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STRIKING THE RIGHT BALANCE: FEDERAL INFRASTRUCTURE TRANSFER PROGRAMS, 2002–2015[†]

Bev Dahlby and Emily Jackson

SUMMARY

Over the last 13 years, the federal government has helped fund a wide array of infrastructure programs: A total of 8,012 projects across the country between 2002 and 2015, funded to the tune of $20.3 billion. A substantial portion of that was done in the name of recession "stimulus." But far from all of it. And, for better or worse, federal programs have become a permanent feature of fiscal federalism. The only question now is, whether Ottawa has been spending federal taxpayer money as effectively as possible when it does fund these projects.

As it turns out, federal handouts for projects in Canadian provinces and municipalities have been relatively well deployed. An analysis finds that a greater amount of federal matching funds were dedicated to projects where provinces faced a higher marginal cost of public funds than the federal government, helping to at least somewhat minimize the negative economic impacts of the additional tax burden. And that a greater amount of funds was dedicated to projects that enhanced economic productivity, such as transit and roads, which increase the probability for national spillover benefits due to the potential for increased federal tax revenue, unlike quality-of-life projects (such as recreation projects) that do not.

However, the persistent fiscal imbalance in the provinces' and the federal government's marginal cost of raising public funds can only continue to exacerbate the demands from provinces for federal matching funds. Despite federal fiscal equalization programs that provide transfers to provinces with below-average per capita tax bases, there remain notable horizontal fiscal imbalances across the provinces, and a vertical imbalance between lower and higher government levels. Recent estimates calculate the federal government's marginal cost to be 1.17, compared to a range of 1.41 for Alberta to 3.60 for Ontario, more than three times as high as the federal government's cost.

There are already several programs that provide large block funding transfers to provinces: The Canada Health Transfer, the Canada Social Transfer, the Gas Tax Fund, and federal equalization grants. These block transfers reduce the fiscal imbalance between Ottawa and the provinces, but they have clearly not closed the gap completely. Were the federal government to increase these block transfers, it could arguably reduce its role in funding individual infrastructure projects, thereby encouraging lower levels of government to plan infrastructure more rationally, rather than being influenced by the distortions created by federal matching offers.

Indeed, among all the projects that received federal matching funds since 2002, a concerning number were small-scale projects. More than half of the 8,000 projects funded had eligible costs of $1 million or less, and a startling 92 per cent had eligible costs under $10 million. A thousand were below $100,000. Small projects may have their benefits as a stimulus response if they are "shovel ready," since large projects may require too much planning to offer the rapid employment and spending benefits desired. But the costs of co-ordination for small projects across multiple levels of government add inefficiencies and so should generally be avoided. Again, by providing more in the form of block grants, Ottawa can leave smaller stuff to smaller governments, where it, and much else, properly belongs.

[†] This paper is part of a three-part series on public infrastructure spending and financing in Canada, along with *An Exploration into the Municipal Capacity to Finance Capital Infrastructure* by Almos Tassonyi and Brian W. Conger, and *Optimal Public Infrastructure: Some Guideposts to Ensure we don't Overspend* by Jack Mintz and Philip Bazel.

1. INTRODUCTION

Public infrastructure—the transportation, environmental, educational, and recreational facilities that are provided by governments—contributes to the quality of life and the productive capacity of Canadians. Most of the public infrastructure in Canada is maintained by the provincial and municipal governments. Many groups have claimed that there is an "infrastructure deficit" in Canada and have called on the federal government to play a larger role in its provision and financing. Whether or not an infrastructure deficit exists, since 2002 the federal government has responded to the pleas for more infrastructure spending by implementing a series of infrastructure transfer programs. With the recent announcement of the New Building Canada Fund programs, federal infrastructure programs have become a permanent feature of Canadian fiscal federalism.

Perhaps because these infrastructure transfers have been relative small, they have received less public attention than the larger, long-established block transfers: the federal fiscal equalization transfers, the Canada Health Transfer, and the Canada Social Transfer.[1] One exception is a recent paper by Boadway and Kitchen,[2] which examines the role of the federal government in funding public infrastructure, based on the normative-theory fiscal federalism within the Canadian constitutional framework. While that paper highlights a number of important principles and issues, it does not provide detailed information on the operation of the federal infrastructure programs. The purpose of our paper is to fill this gap in the public policy literature by providing an analysis of the size, scope, and design of the federal infrastructure transfers based on an Infrastructure Canada database of 8,012 projects funded under 13 separate programs over the period 2002 to 2015.

In Section 2, we discuss the rationale for federal involvement in financing provincial and municipal infrastructure, and in Section 3 we use this framework to derive formulas for the "optimal" matching rates for infrastructure transfers based on the existence of horizontal and vertical fiscal externalities and differences in the marginal cost of public funds of the two levels of government, which is a measure of the fiscal imbalances between the federal government and the provincial governments. One important point that this analysis reveals is that a productivity-enhancing infrastructure project can generate nationwide benefits, and therefore merits federal financing, even if it does not generate direct benefits to individuals in other communities, because the increase in federal tax revenues from the productivity improvement benefits citizens across the country.

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1 Over the five-year period, 2010 to 2015, the average annual commitment under the 13 federal infrastructure programs under review was $1.3 billion, whereas the average payment to the provinces under the equalization, Canada Health Transfer, and Canada Social Transfer was $56 billion per year. The federal Gas Tax Fund ($15 billion from 2005-15) and the Provincial-Territorial Infrastructure Base Fund ($2.25 billion from 2007-15) are not included in our analysis of transfer programs.

2 R. Boadway and H. Kitchen, "A Fiscal Federalism Framework for Financing Infrastructure" (paper prepared for the Institute of Intergovernmental Relations State of the Federation Conference, Queen's University, Kingston, Ont., June 4–6, 2015), http://www.queensu.ca/iigr/conf/2015sotf/papers/BoadwayKitchenSOTF2015.pdf.

In Section 4, we describe the size and scope of the federal infrastructure transfers, with particular attention on the contribution rates for different types of projects.[3] In Section 5, we perform a statistical analysis of the average contribution rates by province and by type of project, which indicates that the federal infrastructure programs were consistent with two basic properties of an optimal matching-rate formula: the contribution rates were higher for projects in provinces with a higher marginal cost of public funds and the matching rates were higher for the productivity-enhancing projects than for the quality-of-life projects. Our overall conclusion is that federal infrastructure transfers can be an important component of the fiscal federalism system in Canada. However, less emphasis should be placed on funding relatively small projects in order to reduce administration and co-ordination costs. Furthermore, increases in the block transfers to the provinces—the Canada Health Transfer, the Canada Social Transfer, the Gas Tax Fund and the fiscal equalization grants—could reduce the need for infrastructure transfers to the provincial and municipal governments because of fiscal imbalances between the levels of government.

2. THE FEDERAL GOVERNMENT'S ROLE IN FINANCING PUBLIC INFRASTRUCTURE

In this section, we discuss four rationales for federal transfers to fund provincial and municipal infrastructure: horizontal externalities, vertical tax externalities, fiscal imbalances and the pursuit of national objectives. We begin with a general discussion of fiscal externalities that give rise to horizontal and vertical fiscal externalities in a federation. See Dahlby[4] for an overview of fiscal externalities and the design of intergovernmental transfers.

