The Social Discount Rate for Provincial Government Investment Projects

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Introduction

Benefit-cost analysis is a way to make rational comparisons between alternative investments to assess whether they are worth undertaking. Since these investments have benefit streams that extend over long periods of time, it is necessary to calculate their present value by taking into account the time value of money. This rate of return, conceptually similar to an interest rate, is referred to as the discount rate.

For private corporations making such calculations, the discount rate is a relatively straightforward calculation of the actual cost of funds, being a weighted average of the return on equity and interest on debt.

However, in the case of government projects, the use of the actual borrowing rate as the discount rate can lead to misleading conclusions. The government is able to borrow large sums of money at low interest rates, but this interest rate may not be a good measure of the opportunity cost of capital.

Unlike a corporation, the government's credit rating does not derive from its balance sheet, and it is able to borrow money primarily due to its power to collect revenue through taxation. If the interest rate is used as the discount rate for evaluating government investment projects, it may lead to inefficient use of the government's borrowing capacity.

The social discount rate (also known as the economic opportunity cost of capital) seeks to mimic the rate of return that would be earned on private sector investments. Inefficiencies in the government's use of capital are minimized by requiring government investments to meet a rate of return hurdle similar to what is earned in the private sector.

Suppose that the government can borrow at 3% because there are some investors who need to put a portion of their funds into a very low risk instrument. Should the government treat 3% as its discount rate, and undertake a road project whose benefits equal costs at a discount rate of 3%?[2] The answer would generally be no. In order to make the citizens as well off as possible, the government should invest public resources where they have the opportunity to earn the highest rate of return.

There is no universally accepted method for choosing the discount rate, and a number of different approaches have been recommended, as discussed in a very comprehensive survey of the literature by Zhuang et al (2007). The choice depends on various philosophical issues and views about the sources and alternative uses of the funds. These go beyond merely empirical questions to more fundamental issues about the choices that are (or ought to be) open to various entities. The "dissonance" that exists about this issue is ably reviewed by David Burgess in his chapter in this volume.

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[2] It has sometimes been argued that additional borrowing raises the interest rate. However, empirical evidence finds that from a province's viewpoint, this impact is negligible. Booth et al (2006) estimated that an increase of government debt equal to 1 percentage point of GDP raises the interest rate on provincial debt by only 0.6 basis points (that is, less than a hundredth of a percentage point). The latest international evidence similarly suggests that, for advanced countries the supply of funds is very elastic, and interest rates would only be impacted if deficits became very large, as in Aisen and Hauner (2008).

The approach taken in this paper is a common-sense compromise between the alternative viewpoints. The discount rate should approximate the rate of return that could be earned on a notional balanced portfolio of financial investments, even if in practice this might not be its most likely alternative use.[3] To earn a lower rate of return than on a passive investment could be characterized as poor stewardship, which clearly fails to maximize real wealth in the economy. It will be seen that the numerical estimate derived using the approach in this paper is close to half way between the high and low ends of the alternative approaches to social discount rates.

Should Risk be Reflected in the Benefit-Cost Stream or the Discount Rate?

It has sometimes been argued that benefit-cost analysis should apply different discount rates in different kinds of projects, to adjust for the project-specific risk of failure in its intended achievements.

However, the general consensus in cost-benefit evaluation tends towards the view that the discount rate should not be adjusted for the risk of the investment, and that instead the dollar amounts of the future estimated benefits and costs should be adjusted to "certainty equivalents." The latest version of the Canadian Treasury Board's Benefit-Cost Analysis guide (2007) also suggests a similar approach, in which a range of scenarios representing the uncertainty of future costs and benefits is discounted.

One recent exception is Brean et al (2005), who propose a method for adjusting the discount rate for risk, focusing specifically on investments in transportation.[4]

If a particular project has an identifiable specific type of risk (e.g., environmental damage), the correct way to take this into account is to include a notional dollar cost of this risk (an estimated "insurance premium") to the future stream of costs, so as not to create a bias in favour of alternatives whose benefit stream is weighted toward the present.[5]

There is a wide range of socioeconomic factors that should be taken into account in a comprehensive benefit-cost analysis.

