Capital Budgeting and Fiscal Sustainability in British Columbia

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Abstract

This paper makes four contributions to the theory and practice of capital budgeting. First, it provides a discussion of capital budgeting in the public sector and demonstrates the relationship between fiscal sustainability and balanced operating budgets. Second, it uses the *Public Accounts* data to decompose the overall budget deficit into operating and capital account deficits based on a model grounded in economic theory. Third, it derives the user cost of capital taking into account the marginal cost of public funds and inflation. Fourth, it applies the analysis to British Columbia to comment on the sustainability of fiscal policy in the province over the period 2005-2017. The public net debt over this period is on the cusp of unsustainability, as the run up in debt since 2008 largely erased the reductions in debt achieved between 2004 and 2008. Thus fiscal restraint is required by the provincial government over the next several years as a prudent measure against future adverse shocks to the budget.

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1 Introduction

The opening sentence in British Columbia's *Budget 2014* is that it "affirms government's ability to balance its budget on an ongoing basis." That statement underscores the focus of public attention on the *operating* budget deficit or surplus.[1] However, the province's financial reporting is based on a capital budgeting approach, whereby new borrowing to pay for capital investments, such as roads, schools, and hospitals, is not reflected in the operating budget. Changes to public net debt, the real bottom line, depend on both the operating budget deficit and the capital budget deficit. So, while the B.C. government expects a $384 million operating surplus in 2014/15 ($184 million after accounting for the forecast allowance), provincial net debt will grow by $1.9 billion. This means pronouncements of balanced budgets by the government must be interpreted with caution. Given the recent run up in public net debt from 12.2 percent of GDP in 2008/09 to 17.3 percent in 2012/13, which was due not only to higher current expenditures and weak revenues, but also from the use of infrastructure spending as fiscal stimulus in the wake of the recession in 2008-2009, this paper examines whether fiscal policy in British Columbia is on a sustainable path.

The paper provides an exposition on the concepts of fiscal sustainability and capital budgeting and uses these to measure the overall financial position of B.C. government. Section 2 defines the meaning of fiscal sustainability in the context of this paper. Section 3 provides a theoretical framework for capital budgeting. Section 4 discusses the pros and cons of capital budgeting. Section 5 examines fiscal policy and sustainability in British Columbia based on *Budget 2014*'s fiscal policy projection for 2014-2017 and the *Public Accounts* data for years going back to 2005. Section 6 provides a summary and conclusions. A technical appendix contains a model that underpins the construction of the user cost of capital for capital budgeting purposes.

[1] British Columbia has a balanced budget law prohibiting *Budget* forecasts of operating budget deficits. It was suspended for two years in 2009.

2 Defining Fiscal Sustainability

Put simply, fiscal sustainability concerns the affordability of the government's program spending, given the cost of servicing the public debt. When the public debt is large, the resulting high interest payments may necessitate program cuts or tax hikes. The unpopularity of such actions often impel governments to finance the interest by borrowing even more. This leads to an upward debt spiral until financial markets become unwilling to lend to the sovereign or the government must sell its bonds at a discount to compensate investors for the risk of default. Such was the situation in Canada during the early 1990s and which currently afflicts several Eurozone countries.[2] Thus fiscal sustainability is about the financial health of the government, based on its ability to meet future debt obligations without major corrections to tax and spending plans. Although it is a forward-looking concept, this paper uses data since 2004/05, together with current budgetary projections, to assess whether the public net debt in B.C. is floating upwards at an excessive rate.

The discussion above provides an intuitive idea about fiscal sustainability, but a more precise definition of sustainability is provided by economic theory. It simply formalizes the conditions under which investors are willing to buy new government bonds. Public net debt, B_t, evolves according to the equation

$$B_{t+1} = (1 + r)B_t + PD_t \tag{1}$$

where r is the interest rate on public net debt and PD_t denotes the *primary deficit* in period t.[3] The primary deficit is the difference between total

[2] The government of Alberta defaulted on its debt in 1936 and Greece partially defaulted in 2012. See Kneebone (1994) for a description of the debt crisis in Canada during the early 1990s and the bond rating agency downgrades of government bonds in several provinces.

[3] I am abstracting from inflation in this section by treating the variables as "real" values as opposed to "nominal" values. Allowing for monetary considerations would entail only minor modifications to Eq. (1). For example, if B_{t+1} refers to the nominal value of the debt in 2015 and B_t is the debt in 2014 reported in 2014 dollars, then multiply the 2014 deficit by the inflation factor and substitute the nominal (i.e. market) interest rate for r. Note that I omit a time subscript for the interest rate just to keep the notation simple;

program spending and total tax revenues. The *overall deficit* is $rB_t + PD_t$. Hence, the public net debt increases from the previous year's level by the size of the overall deficit. Any investment income from the government's financial assets is recorded in the term rB_t, since B_t is defined as liabilities minus financial assets.

By recursively substituting the debt level of each year into Eq. (1) the debt level in some future period T can be written in terms of an initial debt B_0 and the history of primary deficits, as follows,

$$B_T = B_0(1+r)^T + \sum_{t=0}^{T-1} (PD_t)\,(1+r)^{T-1-t} \tag{2}$$

The "initial" period 0 can be interpreted as the date at which we begin our analysis, which could be the current year or some earlier year. As indicated before, sustainability requires the financial market participants to be willing to purchase the government's bonds into the indefinite future. The implication of this can be ascertained by letting T approach infinity. Thus multiply both sides of Eq. (2) by $(1+r)^{-T}$ and let $T \to \infty$ to obtain the equation

$$\lim_{T\to\infty} B_T(1+r)^{-T} = B_0 + (1+r)^{-1} \times \lim_{T\to\infty} \sum_{t=0}^{T-1} PD_t(1+r)^{-t} \tag{3}$$

The left-hand side of Eq. (3) is the present value of the debt at a very distant time in the future. It will go to zero as T approaches infinity, if the growth rate of debt is below the interest rate. The argument for why the debt must grow no faster than the interest rate is that the financial market would cease to purchase the government's bonds if every year the government rolled over its debt in full by borrowing to cover both the principal and interest payments. Such continual rollovers amount to a Ponzi game, which no rational bond buyer would be willing to engage in.[4] Thus eventually,

nothing consequential changes if the interest rate varies across years.

[4]Ponzi schemes (named after Charles Ponzi) are fraudulent investment operations that

when the financial market has sufficient evidence that the government debt is growing without a limit, the market ceases to buy government bonds and a default occurs. Fiscal sustainability is synonymous with a no-Ponzi game restraint on debt accumulation imposed by the behavior of bond buyers:

$$\lim_{T\to\infty} B_T(1+r)^{-T} = 0 \tag{4}$$

Given the no-Ponzi game restriction, Eq. (3) can be simplified to an equation called the Present Value Budget Constraint of the government,

$$-\lim_{T\to\infty} \sum_{t=0}^{T-1} PD_t(1+r)^{-t} = (1+r)B_0 \tag{5}$$

Eq. (5) indicates what is required of fiscal policy for it to be sustainable: the present value of the excess of primary surpluses over primary deficits must match the initial level of the debt and interest.[5] If we take period 0 to be the *current* year, then the left-hand side of Eq. (5) resembles a financial asset based on the promise of future primary surpluses, which must be sufficiently valuable to offset the current level of debt and interest, as otherwise fiscal policy is unsustainable. In section 3, the Present Value Budget Constraint will be discussed in the context of the *operating budget* deficit, when financial reporting is based on public sector capital budgeting.

It is worthwhile to pursue a bit further the implications of the fiscal sustainability condition Eq. (5). In any given year the ability of the government to generate primary surpluses is limited by the size of the economy (see Kremers, 1989). For example, the well-known Laffer curve argument places an upper bound on how much tax revenue can be raised from a tax base. This

generate no actual profits but pay returns to existing investors from the deposits of subsequent investors. No one wants to be left holding the bond at the end of it. See O'Connell and Zeldes (1988) for a formal treatment.