Fiscal externalities arise when the fiscal policies of one jurisdiction affect the well-being of individuals in the rest of the federation. They can lead to suboptimal fiscal decisions because governments will generally ignore the impact of their fiscal decisions on non-residents. Matching grants from the federal government, based on the subnational government's expenditures, can correct these biases by altering the "prices" that the subnational governments face when they make their decisions. This corrective role of matching grants has been a standard topic in the fiscal-federalism literature for many years.

Fiscal externalities can be classified as either direct or indirect and either horizontal or vertical. A direct fiscal externality occurs when a government's expenditures affect the well-being of non-residents by altering the prices they pay for consumer goods, the returns they receive from their inputs, or their consumption of public services. An indirect fiscal externality occurs when the fiscal policies of one government affect the tax revenues or expenditures of other governments. The direct fiscal externalities are always horizontal—that is, they affect individuals in other jurisdictions—whereas the indirect externalities can be either horizontal

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[3] See P. Bazel and J. Mintz, "Optimal Public Infrastructure: Some Guideposts to Ensure We Don't Overspend," University of Calgary School of Public Policy Research Paper (Calgary, Alta.: University of Calgary, forthcoming), on the level and trend of infrastructure spending in Canada; as well as A. Tassonyi and B. Conger, "The Capacity to Finance Municipal Capital Infrastructure: An Exploration," University of Calgary School of Public Policy Research Paper (Calgary, Alta.: University of Calgary, forthcoming); and B. Dahlby and M. Smart, "The Structure and Presentation of Provincial Budgets," University of Calgary School of Public Policy Research Paper 8, 25 (Calgary, Alta.: University of Calgary, May 2015), http://policyschool.ucalgary.ca/?q=content/structure-and-presentation-provincial-budgets, on debt-financing infrastructure.

[4] B. Dahlby, "Fiscal Externalities and the Design of Intergovernmental Grants," *International Tax and Public Finance* 3, 3 (July 1996): 397-412.

or vertical. In the latter case, they affect the budget constraints of another level of government. Finally, fiscal externalities can either be positive, leading to under-provision of the activity, or negative, leading to excessive levels of the activity.

In discussing these fiscal externalities, it is useful to distinguish between infrastructure projects that improve quality of life, and productivity-enhancing projects that increase the productive capacity of the economy. Examples of quality-of-life infrastructure projects are local parks and recreation facilities and environmental projects, such as water and sewage treatment facilities. Examples of productivity-enhancing infrastructure are roads, bridges, public transit, and educational facilities. While some infrastructure projects can enhance both quality of life and the productivity capacity of the economy, this typology is useful in discussing the nature of the fiscal externalities that infrastructure projects can generate.

Horizontal Fiscal Externalities

A direct horizontal fiscal externality occurs when an infrastructure project provides benefits to people in other jurisdictions. Examples of these trans-boundary benefit spillovers include wastewater treatment projects on interprovincial watersheds, highways that are used to move people and goods across the country, and port facilities that handle goods produced in other provinces. These horizontal benefit spillovers can either be due to quality-of-life infrastructure projects, such as water treatment, or productivity-enhancing infrastructure projects. In the case of the latter, the benefit is the increase in the after-tax incomes of individuals and firms in other jurisdictions because of the increase in their productive capacity. Negative externalities could also occur from projects that aid particular industries, such as automotive testing-and-research facilities, rather than general purpose infrastructure, such as public transit systems, ports and highways. In these cases, productivity-enhancing infrastructure in one jurisdiction might attract mobile labour and capital from other jurisdictions and represent a form of fiscal competition that lowers the incomes of the residents in other jurisdictions.[5]

An indirect horizontal fiscal externality occurs when an infrastructure project in one jurisdiction affects the tax revenues or expenditures in another jurisdiction. The above examples indicate that this externality could be positive or negative because a productivity-enhancing project in one province can increase or reduce the income-generating opportunities of individuals and firms in another province, and consequently the amount of tax revenue that is generated in that province. Although these effects could either be positive or negative, in the case of general purpose infrastructure we would expect them to be positive.

Vertical Fiscal Externalities

Productivity-enhancing infrastructure projects, by increasing private sector incomes, will increase federal tax revenues as well as the tax revenues of the subnational government that undertakes them. The increase in federal revenues enables the federal government to reduce tax rates and/or increase expenditures on public services, which will benefit all Canadians. Thus, a productivity-enhancing project does not have to generate horizontal benefit spillovers to generate

[5] See M. Keen and M. Marchand, "Fiscal Competition and the Pattern of Public Spending," *Journal of Public Economics* 66, 1 (1997): 33-53.

nationwide benefits and therefore merit federal financing.[6] This is an important point that is sometimes overlooked in discussions about the federal role in financing local infrastructure projects. For example, a public transit project in one city, such as Toronto, may provide few, if any, direct benefits to individuals in other cities in Ontario or to the residents of other provinces, but it will improve the productivity of Torontonians by reducing the transportation costs of people and goods in the metropolitan area. The resulting boost to income generation in Toronto will increase federal tax revenues, which benefits citizens across the country.

Fiscal Imbalances

The Canadian Constitution sets out the areas of provincial and federal expenditure responsibilities and taxation powers. Most of the public infrastructure in Canada is the responsibility of the provincial and municipal governments. Although the provinces can levy taxes on all of the major tax bases, their ability to generate tax revenue is more constrained than that of the federal government because income-, sales-, payroll- and excise-tax bases are sensitive to differences in interprovincial tax rates. This interprovincial tax-base mobility makes tax bases more tax sensitive at the provincial level than at the federal level. For municipal governments, property taxes and user fees are their main own-source revenues. The property tax base consists of the value of land and structures. While land is in relatively fixed supply in urban areas, the capital invested in structures (residences, commercial and industrial facilities) is sensitive in the long run to property tax rates. The residential property tax is a particularly unpopular tax because of its alleged regressivity and unresponsiveness to changes in economic conditions.[7]

While there is no universally accepted measure of the vertical fiscal imbalance between the federal and provincial governments, Dahlby[8] has argued that the difference in the marginal cost of public funds provides a measure of the degree of fiscal imbalance. The marginal cost of public funds is the cost borne by the private sector when a government raises an additional dollar of tax revenue through a tax-rate increase. Taxes affect individuals' and firms' decisions concerning work, savings, and investment. A higher tax rate, by altering these decisions, will generally result in a less productive allocation of resources in the economy. This loss of productivity from taxpayer responses is a loss on top of the extra tax that the private sector pays when a tax rate is increased. Hence, the cost to the private sector when the public sector raises an additional dollar of tax revenue is generally more than one dollar.

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6 For a more detailed analysis of the provision and financing of productivity-enhancing infrastructure in a federation, see B. Dahlby and L. S. Wilson, "Vertical Fiscal Externalities in a Federation" *Journal of Public Economics* 87 (2003): 917-930.

7 However, McMillan and Dahlby argue that these criticisms of the property tax are much exaggerated: M. McMillan and B. Dahlby, "Do Local Governments Need Alternate Sources of Tax Revenue? An Assessment of the Options for Alberta Cities," University of Calgary School of Public Policy Research Paper 7, 26 (Calgary, Alta.: University of Calgary, September 2014), http://policyschool.ucalgary.ca/?q=content/do-local-governments-need-alternate-sources-tax-revenue-assessment-options-alberta-cities.

