The impressive contribution of Canadian economists to fiscal federalism theory and policy

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Abstract. The study of fiscal federalism has been central to the research of Canadian economists since the Rowell–Sirois Report. To mark the 50th anniversary of the founding of the Canadian Economics Association, it is fitting to take stock of their contributions. We focus on the period since 1982 and emphasize the main scholarly publications of an inclusive array of Canadian economists and economists in Canadian universities. Our attention is devoted to applications in the context of federal and provincial governments, setting aside related issues in municipal government finance. We briefly discuss instances where the fiscal federalism literature has informed policy debates including through policy research institutes, government commissions and international organizations.

Résumé. *La contribution impressionnante des économistes canadiens à la théorie et à la politique du fédéralisme fiscal.* L'étude du fédéralisme fiscal a été un élément central de la recherche des économistes canadiens depuis la Commission Rowell-Sirois. Au moment de célébrer le 50ème anniversaire de la fondation de l'Association canadienne d'économique, le moment est approprié pour prendre la mesure de leurs contributions. On se concentre sur la période après 1982, et on souligne les principales publications savantes d'un ensemble inclusif d'économistes canadiens et d'économistes dans les universités canadiennes. Une attention particulière est portée aux applications dans le contexte fédéral et provincial, mettant de côté les enjeux reliés à la finance municipale. On discute brièvement des instances où la littérature sur le fédéralisme fiscal a éclairé les débats de politiques publiques y compris à travers les instituts de recherche sur les politiques publiques, les commissions gouvernementales, et les organisations internationales.

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1. Introduction

Fiscal federalism studies the fiscal roles, policies and interdependencies of the federal, provincial and municipal governments. The study of fiscal federalism has been a major preoccupation of Canadian economists at least as far back as World War II. The Rowell–Sirois report (Royal Commission on Dominion–Provincial Relations 1940) set in motion a number of defining features of the Canadian federation, including equalization, decentralized fiscal responsibilities and provincial–federal tax harmonization. Canadian economists both influenced and were influenced by these innovations. They made disproportionate contributions to the international literature on fiscal federalism, and continue to do so today. Aspects of Canadian federal–provincial fiscal arrangement have come to represent international best practices, and economists have been influential in developing those arrangements. Issues of fiscal federalism are of ongoing policy importance in Canada, and this is reflected in the research activities of Canadian economists. Our purpose in this survey is to take stock of the breadth of contributions made by Canadian economists to fiscal federalism in recent years to mark the 50th anniversary of the Canadian Economics Association.

Federations are countries with distinct levels of government, each with some degree of legislative discretion, including over fiscal matters through public spending, taxation, borrowing, user pricing and regulation. The features of the Canadian federal system have evolved substantially over the past six decades for historical and political reasons. Canada has become a decentralized federation with total provincial spending being comparable to that of the federal government. Provincial spending provides both provincial and local public goods and major public services delivered to individuals such as education, health care and social services. Provinces raise a large proportion of their own revenues, but still rely on federal transfers.

Federal–provincial fiscal arrangements reflect the evolution of the system. Both levels of government use personal income, corporate income and sales taxes, and these are largely harmonized through bilateral agreements like the personal and corporate tax collection agreements and harmonized sales taxes. The federal–provincial transfer system consists of two main components: equalization payments to address differences in revenue-raising capacity and block transfers to support the substantial social policy spending responsibilities of the provinces. Transfers are largely unconditional reflecting the constitutional decentralization of powers. Responsibilities for redistribution and social insurance are shared via personal income taxation, transfers to the long-term unemployed and the disabled, pensions and unemployment insurance. There are also various instruments of coordination, including an internal free trade pact, a social policy pact, labour mobility and various jointly delivered programs like training, immigration and research and development. Especially important is provincial control of most natural resources and revenues therefrom. These features of the

Canadian federation have had an enormous influence on fiscal federalism research, and the evolution of the federation has been informed by that research.

