variable (capital stock) by variations in an independent or explanatory variable (the tax component of the UCC), while controlling for some other influences (non-tax changes in the UCC, output growth, relative prices of investment goods and industry-specific effects) that may be affecting the target capital stock.

Investment is found to be strongly influenced by the tax reductions. The estimated coefficient on the tax component of the UCC is large and highly significant by the usual statistical standards (see Annex 1). It implies that a 10-per-cent reduction in the tax component of the UCC would raise the real capital stock by approximately 7 per cent over a five-year period. This estimate is well within the range found in other studies of taxation and investment in Canada and the United States (Table 1 and Annex 2).

## Comparison of the Two Approaches

As noted above, a weakness of the regression using annual data is the stylized modelling of the response over time of investment to changes in the tax component of the UCC. A more complete model would include adjustment costs and allow investment to respond over several years to a tax change. Given the relatively small number of annual observations available, it was not feasible to include these features in this study. As a result, the annual approach likely understates the true impact of tax changes on investment. In contrast, the DD approach circumvents the need to model the adjustment process by estimating the investment response over the entire 2000–2004 period, and therefore likely provides a better estimate of the impact of corporate income tax rate reductions on investment.

**Table 1**  
**The Sensitivity of Investment to Tax Changes—Summary of Empirical Results**

Study	Change in Investment From a 10-Per-Cent Reduction in the Tax Component of the User Cost of Capital
This study	
Annual regressions	3-per-cent increase
Difference-in-differences	7-per-cent increase
Range from other studies <sup>1</sup>	3-per-cent to 11-per-cent increase

<sup>1</sup> See Annex 2 for detailed results of other studies.

## Conclusion

The belief that lower corporate income tax rates should lead to more investment is intuitively appealing. It is one of the reasons that tax reductions are considered an important step towards improving Canadian competitiveness. Proving the existence of a relationship between taxes and investment with real-world data is, however, a challenge. Investment is influenced by numerous factors, many of which are also in flux as tax rates

change. Identifying and untangling the contributions of the tax and non-tax influences is a demanding process.

A characteristic of the 2001–2004 tax reductions—the fact that some sectors were affected by the reductions and others were not—created an opportunity to conduct an empirical examination of the effects of the rate reductions on investment. The work described in this study took advantage of that opportunity to test the proposition that lower tax rates boost investment.

Using real-world data from Canadian industrial sectors, the study applied two different statistical tools to investigate the investment–tax rate link. Both provided clear evidence that investment was strongly and positively influenced by the 2001–2004 corporate income tax rate reductions. A 10-per-cent reduction in the tax component of the user cost of capital is associated with an increase in the capital stock in the 3-per-cent to 7-per-cent range, with the latter being the preferred estimate since it is obtained using a more robust methodology.

The results summarized in this study are consistent with empirical work undertaken by other researchers. As shown in Annex 2, studies undertaken since the early 1990s find a strong link between the user cost of capital, which is directly affected by taxes, and business investment in plant and equipment.

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