8 B. Dahlby, "Dealing with the Fiscal Imbalances: Vertical, Horizontal, and Structural," working paper (Toronto: C.D. Howe Institute, September 2005), http://www.cdhowe.org/pdf/workingpaper_3.pdf; B. Dahlby, *The Marginal Cost of Public Funds: Theory and Applications* (Cambridge, Mass.: MIT Press, 2008), chapter 9; B. Dahlby, "The Optimal Taxation Approach to Intergovernmental Grants," working paper (Edmonton: University of Alberta, 2008).

Ferede and Dahlby[9] have recently estimated the marginal cost of public funds of the provincial governments from provincial personal income tax, corporate income tax, and sales taxes based on estimates of the tax sensitivity of these provincial tax bases. Table 1 shows their most recent estimates of the marginal cost of public funds for provincial personal income taxes in 2013. Estimates range from 1.41 in Alberta to 3.60 in Ontario. These results indicate that there are horizontal fiscal imbalances in Canada in spite of the federal fiscal equalization programs that provide transfers to provinces with below-average per capita tax bases. A study by Dahlby and Ferede[10] indicated that the federal government's marginal cost of public funds from a personal income tax increase is 1.17.[11] This indicates that there is a substantial difference in the cost of raising additional tax revenues at the federal and provincial level, especially in some provinces, notably Ontario. This difference in the marginal cost of public funds means that it is more costly to finance expenditures at the provincial level than at the federal level because of the interprovincial mobility of tax bases in response to tax rate differentials. The Canada Health Transfer and the Canada Social Transfer are basically unconditional transfers that reduce the fiscal imbalance between the federal and provincial governments, but these transfers have not completely closed the gap even for Alberta, which had the lowest marginal cost of public funds in 2013. Given the current levels of unconditional transfers from the federal to the provincial governments, the continued existence of the fiscal imbalance between the federal and provincial governments provides a rationale for some federal funding of provincial infrastructure even if the projects do not generate any horizontal or vertical fiscal externalities.

Pursuit of National Objectives

Another set of arguments for federal financing of provincial and municipal infrastructure projects is based on the Constitution, which provides the federal government with a mandate to support "works within a province declared by the Parliament of Canada to be of general advantage to Canada or the advantage of two or more provinces."[12] Boadway and Kitchen[13] argue that Section 36(1), which mandates the federal government and the provinces to promote equality of economic opportunity and development in all regions, also provides the basis for federal involvement in infrastructure projects that are not within federal areas of responsibility. Another justification for federal involvement in infrastructure programs arises when fiscal stimulus is needed to offset declines in private aggregate demand during a severe downturn in the economy. Fiscal stimulus measures are more effective when adopted at the federal level than at the provincial level and spending on public infrastructure can be a useful fiscal instrument in a recession, especially if there are a large number of "shovel-ready" projects across the country. Another rationale for federal involvement in provincial and municipal infrastructure projects

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9 E. Ferede and B. Dahlby, "Estimating the Tax Base Elasticities and the Marginal Cost of Public Funds for Canadian Provinces," University of Calgary School of Public Policy Research Paper (Calgary, Alta.: University of Calgary, forthcoming).

10 B. Dahlby and E. Ferede, "The Effects of Tax Rate Changes on Tax Bases and the Marginal Cost of Public Funds for Canadian Provincial Governments," *International Tax and Public Finance* 19 (2012): 844–883, Table 6A.

11 See Dahlby, *The Marginal,* Table 5.3, for a summary of estimates of the marginal cost of public funds for Canada and other countries.

12 Boadway and Kitchen "A Fiscal," 3.

13 ibid.

is the fulfillment of international trade or environmental agreements that require provision of infrastructure that is normally provided by the provinces or municipalities.

These arguments could be interpreted as giving the federal government carte blanche to intervene in the provision of infrastructure by the provincial and municipal governments, and most federal politicians and bureaucrats seem to relish the opportunity to expand the federal role in areas of provincial responsibility. Nonetheless, we feel that the federal role in financing infrastructure still needs to be justified, and a case has to be made that, in the absence of federal involvement, socially beneficial infrastructure projects would not be undertaken by the provinces and the municipalities.

3. OPTIMAL COST-SHARING FORMULAS FOR INFRASTRUCTURE TRANSFER PROGRAMS

In the previous section, we described, in general terms, the rationale for federal involvement in the financing of infrastructure projects by provincial and municipal governments. From an economics perspective, the main justification is that provincial and municipal infrastructure projects can generate positive externalities to residents in other jurisdictions, either directly through improvements in quality of life or increases in after-tax incomes, or indirectly through a positive fiscal impact on the federal treasury from productivity-enhancing projects. Individual municipalities or provincial governments will not take these external benefits into account in deciding which infrastructure projects to fund and how much to spend on them. A standard fiscal policy tool for dealing with the under-provision of activities that generate positive externalities is the provision of a subsidy that reduces the effective cost of the activity to the firm or government that undertakes it. A leading example of this type of policy is the provision of tax subsidies or grants to the private sector for research and development. Lowering the effective price of the activity through a matching grant is a way of incentivizing subnational governments to undertake more of the activities that generate external benefits. The "optimal" matching rate induces the subnational government to invest in the infrastructure project up to the point where the total marginal benefit from an additional dollar spent on an infrastructure project equals the total marginal cost of spending an additional dollar on that project. Below we develop a simple model that captures the key elements or parameters that determine this optimal matching rate.

To derive the optimal matching-rate formula, we will use the following notation:

MB_i is the present value of the marginal quality-of-life benefit to the residents in subnational government i from an additional dollar spent on a given infrastructure project by subnational government i;

MB_o is the present value of the marginal quality-of-life benefit to the residents of all other subnational governments from an additional dollar spent on a given infrastructure project by government i;

MCF_i is the marginal cost of public funds of subnational government i;

MCF_f is the marginal cost of public funds of the federal government;

ρ_i is the marginal product of spending on the infrastructure project — i.e., $\frac{dY}{dg_i} = \rho_i$ where Y is the present value of total income and g_i is spending on infrastructure by government i;

τ_i is the tax rate on income generated in subnational government i;

τ_f is the total federal tax rate on income;

m is the federal cost-sharing or matching rate under the infrastructure transfer program.

A productivity-enhancing infrastructure project provides two types of benefits: an increase in individuals' after-tax incomes equal to $(1 - \tau_i - \tau_f)\rho_i$ and an indirect benefit through an increase in the governments' tax revenues. The present value of the additional tax revenue that will be generated for subnational government i from an additional dollar of expenditure on the project is $\tau_i\rho_i$ and the present value of the increase in the federal government's tax revenue is $\tau_f\rho_i$.[14]

The optimal expenditure on the project from the perspective of subnational government i occurs when the marginal benefit to its residents from an additional dollar spent on the project is equal to its marginal cost of public funds, MCF_i, times the net amount of revenue that has to be raised to finance a dollar spent on infrastructure, which is $((1 - m) - \tau_i\rho_i)$. The matching grant and the additional revenue generated by the project lower the net amount of revenue that has to be raised to finance an additional dollar spent on the project. Consequently, the subnational government's expenditure on the project will be determined by the following equation:

$$MB_i + (1 - \tau_i - \tau_f)\rho_i = MCF_i[(1-m) - \tau_i\rho_i] \quad (1)$$

The first term on the left-hand side of the equation is the marginal quality-of-life benefit generated by the project and the second term is the increase in the after-tax incomes of the residents of subnational government i from the additional incomes generated by the infrastructure project. Equation (1) is a version of the Atkinson-Stern condition for the optimal expenditure on a public good or service financed by distortionary taxation.[15]

The optimal expenditure on the project occurs when the total direct benefit, $MB_i + MB_o + (1 - \tau_i - \tau_f)\rho_i$, is equal to the cost of financing the project at the lowest possible cost of raising tax revenues. As previously noted, Dahlby and Ferede[16] found that the federal government's marginal cost of public funds is substantially lower than that of the provincial governments. Therefore, the optimal expenditure on the project occurs when the following condition is satisfied[17]:

$$MB_i + MB_o + (1 - \tau_i - \tau_f)\rho_i = MCF_f[1 - \tau_i\rho_i - \tau_f\rho_i] \quad (2)$$

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[14] Although the model uses the generic term for subnational governments, it is best in the Canadian context to view the subnational governments as the provincial governments, which then transfer resources to the appropriate municipal government when infrastructure spending occurs at that level.