The origins of the modern literature on fiscal federalism can be traced to what American economist Richard Musgrave (1959, pp. 179–83) characterized as two approaches to federalism as summarized recently by Canadians economists Robin Boadway and Jean-François Tremblay in Boadway and Tremblay (2012). The first approach, inspired by Charles Tiebout (1956), takes as the role of provinces the provision of provincial public goods to suit the preferences of their residents. Household mobility combined with competing provincial governments would result in an efficient outcome where provincial public goods are efficiently provided and households are allocated efficiently among provinces. The federal government would be responsible for redistribution and macro-economic stabilization, and federal–provincial conditional transfers would internalize any fiscal spillovers across provinces. This view of federalism was the basis for American Wallace Oates' (1972) classic treatise on fiscal federalism, including his "decentralization theorem" according to which decentralization of responsibility for provincial public goods was necessary to ensure that the optimal provision reflected preferences of provincial residents. He also noted some possible negative consequences of decentralization, such as the inability to exploit economies of scale in both public good provision and tax collection, fiscal externalities due to benefit spillovers across provincial boundaries, inefficiencies of tax competition and the compromising of redistribution objectives, all leading to a role for Pigouvian corrective matching grants.

This first approach was refined by Canadian economist Albert Breton in Breton (1965), who noted the impossibility of mapping provincial public goods provision perfectly to provincial geographic borders and the implication of this for fiscal transfers. While this approach still focuses on efficiency as a determinant of the assignment of power, Breton together with the founding Canadian Economic Association president, Anthony Scott, in Breton and Scott (1978) emphasized political economy and institutional aspects such as administration and coordination costs, as well as the role of mobility and signalling in transmitting citizen preferences. Variants of Musgrave's first model form the basis for models of tax competition and political economy approaches to federalism used by Canadian economists.

In Musgrave's second approach, heterogeneity of provincial fiscal capacities is emphasized rather than differences in preferences for public goods. Recognition is also given to the fact that provinces provide important public services to individuals as well as public goods. Differences in fiscal capacity result in differences in net fiscal benefits across provinces (public service benefits less tax costs). Unless these are equalized by federal–provincial transfers, either fiscal equity—equal treatment of equals nationwide—will be compromised or households will migrate inefficiently as pointed out by the work of American public choice economist James Buchanan in Buchanan (1950, 1952). In addition, Musgrave argued that since provincial public services satisfied social wants that serve national redistributive objectives, conditional grants should be used to ensure minimum standards of services. Aspects of this second approach to federalism were further developed by Canadian contributors such as Scott (1950) and Flatters et al. (1974), and recent approaches to equalization transfers by other Canadian researchers build on this model.

An important source of tension in fiscal federalism is the role of fiscal competition. Tiebout emphasized the benefit of fiscal competition as a mechanism for inducing governments to choose public goods and taxes most preferred by their residents. In contrast, the message of the tax competition literature associated with the Canadian economist Peter Mieszkowski and his co-author in Zodrow and Mieszkowski (1986) was that tax competition led to adverse fiscal externalities. Public choice approaches to fiscal federalism stress the benefits of fiscal competition as a discipline device. Competition among governments constrains the ability of rent-seeking governments, or Leviathans—to use the terminology of Brennan and Buchanan (1980), from extracting rents. The competitive federalism approach has been summarized in Breton (1996).

What Oates (2005) has termed second-generation fiscal federalism emphasizes public choice and asymmetric information aspects. It stresses political institutions, including the role of politicians, voters and the political process. It also incorporates dynamic elements like risk sharing and interregional insurance, and the evolution and stability of federations over time. An important consequence of viewing federalism as a dynamic process involving multiple jurisdictions that take interdependent decisions is that the timing of decisions becomes relevant. To the extent that the federal government represents the national interest, one can think of the optimal outcome—or the second-best outcome—as that achieved when the federal government chooses its policies first, followed by provincial governments and then households and firms. If the federal government cannot commit to the intergovernmental transfer policies it announces, provinces can exploit that by enacting policies intended to attract federal transfers, leading to a *soft-budget constraint*. As we shall see below, Canadian economists have made several contributions to the soft-budget constraint literature, as well as to other consequences of the inability of governments to commit.

