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# C.D. Howe Institute COMMENTARY

FISCAL AND TAX COMPETITIVENESS

## What Does it Cost Society to Raise a Dollar of Tax Revenue?

The Marginal Cost of Public Funds

Bev Dahlby  
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### **In this issue...**

The marginal cost of public funds measures the welfare loss to society in raising an additional dollar of tax revenue. The social cost of raising provincial tax revenues through a corporate tax rate increase is very high.

## THE STUDY IN BRIEF

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*Rigorous external review  
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of the Institute's research.*

The marginal cost of public funds measures the welfare loss a society incurs in raising an additional dollar of tax revenue. Tax increases distort economic decisions and erode tax bases because of tax avoidance and tax evasion by taxpayers. This *Commentary* uses econometric estimates of the effects of higher provincial tax rates on the provinces' corporate income tax, personal income tax, and sales tax bases to calculate the marginal cost of public funds (MCF) for these taxes.

The results indicate that the cost of increasing provincial tax revenues through a corporate tax rate increase is very high, and in some provinces, corporate tax rate reductions in 2006 would have increased the present value of the provincial government's total tax revenues. The results also suggest that significant welfare gains would accrue from reducing provincial corporate income tax rates. As well, increasing provincial corporate and personal income tax rates can cause significant reductions in federal tax revenues because the federal and provincial governments levy taxes on the same tax bases. Finally, Canada's system of the equalization grants might reduce the perceived MCF of recipient provinces.

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\$12.00  
ISBN 978-0-88806-833-0  
ISSN 0824-8001 (print);  
ISSN 1703-0765 (online)

No one likes paying taxes, but, as Oliver Wendell Holmes once said, they are the price we pay to live in a civilized society. While the tax system finances most of the physical and social infrastructure provided by the public sector, taxes can erode the economic foundation for both the public and the private sectors. Taxes influence a wide range of economic decisions because they alter the prices consumers pay, and producers receive, for the goods and services that are produced and consumed in a society. A tax drives a wedge between the value of an asset or service to society and the return the owner or provider receives. These tax wedges distort economic decisions, leading to an allocation of resources that, generally speaking, is less productive or beneficial to society as a whole. Collecting taxes also involves large public administration costs and imposes compliance costs on the private sector. Fairness also matters: taxes should not impose a heavy burden on those least capable of shouldering them.

In sum, taxes are needed to finance the public expenditures that are essential for a prosperous and just society, but most of all taxes need to be good – that is, they should impose low collection and compliance costs, cause minimal distortions of economic decisions, and fairly distribute the

burden on taxpayers. Balancing these objectives in choosing the overall level of taxation and the mix of taxes is, however, a major public policy challenge. Economists have contributed to the formulation of tax policy by:

- providing theoretical frameworks and empirical analyses of how the tax burden is shifted from those who nominally pay the tax to those who actually bear the burden of the tax through changes in the prices at which they sell or purchase goods and services;
- measuring the cost of administering and complying with taxes; and
- analyzing the impact of taxes on the level and growth of economic activity.

In this *Commentary*, we contribute to the third aspect of tax policy analysis by measuring the welfare losses imposed on Canadians when provincial governments raise additional tax revenue. We do this by measuring the marginal cost of public funds (MCF) – a measure of the loss incurred by a society in raising an additional dollar of tax revenue from a particular tax source. Thus, the focus of our analysis is on the costs that taxes impose on society through the reallocation of resources from more to less productive uses. It is important to emphasize that we focus on the marginal cost of raising tax revenue, as opposed to the average or total cost, because most public policy decisions are concerned with marginal – that is, relatively small – adjustments to policies, such as whether to reduce the personal income tax rate by one or two percentage points, as opposed to all-or-nothing decisions, such as whether to eliminate the personal income tax. Even when public decisions involve substantive changes in the levels of taxation, the marginal cost of raising tax revenues indicates the most beneficial directions for pursuing tax reforms.

The marginal cost of production is a key element in business decisions: firms cannot make

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Funding for this project was provided by a research grant from the Donner Canadian Foundation. We would like to thank Philippe Bergevin, Robert Brown, Colin Busby, Ben Dachis, Pierre Fortin, Alex Laurin, George McAllister, James Milway, William Molson, Nick Pantaleo, David Podruzny, Finn Poschmann, Bill Robson, and Roger Sanson for their comments on an earlier draft of this paper. They are not responsible for any errors or omission.

good decisions about how to produce goods, or what prices to charge for them, without knowing the marginal cost of production. The marginal cost of public funds is the public sector analogue to the marginal cost of production for the private sector. Governments need to produce tax revenues, and they need to know how to raise these revenues at the lowest possible cost. Knowledge of the marginal cost of raising tax revenue is also important in evaluating public expenditure programs because the marginal benefit of such programs needs to be balanced against the marginal cost of financing them through higher taxes. We hope that, one day, the marginal cost of public funds will play the same role in public decision-making that the marginal cost of production plays in private sector decisions.

Although this *Commentary* is concerned with the costs of taxation, we do not focus on the compliance and administration costs of the tax system. These costs are usually fixed, at least to some degree, and do not increase very much if there is a small increase in the amount of revenue collected. Also, we do not devote a great deal of attention to the distributional effects of taxes, although we recognize that this is extremely important in designing the overall tax transfer system. Taxes that impose a heavy burden on low-income individuals are also costly taxes from a social perspective. The MCF concept can be used to combine equity or distributional concerns with efficiency effects in a summary measure of the total cost to society of raising tax revenues. However, in this paper we focus solely on the efficiency effects of taxes in measuring the MCF of the corporate income tax, personal income tax, and sales taxes.

We begin by explaining what the marginal cost of funds means and how it can be used to evaluate tax policies and public expenditure programs. We show how the concept of the marginal cost of public funds is related to the slope, or curvature, of a government's Laffer curve – a curve that shows the amount of tax revenues that can be collected at different tax rates. We stress the effects of a tax change on all sources of tax revenues, as

well as the effects on future tax revenues, in measuring the MCF.

We then present estimates of the marginal cost of public funds for provincial governments for corporate income tax, personal income tax, and provincial sales tax. We focus on the provinces because they, and local governments, are the big spenders, accounting for around 60 percent of program spending by all levels of government. In addition, the variation in tax rates across provinces and over time provides an ideal laboratory in which to estimate the tax sensitivities of tax bases – the parameters at the heart of our MCF calculations.