[15] A. Atkinson and N. Stern, "Pigou, Taxation and Public Goods," *Review of Economic Studies* 41 (1974): 119–28.

[16] Dahlby and Ferede, "The Effects."

[17] For simplicity, we ignore the effect of subnational government i's infrastructure spending on the after-tax incomes of the residents in, and the tax revenues of, other subnational jurisdictions. We think that these horizontal fiscal externalities are relatively minor in the context of the projects that are funded under the federal infrastructure transfer programs and we have excluded these effects to simplify the model.

The condition for the optimal expenditure in (2) differs from (1) in that: (a) it takes into account the marginal quality-of-life benefits for the residents in other jurisdictions, MB_o; (b) it takes into account the additional revenue that will accrue to the federal government, $\tau_f \rho_i$, which allows the federal government to lower taxes or increase spending on federally provided public services; and (c) it is based on the lowest cost way of raising the additional revenues that could be used to finance the project, MCF_f.

The optimal matching rate for a federal transfer to fund the infrastructure project creates the incentive for subnational government i to spend on the project an amount that satisfies the condition in (2). Substituting $MB_i + (1 - \tau_i - \tau_f)\rho_i$ from (1) into (2) and solving for m yields the following expression for the optimal matching rate:

$$m = \frac{MB_o}{MCF_i} + \frac{MCF_f}{MCF_i}\tau_f \rho_i + \left(1 - \frac{MCF_f}{MCF_i}\right)\left[1 - \tau_i \rho_i\right] \qquad (3)$$

The above equation indicates that the optimal matching rate has three distinct components. The first term on the right-hand side of (3) reflects the quality-of-life benefit spillovers to residents in other jurisdictions. The matching rate increases with the extent of these benefit spillovers to the residents of other jurisdictions, MB_o, and is decreasing in the marginal cost of public funds of the jurisdiction that provides the infrastructure, MCF_i. This means that when the subnational government that provides the infrastructure has a higher marginal cost of funds, the matching rate should be lower, for any given direct benefit spillover, because it is more costly to provide this spillover. This feature of the optimal matching-rate formula is also a property of the optimal Pigouvian corrective tax/subsidy.[18]

The second term on the right-hand side of (3) reflects the vertical fiscal externality from an additional dollar spent on the project. This component is increasing in the additional revenue that accrues to the federal government from the project and is increasing in the ratio of the federal MCF_f to the subnational government's MCF_i. In other words, the higher the subnational government's marginal cost of funds (MCF) relative to the federal MCF, the lower the matching rate should be because it is more costly to induce the subnational government to spend more on the project.

The third term only arises when there is a difference in the marginal cost of raising revenues between the federal government and the subnational government. The most relevant case for Canada is where federal MCF_f is less than the provincial or municipal MCF_i, and this third component of the optimal matching rate will be positive. Note that this component will be larger when the ratio of the federal and subnational governments' MCFs is lower and when the project generates less revenue for the subnational governments.

The Optimal Matching Rate for a Quality-of-Life Infrastructure Project

Consider the case of a project that only yields quality-of-life benefits, i.e., $\rho_i = 0$. We will use the MCFs for Alberta (1.41) and Ontario (3.6) from Table 1 to illustrate the optimal matching rates. If a project in Ontario generates direct benefits for the residents of other provinces of

[18] See Dahlby, *The Marginal*, 65.

$0.10 per dollar of expenditure, then the optimal matching rate would be (0.1/3.6) or 2.8 per cent for a project in Ontario and (0.1/1.41) or 7.1 per cent for a project in Alberta. Although the assumed spillover rate in this example is arbitrary, we expect the direct benefit spillovers across provincial boundaries to be relatively low because of the provinces' relatively large geographic areas and the absence of concentrations of populations at the provincial boundaries (except perhaps on the Quebec-Ontario border). That fact, combined with relatively high MCFs for most of the provincial governments, implies that the matching rates based on quality-of-life benefit spillovers will be very low. It can be shown that the optimal matching rate for a quality-of-life infrastructure project will be increasing in the subnational government's marginal cost of public funds if $MCF_f > MB_o$. Since the federal marginal cost of public funds is greater than one and we expect the direct benefit-spillover from most projects to be relatively low, the optimal matching rate for quality-of-life infrastructure projects will be increasing in the subnational government's marginal cost of public funds.

The Optimal Matching Rate for a Productivity-Enhancing Infrastructure Project

Next consider a productivity-improving project where the present value of the increase in output from an additional dollar spent on the project is $1.10 or $\rho_i = 1.1$, and there are no quality-of-life benefit spillovers, $MB_o = 0$. If the provincial tax rate on an increase in total output in the province is 15 per cent and the total federal tax rate on an additional dollar of income is 25 per cent, the optimal matching tax rate would be 36 per cent for a project in Alberta and 65 per cent for a project in Ontario. This example illustrates a general property of the optimal matching-grant rates for productivity-enhancing projects: the optimal matching rate is increasing in the subnational government's marginal cost of public funds.

The effect of a higher rate of productivity on the optimal matching rate is more complex and, in general, ambiguous because the second term on the right-hand side of (3) is increasing, while the third term is decreasing, in ρ_i. A sufficient condition for the optimal matching rate to be increasing in ρ_i is $\frac{\tau_f}{\tau_i} > \left(\frac{MCF_i}{MCF_f} - 1\right)$. In other words, as long as the ratio of the federal tax rate to the subnational tax rate exceeds the deviation of the subnational and federal MCFs, in percentage terms, then the matching rate will be higher for projects that generate larger productivity increases.

However, the general point is that, since the second and third terms in (3) are positive for productivity-enhancing infrastructure projects and, as argued above, the quality-of-life benefit spillovers in the Canadian context will be relatively low, we expect productivity-enhancing projects to have a higher optimal matching rate than purely quality-of-life infrastructure projects. In Section 5, we test whether this is in fact the case for the average contribution rates of federal infrastructure projects. We will also test the prediction that the optimal matching rate will be higher for the subnational governments that have a higher marginal cost of public funds.

4. DESCRIPTION OF FEDERAL INFRASTRUCTURE PROGRAMS: 2002–2015

In this section, we provide an overview of 13 federal programs that have provided conditional transfers to the provinces and municipal governments to help finance specific infrastructure projects. Table 2 describes each program, the number and types of projects funded, the total federal commitment, and the time period when these commitments were made. Note that the New Building Canada Fund programs are ongoing, with $14 billion committed by the federal government.