[5] A primary surplus is the same as a negative value of the primary deficit.

observation can be represented by the fiscal constraint

$$-PD_t < \phi Y_t \tag{6}$$

where Y_t is GDP in year t and $\phi < 1$ is a parameter indicating the feasibility restraint on primary surpluses. Substituting Eq. (6) for $-PD_t$ in Eq. (5) gives an inequality that expresses the necessary condition for sustainability in a different form:

$$\lim_{T\to\infty} \sum_{t=0}^{T-1} \phi Y_t (1+r)^{-t} > (1+r)B_0 \tag{7}$$

If the expected GDP growth rate g is the same each year, i.e., $g = (Y_{t+1}/Y_t) - 1$ for all t, then by dividing both sides of Eq. (7) by the "initial" year's GDP level Y_0, the sustainability condition in Eq. (7) can be put in terms of the familiar debt-to-GDP ratio:

$$\lim_{T\to\infty} \sum_{t=0}^{T-1} \phi \left(\frac{1+g}{1+r}\right)^t > (1+r)b_0 \tag{8}$$

where $b_0 = B_0/Y_0$ is the debt-to-GDP ratio in period 0.[6] Hence, Eq. (8) provides a rule of thumb that says (taking period 0 to mean the present) the current debt-to-GDP rate b_0 must not be excessively large, where excessive is measured relative to the difference between long-term growth rate of the economy and the interest rate. From this perspective, a dynamic economy can afford a higher current debt level, because it will be relatively easier to repay the debt.[7] In fact, if the long-term growth rate g exceeds the interest

[6] To see this, rewrite Eq. (7) as

$$\phi\left(1 + \frac{(Y_1/Y_0)}{1+r} + \frac{(Y_2/Y_1)(Y_1/Y_0)}{(1+r)^2} + \frac{(Y_3/Y_2)(Y_2/Y_1)(Y_1/Y_0)}{(1+r)^3} + ...\right) > (1+r)B_0/Y_0.$$

[7] Other practical indicators of fiscal sustainability exist based on the debt-to-GDP ratio

rate r, then sustainability based Eq. (8) is automatically satisfied for any $\phi > 0$, because the left-hand side of the equation becomes infinitely large. The more usual situation over a long span of years is $r > g$ (Blanchard, 1990). When the interest rate exceeds the economic growth rate, each year that the debt is rolled over in full causes the debt-to-GDP ratio to grow, making fiscal sustainability more difficult to achieve. When $r > g$, Eq. (8) reduces to a very simple indicator of whether the current debt-to-GDP ratio is sustainable:

$$\phi > (r - g)b_0 \tag{9}$$

In applying Eq. (9) to a particular province, long-run historical averages can be used to estimate r and g.[8] To some extent the historical record is also informative about the maximum size of primary surpluses relative to GDP, i.e. ϕ. However, choosing a realistic value for ϕ requires some prediction about the future. Of particular relevance to Canadian provinces is the rising health care cost associated with an aging population, which may make future primary surpluses as a share of GDP more difficult to achieve going forward, assuming no new revenue sources, spending reductions to other programs, or program reforms that reduce health care costs.

3 A Capital Budgeting Framework

Public sector capital budgeting is based on the full accrual basis of accounting. This means that, together with revenues and current expenditures, only the annual interest and amortization expenses arising from taxpayer-supported investments are reported in the government's annual statement

(see Buiter, 1985, and Blanchard, 1990). However, a stable debt-to-GDP ratio does not guarantee the no-Ponzi game requirement for sustainability (see Chalk and Hemming, 2000).

[8] As I have abstracted from inflation, r is interpreted as the real interest rate and g is the growth rate of real GDP. However, in the application of Eq. (9) to data, the nominal interest rate can be used for r provided that the growth rate of nominal GDP is used for g. Both formulations are equivalent theoretically.

of operations, rather than the cash outlays. This government reporting model was recommended by the Canadian Institute of Chartered Accountants (CICA) and the Public Sector Accounting Board (PSAB) for adoption by April 1, 2005 by senior Canadian governments. Six provinces were already using the full accrual basis for financial reporting before then, while the standard was adopted by the federal government in 2003. The other important aspect of the new reporting model concerns a change in the scope of the Government Reporting Entity. British Columbia conformed with the new definition of the Government Reporting Entity in its 2004/05 financial statements. This means that some of the financial information in the *Public Accounts* and annual budgets of earlier years are not comparable to those after 2004.

An important merit of the capital budgeting approach is that the operating budget deficit or surplus measures the net budgetary impact of a single year's worth of service delivery, which may facilitate the taxpayer's interpretation and assessment of fiscal policy. In contrast, a cash basis of accounting would attribute all of the cost of an investment to the year of purchase, even though the asset may provide benefits to the public for many years to come. Capital budgeting is logically associated with the use of debt financing, rather than pay-as-you-go taxation, to fund capital expenditures. Debt financing allows the government to charge taxpayers for the cost of capital acquisitions over the lifetime of the asset, instead of all at once.[9] But a full reading of the financial health of the government must take account of debt-financed capital spending. Thus, in this section I describe a capital budgeting framework based on a chapter by Bev Dahlby in the monograph *Capital Budgeting in the Public Sector* (Mintz and Preston, 1993) with minor modifications. It provides a *theoretical* foundation for constructing the operating and capital budget accounts. In practice, there are departures from the

[9]Full accrual accounting may be useful for budget planning and transparency reasons even in the absence of debt financing of investments.

theoretical model. The significance of these departures in British Columbia is assessed in section 5.

3.1 Constructing the Operating and Capital Budgets

The government's *overall* budget deficit D_t (the sum of the primary budget deficit and interest on net debt) determines the annual change in the public net debt. Under a capital budgeting approach, the overall deficit is decomposed into an operating budget deficit, D_t^O, and a capital budget deficit, D_t^C, in the following manner:

$$\begin{aligned} D_t &= rB_t + G_t + I_t - R_t \quad (10) \\ &= D_t^O + D_t^C \quad (11) \end{aligned}$$

where

$$\begin{aligned} D_t^O &= rB_t^O + G_t + U_t - R_t \quad (12) \\ D_t^C &= rB_t^C + I_t - U_t \quad (13) \end{aligned}$$

and

$$\begin{aligned} B_t &= B_t^O + B_t^C \quad (14) \\ B_{t+1}^O &= B_t^O + D_t^O \quad (15) \\ B_{t+1}^C &= B_t^C + D_t^C \quad (16) \end{aligned}$$

The notation used in Eqs. (10)–(14) is defined as follows: B_t is the public net debt in period t, B_t^O is the net debt incurred by the operating budget, B_t^C is the net debt incurred by the capital budget, G_t is current government expenditures (i.e., the consumption of goods and services, including transfers to individuals), I_t is gross investment expenditure, and R_t is tax revenues. Note that the primary budget deficit, denoted by PD_t in the previous sec-

tion, equals $G_t + I_t - R_t$. The variable U_t is central to the capital budgeting approach to financial reporting; it represents the annual amortization and interest expenses associated with past capital expenditures. U_t can be regarded as an implicit payment, or annual "user charge," from the operating budget to the capital budget for the use of the province's public capital stock. The transfer of U_t to the capital budget account is what permits the capital budget account to service the capital debt and repay the principal over time.

When *Budget 2014* pledges to balance the budget on an ongoing basis, the government is projecting an operating budget deficit D_t^O close to zero from 2014 to 2017. However, as Eq. (11) makes clear, a balanced operating budget does not imply a balanced overall budget due to the capital budget deficit. In order to relate these observations to the issue of fiscal sustainability, we need to consider the evolution of the public capital stock, K_t, and the appropriate user charge U_t, which may differ from the amount reported (implicitly) in the government's financial statements, for reasons that will be explained later.

The public sector's capital stock accumulates according to the equation

$$K_{t+1} = K_t + I_t - \delta K_t \tag{17}$$

where δ is the economic depreciation rate. The assumption of geometric depreciation in Eq. (17), rather than the straight-line depreciation used in the B.C. government's financial reporting, accords with the conclusion of a Statistics Canada report, that it is the best fitting model for predicting the rate of discards of the capital stock.[10] The report (Patry, 2007) gives values of δ for a wide variety of capital assets, including the types of public sector tangible capital, which I shall use in Section 5 to estimate the depreciation expense for each of the categories of public capital reported in the *Public Accounts* of British Columbia. The depreciation rates are 8% for land and land improvements (e.g. recreation areas, dams, etc.), 5.9% for buildings, 9.4% for highways, 24.7% for transportation equipment, 47% for computer

[10] Geometric depreciation is calculated as a constant fraction of the net capital stock.

hardware/software systems, and 22.8% for "other" (mainly office furniture and equipment, and machinery).

Note that the capital accumulation equation assumes that an investment in year t takes time to build and hence becomes productive only in period $t+1$.[11]

The transfer from the operating budget to the capital budget, U_t, is intended to reflect the *opportunity cost* of financing an investment. It is conceptually similar to a competitive market price for renting private capital. However, an important difference between private capital and public capital is that public sector acquisitions must ultimately be financed by taxation. The distortionary effects of taxation on economic performance represents part of the opportunity cost of public expenditures. I shall return to this issue section 3.3. The user charge in year t is given by the equation

$$U_t = cI_{t-1} + (1-\delta)U_{t-1} \tag{18}$$

where c is the so-called user cost of capital, meaning the opportunity cost per dollar of capital investment. If we ignore the distortionary effects of taxation, the user cost of capital is given by

$$c = r + \delta \tag{19}$$

The interpretation of Eq. (19) is that each dollar of capital investment entails an interest expense and a depreciation expense.