Our estimates are based on an econometric study of the tax sensitivity of provincial tax bases (Dahlby and Ferde 2011), which is available as a working paper on the C.D. Howe website. In that study, we show that higher provincial corporate income tax rates erode provincial corporate tax bases by deterring investment and encouraging tax-planning measures. Since provincial corporate income tax bases are highly mobile, both interprovincially and internationally, they are highly sensitive to tax, and thus the MCF for provincial corporate income taxes is very high. The MCF for provincial personal income taxes is lower than that for provincial corporate income taxes, however, in all provinces except Quebec, while the lowest MCF is that for provincial sales taxes.

In the penultimate section, we discuss some of the policy implications that flow from our computations of the MCF for both the federal and provincial governments. Our results indicate that the cost of raising additional tax revenue through corporate and personal income tax increases is high, and that significant welfare gains would flow from reducing provincial corporate income taxes along with a revenue-neutral switch to higher provincial sales taxes in Alberta, British Columbia, Manitoba, New Brunswick, and Quebec. In the other five provinces, a cut in the corporate income tax rate in 2006 would have increased the present values of their total tax revenues and, therefore, would not have required an offsetting increase in provincial sales taxes.

Another implication of our results is that governments should use expenditure restraint to rebalance their budgets because it is likely that some expenditure programs cannot generate benefits at the margin that would cover the marginal cost of financing them. Our results strongly endorse the cuts to the federal corporate income tax rate that have taken place over the past eight years and that are scheduled for 2011 and 2012.

Another reason provincial governments should not try to solve their fiscal problems by increasing personal and corporate income tax rates is that doing so would erode these bases, which the provinces share with the federal government. Our results indicate that an increase in the provincial corporate income tax rate that would raise an additional dollar of tax revenue for the province would lower the present value of federal tax revenue by an amount that ranges from \$0.78 in Manitoba to \$2.09 in Quebec, while an additional dollar of provincial personal income tax revenue would reduce federal revenue by \$0.75 in Quebec and \$0.89 in the other provinces. Our computations also indicate that the equalization grant formula might reduce drastically the perceived MCF of provinces that receive these grants. Reducing the size of the fiscal gap the equalization program fills or tying the formula used to calculate the grants less closely to provincial tax bases would reduce the potential bias in the recipient provinces' perceived MCF.

In the final section, we summarize our main results.

## The Concept of the Marginal Cost of Public Funds

Taxes influence economic decisions. Generally speaking, more tax revenue can be obtained from a tax base only by giving up some of the private sector activity that generates that tax base. For example, personal income taxes reduce income-generating activity because they create disincentives

to work, save, and invest. Increasing a provincial retail sales tax will reduce retail activity in a province by increasing the incentive to engage in cross-border shopping. The efficiency loss from the reallocation of resources caused by tax increases is reflected in the shrinkage of the tax base.

Of course, taxes can help to improve the allocation of resources by reducing activities that generate harmful externalities – that is, where the private cost to an individual or firm of engaging in an activity is less than its full social cost because part of the cost is borne by a third party. While economists generally support the use of taxes to control the effects of harmful externalities, here we are concerned with three broad taxes – corporate income taxes, personal income taxes, and provincial sales taxes – whose primary function is to raise revenue and which play only a minor role in offsetting externalities because they do not focus on a narrow range of externality-producing activities.

When the tax rate increases, it shrinks the tax base by encouraging tax avoidance or tax evasion – the percentage increase in tax revenue then is less than the percentage increase in the tax rate. For example, if a government raises a tax rate by 10 percent and the private sector responds by reducing the amount of the taxed activity by 2 percent, the government's tax revenue will increase by 8 percent, not 10 percent. The efficiency loss from the reallocation of resources in the economy due to a tax is reflected in this shrinkage of the tax base. To illustrate how this phenomenon affects the calculation of the marginal cost of public funds, because the 10 percent tax rate increase generates only an 8 percent increase in tax revenue, the cost of raising that last, or marginal, dollar of tax revenue is  $10/8$ , or 1.25. In other words, at the existing tax rate, raising an additional dollar of tax revenue costs society \$1.25.<sup>1</sup>

The notion that taxes create a deadweight loss or excess burden has been one of economists'

<sup>1</sup> This is only an approximation of the MCF, since a 10 percent tax rate increase is not a marginal increase. But using a 10 percent change, instead of an infinitesimal increase, allows us to illustrate the concept using simple arithmetic. For a more rigorous treatment of the foundation of the MCF, see Dahlby (2008, chap. 2).

insights since at least the time of Adam Smith, who, in the *Wealth of Nations*, described the deleterious effects of a window tax that was levied in his time. Homeowners boarded up windows in their houses or built new houses with fewer windows to reduce the amount of tax they would have to pay, which impaired living conditions. In this way, the burden of the window tax exceeded the tax revenue collected by the government. The MCF concept builds on Smith's insight and is a way of quantifying the additional excess burden imposed on the economic system as additional tax revenue is raised.

If the size of the tax base were not affected by the tax rate, then a 10 percent increase in the tax rate would increase tax revenue by 10 percent, and the MCF would be 1.00 – that is, the cost to society of raising an additional dollar of tax revenue is \$1.00. As previously noted, however, in almost all cases we expect the tax base to shrink when the tax rate increases and, therefore, the MCF usually is greater than 1.00. It is even possible for the MCF of a tax to be less than 1.00 if it reduces the production and consumption of products with harmful externalities, or if a tax rate increase on one base causes other tax bases to expand as taxpayers shift their activities to the lower-taxed bases. Indeed, the MCF for the corporate income tax in Quebec has been less than 1.00 because higher corporate income tax rates have led to a larger personal income tax base. (We discuss the interaction between tax bases and the implications for the MCF in more detail below.)