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[3] Public sector portfolio investments of this type already exist in the form of the Alberta Heritage Fund and the Canada Pension Plan. Recently, concerns about the inadequacy of voluntary private retirement savings have led to calls for the establishment of supplementary public pension plans above the CPP, which could be run by provincial governments. See, e.g., Ambachtsheer (2008).

[4] They undertake regressions that relate the demand for various kinds of transportation services to GDP growth. Where the demand elasticity is greater than one, they assume that this represents a greater than average risk factor. This is an innovative approach, but it is of less relevance to long-term projects. Here, the important risks relate to the long-term demand, affected by such things as major population shifts and technological changes, rather than whether it will be temporarily underused in a recession.

[5] H. Bierman and S. Smidt, *The Capital Budgeting Decision*, New York, Macmillan, 1980.

For example, it was argued above that government borrowing does not significantly affect the interest rate on private sector borrowing. However, financial capital is not the same as physical resources. Financial capital borrowed from abroad is useful if the incremental demand for physical resources can be met by using the foreign money to buy imported goods and services. Quite often this is not possible, and this has sometimes been referred to as the "transfer problem." Government projects draw on local construction resources, where bringing in foreign workers may not be practical. In periods of full employment, the government activity may lead to the postponement of private sector construction (or higher costs for these projects).

This can be a significant issue that should be factored into government decision-making, but the discount rate is not the appropriate way to deal with it. Private sector construction spending has always been one of the most volatile components of the economy. Good macroeconomic policy would dictate that the government should be concerned about these issues and should try to stream its projects as much as possible to smooth out the fluctuations in the construction sector.

Benefit/cost analysis typically takes into account socioeconomic impacts such as job creation in the economy. As a corollary, any negative impact on private sector employment (caused by labour shortages) should also be taken into account as a disbenefit, to help signal that projects should proceed more slowly during periods of excess demand. Similarly, the positive impact that public infrastructure has on private sector productivity should be taken into account in the benefit stream.[6]

No doubt, all these factors are hard to forecast. However, the only way to evaluate the reasonableness of the forecasts for different factors is if they are laid out individually. This creates greater transparency, and better decision making, than if they are all lumped together as a miscellaneous "risk factor" in the discount rate.

Estimate of the Private Sector Return on Equity Capital

The view taken in this paper is that government borrowing does not have a material crowding-out impact on private sector investment. The opportunity cost of public funds comes from the fact that the money could instead be invested in financial markets, either directly by the government, or by the citizens it represents if they received this money in the form of lower taxes. In that case, it is an after-tax rate of return on financial capital that is relevant.

This contrasts with the view often taken in previous Canadian studies, which sought to use the pre-tax rate of return. These studies were all conducted from the viewpoint of the national government. Even if one were to accept that crowding-out occurs, from the viewpoint of a provincial government, the tax share would be quite small, reflecting that provincial

[6] Harchaoui et al (2004) provide a methodology for estimating these benefits.

government's share of the total corporate tax revenue received in Canada (about 15 percent of the total in 2005 for Ontario, and much less for other provinces).[7]

One potential approach to estimating the opportunity cost would be to look directly at rates of return on equity investments in the stock market. However, this has such extreme volatility, even over time horizons as long as a decade, that it is hard to make any reasonable inference from it for long-run trends. A still imperfect, but somewhat more stable source of information about underlying fundamentals comes from looking directly at data on rates of return on business capital.

Statistics Canada publishes data on the average rate of return on equity for corporations going back to 1988. To smooth out the volatility of profits that occurs over the course of the business cycle, average data over the latest ten years (1998 to 2007) is used, and returns for the oil and gas sector are excluded. The average return on equity over this period was 9.7 percent. (The average is 8.8 percent over the whole data sample back to 1988.) As this is calculated on the book value of equity, it is a nominal rate that needs to be adjusted to reflect inflation. Subtracting 2 percent as the long-run average expected inflation rate leaves 7.7 percent.