In Eq. (18), U_t depends on U_{t-1}, and similarly, U_{t-1} depends on U_{t-2}, and so on, back in time. Therefore, the *initial* user charge, at the start of the capital budgeting exercise, has an impact on the current user charge. The size of the initial user charge determines implicitly the proportion of the pre-existing public capital stock that is to be allocated to the capital account. It

[11] Eq. (17) is a slight departure from the equation in Dahlby (1993), but it leads to an expression for the user charge for capital that corresponds more closely to accounting definitions of amortization and interest costs.

is natural to allocate the entire public capital stock to the capital account at the start of capital budgeting. In that case, the net book value of the capital stock, which is reported in the *Public Accounts* at historical costs, should be adjusted for inflation to obtain the nominal value of the capital stock in the year of the capital account's inception. The initial user charge is then $U_0 = cK_0$ where K_0 is the net book value of B.C.'s public capital in year 0, adjusted for inflation to period 0 dollars. In that case, Eq. (18) implies, via recursive substitutions of the user charge, that[12]

$$U_t = (r + \delta)K_t \tag{20}$$

Eq. (20) shows clearly why U_t is a user charge paid by the operating budget to the capital budget for using the province's public capital stock. It reflects one year's cost of financing and wear and tear and hence appears as an annual expense in the operating budget deficit Eq. (12). The interest rate r in Eq. (20) should be the *current* interest rate, not the weighted average interest rate of the government's existing debt portfolio.[13] In this way the current cost of undertaking new investments is recognized in the operating budget. Finally, the payments from the operating budget to the capital budget is what enables the capital budget to "pay off" the capital debt associated with each investment, gradually over time as the assets wear out. In theory, this preserves an equality between the capital debt and the value of the capital stock. Thus to be consistent with the debt financing of capital investments, suppose that the capital net debt at the inception of the capital account equals the initial value of the capital stock, $B_0^C = K_0$.[14]

[12] If the initial user charge U_0 differs from cK_0, then Eq. (20) will hold only once the capital stock is mature, meaning that each year new investments just offset the depreciation of the capital stock.

[13] I assumed c is constant over time in Eq. (19) just to keep the notation simple, but of course interest rates change year by year.

[14] In practice, British Columbia also uses cash and other working capital to finance a portion of investment. In principle, the working capital used to finance the initial capital stock K_0 is a liability to be assigned to the capital account along with the outstanding

These observations suggest a connection between operating budget deficits, which headline the government's budget documents, and fiscal sustainability.

3.2 Operating Budgets and Fiscal Sustainability

An important fact about the model sketched above is that, viewed over the entire horizon of fiscal policy-making, a sustainable operating budget is both a sufficient condition and a necessary one for the government's overall fiscal policy (both the operating and capital budgets) to be sustainable (Dahlby, 1993). This is because the present value of the future stream of interest and amortization costs that is incurred for each new capital expenditure is equal to that expenditure. Table 1 can be used to demonstrate this important result. The second row shows the investment in year t. Recall from Eq. (18) that the user charge for the addition of I to the capital stock begins in year $t+1$. The third row of the table shows the stream of user charges associated with the investment. The fourth row shows the value of each user charge discounted to year t.

Table 1

Year	t	$t+1$	$t+2$	$t+3$	...
Investment	I	0	0	0	...
User charge U	0	cI	(1-δ)cI	$(1-\delta)^2 I$	...
Present value of U	0	$\frac{cI}{1+r}$	$\frac{(1-\delta)cI}{(1+r)^2}$	$\frac{(1-\delta)^2 I}{(1+r)^3}$	...

The present value of the infinite stream of user charges is the sum of the terms in the fourth row of the table. This adds up to $cI/(r+\delta)$. But with $c = r+\delta$, the present value of the stream of user charges equals the investment expenditure I. This will be true of every year's investment. To see the implication of this for fiscal sustainability, recall from section 2 that the

capital net debt.

sustainability of the overall budget requires the present value of the excess of primary surpluses over primary deficits to match the initial debt level.[15] Taking the "initial" period to mean the year of inception of the capital account, the course of fiscal policy is sustainable when

$$\lim_{T\to\infty} \sum_{t=0}^{T-1} (R_t - G_t - I_t)(1+r)^{-t} = (1+r)B_0 \tag{21}$$

Similarly, the operating budget is sustainable when

$$\lim_{T\to\infty} \sum_{t=0}^{T-1} (R_t - G_t - U_t)(1+r)^{-t} = (1+r)B_0^O \tag{22}$$

But as shown above, $\sum_{t=1}^{\infty} U_t(1+r)^{-t} = I_t$ for each I_t in the summation in Eq. (21). Furthermore, the initial charge $U_0 = cK_0$ generates an infinite sequence of charges, cK_0, $(1-\delta)cK_0$, $(1-\delta)^2cK_0$, etc., that has a present value of $(1+r)K_0 = (1+r)B_0^C$, given $B_0^C = K_0$. Therefore, Eq. (21) and Eq. (22) are identical conditions. Thus the sustainability of the operating budget guarantees the sustainability of the overall policy, which also implies that the capital budget is sustainable. In contrast, the sustainability of the capital budget does not imply overall sustainability, because current public expenditures, G_t, affect the operating budget deficit and the overall budget deficit, but do not affect the capital account budget deficit.

These remarks explain the attention given to the operating budget. The implicit message of fiscal sustainability in the B.C. government's *Budget 2014* pledge to "balance its budget on an ongoing basis" is, however, predicated on some future years of operating budget surpluses in excess of years with deficits, as well as considering a long enough time horizon that the capital budget deficits have been absorbed by the operating budget through the amortization expenses. Over shorter periods of time, the operating budget

[15] The representations of the overall budget by Eq. (1) in section 2 and by Eq. (10) in section 3 are equivalent, since $B_{t+1} - B_t = D_t = rB_t + PD_t$ by definition.

may be balanced, while the overall budget may yet be unsustainable due to capital budget deficits. As we shall see in section 5, this has been the case in British Columbia for a number of years—both in the past and likely in the future. Finally, the requirement of the province's *Finance Statutes Deficit Authorization and Debt Elimination Amendment Act 2009* to apply operating budget surpluses toward eliminating the operating budget debt is consistent with the meaning of Eq. (22).

3.3 Factoring in the Marginal Cost of Public Funds

As I noted in section 3.1, the user cost of capital given by Eq. (19), $c = r + \delta$, while appropriate for private sector capital budgeting, omits an important aspect of fiscal policy. The difference is that public sector expenditures must ultimately be financed by taxation, which can cause economic distortions as individuals and businesses alter their behaviors to reduce their tax burdens.[16] The marginal cost of public funds (MCPF), defined as the cost to taxpayers per dollar of tax revenue collected, is a concept that takes these distortions into account. The MCPF is always greater or equal to one, since a dollar of extra revenue from the taxpayer is a dollar less in the pocket of the taxpayer. But it can exceed one when the taxes cause distortions in resource allocations. The MCPF is central to the argument for the debt-financing of investments and a capital budgeting framework for financial reporting. In particular, the use of debt financing instead of pay-as-you-go means that tax burdens are more *stable* over time, which contributes to efficiency, since it is a basic tenet of public finance theory that episodes of high taxation can damage economic performance by more than episodes of low taxation can improve it. In the technical appendix I show that the government should use debt financing such that the MCPF is equal across years and that the user cost of capital

[16] See Murphy et al. (2013) for a discussion of tax distortions in Canada.

for public sector capital budgeting is given theoretically by

$$c = MCPF \times (r + \delta) \tag{23}$$

Hence, Eq. (19) is a special case that presumes there are no distortions from taxation (MCPF=1). Accounting for the user cost of capital in this manner will tend to increase the "true" size of the operating budget deficit from an economic, as opposed to a financial accounting, perspective. Government planning based on a user cost that takes the MCPF into account generally entails a reduction in the optimal amount of capital investment compared to when the MCPF is ignored.[17]

3.4 Capital Budgeting in Practice: The Case of the Government of British Columbia

Although the province of British Columbia uses the government reporting model recommended by the CICA and PSAB, the annual *Public Accounts* and provincial budgets do not explicitly report a capital budget deficit or a user charge paid by the operating budget account to the capital budget account. However, these accounting items are implicit in the operating budget statement. This section reconciles the province's financial reporting with the theoretical model of capital budgeting described in section 3.1.

The officially reported operating budget deficit can be represented with the following stylized equation:[18]

[17] I am abstracting from the observation that public infrastructure may result in an increase in tax revenues by improving private sector productivity. In that case, the MCPF should take into account not only the cost of distortions resulting from taxation, but also the tax benefit side.

[18] This is not exactly how the revenue and expense line items are presented in the *Budget*. But the equation shows the essential items for understanding capital budgeting. Expenses such as interest and amortization are embedded in the program spending entries of the *Budget*'s statement of operations, but they can be recovered from the *Public Accounts* breakdown of expenses by category of spending.