There is a direct connection between the MCF and the slope of the so-called Laffer curve – the curve that shows the amount of tax revenue that can be raised at various tax rates.<sup>2</sup> Usually, the Laffer curve is portrayed as having an inverted U shape, implying that it has both upward and downward sloping sections (see Figure 1). If the tax base is highly tax sensitive, perhaps because it

is easy to switch to non-taxed activities or commodities, or if the tax rate is very high, then a tax rate increase might lead to a reduction in total tax revenue. Conversely, a tax rate reduction might lead to an increase in tax revenue. For example, if a government is at point D, on the downward-sloping section of the Laffer curve in Figure 1, and it increases its tax rate by 10 percent, the tax base will shrink by more than 10 percent, causing total tax revenue to decline. Conversely, a small tax rate reduction at the same point will cause the base to increase by a larger percentage, leading to an increase in total tax revenue. Thus, on the downward-sloping section of the Laffer curve, a tax rate reduction will improve social welfare because taxpayers will benefit from the lower tax rate and the government will have more revenue with which to provide more public services or be able to cut other taxes. At the same time, the MCF of a government on the downward-sloping section of the Laffer curve is not well defined since the government can raise more revenue through a tax rate reduction.

If, however, the government is near, but not at, point C – the top of the Laffer curve – and it increases the tax rate by a small amount, it will impose an additional burden on taxpayers while raising very little additional tax revenue. Some taxpayer pain with virtually no revenue gain implies that the cost of an additional dollar of tax revenue is very high – indeed, infinite if the government is at point C on the curve. Since the marginal benefit to society from additional tax revenue is rarely, if ever, infinite, a government should operate on the upward-sloping section of the Laffer curve, such as at points A or B. Generally speaking, we expect the MCF to increase as the tax rate increases because, as Figure 1 illustrates, a given tax rate increase generates smaller increments in tax revenue at higher tax rates. This is reflected in the declining slopes of the tangents to the

2 The notion that a higher tax rate can lead to lower tax revenue is often attributed to the US economist Arthur Laffer – and thus the relationship is popularly known as the Laffer curve – although the phenomenon was noted as early as 1776 by Adam Smith in *The Wealth of Nations*, by Alexander Hamilton in *The Federalist Papers*, by the French economist-engineer Jules Dupuit in 1844, and by John Maynard Keynes.

Figure 1: The Laffer Curve

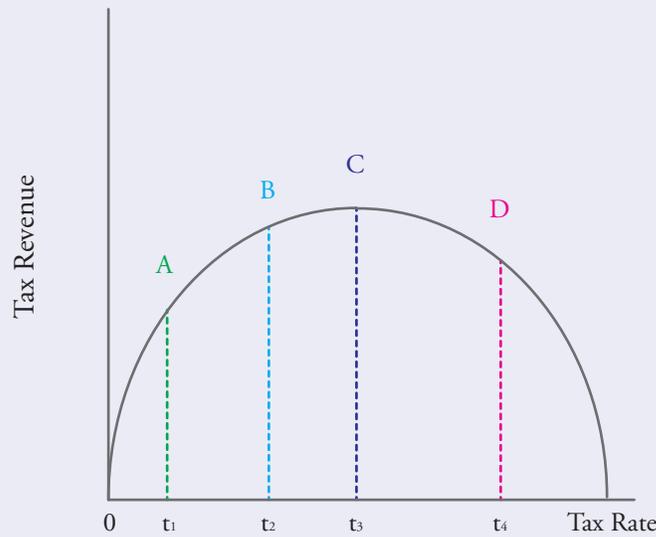
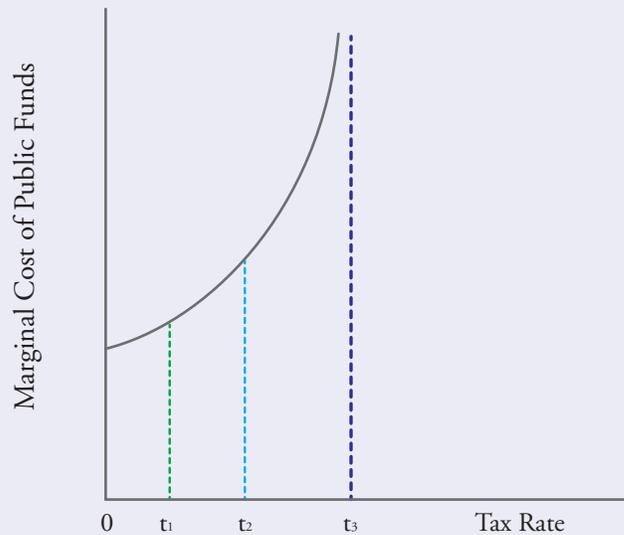


Figure 2: The MCF Curve



Laffer curve as the tax rate increases from  $t^1$  to  $t^2$  to  $t^3$ . The key point is that raising more tax revenue through tax rate increases usually comes at an increasing marginal cost. Figure 2 therefore shows the MCF curve that corresponds to the stylized Laffer curve in Figure 1.

Importantly, governments can use the MCF concept to help make tax policy and expenditure decisions. With regard to tax policy, the basic idea

is that governments should try to raise revenue from the least costly sources of tax revenue.<sup>3</sup> If the MCF of one source of tax revenue (say, personal income tax) is higher than that of another source of tax revenue (such as sales tax), then there is a potential efficiency gain from a revenue-neutral tax reform that lowers the personal income tax rate and raises the sales tax rate. For example, if the MCF of personal income tax is 1.50 and the

3 They should bear in mind, however, that different taxes have different compliance and administration costs that might fall on different segments of the population.

MCF for provincial sales tax is 1.25, then shifting a dollar of tax revenue from the former to the latter will result in a net gain for society of 0.25. Of course, the change in the distribution of the tax burden should be taken into account in assessing the overall impact of the tax reform, but a large differential in the MCF of various taxes indicates that potentially large efficiency gains are to be had from tax reform, which would justify measures to ameliorate any undesirable changes in the distribution of the tax burden, such as refundable tax credits for low-income individuals.