Figure 1 shows total commitments by the federal government (in current dollars) under each of these programs over the 2002–2015 period.[19] Prior to 2009, total commitments averaged around $1 billion per year, with the notable exception of 2003 when the commitment under the Canada Strategic Infrastructure Fund was $1.6 billion, which then declined in 2004 to $441 million. There was a huge increase in the infrastructure transfers in 2009 as part of the federal government's fiscal stimulus program, which was a response to the onset of the Great Recession. The Infrastructure Stimulus Fund represented about 51.4 per cent of the total commitments in 2009. The Building Canada Fund programs also increased dramatically in 2009 and represented 42.4 per cent of the total infrastructure transfers in that year. In 2010 and 2011, while commitments under the Infrastructure Stimulus Fund declined sharply, the Building Canada Fund's Major Infrastructure Component was ramped up, and total commitments exceeded $2 billion in both years. The years 2012 to 2014 saw sharp reductions in the commitments under the infrastructure programs, but in 2015 there has been an increase with the introduction of three components of the New Building Canada Fund. Over the entire period, 2002–2015, 8,012 projects were funded under the 13 infrastructure programs, with a total federal commitment of $20,272,760,838.[20]

[19] The data in this section were obtained from the Infrastructure Canada Data Warehouse - data as of July 2015.

[20] These are the conditional transfer programs, earmarked for specific types of infrastructure, where the federal government approved the capital plan prior to the provinces receiving the funds. Some other conditional programs provided by Transport Canada are not included in the Infrastructure Canada database.

FIGURE 1 COMMITMENTS UNDER THE FEDERAL INFRASTRUCTURE PROGRAMS

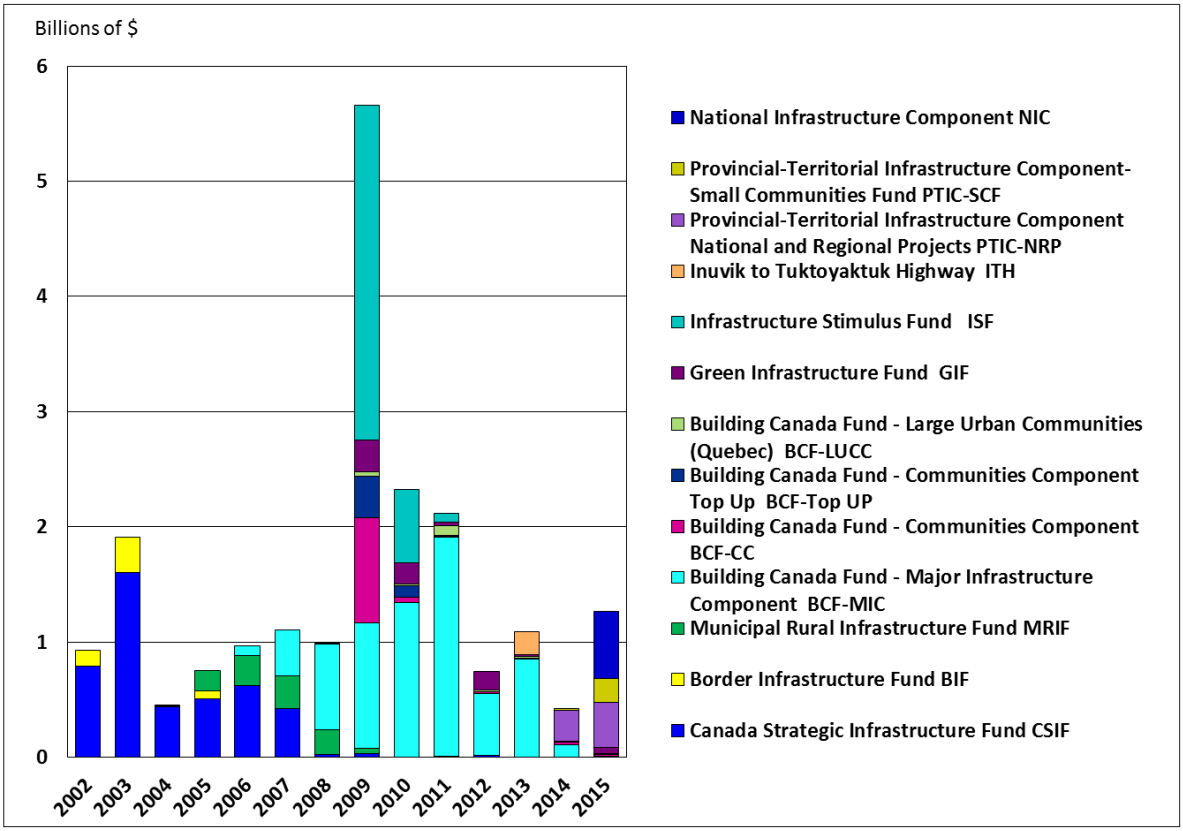
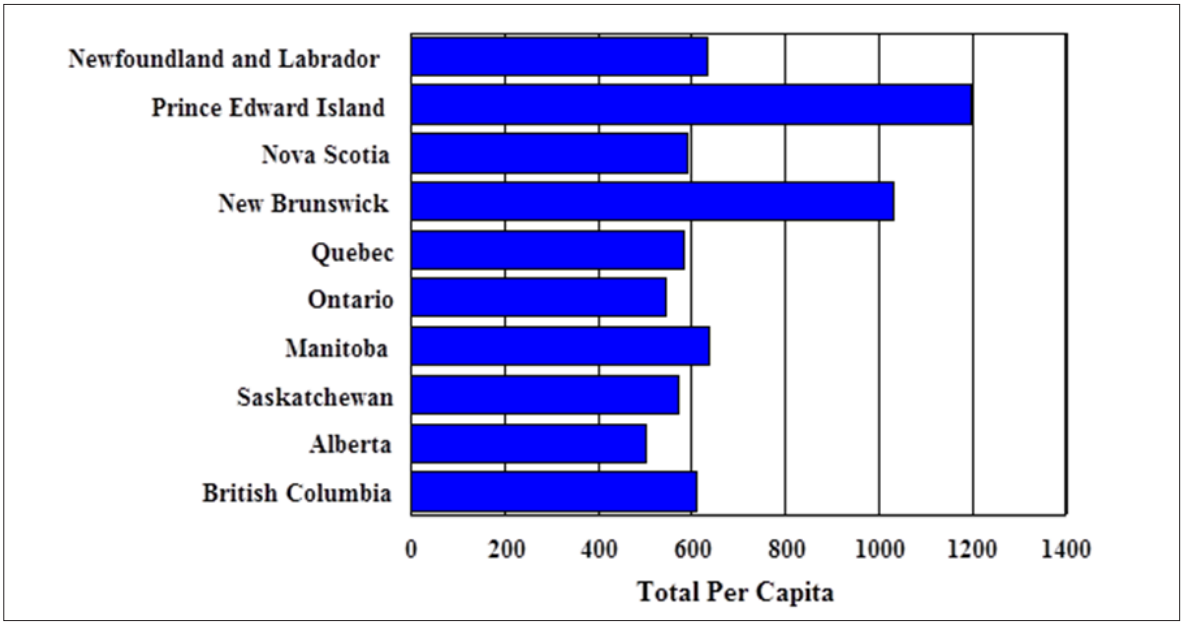


FIGURE 2 TOTAL COMMITMENTS PER CAPITA 2002 TO 2015



Of the $20.3 billion committed under the programs, it is not surprising that Ontario received the largest amount, $7.2 billion, and Prince Edward Island received the smallest amount, $170 million. However, as Figure 2 shows, Prince Edward Island received $1,202 per capita, which was more than twice the average per capita commitment of $581, while New Brunswick also received significantly more than the average amount, at $1,033. Alberta received the lowest per capita commitment of $507. It should be stressed that the model of optimal matching rates in Section 3 would not, in general, allocate infrastructure funds on an equal per capita basis across provinces. The model indicates that provincial variations in the marginal cost of public funds, the rate of return on infrastructure investments, and interprovincial spillovers of benefits could lead to very substantial differences in the per capita allocation of infrastructure funds across provinces. In the following section, we examine the data on matching rates by province and by the type of infrastructure supported in order to test whether the pattern of matching rates under the federal programs was consistent with the optimal-matching-rate model developed in Section 2.