The real rate of return derived this way, at 7.7 percent, is considerably higher than the historical real return from the viewpoint of a private investor. The real return on the Toronto Stock Exchange (including dividends) has averaged about 6 percent.[8] Therefore, it can be considered a reasonably conservative estimate of the opportunity cost of equity capital.

Interest Rate Component

In long-term financial evaluations, it is important to remember that dollars in the distant future will not have the same value as they have today, due to inflation. In recent decades, the Bank of Canada has pursued a target of maintaining inflation near 2 percent, but there is no certainty that this policy regime will remain unchanged in the future.

The yields on ordinary (not indexed for inflation) bonds implicitly take into account a future average inflation rate, to compensate lenders for the expected decline in the real purchasing power of the money they will get back in the future.

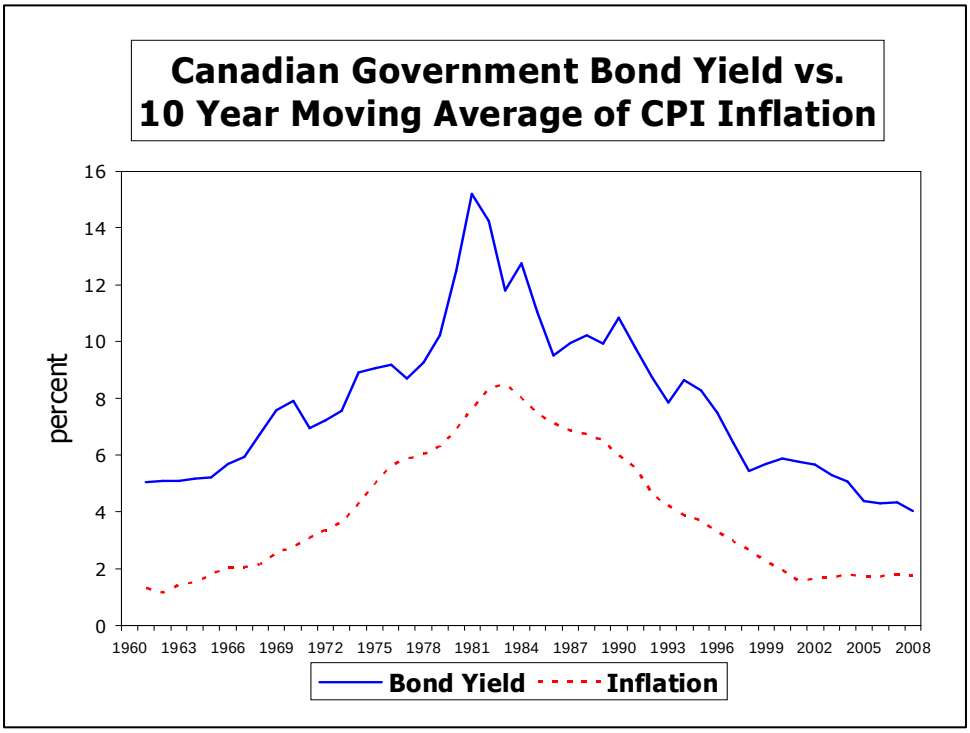
Financial evaluations that use future streams of costs and benefits in nominal dollars should use a nominal discount rate. They need to be reasonably sure that the discount rate and

[7] At first glance, this might be considered a "selfish" approach. However, in the absence of an explicit decision by all provinces to do differently, it is the rational approach. There are numerous examples in intergovernmental fiscal relations (both within Canada and internationally) where greater coordination would be optimal, but unfortunately has not happened.