With regard to expenditure decisions, the fact that additional spending sooner or later must be funded by additional tax revenue implies that the marginal benefit from an additional dollar spent on a public program should be greater than or equal to the MCF for the taxes that will be used to finance it. To illustrate, suppose that spending an additional dollar on a transportation project generates \$1.15 in direct benefits to individuals because the project shortens their commuting time. In that event, additional spending on the transportation project would be worthwhile if the MCF is equal to 1.00. Suppose, however, that the government must finance the spending with an increase in personal income tax, and the MCF for the tax is 1.50. The cost of raising an additional dollar of tax revenue is thus \$1.50, which exceeds the additional direct benefit to taxpayers from the expenditure (\$1.15), so that additional spending on the transportation project would not be warranted on a cost-benefit basis. In short, the marginal benefit from public spending has to exceed the MCF for the tax that is used to finance the spending if expanding the program is to be justified on a cost-benefit basis. If the MCF exceeds the marginal benefit from the spending program, then the expenditure program should be cut until the marginal benefit from the last dollar spent on the program is at least as large as the

MCF. Another way of saying this is that the threshold marginal benefit for public expenditure programs will be higher the higher is the government's MCF.<sup>4</sup>

The preceding example also illustrates how governments should evaluate productivity-enhancing public expenditures. Suppose the transportation project not only reduces commuting time, with a marginal benefit of \$1.15 for each additional dollar spent on the project; it also allows firms to ship more products to an export market at a lower cost. This increase in economic activity would generate additional income, which, in turn, would generate additional tax revenue for the government. Suppose the project generates \$0.25 in after-tax income and \$0.10 in additional tax revenue for each additional dollar spent on the project on top of the \$1.15 in direct benefits from reduced commuting time. For the purposes of cost-benefit analysis, each additional dollar of tax revenue should be valued at the MCF because it can reduce or displace the need to raise additional costly tax revenue. In this example, the total marginal benefit from an additional dollar spent on the project is  $1.15 + 0.25 + (1.50)(0.10) = 1.55$ , and additional spending on the transportation project would be worthwhile because the total marginal benefit, 1.55, exceeds the MCF, 1.50.

While a tax's MCF is directly related to the tax sensitivity of its tax base, tax bases are often interrelated, in the sense that an increase in the tax rate on one base can either increase or reduce other tax bases. For example, the personal income tax rate might affect individuals' decisions about whether or not to incorporate their businesses. If the rate increases, more individuals might find it advantageous to incorporate their businesses to shelter or delay their business income from the personal income tax. Thus, a personal income tax rate increase might increase the size of the corporate income tax base and shift some of the

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4 See Dahlby (2009) for an example of how the MCF can be used in cost-benefit analysis and how it raises the threshold return that programs or policies have to meet.

government's tax revenues from the personal income tax to the corporate income tax. If a tax rate increase causes taxpayers to shift their activities in ways that expand the government's other tax bases, then the MCF for that tax will be lower than it otherwise would be because of the additional tax revenue that it generates from the expansion of the other tax bases. In other cases, a higher tax rate on one base will erode other tax bases. For example, a personal income tax increase might reduce the incentive to work, causing a reduction in hours worked and income earned. Consumption spending will decline, leading to lower sales tax revenue. When a tax rate increase erodes other tax bases, as well as causing its own base to shrink, then the MCF will be correspondingly higher because of the reductions in tax revenue from other tax bases. The key point in evaluating the effect of any tax rate increase, and measuring the MCF for a tax, is that we need to assess its impact on total tax revenue, not just on the revenue generated from that tax source.

Another important point to stress is that it almost always takes several years for a tax base to adjust fully to a change in the tax rate. This is particularly true for the corporate income tax, as businesses gradually adjust their levels of investment and, in some cases, their production locations in response to a tax rate change. Thus, the short-run decline in a tax base in response to a tax rate increase might be considerably smaller than the long-run decline that occurs after individuals and firms have had time to adjust fully their consumption and business plans. For this reason, in calculating the MCF we focus on the effects of a tax rate increase on the present value of the stream of total tax revenue it will generate, rather than on the current or short-term effects, because a government's effective budget constraint is its intertemporal one, which requires that an additional dollar of program spending be financed by an additional dollar of tax revenue, both measured in present value terms.

## The Provincial Governments' MCF

In this section, we list some of our key assumptions in calculating the MCF of the provincial governments – for a brief description of how we calculated the MCF, see the Appendix. Specifically, we assumed that:

- changes in the rates of corporate income tax, personal income tax, and provincial sales tax do not affect property tax revenues and other tax revenues;
- the burden of the corporate income tax, personal income tax, and provincial sales tax is borne by residents of the province – that is, there is no interprovincial or international shifting of these tax burdens;
- the interactions between the tax bases of the provincial and federal governments are not incorporated; and
- the non-tax distortions in the economy, such as the rate of involuntary unemployment, are not affected by increases in these taxes.

Table 1 shows our calculations of the provincial governments' MCF for the three tax bases in 2006. In line with expectations concerning the tax sensitivity of provincial business tax bases, the MCF for corporate income tax is very high. We did not compute the MCF for corporate income tax for Nova Scotia, Ontario, Prince Edward Island, or Saskatchewan because these four provinces are on the downward-sloping section of the Laffer curve with respect to their corporate income tax rates. In these provinces, a reduction in the corporate income tax rate would increase the present value of the provincial government's total tax revenue, and a reduction in the corporate income tax in 2006 would have had a welfare-improving effect. For the other provinces, the MCF for the corporate income tax ranges from 40.83 in Alberta to 2.25 in Manitoba.

In Quebec, the MCF for the personal income tax exceeds that for the corporate income tax (for reasons we discuss below), while in Manitoba the MCF for these two taxes is about the same. In four other provinces – Alberta, British Columbia, New Brunswick, and Newfoundland and Labrador – the MCF for the corporate income tax exceeds that for the personal income tax.

Table 1: The Marginal Cost of Public Funds for Corporate Income Tax, Personal Income Tax, and General Sales Tax, Provincial and Federal Governments, 2006

	Corporate Income Tax	Personal Income Tax	General Sales Tax
<i>marginal cost of public funds (\$)</i>			
<b>British Columbia</b>	11.64	1.83	1.13
<b>Alberta</b>	40.83	1.45	1.00
<b>Saskatchewan</b>	*	1.86	1.13
<b>Manitoba</b>	2.25	2.16	1.13
<b>Ontario</b>	*	2.16	1.15
<b>Quebec</b>	2.57	3.85	1.15
<b>New Brunswick</b>	4.30	2.22	1.15
<b>Nova Scotia</b>	*	2.46	1.15
<b>Prince Edward Island</b>	*	2.31	1.21
<b>Newfoundland &amp; Labrador</b>	30.31	2.54	1.15
<b>Federal Government</b>	1.71	1.17	1.11

\* The MCF is undefined because a small reduction in the corporate income tax rate would increase the present value of the government's total tax revenue, resulting in a social welfare gain.