Table 3 shows the allocation of federal infrastructure funds, the number of projects funded, and descriptive statistics on the matching rates for 21 categories of investment. Public transit projects received the largest share of the federal infrastructure funds (24.2 per cent), followed by projects categorized as "Core National Highway System" (18.8 per cent), "Local Roads" (13.1 per cent) and "Waste Water" (13.1 per cent). The remaining 31 per cent of the funds was allocated over the other 17 categories of investment. Local roads, drinking water, and wastewater represented two-thirds of the total number of projects funded. The last column in Table 3 indicates that 33 per cent and 50 per cent were the most frequent contribution rates from the federal government under 13 different programs. However, the table also shows that there was substantial variation in the contribution rates within each category. For example, for drinking-water projects, the maximum contribution rate was 50 per cent, while the average contribution rate was 31 per cent.[21] For the largest categories by funding, the contribution rates varied from 10 per cent to 72 per cent for Core National Highway System, from 10 to 50 per cent for public transit, from two to 50 per cent for wastewater, and from six to 50 per cent for local roads. These data also indicate that the average contribution rate varied across categories, with Core National Highway System having the highest average contribution rate at 48 per cent, one percentage point higher than the contribution rate for disaster mitigation, and the lowest average contribution rate was 27 per cent for "Brownfield Remediation and Redevelopment." Basically, the data indicate that the contribution rates were not uniform across categories of investment or even within a given category of investment.

Table 4 shows the distribution of projects funded under the 13 infrastructure programs and, in particular, the number of projects funded under the Infrastructure Stimulus Fund, by the eligible cost of the project.[22] Of the 8,012 projects funded, 51 per cent had eligible costs of $1 million or less and 92 per cent had eligible costs of less than $10 million. Over half of these were projects funded under the Infrastructure Stimulus Fund and over half of the projects were funded in 2009, at the height of the fiscal-stimulus policies of the federal government. In contrast, only

[21] The average contribution rate is defined as the total federal contribution as a percentage of the total eligible costs for all projects in that category.

[22] The eligible and ineligible costs vary by program. For the Small Communities Fund, ineligible costs include expenditures incurred before the approval of the project, expenditures incurred after the project completion date, expenditures related to developing a business case or proposal for funding, and the expenditures related to purchasing land, buildings and associated real estate and other fees. See http://municipalaffairs.alberta.ca/documents/LGS/SCF_Guidelines_-_Final.pdf

seven major projects with eligible costs of over $1 billion were funded and none of these were Infrastructure Stimulus Fund projects.

Given that the administration and co-ordination costs incurred by two and sometimes three levels of government are undoubtedly higher for small projects relative to the amount of funding and incremental benefits that they generate, the large number of small projects funded under the infrastructure programs is a concern. For example, 1,071 funded projects had eligible costs of $100,000 or less, and fewer than half of these (477) were Infrastructure Stimulus Fund projects. A case can be made for funding relatively small projects under a fiscal stimulus program if the objective is to ramp up spending relatively quickly, because there may be a large number of "shovel-ready" small projects at any one time. Large projects, say $100 million or more, are likely to involve significant planning and co-ordination time, making them unsuitable for a fiscal stimulus program where the objective is to quickly inject spending into many regions instead of concentrating spending in a few regions. Nonetheless, the large number of small projects not funded by the Infrastructure Stimulus Fund, but funded under the various programs, suggests that a relatively high *de minimis* should be part of any federal infrastructure program.[23]

5. AN ANALYSIS OF THE MATCHING RATES UNDER THE FEDERAL INFRASTRUCTURE TRANSFER PROGRAMS

Section 3 indicated that an optimal matching rate for infrastructure programs should have two basic properties in the Canadian context. First, the productivity-enhancing infrastructure projects should have a higher matching rate than quality-of-life infrastructure projects. In order to test whether the federal infrastructure programs had these characteristics, we grouped projects into six categories: Transportation, Economic Development, Water, Environment, Culture-Recreation-Sports, and Miscellaneous. We consider the Transportation and Economic Development projects to be productivity-enhancing projects, so they should have a higher matching rate than the Culture-Recreation-Sports projects, which we classify as quality-of-life projects. While the Water and Environment projects may yield increased productivity to some degree, we think that they are primarily quality-of-life projects and therefore should have lower matching rates than the Transportation and Economic Development projects. Finally, the Miscellaneous category is a "mixed bag" of projects that are difficult to classify, and we are *a priori* agnostic about whether they should have relatively high or low contribution rates.

Tables A1 to A6 show the average contribution rates by province for each type of project calculated by dividing the federal government's total contribution by the total of all eligible costs for all projects of that type in that province. This method of computing the average contribution rate gives more weight to the contribution rates for the large projects than would a simple average of contribution rates for individual projects. We think that the size of the project is an important feature that may affect the decisions concerning the matching rate (even though this is not part of the theoretical model in Section 3). Once the administrative costs of evaluating projects are taken into account, size may matter because it is more important to "optimize" when a lot of costs and benefits are at stake. The government may use "boilerplate" matching

[23] See B. Dahlby, "Notes on the Calculation of the Optimal *De Minimis* for an R&D Subsidy Program," mimeo (Edmonton, Alta: University of Alberta, 2011), on the calculation of the optimal *de minimis* for an R&D subsidy program. A similar model could be developed to determine the optimal *de minimis* for an infrastructure transfer program.

rates for small projects, but optimize the matching rate for large projects. The effect of size on the matching rate is an interesting research question, but one that we do not pursue in this paper. Future research projects could use individual observations on all 8,012 projects to determine whether the size of the project matters.

The optimal matching rates for both productivity-enhancing and quality-of-life infrastructure projects should be higher in provinces that have a higher marginal cost of public funds. Much of the stock of public infrastructure is the responsibility of the municipal governments. We have assumed that because "the municipalities are creatures of the provinces," the provinces make transfers to the municipalities to equalize the marginal cost of public funds between the two levels of government in each province. This is a "heroic" assumption, but a necessary one, because we only have measures of the MCFs at the provincial level as shown in Table 1 and do not have estimates of the MCFs for the municipal governments.