There are other methodological issues in fiscal federalism to which Canadian economists have contributed. One is the characterization of fiscal externalities and their consequences for policy. Related to that are the concepts of horizontal and vertical imbalance as arguments for federal–provincial transfers. Canadian economists have also pioneered the use of the marginal cost of public funds as a device for analyzing the inefficiency of fiscal systems and for designing reforms. They have studied the role of voluntary interprovincial agreements as means to address inefficiencies arising from migration, public goods and externalities. And, they have undertaken empirical studies of tax and transfer policies in the Canadian context.

Our emphasis in this survey will be on the fiscal federalism research literature. This has been dominated by theoretical studies, but also includes empirical applications. The defining questions of this literature include: (a) Why are federations formed and how are fiscal responsibilities assigned to different levels of government? (b) How decentralized should revenue raising be relative to expenditures, and so how large should the vertical fiscal gap be (Watts 2008)? (c) How should intergovernmental transfers be designed to address the vertical fiscal gap, horizontal fiscal imbalances and cross-provincial fiscal spillovers? (d) How much should each level of government be responsible for redistributive policies? (e) To what extent does fiscal competition cause inefficiency and what policies can correct it?

Canadian economists have also made significant contributions to fiscal federalism policy, much of it drawing on the research literature. We cannot do full justice to those policy contributions, but highlight some key policy work by Canadian economists that has influenced and shaped federalism policies in Canada and elsewhere.

The volume of Canadian work on fiscal federalism is vast, so we limit the scope of our survey mainly to contributions since the early 1980s and the landmark Economic Council of Canada (1982) study entitled *Financing Confederation*. Key contributions of earlier years will also be mentioned because of their lasting effect on the literature. We take a rather broad approach to defining who is a Canadian economist. In addition to Canadians working in Canada, we include Canadians who did much of their work abroad. We also include those who did some of their research while studying or working in Canada regardless of their nationality.

We organize the literature around four themes following a natural sequence. First, we consider the constitutional issue, including both the decision to form a federation and the assignment of responsibilities to federal and provincial levels of government. Then, we focus on the extent of decentralization in the exercise of fiscal responsibilities and the possibility of a vertical fiscal gap. Third, we turn to the role of intergovernmental transfers to address both vertical and horizontal imbalances in the federal fiscal system. Fourth, we consider fiscal competition, which is a natural consequence of decentralized decision making. We then conclude. Our terminology follows Canadian conventions, using terms like federal government, provinces, equalization, etc., although many arguments apply as well to other countries.

2. The Constitution

Consider first why federations might form. Doing so sheds light on the constitutional assignment of responsibilities. Two approaches can be adopted, which differ in their starting point. The top-down approach begins with a unitary nation and considers what advantages can be had from devolving responsibilities to autonomous provinces. This is consistent with the approach adopted by Oates (1972) and leads to his decentralization theorem, which bases the case for provincial responsibilities on efficiency grounds. Breton (1965) and later Breton and Scott (1978) elaborate on that approach as discussed above. The bottom-up approach takes as its starting point independent provinces and considers what is to be gained from federating. In particular, what functions should the provinces give up to a federal government? The principle of subsidiarity adopted by the European Union comes out of this approach. Under subsidiarity, decentralized responsibility is the default position and the federal government should only undertake functions in which it enjoys a clear advantage.

Canadian economists have formalized two reasons why sovereign regions might form a federation. The first is to capture the efficiency gains from policy coordination (Burbidge et al. 1997) and the second is to provide insurance against region-specific fiscal uncertainty (Bucovetsky 1998). Regarding the first, decisions by sovereign governments can exert fiscal externalities on other governments. By forming a coalition or federation, participating governments can internalize these externalities and maximize the coalition's aggregate consumption. Burbidge et al. (1997) use cooperative game theory to explain the endogenous formation of federations. In their framework, members of the coalition can commit to behaving cooperatively both in their fiscal decisions and in the division of the aggregate consumption according to some sharing rule. Bucovetsky instead focuses on the insurance role a federal constitution can provide when there is uncertainty over region-specific rents and populations are risk averse. In both of these cases, as Garon (2012) has argued, the federal constitution can be viewed as a device for enabling provinces to commit to policies that are ex ante optimal, but which they could not commit to maintaining when circumstances change.