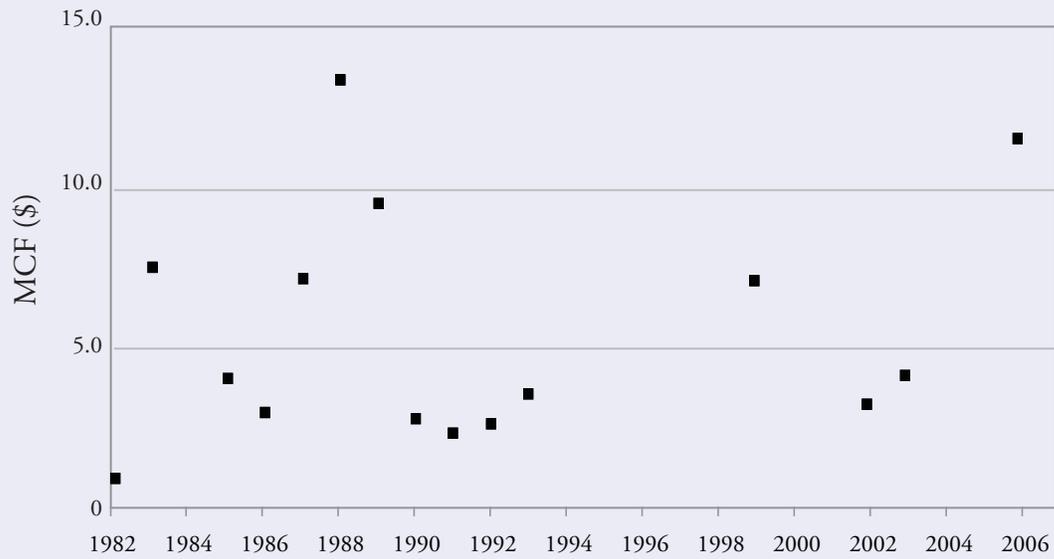
As well, the MCF for the corporate income tax varies widely from year to year, as Figure 3 shows for British Columbia. Here, we did not compute the MCF for the period from 1972 to 1981 because a reduction in the tax rate would have increased the present value of the province's total tax revenue. This was also the situation in 1984, 1994 to 1998, 2001, and 2004. In the other years in which the MCF for the corporate income tax had positive values, it ranged from 0.96 in 1982 to 184.39 in 2000. The reason for these wide fluctuations is the large year-to-year changes in corporate income tax's share of total tax revenue in British Columbia – in other words, random fluctuations in the size of the corporate income tax base produced large year-to-year variations in our computed MCF. Using a five-year moving average for the tax shares reduces the variations in the MCF somewhat, but year-to-year variations are still quite large: 12.22 in 2002, 8.87 in 2003, 7.48 in 2004, 6.14 in 2005, and 8.70 in 2006. Nevertheless, the main point is clear: the cost of increasing provincial tax revenue through a

corporate tax rate *increase* is very high, and in some provinces a corporate tax rate *reduction* would increase the present value of the government's total tax revenue.

As for personal income tax, the MCF in 2006 ranged from 1.45 in Alberta to 3.85 in Quebec, and were generally higher in the Atlantic provinces than in the three western provinces; for Ontario, the MCF was 2.16. Figure 4 shows how the MCF for the personal income tax has varied in Ontario since 1972. During the mid-1990s it exceeded 2.50; in 1994 and 1995 it exceeded 3.00. These calculations indicate that, even in Canada's largest province and industrial heartland, the cost of raising additional revenue through the personal income tax has been relatively high.

The lowest MCF was that for provincial sales tax, ranging from 1.00 in Alberta to 1.21 in Prince Edward Island. Alberta's MCF was low, of course, because that province does not levy a general sales tax. In addition, our results show that an increase in provincial sales tax does not have a significant effect on other provincial tax bases,

Figure 3: The MCF for the Corporate Income Tax, British Columbia, 1982-2006



Source: Authors' calculations.

Figure 4: The MCF for the Personal Income Tax, Ontario, 1972-2006



Source: Authors' calculations.

implying that, in Alberta, the MCF from introducing a small sales tax would be 1.00, much lower than the MCF for either the corporate or personal income tax in that province.<sup>5</sup>

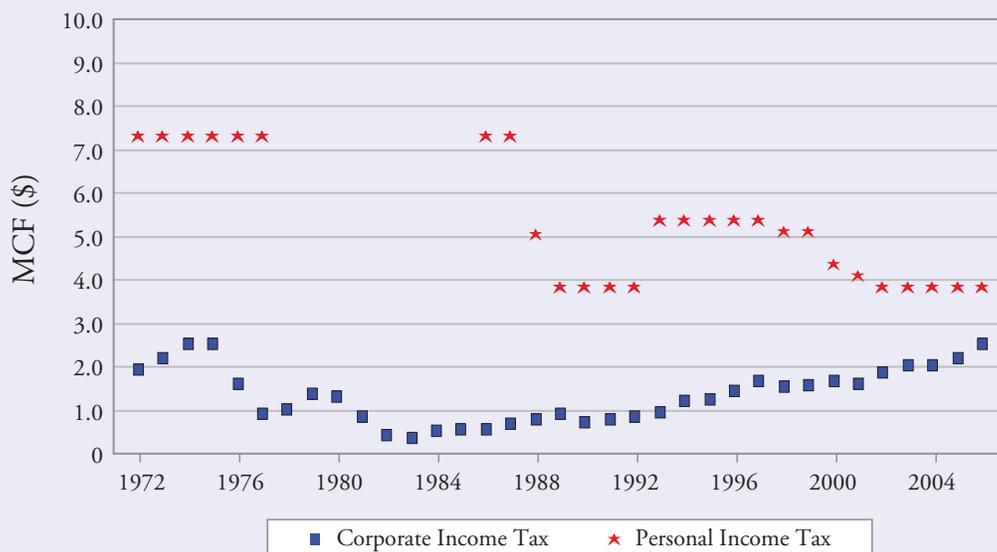
Figure 5 shows the MCF for both the corporate income tax and personal income tax for Quebec over a 35-year period. From 1978 to 1983, however, we could not compute the MCF for the personal income tax because a reduction the personal income tax rate would have increased the present value of total tax revenue. Note also that the MCF for the corporate income tax was less than 1.00 in the mid-1980s because our econometric model indicates that an increase in the corporate income tax rate would have increased the personal income tax base, resulting in a significant increase in revenue from personal income tax, given Quebec's high personal income tax rates.<sup>6</sup> Subsequent adjustments in the rates of both corporate and personal income tax, however, have narrowed the gap between the two taxes' MCF.