In order to test whether the contribution rates of the federally funded infrastructure projects have the two characteristics of optimal matching rates, we have estimated the following regression equation on the data on average contribution rates contained in tables A1 to A6.

$$\ln m = \underset{(37.93)}{3.175} + \underset{(2.61)}{0.201}\ln(MCF_i) + \underset{(4.73)}{0.284}Tran + \underset{(2.63)}{0.195}Econdev + \underset{(1.14)}{0.085}Water + \underset{(0.15)}{0.010}Envir + \underset{(2.64)}{0.193}Misc$$

Number of Observations = 162 $R^2 = 0.208$

The t statistics are in brackets. *Trans, Econdev, Water, Envir*, and *Misc* are dummy variables for these categories of projects. (The excluded category is Culture-Recreation-Sports projects.) The coefficients of MCF_i, *Trans*, and *Econdev* are positive and statistically significant at the one per cent level. These results indicate the average contribution rates of the federally funded infrastructure projects were consistent with two basic properties of optimal matching rates: the matching rates were higher for projects in provinces with a higher marginal cost of public funds and the matching rates were higher for the productivity-enhancing Transportation and Economic Development projects than for the quality-of-life Culture-Recreation-Sports projects. The fact that the contribution rates were higher in provinces with higher marginal costs of public funds is surprising because the transfer programs did not explicitly use the provincial MCFs as award criteria. What the regression results show is that the flexibility within each of the programs in awarding funds has been exercised in such a way that the matching rates were on average higher in provinces with higher MCFs.

The fact that the contribution rates were higher in provinces with higher MCFs does not mean that they were "optimal," only that they shared this characteristic. To investigate more fully how the contribution rates varied with the provincial governments' MCFs, we have used the regression coefficient estimates to calculate the predicted average contribution rates for each type of project in the provinces with the lowest and the highest MCFs—Alberta and Ontario. For Transportation projects, the regression model implies average contribution rates of 34 per cent in Alberta and 41 per cent in Ontario. For Economic Development and Miscellaneous projects, the regression model implies that average matching rates were 31 per cent in Alberta and 38 per cent in Ontario. For Water, Environment, and Culture-Recreation-Sports projects, the regression model indicates average matching rates of 26 per cent in Alberta and 31 per cent in Ontario. Whether these rates are truly optimal is impossible to tell without estimates of the

other parameters that determine the optimal matching rates, but they seem "reasonable" if not somewhat "conservative."

6. CONCLUSIONS AND RECOMMENDATIONS

Our overall conclusion is that federal infrastructure transfers can be an important component of the fiscal federalism system in Canada. Direct benefit spillovers across provincial boundaries may be relatively minor, given the provinces' large geographic areas and the absence of population concentration near provincial boundaries. Nonetheless, there is a justification for such transfers because productivity-enhancing infrastructure projects have a positive impact on federal tax revenues and because of the persistence of vertical fiscal imbalances between the federal government and the provinces, as measured by differences in their marginal cost of public funds. With regard to the design of the federal transfer programs, it is somewhat reassuring that our statistical analysis indicates the average contribution rates were consistent with two basic properties of an optimal matching-rate formula: the contribution rates were higher for projects in provinces with a higher marginal cost of public funds and the contribution rates were higher for the productivity-enhancing projects than for quality-of-life projects. However, less emphasis should be placed on funding a large number of relatively small projects in order to reduce administration and co-ordination costs. Furthermore, increases in the block transfers to the provinces—the Canada Health Transfer, the Canada Social Transfer, the Gas Tax Fund and the fiscal equalization grants—could reduce the need for infrastructure transfers to the provincial and municipal governments because of fiscal imbalances between the levels of government.

TABLE 1 THE MARGINAL COST OF PUBLIC FUNDS FROM PERSONAL INCOME TAXATION BY CANADIAN PROVINCES AND THE FEDERAL GOVERNMENT IN 2013

Newfoundland and Labrador	2.66
Prince Edward Island	2.80
Nova Scotia	2.45
New Brunswick	1.73
Quebec	2.68
Ontario	3.60
Manitoba	2.42
Saskatchewan	2.38
Alberta	1.41
British Columbia	2.86
Federal Government	1.17

Source: E. Ferede and B. Dahlby, "Estimating the Tax Base Elasticities and the Marginal Cost of Public Funds for Canadian Provinces," University of Calgary School of Public Policy Research Paper (Calgary, Alta.: University of Calgary, forthcoming).

The MCFs for Nova Scotia and the federal government are from B. Dahlby and E. Ferede, "The Effects of Tax Rate Changes on Tax Bases and the Marginal Cost of Public Funds for Canadian Provincial Governments," *International Tax and Public Finance* 19 (2012): 844–883.

TABLE 2 PROGRAM DESCRIPTIONS

Program	Description of Program and Projects Funded	Total Number of Projects Funded	Total Federal Contribution (Millions)	Time Period for Which Funds Have Been Committed
Municipal Rural Infrastructure Fund (MRIF)	Supported small-scale municipal infrastructure projects, with 80 per cent of funding dedicated to municipalities with a population of less than 250,000. Generally cost-shared on a one-third basis by three levels of government. Includes a variety of productivity-enhancing and quality-of-life projects; including 438 "collaborative projects," 421 drinking water, 366 local roads, 150 recreation, and 362 wastewater projects.	1,926	$982	2004–11
Canada Strategic Infrastructure Fund (CSIF)	Productivity-enhancing and quality-of-life projects that sustain economic growth and enhance the quality of life of Canadians. Provides federal cost-matching up to 50 per cent. Includes $1.2 billion for 19 Core National Highway projects; $1.5 billion for public transit; and $335 million for wastewater projects.	82	$4,014	2002–07
Border Infrastructure Fund (BIF)	Infrastructure at border crossings between Canada and the United States. Provides federal cost-matching up to 50 per cent.	11	$523	2002–07
Building Canada Fund–Major Infrastructure Component (BCF–MIC)	Large infrastructure projects of national or regional significance. Includes $639 million for eight drinking-water, $1.1 billion for 13 wastewater, $1.4 billion for 65 core national highways, and $3 billion for 22 public transit projects.	189	$7,068	2006–12
Building Canada Fund—Communities Component (BCF-CC)	Supports infrastructure needs of small communities with populations of less than 100,000. Generally cost-shared on a one-third basis by three levels of government: $269 million for 272 drinking-water, $344 million for 272 wastewater treatment, $175 million for 231 local roads and $93 million for 49 recreation projects.	955	$1,029	2008–15
Building Canada Fund—Communities Component Top-Up (BCF-CC Top-Up)	Provided additional funding to the BCF-CC as part of the Economic Action Plan to provide short-term economic stimulus. Funds were required to be spent in 2009–10 and 2010–11 for projects completed by October 2011.	534	$463	2009–11
Building Canada Fund—Large Urban Centres Component (LUCC)	Infrastructure projects in communities with populations over 100,000 in Quebec. Includes $87 million for nine drinking-water projects and $45 million for eight wastewater projects.	24	$175	2009–15
Green Infrastructure Fund (GIF)	Environmental infrastructure projects. Provides federal cost matching up to 50 per cent: $295 million for 10 wastewater, $179 million for seven solid-waste management, and $251 million for three green energy projects.	20	$725	2009–15
Infrastructure Stimulus Fund (ISF)	Part of the Economic Action Plan, to provide short-term stimulus to the Canadian economy during the Great Recession. Provided up to 50 per cent federal cost matching.	4,029	$3,626	2009–11
Inuvik to Tuktoyaktuk Highway Program	Construction of an all-season road between Inuvik and Tuktoyaktuk.	1	$200	2013
New Building Canada Fund: Provincial-Territorial Infrastructure Component—National and Regional Projects (PTIC-NRP)	A $9 billion fund for medium- and large-scale projects of national and regional significance. Each province and territory will receive a base amount of $250 million plus a per capita allocation based on the Statistics Canada Final 2011 Census. Individual projects are selected by the federal government, with consideration given to a province's submitted list of priorities.	33	$658	2014–
New Building Canada Fund: Provincial-Territorial Infrastructure Component—Small Communities Fund (PTIC-SCF)	A $1 billion fund for communities with populations less than 100,000. Ten per cent of the PTIC allocation of each province and territory will be set aside for the PTIC-SCF. An application-based program with projects selected by the province, but requiring final approval from the federal government. Generally cost-shared on a one-third basis by three levels of government.	203	$222	2014–
New Building Canada Fund: National Infrastructure Component (NIC)	A $4 billion fund that supports productivity-enhancing projects of national significance. Federal cost matching up to 50 per cent.	5	$587	2015–