Agreement to form a federation entails stipulating the legislative responsibilities of the federal and provincial governments. The main fiscal components include the assignment of taxation and expenditure responsibilities, as well as the ability to make intergovernmental transfers. Legislative responsibilities typically do not constitute obligations. Governments can exercise their responsibilities as they see fit, possibly subject to some broad mandates set out in the constitution. In some countries, these can include a requirement to satisfy basic rights. In Canada, it includes a commitment in principle that the federal government make equalization payments to the provinces and that it facilitate the provision of basic public services, equality of opportunity and regional development (*Constitution Act*, 1982, Section 36).

There is considerable latitude in the way governments exercise their taxation and spending obligations, and the consequences can lead to fiscal imbalances. Importantly, federal and provincial governments exercise their fiscal responsibilities with a high degree of independence. They may do so non-cooperatively, leading to various fiscal spillovers or externalities. They may do so strategically, that is anticipating how other governments will react. In the case of the federal government, strategic behaviour can be used to mitigate adverse consequences of provincial decisions. In the case of the provinces, strategic behaviour can lead to exploiting perceived soft-budget constraints arising from fiscal transfers. Finally, governments can choose to behave cooperatively, such as when they harmonize their policies or agree to internal free trade pacts. These various forms of behaviour inform our discussion below.

2.1. Assignment of expenditure functions

The traditional approach, following Tiebout (1956) and Oates (1972), emphasizes the main role of provinces in providing provincial public goods, that is, goods whose benefits apply to residents in the province. The presumption is that assigning provincial public goods to provinces ensures that they will be provided efficiently, so will satisfy a provincial Samuelson-type condition where the sum of the marginal benefits of public good provision is equal to the marginal cost of provision. Both Tiebout and Oates argued that efficiency would prevail, though for different reasons. Tiebout saw decentralized provision leading to fiscal competition as local governments competed for mobile households who migrated to localities whose tax-spending mix best suited their preferences. Oates saw decentralized provision of provincial public good as enabling provincial governments to cater to the preferences of their residents rather than being forced to accept uniform federal provision.

The Tiebout–Oates approach has led to a substantial literature on the efficiency of decentralized provision and financing of provincial public goods. Much of this is summarized in Boadway and Tremblay (2012), and we focus on the Canadian contributions. As already mentioned, Breton (1965) has pointed out the inevitability of mismatches between the geographical reach of public goods and provincial borders. This leads to spillovers of benefits of public goods provided in one province to residents of another. Dahlby (1996) characterizes these benefit spillovers, or fiscal externalities, along with the many other spillovers that can occur, the results of which are the under-provision of provincial public goods with positive spillovers and the over-provision of others that may have negative spillovers.

Benefit spillovers are not the only form of fiscal externality that can result in inefficient provincial public good provision. Provincial taxation can also lead to fiscal externalities and inefficient provincial decisions. If provincial taxes apply to income or purchases made by non-residents (or property owned by them), two conflicting externalities can occur. To the extent that non-residents cannot, or choose not to, escape the tax by moving their source of income elsewhere, tax exporting occurs that reduces the cost to residents of provincial spending so encourages over-provision. A pertinent example of this is the case where provinces apply source-based taxes to income generated from provincial tax bases that are immobile, such as natural resources or real property. To the extent that the resources or property are owned by non-residents, tax exporting occurs as discussed in Boadway and Tremblay (2012). On the other hand, if taxes on non-residents induce them to move their income source elsewhere, tax competition occurs that tends to bid tax rates down. These tax externalities are taken up in more detail later. For now, we note that both tax exporting and tax competition can occur with the same type of tax, as analyzed by Mintz and Tulkens (1986) and Kanbur and Keen (1993) for commodity taxation.

Inefficient provincial public good provision can also occur as a result of interprovincial household mobility. Suppose provincial public goods are financed by a tax levied on residents, but residents can migrate from one province to another in response to changes in provincial taxes and public good levels. Efficiency of public good provision then depends on the objective of the provincial government. If its objective is to maximize the sum of utilities of pre-migration residents, or per capita utility when household are identical, the relevant Samuelson condition will be satisfied at the provincial level. This result is what Myers and Papageorgiou (1993) call *incentive equivalence*: free migration equates per capita utility across provinces, so maximizing per capita utility in a given province is equivalent to maximizing it nationwide.