Although we have focused on the provinces, some of our regression results also can be used to compute the federal government's MCF for the corporate income, personal income, and sales

taxes. Ottawa's MCF is, of course, important in itself for the purposes of tax policy and expenditure evaluation, but comparing it with that of provincial governments also provides a measure of the vertical fiscal imbalance in the federation. Our estimates of the federal government's MCF for the corporate and personal income taxes, shown in the last row in Table 1, are 1.71 and 1.17, respectively – substantially lower than that for any province, since the corporate and personal income tax bases are much more sensitive to provincial than to federal taxes.<sup>7</sup> Our estimate of the MCF for a federal sales tax, at 1.11, is similar to the provincial governments' MCF because we assumed the tax bases sensitivities to be the same and the only differences in the computations of the federal and provincial sales tax MCF are due to variations in their tax shares. Since, in recent years, the federal government has cut corporate income, personal income, and sales tax rates, it is useful to consider Ottawa's overall MCF as a weighted average of these three taxes, with weights based on their relative shares of federal tax revenue. The resulting weighted average MCF for the federal government was 1.26 in 2006.<sup>8</sup>

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- 5 Our econometric analysis (Dahlby and Ferde 2011) does not indicate that the corporate and personal income tax bases are less sensitive to sales tax increases in provinces with a harmonized sales tax than in provinces that levy a retail sales tax, where business inputs are included in the tax base. Therefore, our MCF calculations for sales taxes are the same for both harmonized and retail sales taxes, even though previous studies (such as Smart and Bird 2009; and Dahlby and Ferde 2009) have found that retail sales taxes have a negative effect on business investment and economic growth. In view of the latter results, we continue to endorse the policy of switching from a retail sales tax to a harmonized sales tax.
- 6 Although Quebec levies a high marginal tax on its residents' incomes, the federal personal income tax rate is reduced by 16.5 percent because of the Quebec abatement, an arrangement whereby Quebec receives a lower federal transfer in exchange for increased tax room. However, the lower federal personal income tax rate does not reduce Quebec's MCF from an increase in the personal income tax rate because it is the provincial tax rate, not the combined federal and provincial marginal tax rate, that determines the province's MCF. On the other hand, an increase in Quebec's personal income tax rate has a lower effect on federal revenue than does an increase in any other province because of the Quebec abatement.
- 7 It should be noted that our measure of the tax sensitivity of the federal personal income tax base is not as precisely estimated as the tax sensitivities of the federal corporate income tax base or the provincial corporate and personal income tax bases; therefore, one should place a large "confidence interval" around it.
- 8 It is interesting to compare our regression-based results for the federal government's MCF with those obtained by Baylor and Beauséjour (2004) using a dynamic computable general equilibrium model. If we convert their marginal distortionary loss calculations into estimates of the MCF, they obtain an MCF of 1.40 for the corporate income tax, 1.30 for the personal income tax, and 1.10 for a consumption tax. Our estimates of the MCF for the corporate income tax are somewhat higher than theirs, but, as we noted above, our estimates vary considerably from year to year because of fluctuations in the business tax base. Our results for the MCF for the personal income tax are somewhat lower than either those by Baylor and Beauséjour or computations from the early 1990s by Dahlby (1994). Finally, our estimates for the sales tax are very similar to the results of Baylor and Beauséjour for a consumption tax. They also compute a weighted average MCF of 1.30, which is remarkably close to our weighted average of 1.26 and the same as Dahlby (2009) computes for Canada using a dynamic growth model with public sector debt. While there are differences in the estimates of the MCF, our estimates are based on a regression model of the tax sensitivities of the three tax bases, while earlier results are based on simulation models using "best guess" estimates of the key parameters that affect tax sensitivities.

Figure 5: The MCF for the Corporate Income Tax and Personal Income Tax, Quebec, 1972-2006



Source: Authors' calculations.

### Policy Implications

In broad terms, we find that provincial corporate income tax has the highest MCF and sales tax the lowest, which is consistent with research on the distortionary effects of taxes in Arnold (2008) and Johansson et al. (2008). Further, there would have been significant welfare gains in 2006 from reductions in provincial corporate income tax rates, with a revenue-neutral switch to higher provincial sales taxes, in Alberta, British Columbia, Manitoba, Quebec, and New Brunswick. In the other five provinces, a cut in the corporate income tax rate would have increased the current value of total tax revenue and, therefore, would not have required an offsetting increase in provincial sales tax.

This endorsement of a greater emphasis on sales taxes is consistent with advice many economists have given over the years, but governments usually have firmly resisted this policy option because of the perceived regressivity of sales tax. Indeed, the adverse distributional effects of sales tax are a concern, and provinces need to take measures to

protect vulnerable groups, such as low-income seniors, if they choose to rely more on such a tax. Nonetheless, data on annual total consumption spending by income level – typically used in tax-incidence studies – overstate sales tax regressivity, since ratios of consumption to income vary less by income when longer periods are used to measure the incidence of the sales tax. That said, the potential gains from a greater emphasis on sales tax revenue are so large that provincial government officials and the public should carefully consider this option. If it should prove politically infeasible, however, then another option, which would yield welfare improvements in every province except Quebec,<sup>9</sup> is to reduce corporate income tax rates with offsetting revenue-neutral increases in personal income tax rates. Since our econometric model indicates that an increase in the corporate income tax rate increases the personal income tax base, such a move would help to reduce the MCF for the corporate income tax, especially in Quebec, where the personal income tax rate is high.

9 The situation in Quebec is anomalous because of that province's high personal income tax rates combined (until recently) with relatively low corporate income tax rates.