Operating budget deficit = Current expenditures of ministries
+ SUCH sector expenses + Funding for capital expenditures
−Funding provided to the SUCH sector
+ Interest on total gross debt + Amortization − Investment income
−Tax revenue − Resource revenue − Federal transfers

where total gross debt is the sum of operating gross debt, taxpayer-supported capital gross debt, and the gross debt of commercial Crown corporations. The SUCH sector consists of the service delivery agencies: school districts, universities, colleges and institutes, and hospitals. The definition of the Government Reporting Entity (GRE) in British Columbia includes non-commercial Crown corporations and, since 2004, the SUCH sector. Self-supported (i.e. commercial) Crown corporations are not part of the GRE, although the B.C. government. borrows money on behalf of the self-supported Crowns through the Fiscal Agency Loan program and the Warehouse Borrowing program.

When comparing the above expression for the operating budget deficit with the theoretical equation for D_t^O given by Eq. (12) in section 3.1, there seemingly are a number of differences. However, the items appearing in the above expression which do not appear in Eq. (12) in fact cancel each other out. "Funding for capital expenditures" (and other transfers from the ministries to the SUCH sector) is cancelled via the subtraction of "Funding provided to the SUCH sector." A portion of "Investment income" is money received from commercial Crown corporations, that offsets the GRE's interest payments on the debt of commercial Crown corporations.[19] The remainder of

[19] On the balance sheet the portion of gross public debt held by the provincial government on behalf of commercial Crown corporations is offset by its equity in the calculation of net financial assets, i.e., the public net debt of the GRE. The balance sheet impacts are reversed as the self-supported Crowns repay the debt to the GRE. Hence, the operating budget of the GRE is essentially insulated from the borrowing it does on behalf of the

the interest payments on the gross debt corresponds to interest on operating debt and interest on the GRE's capital debt. The interest on capital debt plus the amortization expense are conceptually equivalent to the user charge, U in the theoretical model. Moreover, to the extent that the GRE finances its capital acquisitions partly out of cash and working capital, rather than fully from bonds, the relative reduction in the capital debt compared to the tangible capital stock is offset by a fall in the GRE's financial assets. This implies that the interest payments on gross debt minus the portion of investment income stemming from financial asset returns is approximately independent of how capital is financed (except for differences in interest rates).[20] Consequently, the operating budget deficits reported in *Budget 2014* and in the *Public Accounts* for previous years are logically consistent with capital budgeting theory and with the province's use of debt and working capital to fund public sector capital investments.[21]

Although the government does not report a capital budget deficit, by definition the overall budget deficit is the sum of the deficits of the operating budget and the capital budget. Hence, the capital budget deficit can be calculated by taking the difference between the change in public net debt and the operating budget deficit. The change in the public net debt is reported in the province's statement of financial position as the change in net liabilities.[22]

There are some potentially important differences between the capital budgeting approach in the government's reports and the theoretical model of section 3.1. I examine the importance of these differences in section 5.

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self-supported Crowns.

[20] The province also relies on Public Private Partnerships (P3) for some of its capital funding. The annual service payments to the P3 partners show up in the current expenditures of the ministries. Presumably the basis for the service payments includes interest and maintenance, but excludes amortization, since the amortization expense reported in the GRE's financial statements is already inclusive of P3 funded capital.

[21] British Columbia has used long-term borrowing to fund infrastructure investments since the mid-1960s.

[22] B.C.'s financial statements also report the "taxpayer-supported debt." There are only very minor differences between net liabilities and taxpayer-supported debt.

4 Pros and Cons of Capital Budgeting

There are several advantages of capital budgeting from the perspective of fiscal planning. First, since many capital investments are long-lived assets, the stream of annual expenses can be designed to match the annual benefits of the investment, which accords with the benefit principle of fairness across multiple generations of taxpayers. Highway infrastructure, for example, accounted for 24 percent of B.C.'s new capital investments in 2013 and has an estimated useful life of 15 to 40 years. Second, the use of debt financing instead of pay-as-you-go contributes to economic efficiency because it facilitates tax smoothing, as discussed in section 3.3. Third, the observation of high deficits due to periodically high capital expenditures, when accrual accounting policies are not used, may discourage elected officials from spending on valuable public infrastructure. In contrast, under capital budgeting, the deficit due to increased infrastructure spending goes into the capital account, which may be less alarming to voters since the capital budget deficit is matched by the acquisitions of tangible capital reported in the budget documents. Poterba (1995) finds that U.S. states with separate capital budgets tend to spend more on public capital projects than comparable states with unified budgets. Relatedly, a federal government report noted that under a cash basis of accounting, departments sometimes decide on investments simply based on the funds available, and that there is a bias toward leasing assets (Marleau, 2006). Fourth, capital budgeting is accompanied by greater accounting detail on the amount and type of assets owned by the government. The focus on assets assists the government in planning for capital maintenance and replacement, and in managing the debt incurred for capital expenditures. In contrast, under the previously used cash basis of accounting, government decision-makers often had little idea about the state of the public capital stock. The so-called infrastructure deficit in Canada has been attributed to this lack of information (CICA, 2003). Finally, as shown in section 3.1, under a properly formulated capital budgeting frame-

work, a balanced operating budget over many years implies that fiscal policy is on a sustainable path. This is because a balanced operating budget means that annual tax revenues and investment earnings are sufficient to offset the sum of current government expenditures and capital depreciation, plus debt servicing costs.

A potential drawback of capital budgeting, compared to an expenditure basis of reporting annual deficits, is that the inclusion of only the amortized portion of capital expenditure as a cost in the calculation of the budget deficit or surplus may obscure the size of the overall change in financial debt and hence may mask an approaching fiscal challenge. This is especially so when the amortization rates are lower than the rates of economic depreciation of the assets, as Boothe (1993) argues occurred in Alberta during the 1980s. More generally, the special attention accorded to the operating budget deficit or surplus may distract taxpayer-citizens from assessing the financial debt statistic. To put it differently, a rising capital budget deficit is a harbinger of higher future operating budget deficits, which may not be adequately recognized in the forecast of upcoming operating budget deficits. These concerns can be addressed within the capital budgeting framework by paying due attention to changes in the public net debt reported in the annual *Budget and Fiscal Plan*. The government also reports its accumulated operating budget surplus/deficit in its statement of financial position. This measure is equivalent to the public net debt less the net book value of physical capital. Although this balance sheet practice is used by the private sector to measure solvency, public sector capital often has no resale value or is never intended to be sold. Consequently, the financial health of the government, in the sense of net worth, may be obscured by the inclusion of capital assets with essentially little or no liquidation value (Kelly, 1993). A defense of this practice is that it is a catch-all way to inform the taxpayer about the extent to which the financial debt is accounted for by tangible investments, which represent resources available for future service delivery.

Another objection that is sometimes raised against capital budgeting is that a definition of public sector capital that is restricted to tangible capital assets, such as highways, buildings, etc., may bias decision-makers against investments in less tangible stocks, such as human capital (Auld, 1993). The exclusion of expenditures on human capital generation (e.g. health and education services) from the definition of public capital in the government reporting model of the CICA and PSAB stems from its requirement that the asset be under the government's control. Control means the owner has the right to deploy or liquidate the asset to its advantage. This obviously cannot apply to government ownership of human capital. Although it is true that many of the government's physical assets exist solely to produce services and are not for resale, the privatization initiatives of many governments during the 1990s, when public debt levels were particularly high, shows that control of assets has value for disposing of debt. Furthermore, the practical difficulties of determining depreciation rates for non-tangible assets is problematical. It appears justifiable in the context of debt management to limit the definition of public capital to tangible assets.

The treatment of natural resource revenues poses a problem for capital budgeting. Governments include non-renewable resource revenues in the operating budget. However, non-renewable resources amount to a conversion of one form of asset to another—from the natural resource in the ground to cash. It is more consistent with the capital budgeting approach to assign non-renewable resources to the capital account rather than the operating account and to treat non-renewable resource revenue as a negative investment (Dahlby, 1993). The issue may become increasingly important in British Columbia if, as the government hopes, revenues from liquified natural gas (LNG) royalties figure more prominently in annual revenues.

Finally, capital budgeting may be opposed if debt-financing itself is perceived to contribute to excessive government spending because of failures in

the mechanisms of public choice.[23] That is, if pay-as-you-go financing of investments is the preferred method on political economy grounds, then reporting capital costs on an expense basis is pointless. Supporters of this view may point to various accounting tricks that governments can use in a capital budgeting framework to understate the actual size of the operating budget deficit. Related to this problem is the fact that there are many different versions of capital budgeting used by governments in practice.