[8] Some would argue that this overstates the effective rate of return, as stock market investors are being compensated for risk. Conversely, it could be argued that what is risky from the viewpoint of the individual is much less risky from the viewpoint of society as a whole (as discussed below), and therefore the whole observed return to equity is part of the opportunity cost.

the inflation rates used in the project come from consistent sources. The preferred approach is probably to use constant dollar amounts and a real discount rate, so that inflation has been factored out of both the numerator and denominator.

In the past, it was necessary to make a forecast of the long-term future inflation rate in order to estimate the real interest rate. This is always a problem for borrowers and lenders in the nominal bond market as well, and the bond market only imperfectly predicts the future inflation rate. Historically, the bond market has tended to base its expectations of future inflation on the average inflation over the previous ten years or so, and has made substantial forecasting errors when the trend rate of inflation had a major change (Figure 1).[9] Investors who bought bonds in the 1960s earned negative real returns, as inflation continued to rise beyond what they had expected. Conversely, borrowers who issued long-term bonds in the late 1970s and during the 1980s, before the large downward trend in inflation, ended up paying extraordinarily high real yields.[10]



Fortunately, an alternative source of information now exists. This is the market yield on a real return bond. These are bonds in which the value of the principal rises each year with the rate of inflation, and the yield the investor earns is applied to this rising base. The yield on this

[9] A discussion of the problem of measuring real interest rates can be found in Peter Spiro, *Real Interest Rates and Investment and Borrowing Strategy*, New York, Quorum Books, 1989.

[10] This was the source of a large part of Ontario Hydro's "stranded debt," which continues to impose a cost on Ontario's electricity ratepayers long after Hydro's dissolution. If real return bonds had been issued at that time, as urged by numerous economists (including the present author), Hydro's losses and debt would have been much lower.

bond reflects the bond market's current forecasts of the long-term real interest rate. Along with other interest rates, this yield has been declining over the past few years, and has recently been in the area of 2 percent.

The approach below will base the discount rate on the yield for a specific provincial government real return bond. One might ask why this synthetic discount rate combines the provincial government's borrowing rate (rather than the private sector's borrowing rate) with the private sector return on equity capital? The reasoning behind this is that the higher bond yields paid on corporate debt merely compensate lenders for the higher default risk perceived to apply to that debt. If the government, with its lower default risk, is using the capital, the social opportunity cost is to that extent lower than when the capital is used by the private sector.[11]

This view follows the analysis of Arrow and Lind (1970), which continues to offer useful guidance for benefit-cost analysis in the public sector. Arrow and Lind argued that governments represent a kind of pooling of risk that reduces financing risk to negligible levels. This has been criticized in recent years by "perfect capital markets" theorists, who argue that the private sector effectively has access to the same kind of risk pooling through diversification in the capital markets. However, as discussed by Spackman (2001), significant legal and institutional factors exist that create a greater risk in lending to the private sector than the public sector. This view received further confirmation in the private sector defaults triggered by the sub-prime mortgage collapse in 2008, which further undermined the position of efficient market theorists. In practical terms, Arrow and Lind's hypothesis still seems to hold.

This issue is particularly relevant when considering the discount rate for government owned enterprises such as electric utilities. These companies have their own capital structures, including equity owned by the government, and may borrow without an explicit guarantee on their debt. As private sector entities, they would face considerable enterprise-specific risks, not least of which would be the effects of government regulation. Shareholders would require a higher rate of return on equity to compensate for this risk. However, if the Arrow and Lind view holds, it could be argued that, when these enterprises are in the public sector, their opportunity cost of capital is the general government discount rate.

Combining the Factors to Calculate the Social Discount Rate

The table below provides an example of how the reasoning described above can be used to calculate a discount rate. This example uses data for from the first half of 2008, with the province-specific values that apply to the province of Ontario. The resulting estimate of the social discount rate is 5%. This is a real rate of return, since it is based on the real return on equity and the real interest rate.

[11] Montmarquette and Scott (2007), in proposing a social discount rate for Quebec, similarly make use of the yield spread between Quebec and Canadian government bonds. They recommended a real discount rate of 6 percent for Quebec.