Over the next few years, the federal and provincial governments will have to exercise fiscal restraint to eliminate deficits. Since our results indicate that the cost of raising additional tax revenue through corporate and personal income tax increases is high, governments accordingly should look first at expenditure cuts or, at least, expenditure freezes to rebalance their budgets because it is likely that there are programs that cannot generate benefits at the margin that exceed the marginal cost of financing them. (Borrowed dollars have to be financed by future tax increases that have a high MCF.) In particular, our results strongly endorse the cuts to the federal corporate tax rates that have taken place over the past eight years and scheduled for 2011 and 2012. They also mean that the provinces should not try to restore fiscal balance by increasing provincial corporate tax rates.

#### *Vertical Tax Externalities*

Another reason provincial governments should not try to solve their fiscal problems by increasing tax rates is that doing so would erode the tax bases that the provinces share with the federal government. Indeed, all the major tax bases – personal income, corporate income, and sales and excise taxes – are taxed by both levels of government. When two levels of government levy taxes on the same or similar tax bases, an increase in the tax rate imposed by one level normally (but not always) will reduce the revenue the other level can collect at its existing tax rate because the tax base shrinks when the combined tax rate increases. Our results indicate that an increase in the provincial corporate income tax rate that would raise an additional dollar of tax revenue for a provincial government would lower the current value of federal tax revenue by an amount that ranges from \$0.78 in Manitoba to \$2.09 in Quebec,<sup>10</sup> while an

additional dollar of provincial personal income tax revenue would reduce the present value of federal revenue by \$0.75 in Quebec and by \$0.89 in the other provinces. Further, the vertical tax externality is relatively minor for provincial sales taxes: an additional dollar of provincial sales tax revenue would reduce federal revenue by only \$0.10. Thus, if provinces tried to resolve their fiscal problems through corporate or personal income tax increases, they would only exacerbate the federal government's fiscal situation. Canadians taxpayers would not benefit if their provincial governments simply passed the fiscal hot potato to Ottawa.

If the provinces ought not to raise income taxes to solve their fiscal problems and if expenditure restraint is difficult in view of the inexorable spending increases on health care, should higher federal transfers to the provinces be part of the fiscal adjustment policy? Our results provide qualified support for maintaining, if not increasing, cash transfers to provinces under the Canada Health Transfer and Canada Social Transfer programs, which are to be renewed in 2014, since the federal government's MCF is lower than those of the provincial governments. In that sense, it would be better for Ottawa to raise taxes, or forgo program spending, than for the provinces to raise corporate or personal income taxes if they are unable to accomplish fiscal adjustment solely through expenditure restraint. Renegotiating these cash transfers, however, would involve a number of other important issues, such as whether or not the transfers should increase automatically each year, which might create a bias toward higher provincial expenditures, including higher negotiated wage settlements. Finally, the lowest-cost way to finance rising healthcare costs would be to increase sales taxes. Though unpopular, such a move would force the provinces

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10 When a province increases corporate and personal income tax rates, it shrinks these tax bases, thus lowering the amount of revenue the federal government can collect at constant rates. Furthermore, our econometric results do not indicate that there is any offsetting increase in federal tax revenues from increases in the tax bases of other provinces when a given province increases its tax rate. The effect on federal tax revenue of an increase in the provincial corporate income tax rate varies considerably across provinces because the total effect includes the effect on federal personal income tax revenue as well as the effect on federal corporate income tax revenue, and there are large variations in the relative sizes of the corporate and personal income tax bases among the provinces.

Table 2: The Perceived Marginal Cost of Public Funds for Corporate Income Tax, Personal Income Tax, and General Sales Tax, Provinces Receiving Equalization Payments, 2006

	Corporate Income Tax	Personal Income Tax	Provincial Sales Tax
<i>marginal cost of public funds (\$)</i>			
<b>British Columbia</b>	1.17	0.99	1.02
<b>Saskatchewan</b>	1.44	0.94	1.01
<b>Manitoba</b>	1.27	1.01	1.01
<b>Quebec</b>	0.83	1.44	1.04
<b>New Brunswick</b>	0.95	1.01	1.02
<b>Nova Scotia</b>	1.59	1.06	1.02
<b>Prince Edward Island</b>	1.69	1.03	1.07
<b>Newfoundland &amp; Labrador</b>	1.14	1.07	1.02

Source: Authors' calculations.

to undertake much needed reforms of their healthcare systems.

### *Fiscal Equalization*

What about expanding transfers under the equalization program to reduce fiscal pressures on recipient provinces? One major concern with making the equalization program more generous is that it might reduce the provinces' perceived MCF, because equalization compensates provinces through higher transfers if their tax bases decline as a result of a tax rate increase. As Smart puts it, "the [equalization] grants in effect subsidize increases in distortionary taxes by equalization-receiving governments" (2007, 1208). He finds that, when deficiencies in fiscal capacity that are equalized increase from 50 percent to 100 percent, the recipient provinces' average effective tax rates increase by about seven percentage points.

If we modify the computations of the MCF to account for the increase in equalization payments a province receives if it raises its tax rate and its tax base then declines, we find that the MCF for both corporate and personal income tax declines greatly (see Table 2). Three provinces – Nova Scotia, Prince Edward Island, and Saskatchewan – that were on the negatively sloped sections of the

Laffer curve for the corporate income tax rate, according to our calculations presented in Table 1, now would be on the upward-sloping section of the curve, and their MCFs would range from 1.44 for Saskatchewan to 1.69 for Prince Edward Island. Note also that the MCF for the corporate income tax in Quebec now would be less than 1.0. Similar, though less dramatic, reductions would occur in the MCF for personal income tax for the equalization-receiving provinces. In short, equalization transfers create a significant downward bias in the perceived MCF of recipient provinces.

Is inducing higher tax rates by equalization-receiving provinces a good thing? Models developed by Köthenbürger (2002) and Bucovetsky and Smart (2006) show that, by inducing higher rates of taxation, an equalization grant formula can offset the downward pressure on tax rates caused by interprovincial tax competition for mobile tax bases. Smart concludes, however, that

the effects of tax competition within the federation on tax rates are negligible, so that equalization grants cannot be interpreted as (however unintentional) a corrective device for tax competition, and the tax-raising effect of the grants is deleterious to consumer welfare (2007, 1,210), a conclusion that is consistent with our own finding of little evidence that tax rates in other

provinces affect a given province's tax base (Dahlby and Ferde 2011). Consequently, we conclude that, to the extent that recipient provinces' tax policies are affected by the equalization grant formula, they underestimate the marginal cost of raising provincial tax revenue. When we compare the actual MCF in Table 1 with the perceived MCF in Table 2 and add Smart's empirical results on the effects of the equalization formula on provincial tax rates, we conclude that making the equalization formula more generous might simply lead to higher provincial tax rates, which would come at a high social cost. Reducing the size of the fiscal gap that is filled through the equalization program would reduce the potential bias in the recipient provinces' perceived MCF.