5 BC's Fiscal Policy: Is it Sustainable?

During the early 1990s the B.C. government, like many other Canadian governments, struggled with escalating public debt. Hence, in its 1995 *Budget Report* the government established a 20 year debt management plan with benchmarks for the province's taxpayer-supported debt-to-GDP ratio at five year intervals until 2015. It is interesting to revisit this document, which states that, "The plan commits the government to achieve these benchmarks regardless of actual economic performance." The debt ratio at the time, in 1995, stood at 19.1 percent and was scheduled to be reduced to 10.2 percent by 2015. Yet, *Budget 2014* projects the debt ratio to equal 18.4 percent on March 31, 2015 and 17.8 percent in 2017. One should not read too much into this past plan, or the government's projections for that matter, but it does provide a reality check on the difficulties of public debt management.

In this section, I discuss the sustainability of fiscal policy in British Columbia. Although fiscal sustainability is a forward-looking concept, the ability of the provincial government to manage its debt can be gauged to some extent by its fiscal history. My analysis covers the period spanning the 2004/05 fiscal year ("2005") up to 2016/17 ("2017"). The starting year for the analysis reflects the change in the definition of the Government Reporting Entity to include the SUCH sector. The last three years incorporate the

[23] See Lammam et al. (2013) for instances of government failures.

fiscal plan announced in *Budget 2014*. The period 2005-2017 is, in any case, an interesting one to examine, because of the stimulus spending undertaken by the government of B.C. in response to the economic crisis beginning in 2008. The 2005-2017 horizon is long enough to span a business cycle and to provide some time for capital investments to mature.[24]

I begin by examining fiscal policy in the province from 2005–2017 by decomposing the overall budget deficit into the operating and capital account deficits taking the financial statements at face value. However, the accounting practice of presenting financial facts in a transparent and verifiable manner means that there are inevitable differences between officially reported measures and more economically meaningful constructs. Therefore, I shall also reconstruct the operating budget and capital budget deficits using the model from section 3.1. This may provide a more reliable picture of the future operating budget deficits/surpluses. Finally, I calculate two indicators of sustainable fiscal policy based on the theory provided in section 2.

5.1 Fiscal Policy in British Columbia: 2005-2017

Figure 1 displays current expenditures, taxpayer-supported tangible capital expenditures, and total government revenues from 2005-2013 in millions of current dollars.[25] It shows a substantial drop in revenues during the period of global economic crisis beginning in 2008 and a recovery in revenues in 2011. It also depicts a steady increase in current expenditures with a jump in 2012. Investments in tangible capital rose moderately between 2007 and 2010, but then increased sharply (by 10 percent) in 2011, before falling back in 2012 and 2013 toward pre-recession levels. Capital spending also increased each year prior to 2008, especially in 2006.

[24] The average age of infrastructure in British Columbia is about 16 years (Gagnon et al. 2008).

[25] Figures 1 to 5 are not adjusted for inflation. Figure 1 ends with 2013 because the calculation of current expenditures requires the amortization amounts, which are only available in the *Public Accounts*.

Figure 2 displays the operating budget deficit (or surplus) and the capital budget deficit (or surplus) in millions of current dollars.[26] The capital budget deficit is constructed from the *Public Accounts* as the difference between the change in public net debt and the size of the operating budget deficit. The period 2014-17 uses the *Budget and Fiscal Plan* projections for 2014-2017. Figure 2 shows a turn in 2009 from a period of operating budget surpluses to operating budget deficits. This partly reflects the weakness in revenues in 2009 and 2010 while current expenditures increased. However, a more startling observation is the persistently large capital budget deficits throughout the whole period, and especially in 2011. The fact that the capital budget deficit is large in every year in figure 2 is attributable to a steady flow of new capital investments that exceed the size of amortization in every year, which has the effect of growing the value of the net capital stock. This is consistent with the Statistics Canada report (Gagnon et al., 2008), which finds that the average age of B.C.'s infrastructure declined from 16.7 years to 16.3 years between 2002 and 2007. Furthermore, the yearly average of capital expenditures between 2008 and 2013 was 26 percent higher than the average between 2005 and 2007. *Budget 2014* notes that this increase was due to an accelerated construction schedule as part of the federal-provincial shared cost spending on infrastructure to stimulate aggregate demand. However, as the smoothing of capital costs is the essence of capital budgeting, the increase in capital expenditures that are reflected in the large capital budget deficits will gradually be transferred to the operating budget account via amortization, thereby putting upward pressure on the operating budget deficit over the next several years. Hence, the surplus position of the cumulative operating budget account, shown below, and the future balanced operating budgets projected in *Budget 2014*, do not yet reflect the bulge in capital expenditures, which have exceeded amortization expenses, throughout the period 2005-2017. In

[26] In figure 2, a surplus is a negative deficit; e.g. the operating budget deficit of -$2,696 in 2005 is a surplus of $2,696.

other words, pursuing a sustainable fiscal policy will likely require future spending cuts.

The cumulative deficits are depicted in figure 3. The cumulative operating budget has posted a surplus since 2005, while the cumulative capital budget deficit increased from 2005 to 2017 by more than $24 billion.[27] But this is not the whole story. The decomposition of the overall deficit in figures 2 and 3 is based on the officially reported operating budget deficits and surpluses. As I shall now explain, the actual size of capital amortization is likely to be much greater than what is recorded in the *Public Accounts*. Correcting for this would tend to decrease the size of the capital budget deficits and increase the operating budget deficits.

Hence, as a robustness check on the impressions formed by figures 2 and 3, I reconstructed the operating and capital budget accounts for the period 2005-2013 using the model of section 3.1 and financial data from the *Public Accounts*. It is not possible to incorporate the government's projections for 2014-2017, because the calculations require information from the *Public Accounts*, which are not available beyond 2012/13. Accounting for inflation is required to express the historical cost of the public capital stock in terms of current value, which is not done in the *Public Accounts*. Thus I assume that the initial user charge is based the user cost of capital times the inflation-adjusted the net book value of public capital the at the start of the 2004/05 fiscal year, disaggregated by type of capital.[28] The user charge for

[27] In anticipation of the change in the definition of the Government Reporting Entity, the Public Accounts of 2002/03 and 2003/04 provided figures for the operating budget deficit that encompass the SUCH sector. The B.C. government ran operating budget deficits in 2002/03 and 2003/04. Hence, the cumulative operating budget surplus would not be larger if the analysis were to start in 2003. I start the analysis in 2004/05 because the earlier *Public Accounts* do not report tangible capital additions for the redefined GRE for the earlier years, which I require for my reconstruction of the budget deficits given below.

[28] My inflation adjustment uses the fact that the average age of infrastructure in B.C. is about 16 years; hence I multiply the net book value of capital at the end of 2004 by 16 years of compounded inflation, i.e. the change in the Consumer Price Index between 1988 and 2004.

public capital replaces the amortization and interest expenses in the operating budget. The amortization portion of the user charge uses geometric depreciation rates, while the interest cost portion applies the long-term interest rate on new government borrowing to the gross additions to the tangible capital stock.[29] Since the interest on *net* debt is now endogenous, I adjust the total revenues of the operating budget by subtracting investment income. The calculation of the initial operating budget net debt and capital budget net debt uses information from the *Public Accounts* on the amount of the taxpayer-supported debt that was incurred for operations. After the initial year, values for the operating and capital net debts use the net debt accumulation equations.

Figure 4 shows the results of my reconstruction of the operating and capital budget deficits and surpluses. Now the operating budget deficits after 2008 are quite large compared to figure 2, while the capital budget deficits are greatly diminished. The interpretation of the differences compared to figure 2 is that the lack of an inflation adjustment in the calculation of amortization at historical costs in the *Public Accounts* understates the value of depreciation actually taking place. Under the budget reconstructions, the user charge from paid from the operating budget to the notional capital budget is larger than in the government's financial statements. To put it differently, we should expect that it will be more expensive in the future to maintain the economic value of the public capital stock than is perhaps anticipated in the *Budget 2014* forecasts of capital spending. In that case, current expen-

[29] Since the model-based operating and capital budget deficits are now endogenous variables, their sum can depart from the historical values of the change in public net debt. To ensure that the sum of the operating and capital budget deficits equal the observed changes in net liabilities, I apply a normalization factor to each component in the obvious way. My reconstructed operating budgets may slightly overestimate the operating budget deficits because a part of capital investments are financed by P3 partners, and the annual service payments to P3 partners are already included in the operating budgets as current expenditures. However, I am unable to adjust the calculations for P3 financing because the share of capital financed by P3 partners is only provided in the provincial budgets starting in 2009/10.

ditures (consumption spending and transfers to individuals) would need to be reduced to preserve budgetary balance.

5.2 Sustainability Indicators

The discussion above concerns the upcoming operating budget deficits. I shall now consider the sustainability of fiscal policy by calculating two indicators of sustainability based on the theory in section 2. These address more directly the growth of the public net debt over the period.[30] It must be stressed that judgments about fiscal sustainability are not to be confused with imminent threats to the province's bond rating. Fiscal sustainability only addresses the question as to whether the present course of policy is sustainable into the indefinite future without major corrections to spending or tax burdens. I interpret the present course of policy to be the trend that has been pursued by the government since 2005.