A	Rate of return on equity, corporations excluding oil and gas extraction (Statistics Canada, Cansim Table 180-0002 - Financial and taxation statistics for enterprises), 1998 to 2007 average, less 2% to convert to a real rate.	7.7%
B	Ratio of debt to equity, non-financial industrial corporations	1.0
C	Yield on Government of Ontario real return bond, maturing in 2036[12]	2.2%
D	Social discount rate = [A + B*C]/(1+B)	5.0%

As I emphasize below, the estimate of the discount rate should not be viewed as a fixed value, but rather should be recalculated periodically as market conditions change. There is also a margin of error in such estimates, and sensitivity testing should be used to gauge the significance of potential errors.

Real versus Nominal Rates

As the 5% discount rate is a real return, it should be applied to constant dollar values of future revenues and expenses, which do not include the effects of price inflation on the cost of activities.

If a stream of future project expenses and benefits has been expressed in nominal dollars, based on a 2% inflation rate, then this should be added onto the real discount rate to arrive at a nominal discount rate of 7%.

Sensitivity Testing

The most significant risk that needs to be taken into account directly in the use of the discount rate is the uncertainty in the estimation of the cost of capital itself. There are two aspects to this.

The first is due to the fact that in practice there are usually long time lags, stretching to several years, between when a project is analyzed and when the construction for it takes place. Major infrastructure projects such as transit lines or power plants often take five or even ten years from initial planning to the completion of financing. Even if one can know with precision what the discount rate should be today, its appropriate value might turn out to be different at the time the bulk of the investment is made.

The risk of higher future interest rates may be particularly relevant in periods, such as the present, when the real interest rate is far below its long-term historical average.

[12] Yield as of March 6, 2008. Manitoba and Quebec have also issued real return bonds in the last several years, and the federal government began issuing them in 1991. For a province that does not have such bonds, one can estimate the yield based on their provincial spreads relative to federal government bonds.

The second factor is the inherent uncertainty in any methodology for estimating the social discount rate. For example, some economists have argued that increased government borrowing makes it harder for the private sector to gain access to funds, referring to this phenomenon as "crowding-out." This was based on the view of a fixed pool of capital in a small, closed economy. This may have had more relevance in the 1960s and 1970s, but international financial market integration has increased dramatically over the past few decades.

Two recent empirical studies focusing specifically on provincial borrowing illustrate that markets can absorb quite large changes in borrowing with little impact. It has sometimes been argued that additional borrowing raises the interest rate. Booth et al (2006) estimated that a quite substantial increase of government debt, equal to 1 percentage point of GDP, raises the interest rate on provincial debt by less than one-hundredth of a percent, while Landon and Smith (2006) found no statistically significant impact at all.[13]

This paper assumes, based on recent econometric research, that the financial crowding-out is not a material factor in the current environment. However, the econometric analysis that supports such a view can never have 100 percent certainty, and changing fiscal and financial market conditions could alter the situation.

On the downward side, there are some economists who argue on theoretical grounds for a social rate of time preference approach to the discount rate. This would be considerably lower, with a value of about 3 percent. [14] The UK government, which previously specified a social discount rate of 6 percent, has switched to a 3.5 percent rate based on the social rate of time preference (HM Treasury, 2003).

Based on these uncertainties, it is suggested that a range of plus or minus 2 percentage points around the central estimate of the discount rate is appropriate for sensitivity testing for long-term investment projects (20 years or more), while for short-term investments a proportionately narrower range of uncertainty would be appropriate.

The conceptual reason for this uncertainty is that the government takes on the debt and locks itself into a long-term obligation for a long-term project. Whether it is actually paid for through taxes or borrowing does not make a difference from the opportunity cost viewpoint. The longer the locked-in obligation to own and/or pay for the project, the greater the risk of "regret" that it was chosen given changing investment opportunities in the economy. This is analogous to an investor buying a twenty year bond today with a 4% yield, and suffering a loss of capital value if market yields subsequently rise.