TABLE 3 THE ALLOCATION OF FUNDS, NUMBER OF PROJECTS, AND MATCHING RATES BY INFRASTRUCTURE CATEGORIES—2002 TO 2015

	Share of Total Federal Contributions (%)	Number of Projects	Matching Rate			
			Minimum	Maximum	Average	Mode
Affordable and Temporary Housing	0.2	12	33	50	41	33
Border Infrastructure	2.6	11	22	50	44	50
Broadband and Connectivity	0.9	26	13	75	39	33
Brownfield Remediation and Redevelopment	0.2	11	25	33	27	33
Collaborative Projects	0.1	454	9	50	41	33
Core National Highway System	18.8	303	10	72	48	50
Culture	3.5	239	6	50	32	33
Disaster Mitigation	1.9	73	10	50	47	33
Drinking Water	6.3	1,323	1	50	31	33
Green Energy	1.5	100	12	50	28	33
Local Roads	13.1	2,265	6	50	37	33
Marine	1.9	53	28	100	41	50
Other	1.1	182	8	50	33	33
Public Transit	24.2	125	10	50	29	33
Recreation	4.1	730	2	50	30	33
Regional and Local Airports	0.4	38	20	50	34	33
Short Line Rail	0.3	4	25	50	39	-
Solid Waste Management	1.1	94	15	45	33	33
Sport	2.0	156	6	45	32	33
Tourism	2.7	41	13	50	30	33
Waste Water	13.1	1,772	2	50	34	33

Source: Calculations based on data from the Infrastructure Canada Data Warehouse: data as of July 2015.

TABLE 4 THE DISTRIBUTION OF PROJECTS BY ELIGIBLE COST

Total Eligible Cost of the Project	Total Number of Projects	Infrastructure Stimulus Fund Projects
Less than or equal to $1 million	4,100	2,181
$1 million to $10 million	3,258	1,678
$10 million to $100 million	575	170
$100 million to $1 billion	72	0
More than $1 billion	7	0
Total	8,012	4,029

Source: Calculations based on data from the Infrastructure Canada Data Warehouse: data as of July 2015.

TABLE A1 CONTRIBUTION RATES FOR TRANSPORTATION PROJECTS

	Border Infrastructure	Core National Highway System	Local Roads	Marine	Public Transit	Regional and Local Airports	Short-Line Rail
Newfoundland and Labrador		50	44			33	
Prince Edward Island		46	39	28	33	33	
Nova Scotia		41	47				
New Brunswick	50	49	45	36	50	33	25
Quebec	24	44	40	38	33	33	40
Ontario	50	43	34	39	33	34	45
Manitoba		48	37			33	
Saskatchewan	49	50	38				
Alberta		25	43		15	33	
British Columbia	50	48	34	56	26	31	50
Average (simple)	45	45	40	39	32	33	40

TABLE A2 CONTRIBUTION RATES FOR ECONOMIC DEVELOPMENT PROJECTS

	Broadband and Connectivity	Brownfield Remediation and Redevelopment	Tourism
Newfoundland and Labrador	13		
Prince Edward Island			36
Nova Scotia	21		
New Brunswick	37	33	
Quebec	68	25	28
Ontario	33	33	34
Manitoba	19		29
Saskatchewan		33	33
Alberta	33		36
British Columbia	67	33	28
Average (simple)	47	31	32

TABLE A3 CONTRIBUTION RATES FOR WATER PROJECTS

	Drinking Water	Waste Water
Newfoundland and Labrador	31	32
Prince Edward Island	30	32
Nova Scotia	32	31
New Brunswick	31	31
Quebec	29	35
Ontario	33	35
Manitoba	29	29
Saskatchewan	32	27
Alberta	31	28
British Columbia	31	35
Average (simple)	30.9	31.5

TABLE A4 CONTRIBUTION RATES FOR CULTURE, RECREATION, AND SPORTS PROJECTS

	Culture	Recreation	Sport
Newfoundland and Labrador	33	24	33
Prince Edward Island	27	32	17
Nova Scotia	33	28	32
New Brunswick		24	31
Quebec	36	31	36
Ontario	29	34	35
Manitoba	34	24	21
Saskatchewan	19	39	23
Alberta	35	28	30
British Columbia	29	25	25
Average (simple)	31	29	28

TABLE A5 CONTRIBUTION RATES FOR ENVIRONMENTAL PROJECTS

	Disaster Mitigation	Green Energy	Solid-Waste Management
Newfoundland and Labrador		33	
Prince Edward Island	27	37	
Nova Scotia	33	33	33
New Brunswick	33		33
Quebec			33
Ontario	33	32	34
Manitoba	50	17	28
Saskatchewan	33	20	28
Alberta	10	22	31
British Columbia	33	22	33
Average (simple)	32	27	32

TABLE A6 CONTRIBUTION RATES FOR MISCELLANEOUS PROJECTS

	Affordable and Temporary Housing	Collaborative Projects	Other
Newfoundland and Labrador		33	33
Prince Edward Island		39	33
Nova Scotia		48	33
New Brunswick		33	44
Quebec		45	32
Ontario	34	34	33
Manitoba			27
Saskatchewan		50	33
Alberta		32	19
British Columbia	50	33	31
Average (simple)	42.0	38.6	31.8

About the Authors

Bev Dahlby, Professor of Economics and Distinguished Fellow at The School of Public Policy, University of Calgary, attended St. Peter's College, the University of Saskatchewan, Queen's University, and the London School of Economics. Dr. Dahlby has published extensively on tax policy and fiscal federalism.

He has served as a policy advisor to the federal and provincial governments. His international experience includes advisory work on tax reform for the IMF in Malawi, for the Thailand Development Research Institute, and for the World Bank in Brazil and Mexico. He was a member of the Jenkins Panel on federal support to research and development, a research fellow at the C.D. Howe Institute, and currently serves on Canada's Ecofiscal Commission.

Emily Jackson is a recent graduate of the Master of Public Policy program at the University of Calgary and holds a BSc in Economics from Dalhousie University. Her Masters capstone project offers a critical analysis of the design of the Canadian federal infrastructure programs in relation to the optimal role of the federal government in infrastructure financing. Her policy interests are in infrastructure, urban development and intergovernmental relations.

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The School of Public Policy
University of Calgary, Downtown Campus
906 8th Avenue S.W., 5th Floor
Calgary, Alberta T2P 1H9
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