5.2.1 First Fiscal Sustainability Indicator

The first indicator of fiscal sustainability is motivated by Eq. (3) in section 2. I compare the values of $B_T(1+r)^{-T}$ and B_0, treating 2005 as the "initial" period, year 0, and year T as either the present, 2014, or the final year of the *Budget and Fiscal Plan*, 2017. The question is whether over these intervals the government of British Columbia exhibited restraint in the growth of its public net debt that is consistent with a decline in the discounted value of the net debt? The province's public net debt stood at $26,932 million in 2005. Figure 5 displays the trend in the (nominal value of) public net debt in millions of dollars, discounted to its present value in 2005 using the (nominal) compound long-term interest rate for new provincial government borrowing.[31] By using the nominal interest rate, the increase in public net debt due to

[30] Statistical tests of fiscal sustainability exist, but implementing them requires a longer period of consistent data than is available for British Columbia.

[31] The interest rates are provided in the annual *Budget and Fiscal Plan*.

price inflation is accounted for. As figure 5 shows, the present value of the net debt in 2014 slightly exceeds its value in 2005. The calculation suggests that fiscal policy over the period 2005 to 2014 was unsustainable. In other words, the government has, in effect, rolled over its initial debt in full by issuing new debt to pay the interest on existing debt and to repay holders of maturing debt during this period. This is the case because the increase in net debt since the recession erased the reductions achieved between 2005 and 2008. However, with the addition of *Budget 2014*'s projected fiscal plan the debt trajectory dips back toward sustainability in 2017. Prudent debt management in the years 2005 to 2008, together with the government's commitment to reduce future capital spending in the *Budget and Fiscal Plan 2014/15-2016/17* are just sufficient for the fiscal path over the whole period 2005 to 2017 to be sustainable, according to this indicator.

5.2.2 Second Fiscal Sustainability Indicator

The second indicator of fiscal policy sustainability is based on the debt ratio requirement described by Eq. (9) in section 2. It asks whether the largest primary surpluses (calculated as revenues minus non-interest expenditures) observed in the past would be sufficient to stabilize the debt-to-GDP ratio, given the interest rate and economic growth rate expected in the future. Thus I check whether $\phi/(r-g) > b_0$ holds. The inequality will tend to be satisfied if the long-run trend in the real GDP growth rate g is large relative to the long-run average real interest rate on government bonds r. Figure 6 depicts the ratio of public net debt to provincial GDP from 2005 to 2017. The debt ratio in 2004/05, b_0, was 16.72 percent. For the expected real growth rate g, I take the estimate of 1.7 percent projected for the period 2019-2050 by the Department of Finance (Canada, 2013). For the real interest rate r, I take the historical Canadian average of 4.8 percent over the period 1979-2011 (see Beaudry and Bergevin, 2013). Recall that ϕ represents the maximum size of the primary surplus as a proportion of provincial GDP. The largest primary

surplus in the period 2004/05 to 2013/14, i.e. under the new definition of the Government Reporting Entity, was in 2004/05, which equalled 2.48 percent of GDP. Moreover, the largest ratio of primary surplus to GDP recorded in the province since at least 2000 occurred in 2001/02, when the ratio reached 2.62 percent.

Applying these figures to the inequality test for sustainability, I obtain $.0262 \div (.048 - .017) = 0.845$, which exceeds the public net debt-to-GDP ratio of 16.72 percent in 2005, or indeed in any subsequent year, thus passing the sustainability test. While this shows that the British Columbia government has the fiscal capacity for sustainability, given its debt ratio and forecasts of interest rates and GDP growth, it presumes that the government also has the political will to run sufficient primary surpluses in the future. Indeed, the *average* size of the primary surplus as a proportion of GDP between 2004/05 and 20012/13 was only 0.8 percent, far short of the maximum observed ratio.

Overall, based on a balanced assessment of the indicators and a reading of *Budget 2014*, fiscal policy since 2004/05 in British Columbia appears to be on the cusp of sustainability. The advantage of gauging policy trends from the lens of 13 years is precisely that the actions of the government in both good times and bad can be seen as a whole. Going forward from 2014, fiscal discipline will be necessary in the medium term to keep the provincial debt level under control.

6 Conclusions

In this paper, I provided an exposition on the theory of fiscal sustainability in the context of the government financial reporting model known as full accrual accounting, or capital budgeting. I then applied the ideas to fiscal policy in British Columbia over the period from 2005 to 2017. Under capital budgeting, the government typically borrows to pay for capital expenditures

and records only the annual cost of interest and amortization in the operating budget. This has the important merit of spreading the taxpayers' cost of capital acquisitions over the life spans of the assets. However, it also creates the potential for taxpayers to overlook the accumulation of debt when the government reports a balanced operating budget. As British Columbia uses a capital budgeting approach to fiscal planning and financial reporting, the pronouncements of balanced budgets in the province's *Budget 2014* must be interpreted with due diligence.

As a contribution to this exercise, I examined the province's annual surpluses or deficits of the operating budget and the capital budget starting with the 2004/05 fiscal year. I also reconstructed these budget accounts to correspond more closely with economic theory to obtain additional insights. I then calculated two indicators of sustainability in British Columbia, based on the government's fiscal policy track record and the projections in *Budget 2014*. The paper also makes a contribution to the theory of the user cost of capital in public sector capital budgeting.

The government of British Columbia's *Strategic Plan: 2014/15-2017/18* lists the achievement of a balanced budget over the planning period and the protection of the province's AAA credit rating as two key outcome measures. The challenge for the government is to restrain the growth of its public net debt, which increased by over 75 percent since the economic crisis hit in 2008. *Budget 2014* forecasts the public net debt for 2014/15 to be over $41 billion. Moreover, since the province uses the full accrual basis of accounting, only the amortization and interest expenses associated with the fiscal stimulus spending on infrastructure since the 2008 economic crisis has been registered in the current and previous operating budget deficits. The high level of capital spending in the province is bound to show up as rising amortization costs in the operating budget statements in the next several years, straining the government's aim for balanced budgets. Since the current expenses relating to capital are driven by past acquisitions, sustainable fiscal policy will surely

require reductions in spending, especially if interest rates rise.

Fiscal sustainability is a forward-looking concept. No one knows with certainty how the economy will perform or how fiscal policy will unfold in the years ahead. What is to be avoided is a public net debt level that drifts upwards over long stretches of time at a rate exceeding the compound interest rate. This requires not only balanced budgets, but also some future years of substantial operating budget surpluses. Thus examining fiscal policy over the past decade, that is since 2005, when the definition of the Government Reporting Entity was changed to include the SUCH sector, to 2017, which is the last year reported in the government's current *Budget and Fiscal Plan*, provides a suitable window to view the longer run track that fiscal policy is on. As it turns out, the fiscal prudence demonstrated by the provincial government prior to the economic crisis, and its commitment in *Budget 2014* to restrain capital investments, appear to be just sufficient to put the province on a razor's edge between unsustainable and sustainable fiscal policy. Capital spending projected for 2017 is less in inflation-adjusted terms than in every year since 2005. My observations about the operating budget suggest that this commitment to reduce spending will prove challenging for the government to keep.

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Technical Appendix

In the main text, I sketched a simple model and applied it to British Columbia. However, the model omitted further considerations, such as accounting for inflation and the role of the marginal cost of public funds. The marginal cost of public funds is a concept that takes into account the economic distortions brought about by taxation and is central to the argument for capital budgeting and the use of debt-financing of investments. Hence, in this appendix, I provide a detailed mathematical model of the optimal fiscal policies and their implication for capital budgeting. The model generates additional insights regarding the user charge to be paid by the operating budget to the capital budget for the use of the public capital stock.

Suppose that the objective of policy is to maximize the utility of a representative agent over the infinite horizon, $t = 0, 1, 2, \ldots$, and that current consumption expenditures, G_t, and tangible capital goods, K_t, generate distinct services, according to the utility function $U(G_t, K_t)$, as in Poterba (1995). Furthermore, assume that raising R_t dollars of tax revenues costs the taxpayer $f(R_t)$ in terms of forgone private consumption goods. The marginal cost of public funds (MCPF) is the derivative $f'(R_t)$, which is never less than 1, since a dollar of extra revenue from the taxpayer is a dollar less in the pocket of the taxpayer. The value of may exceed 1, however, as a result of the distortions in economic behavior brought about by the taxpayer's desire to reduce his or her tax cost. All of these variables, G_t, K_t, and R_t, are to be regarded as "real" variables in the sense that they will be values expressed in terms of time 0 dollars.