Bucovetsky (2011) and Aoyama and Silva (2014) show that incentive equivalence continues to apply with fixed migration costs and attachment-to-home migration, respectively. On the other hand, if provincial governments maximize the sum of utilities of post-migration residents, the level of provincial public goods will be inefficient as shown by Myers and Papageorgiou (1997), and by Mansoorian and Myers (1997) for the case where migration is costly because of attachments to home. In effect, provinces will have an incentive to encourage in-migration since a larger population increases the sum of utilities. Similar results apply when households are heterogeneous as shown by Boadway et al. (2003). A Tiebout-type argument in relative efficiency of provincial public good provision can, however, still apply when there is imperfect information about individuals willingness to pay for public goods. Gravel and Poitevin (2015) show that decentralization of public good provision, together with mobility of individuals, can be used to reveal information about individuals' willingness to pay for public goods, and can be preferable to uniform or centralized provision provided the federal government can transfers resources across provinces to ensure a balanced budget.

The mobility of households among provinces raises the question of whether migration is efficient, that is, whether migration equalizes worker productivity across provinces net of migration costs. One of the key findings of the early fiscal federalism literature was that, contrary to Tiebout's conjecture, migration will generally be inefficient in a federation in which provinces choose their own levels of public goods and resident taxation. The original insight of Buchanan (1952) was formalized by Flatters et al. (1974) and has been developed by various Canadian economists since then. Boadway and Flatters (1982a) characterize the incentive for inefficient migration as the net fiscal benefit (NFB) of provincial policies. This is roughly the value of public spending less the per capita tax liability to residents. It can differ among provinces not only because of joint consumption benefits from provincial public goods as in Flatters et al. but also because of differences in access to source-based taxes like business and natural resource taxes. Watson (1986) suggested that the deadweight loss of inefficient migration, like standard deadweight loss estimates of taxes, was likely to be relatively small. Wilson (2003), however, argued that once one took account of the long-lasting nature of migration decisions, the deadweight loss could be significant. The debate was contingent on migration responding to fiscal variables, which was confirmed in the empirical analysis of fiscally induced migration by Day (1992) and Day and Winer (2006, 2012). We return to the consequences of fiscally induced migration for federal–provincial transfers below.

Canadian economists have also studied instances where provincial contributions to national public goods can lead to efficient outcomes. This is counterintuitive since it is well known that voluntary contribution models of public good provision lead to undersupply. Caplan et al. (2000) and Silva (2014) show that efficiency can prevail under what they call decentralized leadership, that is, where provinces choose their contributions to the federal public good first, followed by the federal government choosing an equalization system. In a manner analogous to the well-known rotten kid theorem (Becker 1974), the equalization system induces each province to take the welfare of other provinces into account thereby eliminating free riding on other provinces' voluntary contributions. Boadway et al. (2013) explore how this generalizes when provincial policies involve pollution control that benefits all residents of the federation. They consider various mechanisms besides federal equalization transfers that induce provinces to implement nationally efficient pollution control. These include voluntary interprovincial transfers, promises of provinces to match other provinces' pollution control policies and commitments by some provinces to specific levels of pollution abatement contingent on the emissions of others not exceeding some maximum level.

The above discussion concerns the assignment of responsibility for provincial public goods to provinces. In practice, provinces are also heavily involved in redistribution. Canadian provincial budgets are dominated by education, health and welfare expenditures, all of which serve primarily redistributive or social insurance functions. As well, provincial tax systems are redistributive, which is an inevitable consequence of giving provinces independent access to the income tax. There are two broad arguments for assigning redistributive policy instruments to provincial governments. One is that provinces might have strong preferences for redistribution among their residents, and these may differ across provinces. In the literature, preferences for redistribution often take the form of local altruism (Pauly 1973, Wildasin 1991). The other, summarized in Boadway and Shah (2009), is that redistributive public services like education, health and welfare might be more efficiently delivered by provincial governments, which are closer to those being served. Provinces might be better informed about where the needs are the greatest. They can deliver the services in the least costly way. And, they can experiment with innovations in service delivery in ways that can be imitated by other provinces, referred to as laboratory federalism.