Other things equal, a project that has a positive net present value at 7 percent is better than one that is only viable at 5 percent. However, there are obviously a great many

[13] Even if it was believed that there is some impact, it could be argued that the relevant opportunity cost for provincial government borrowing would be the impact on private sector borrowing within its own province, which would be smaller than the Canada-wide impact that is appropriate for federal government project evaluations.
[14] Treasury Board of Canada Secretariat (2007), p. 42.

uncertainties through all phases of an investment analysis, and a considerable amount of judgement needs to be applied. A project that appears to have a positive present value only with a low discount rate such as 5 percent is in a gray area, but it might be possible to justify it if there is a potential for large benefits of a type that are hard to quantify. The discount rate is just one factor in a project evaluation, and it is important to estimate the cost and benefit streams as rigorously as possible.

The Social Discount Rate Should be Reviewed Annually

There has been a tendency for some government agencies to issue a discount rate and then never review it, as if the discount rate was a constant like the value of *pi*. The Treasury Board of Canada was, until very recently, prescribing a 10 percent real social discount rate for federal government projects that had not been revised for 30 years.[15] This estimate was based on data for the return on capital for the very distant past period from 1965 to 1974.[16]

These estimates took into account factors such as the actual historical interest rates and return on capital. All of these factors can change considerably as world financial market conditions change. The high real interest rates of past decades have given way to very low real interest rates currently. In 2005-06, the Ontario Government issued $1 billion of real return bonds with a maturity of 30 years at a coupon rate of 2 percent.

The low real interest rates prevailing since 2000 are partly due to high savings rates in countries such as China which have undergone dramatic growth in income, as shown by Warnock and Warnock (2006). The financial crisis starting in 2008 has driven interest rates even lower, to record low levels in some major countries. At the same time, government deficits and borrowing have soared due to the recession and stimulus efforts. This inverse correlation, where higher government deficits are associated with lower interest rates, is actually the common historical pattern, as noted by Spiro (1994). While higher government demand for loans might be expected to increase interest rates, this is more than offset by lower demand from the private sector during recessions.

In the future, real rates may rise again, if demand and supply conditions change, but for investment projects undertaken in the near term, it is appropriate to use a correspondingly low discount rate.

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[15] However, it appears that this was not universally used even in the federal government. For example, in a regulation under the *Environmental Protection Act*, a 5 percent social discount rate was prescribed. P.C. 2003-262, 27 February, 2003, in *Canada Gazette* Vol. 137, No. 6, March 12, 2003.

[16] This estimate, originally found in Jenkins (1977) was recently updated in Jenkins and Kuo (2007). The latter reduced the rate to 8 percent, but the methodology continues to assume that there is considerable crowding-out of private investment. The crowding-out is based on the assumption of a low elasticity of foreign capital inflows, but they do not provide any empirical evidence to support this, and other recent studies suggest quite high elasticities (see note 1 above). As well, they assume that increased government debt in Canada is offset partly by equity capital inflows, with a higher capital cost than debt.

Conclusions

There is a widely held view that the opportunity cost of capital is higher than the borrowing rate on government bonds. This paper has suggested a conceptual framework for establishing that opportunity cost.

However, it is argued that the appropriate discount rate is not fixed, and varies with financial market conditions. The calculations used in this paper, based on values for the first half of 2008, imply that a real discount rate of about 5 percent would have been appropriate for provincial government benefit/cost analysis of investment projects. In periods of significant excess capacity in the economy, the opportunity cost of capital can drop considerably. This happened in 2009, following the global financial crisis, and the implied discount rate in such a period would be even lower.

The supply and demand conditions in the economy that determine the social discount rate can change substantially over time. It is appropriate to regularly review the value of the social discount rate by examining changes in financial market indicators of the return on capital. For a variety of reasons, there is also a degree of uncertainty in choosing the appropriate values of financial market variables that go into the construction of discount rates. It is appropriate, therefore, to experiment with sensitivity analysis that looks at a range of possible values.

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