Let r be the social discount rate, which I take to be identical to the "real" interest rate in the economy, that is, net of inflation expectations. For simplicity, I assume it to be constant. From these considerations, the

government seeks to maximize welfare, W, given by[32]

$$W = \sum_{t=0}^{\infty} (1+r)^{-t} \left[U(G_t, K_t) - f(R_t) \right] \tag{24}$$

The capital stock is affected by new additions and depreciation, according to the equation

$$K_{t+1} = I_t + (1-\delta) K_t \tag{25}$$

where I_t is the addition to the gross capital stock in period t, again expressed in period 0 dollars; and δ is the rate of economic depreciation due to the aging of the stock.

The nominal value of the public debt, B_t, evolves according to the equation

$$B_{t+1} = (1+i_t) B_t + D_t \tag{26}$$

where i_t is the "nominal" or market interest rate in period t and is D_t is the overall budget deficit in period t. Note that the debt and deficit are to be regarded in nominal terms, that is, they are in period t dollar values, rather than period 0 values. Consequently, the deficit is period t is given by

$$D_t = P_t (G_t + I_t - R_t) \tag{27}$$

where P_t is the price index in period t and

$$P_0 = 1 \tag{28}$$

Letting π denote the annual rate of price inflation, which for simplicity I

[32] In the welfare function Eq. (24) the social marginal benefit of a unit of private consumption equals unity.

will treat as a constant over time, the price index in period t equals

$$P_t = (1+\pi)^t \tag{29}$$

I now use Eqs. (25)–(27) to express the objective of government in terms of debt and capital, as follows:

$$\begin{aligned} W &= \sum_{t=0}^{\infty} (1+r)^{-t} \qquad (30) \\ &\times \left[U(G_t, K_t) - f\left(\frac{(1+i_t)\, B_t - B_{t+1}}{(1+\pi)^t} + G_t + K_{t+1} - (1-\delta) K_t \right) \right] \end{aligned}$$

Optimization of W in Eq. (30) is obtained by calculating the first-order conditions with respect to K_t, B_t, and G_t. This gives the following results:

$$\begin{aligned} \frac{\partial W}{\partial K_t} &= (1+r)^{-t} \left[u_{Kt} + f_t'(1-\delta) \right] - (1+r)^{1-t} f_{t-1}' = 0 \qquad (31) \\ &\Rightarrow \quad (1+r)^{-1} u_{K_t} + (1-\delta)(1+r)^{-1} f_t' = f_{t-1}' \qquad (32) \end{aligned}$$

and

$$\begin{aligned} \frac{\partial W}{\partial B_t} &= -(1+r)^{-t} f_t'(1+i_t)(1+\pi)^{-1} + (1+r)^{1-t} f_{t-1}'(1+\pi)^{1-t} = 0 \qquad (33) \\ &\Rightarrow \quad (1+i_t)(1+r)^{-1}(1+\pi)^{-1} f_t' = f_{t-1}' \qquad (34) \end{aligned}$$

as well as

$$\frac{\partial W}{\partial G_t} = u_{G_t} - f_t' = 0 \tag{35}$$

The term u_{K_t} is the marginal utility of an extra dollar of "real" tangible capital (i.e., in year zero dollars) and similarly u_{G_t} is the marginal utility of an extra dollar of "real" public consumption services (i.e. in year 0 dollars). Eq. (35) states that current consumption expenditures should proceed to the point where the social marginal utility of consumption equals the MCPF.

The theory of market interest rates states that the "nominal" or market interest rate depends on the real interest rate and the inflation rate, as a result of arbitrage in financial markets, in the following way:

$$(1 + i_t) = (1 + \pi)(1 + r) \tag{36}$$

Once this is recognized, we obtain from Eq. (34) the equality, $f'_t = f'_{t-1}$, which is a central argument for debt financing of capital acquisitions: debt allows permits the smoothing of the tax burden across periods, in order to minimize the excess burden of taxation. Although this was alluded to in the discussion in section 3.3, Eqs. (34) and (36) in the model show why this is an optimal policy. Substituting the constant value f' for $f'_t = f'_{t-1}$ into Eq. (32) gives the expression for the user cost of capital:

$$u_{K_t} = f'(r + \delta) \tag{37}$$

The expression on the right-hand side of (37) corresponds to the expression (23) in section 3.3. Optimal public sector capital investment requires equality between the marginal social utility of capital and the user cost, which is the MCPF times the real rate of interest and the rate of depreciation. The MCPF factor is usually ignored in capital budgeting in practice, which assumes implicitly that in all periods MCPF=1; that is, the marginal excess burden from taxation is assumed to be nil. The upshot for capital budgeting is that, the greater is the marginal cost of public funds, f', the larger should the payment be from the operating budget to the capital budget per dollar of new investment.

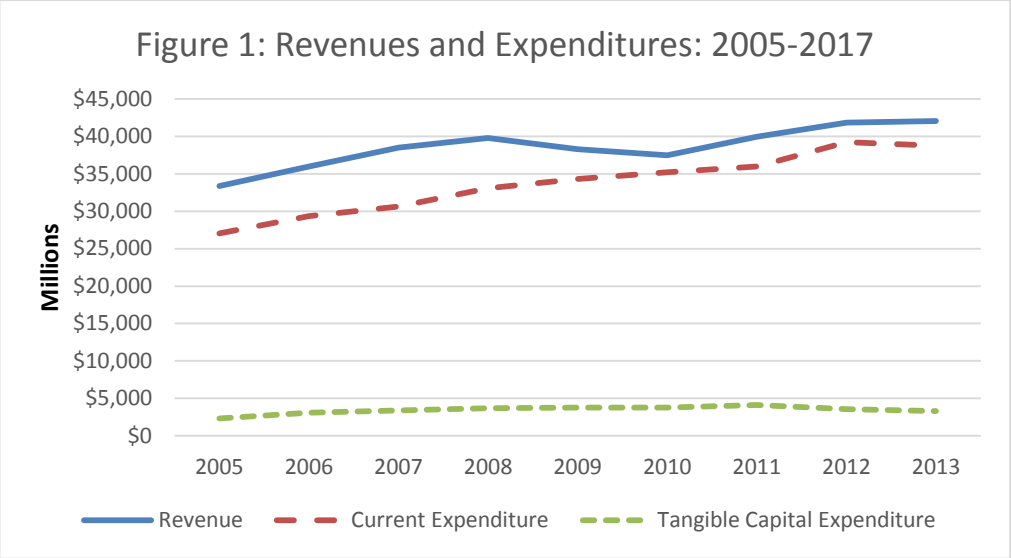
The appropriate user charge for the capital stock in period t, expressed in period t dollars, is given by

$$\begin{aligned} U_t &= f'(r + \delta) P_t K_t & (38) \\ &= f'(r + \delta) P_t I_{t-1} + (1 - \delta)(1 + \pi) U_{t-1} & (39) \end{aligned}$$

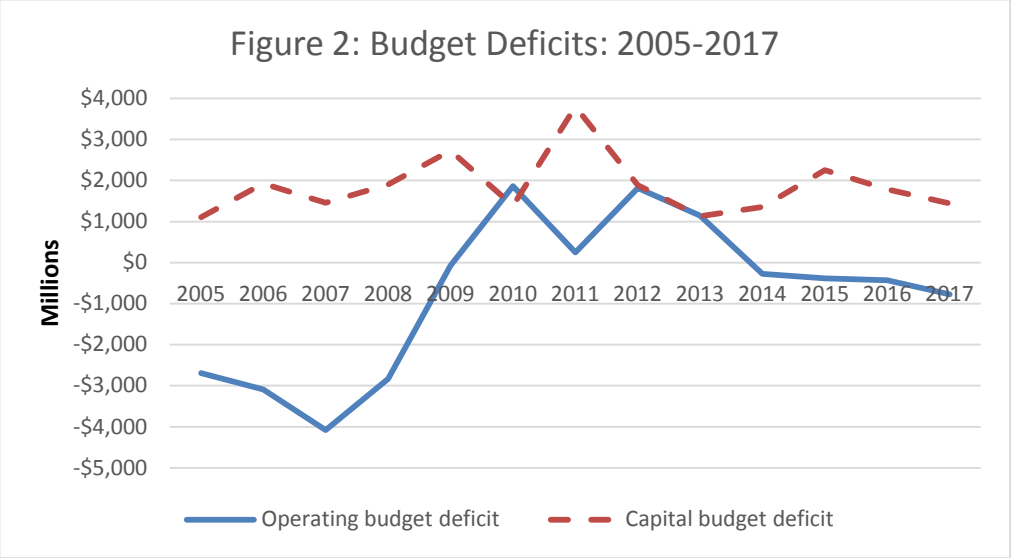
where $P_t = (1+\pi)^t$ is the price index in period t relative to period 0.[33]

Eq. (39) is the basis for my inflation adjustment in reconstructing the user charge section 5. Observe that the rate of interest on the debt in Eq. (26) is the "nominal" or market interest rate, i_t, which factors in price inflation via the Fisher equation. As a result of this, the debt accrues with inflation and hence so must the user charge, which preserves the equality of the nominal value of the tangible capital stock and the size of the net public debt of the capital account in a capital budgeting framework. The fact that the construction of the operating budget deficit in the *Public Accounts* is based on the amortization of the historical cost of capital acquisitions is a significant difference between using accounting financial statements at face value, and the reconstructed operating and capital accounts in section 5.