Canadian economists have studied the consequences of provinces assuming some responsibility for redistribution alongside the federal government. Boadway and Flatters (1982a,b) argued, following Buchanan (1952), that net fiscal benefit differences will arise across provinces when public services made available to all residents are financed by income taxation. The result will be both an incentive for inefficient migration and fiscal inequity for those who do not migrate. Burbidge and Myers (1994a) generalized the analysis to the case where provincial governments enact redistributive policies according to diverse preferences for redistribution and show that inefficient migration can also occur in this case. Boadway et al. (1998) study the consequences of redistributive provincial income taxes for migration efficiency and national equity, and Boadway et al. (2003) find that it is necessary to have province-specific redistribution policies to achieve an efficient allocation of population among provinces when migration is costly.

2.2. The tax assignment problem

Federal constitutions also specify the taxes that both levels of government are able to use. Both federal and provincial governments might have access to one or more common base, especially broad-based ones given the substantial expenditure responsibilities of each. The economic principles of tax assignment are well established, although these may differ from those listed in the constitution. In Canada, both federal and provincial tax powers are very broad, so consistency with the economic principles of tax assignment is pursued more in the exercise of those rights, including through federal–provincial harmonization agreements. The fiscal federalism literature has approach the tax assignment problem by focusing on what tax bases the provinces should have access to. There has been less concern with limiting federal tax instruments, although some revenue sources are in practice restricted to provinces and their municipalities such as property taxes, user fees and sometimes natural resource taxes.

The classic principles of tax assignment were enunciated by Musgrave (1959) and expanded on by McLure (1983). Modern restatements can be found in Bird (2009) and Boadway and Shah (2009). Bird (2000), among his many other contributions to this literature, has outlined the application of those principles to developing countries where administrative capacity constrains the ability to raise revenues from income-type taxes. The principles can be stated concisely. Tax bases that are relatively mobile should be preserved for the federal government to avoid interprovincial fiscal externalities from provincial taxation, that is, tax-induced movement of tax bases. Thus, taxes on capital income and reproducible capital should be federal. As well, taxes that are important redistributive instruments should be federal, though with some provincial access where redistribution is deemed a provincial objective. The federal government should also have access to tax bases that are distributed unevenly across provinces. In addition, the federal government should control taxes, such as carbon taxes, that are used to correct for externalities that are national in scope.

In a relatively decentralized federation, provinces need access to broad-based taxes to be able to finance a significant proportion of their expenditures by own revenues, which is presumed to enhanced accountability. Provincial broad-based taxes could include those that apply to relatively immobile tax bases, like personal income, consumption and payroll taxes. Where the federal government and the provinces have access to the same tax bases, harmonization agreements are useful to minimize interprovincial distortions, to economize on compliance and collection costs and, where appropriate, to coordinate progressivity.

Assignment objectives can be conflicting, as the case of natural resource taxes illustrates (McKenzie 2006). On the one hand, resources are immobile and resource development is often managed by provincial governments, which would favour provincial taxation. On the other hand, resources are also unevenly distributed among provinces, which would suggest federal taxation for equity reasons. The federal government might also be able to administer natural resource taxation more efficiently given the extent to which multinational resource companies are involved. Not surprisingly, the taxation of natural resources has been contentious in Canada (see, for example, Feehan 2005 and Courchene 2005). That natural resources are deemed to be owned by the provinces has meant in practice that their taxation is considered a provincial prerogative as recognized as in the *Constitution Act*, 1982, Section 92A.

Canadian contributions to the tax assignment issue have been diverse and have drawn heavily on Canadian experience. Bird and Gendron (2001) and Bird et al. (2006) have argued that value-added taxes are feasible for provincial governments whether or not the tax base is co-occupied by the federal government. The essential problem is to apply the destination principle to provincial taxes, and they propose methods for doing that. Smart and Bird (2009) study the effect of replacing retail sales taxes with provincial value-added taxes in Canada, emphasizing the fact that the latter purges sales taxation from business inputs. Their results confirm that the value-added tax is borne largely by consumers, consistent with the elimination of the tax on business inputs.