## Conclusions

The marginal cost of public funds is an important concept that should be used in evaluating governments' tax policies and expenditure programs. We estimate that, in 2006, the marginal cost of public funds for corporate income tax was very high in six provinces, ranging from 40.83 in Alberta to 2.25 in Manitoba. We did not compute the MCF for Nova Scotia, Ontario, Prince Edward Island, and Saskatchewan, however, because a reduction in the corporate income tax rate in these provinces would have increased the present value of their government's total tax revenue, and a reduction in the corporate income tax in 2006 would have had a welfare-improving effect. For personal income tax, the MCF in 2006 ranged from 1.45 in Alberta to 3.85 in Quebec; only in Quebec was the MCF for corporate income tax lower than that for personal income tax. The lowest MCF was that for provincial sales tax, ranging from 1.00 in Alberta to 1.21 in Prince Edward Island.

Although we focused on the provinces' MCF, we also calculated the marginal cost of public funds when the federal government raises its tax rate. The federal government's MCF for the corporate and personal income tax in 2006 was 1.71 and 1.17, respectively, which was

substantially lower than that for any province, while the MCF for an increase in the goods and services tax, at 1.11, was similar to the provincial governments' MCF for an increase in the general sales tax. The weighted average MCF for the federal government was 1.26.

Our results indicate that the cost of raising additional tax revenue through corporate and personal income tax increases is high, and that there would be significant welfare gains from reducing provincial corporate income taxes, with a revenue-neutral switch to higher provincial sales taxes in Alberta, British Columbia, Manitoba, New Brunswick, and Quebec. In the other five provinces, a cut in the corporate income tax rate would have increased the present value of total tax revenue and, therefore, would not have required an offsetting provincial sales tax increase.

Another implication of our results is that governments should use expenditure restraint, rather than increases in corporate and personal income tax rates, to solve their fiscal problems, not only because it is likely that some expenditure programs are unable to generate benefits at the margin that would cover the marginal cost of financing them, but also because increasing tax rates would erode the tax bases that the province share with the federal government.

Our results also strongly endorse the cuts to the federal corporate income tax rate that have taken place over the past eight years and that are scheduled for 2011 and 2012. We find that an increase in the provincial corporate income tax rate that would raise an additional dollar of provincial tax revenue would lower the present value of federal tax revenue by an amount that ranges from \$0.78 in Manitoba to \$2.09 in Quebec. Similarly, an additional dollar of provincial personal income tax revenue would reduce federal revenue by \$0.75 in Quebec and by \$0.89 in the other provinces.

Finally, equalization transfers might reduce significantly the perceived MCF for the provinces that receive these grants. Reducing the size of the fiscal gap that is filled through the equalization program would reduce the potential bias in the recipient provinces' perceived MCF.

## Appendix: Calculation of the MCF Based on Estimates of the Sensitivity of Tax Bases to Tax Rate Changes

For a detailed description of how we compute the MCF, see Dahlby and Ferede (2011). Here, we provide a brief summary. For a given province in a given year, the marginal cost of public funds for tax base  $i$  is computed according to the formula

$$MCF_{\tau_i} = \frac{s_i}{s_i + \tau_i \sum_{j=1}^3 s_j H_{ji}},$$

where  $s_i$  is tax base  $i$ 's share of total tax revenue for the province,  $\tau_i$  is the tax rate imposed on tax base  $i$ , and  $H_{ji}$  is the present value weighted average of the change in tax base  $j$  with respect to a one percentage point increase in the tax rate on tax base  $i$ .<sup>11</sup>  $H_{ji}$  reflects the own-tax base change when its tax rate increases, and  $H_{ji}$  (with  $j$  not equal to  $i$ ) measures the interdependence of the tax bases – specifically, the effect of an increase in tax rate  $i$  on tax base  $j$ .

The key behavioural components of the MCF are the  $H_{ji}$  parameters, which we estimate using regression equations based on annual panel data for the 10 Canadian provinces for the period 1972-2006 for the corporate income tax, the personal income tax, and the sales tax. We find that the effect of a tax increase on its own base, the  $H_{ii}$ , was negative and statistically significant for all three taxes. A one percentage point increase in corporate income, personal income, and sales tax rates was associated with 2.3, 0.76, and 0.63

percent reductions, respectively, in their tax bases in the short run. The corresponding long-run percentage reductions were higher: 15.50, 3.65, and 1.82, respectively. The corporate income tax exhibited the largest tax-sensitivity parameter (in absolute value) and the sales tax the smallest, which is in line with the expectation that the corporate income tax base is the most tax sensitive, in part because interprovincial and international tax-base shifting is possible through the use debt financing and transfer pricing and because, in the long run, higher corporate income taxes discourage corporate investment, ultimately leading to a lower corporate tax base. On the other hand, the sales tax base is relatively tax insensitive, although the base is eroded through cross-border shopping and other tax-avoidance and tax-evasion measures. The only statistically significant cross-base effect is that of a corporate income tax rate increase on the personal income tax base, and this effect is positive.

We calculated the  $s_i$  parameters from the share of total tax revenue – defined as the sum of provincial income taxes, consumption taxes, property and related taxes, and other taxes – for the corporate income tax, personal income tax, and provincial sales tax in each province in each year. In all provinces (except Alberta, which has no provincial sales tax), these three taxes represent a significant share of total tax revenue. The tax rates we used in the analysis are the general provincial corporate income tax rate, the provincial marginal tax rate levied on the top tax bracket, and the provincial sales tax rate.

11 The percentage reduction in the tax base increases over time as taxpayers find ways to adjust to a tax rate increase. Because the government's intertemporal budget constraint depends on the present value of its tax revenue and expenditure, the  $H_{ji}$  parameter reflects the present value of the reduction in the tax base, which is between the short-term, and ultimate long-term, percentage change in the tax base.

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