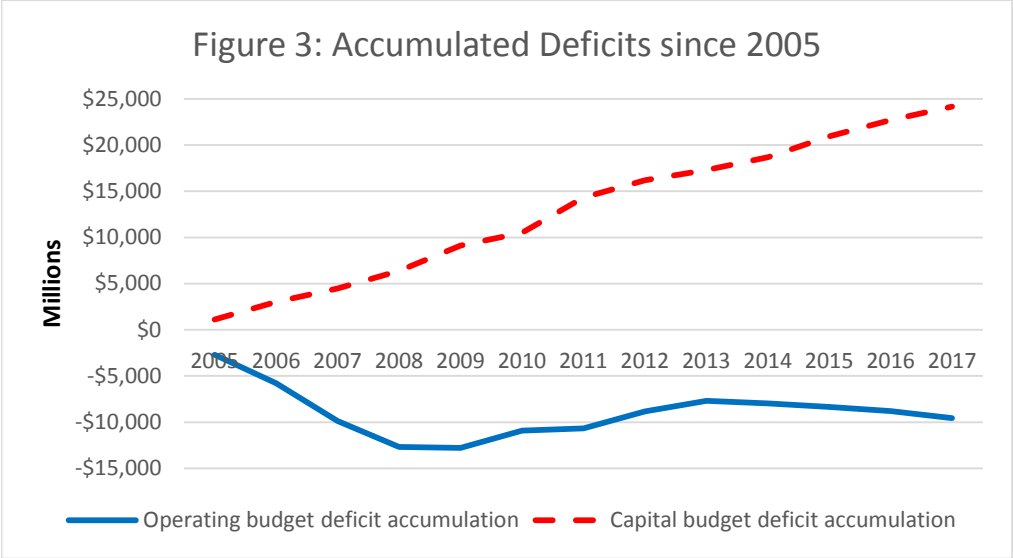
[33] Note that the dependence of the user charge on the previous period's (real) investment, I_{t-1}, instead of the current year's (real) investment, I_t, owes to the assumption in my model, that new investments become productive only in the following year. If investments became productive in the same year as the expenditure, then the user charge would depend on I_t. In that case, the expression for user cost of capital changes to $f'(r+\delta)/(1+r)$.



Sources: Author's calculations using the B.C. *Public Accounts* , various years, and the Budget and Fiscal Plan 2014/15-2016/17.



Sources: Author's calculations using the B.C. *Public Accounts* , various years, and the Budget and Fiscal Plan 2014/15-2016/17.



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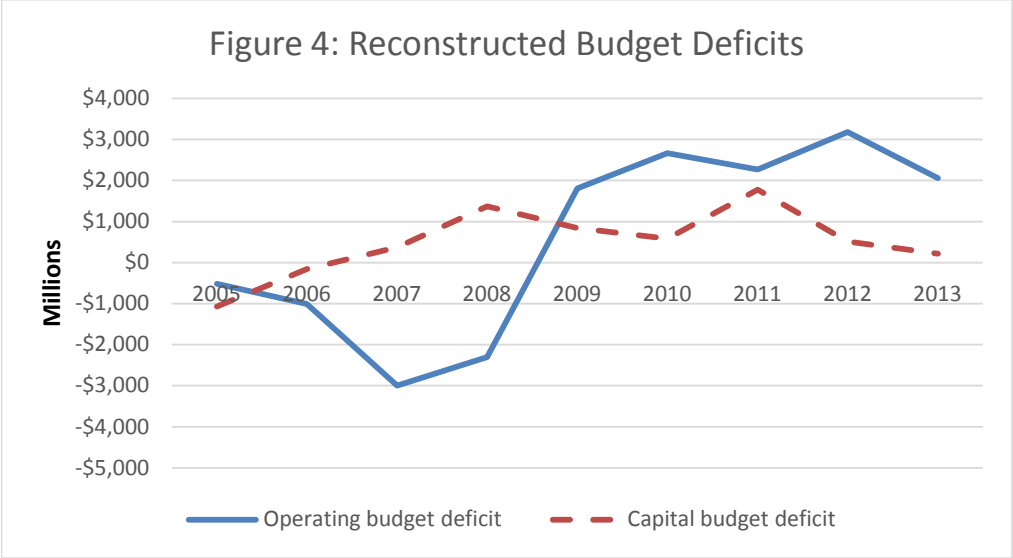
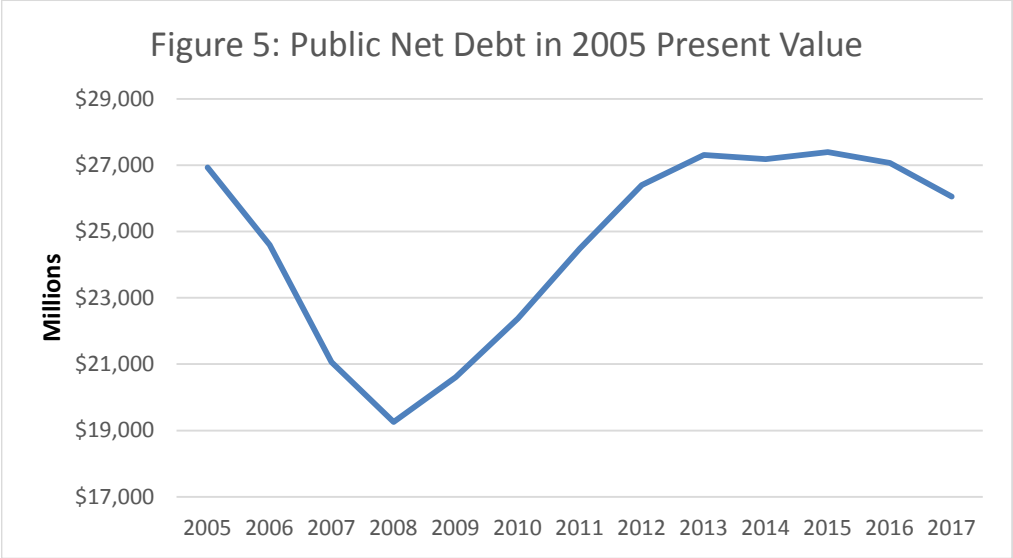


Sources: Author's calculations using the B.C. *Public Accounts* , various years.



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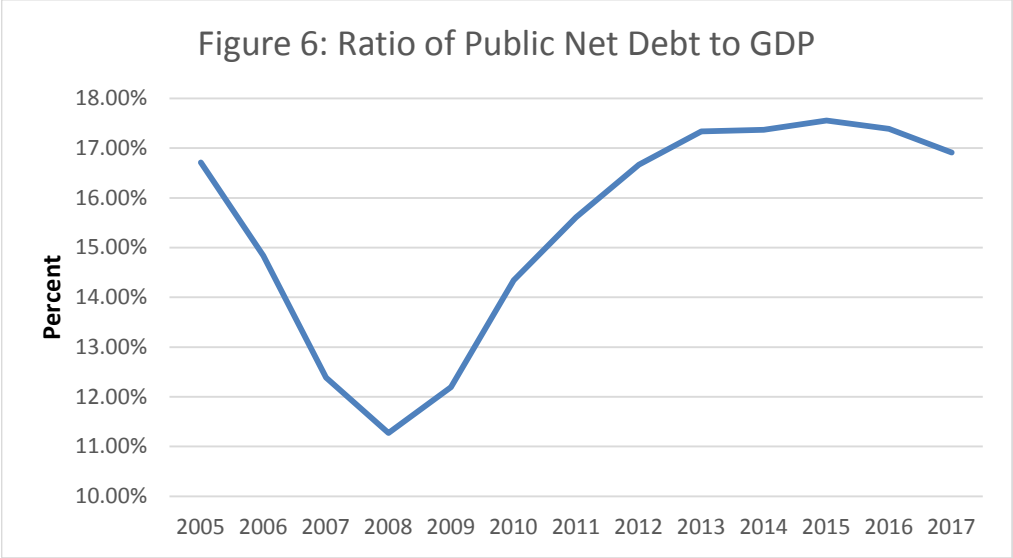

Sources: Author's calculations using the B.C. *Public Accounts* , various years, and the Budget and Fiscal Plan 2014/15-2016/17.
Provincial GDP is from Statistics Canada, CANSIM table 384-0038, accessed Feb 28, 2014.