Others have looked at aspects of provincial corporate taxation, which in Canada is harmonized with the federal corporate tax. Two important component of corporate tax harmonization are the use of a common tax base and the allocation of profits among provinces using formula apportionment, both administered by a single tax collecting agency. Mintz (2004) outlines the lessons learned from Canadian corporate tax base harmonization for member states of the European Union, and Mintz and Weiner (2003) consider alternative approaches to formula apportionment. Dahlby et al. (2000) analyze the interaction between federal and provincial business income taxes, especially whether the latter should be deductible from the federal corporate income tax base. At stake is the fact that there is a vertical fiscal externality between the two governments resulting from the fact that changes in the tax rate by one level of government affects the tax base of the other. They argue that the rate of deductibility can be chosen to neutralize the externality and deductibility should generally be partial. Bazel and Mintz (2016) calculate significant differences in marginal effective tax rates across provinces, which is evidence that provincial corporate taxes result in an inefficient allocation of investment across provinces. To avoid that, and more generally to avoid provincial corporate tax competition discussed below, Tremblay (2012) argues that corporate taxes should be reassigned to the federal government with the provinces compensated through more personal tax room.

A tax base that has become more relevant recently is carbon taxation. Although the purpose of this tax would be to correct for an externality that transcends borders, provinces might claim the right to implement a carbon tax, which affects consumers and firms within their borders and generates revenues that they would cherish. Courchene and Allan (2008) have proposed the analogue of a value-added tax on carbon referred to as a carbon-added tax. It would apply to the full carbon content of firm sales at each stage of production with credit given for the tax paid at earlier stages. They argue that such a tax could be used by both the federal government and the provinces and harmonized in a similar manner to provincial value-added taxes. Snoddon (2016) considers the role of the federal government in carbon pricing given that several provinces have already implemented forms of them. She advocates the federal government imposing a minimum national carbon price with the eventual aim of a fully harmonized federal–provincial carbon price regime. The federal government would return revenues from a federal carbon tax to the provinces of origin, which makes it more attractive for the provinces to harmonize.

3. Decentralization and the vertical fiscal gap

In virtually all federations, the federal government raises more revenue than it needs for its own program expenditures, and the provinces raise correspondingly less. The consequence is a vertical *fiscal gap* that is closed by federal–provincial transfers. The size of the fiscal gap differs among federations, reflecting mainly differences in the extent to which revenue-raising is decentralized. Canada is relatively decentralized: provinces raise a significant proportion of their own revenues compared with, say, Australia or Germany. It is generally accepted in the fiscal federalism literature that the arguments for decentralizing expenditure responsibilities are stronger than those for revenue-raising. Provincial governments are closer to the citizens they serve and are better able to deliver important public services like education, health and welfare. At the same time, there are economic advantages to maintaining a relatively more centralized tax system. Provincial taxation can lead to possibly adverse tax competition that can detract from efficiency and equity objectives, as discussed in a later section. In addition, decentralization of revenue-raising increases horizontal disparities among provinces to the extent that provinces have different revenue-raising capacities, and this leads to inefficiency in the allocation of resources across provinces and/or fiscal inequity. The federal government is better able to facilitate tax harmonization among provincial tax systems to the extent that it takes a significant share of revenues from a given tax base. Finally, a fiscal gap may reflect that fact that federal–provincial transfers are useful for policy as we discuss later.

The size of the fiscal gap is endogenous since it depends on the joint policies of the federal and provincial governments (Hettich and Winer 1986). Moreover, the size of federal–provincial transfers and the division of revenue-raising by the two levels of government are interdependent. It can be argued that the federal government assumes a leadership role in determining the size of the fiscal gap in the sense that it is plausibly seen as a first mover in choosing tax rates and the size of the transfer. This led to substantial policy debate in Canada in the early 2000s about both the size of the fiscal gap and the compatibility between the tax rates the federal government chose for itself and the size of federal–provincial transfers, that is, *vertical fiscal imbalance* (Lazar et al. 2004, Commission on Fiscal Imbalance 2002, Ruggeri and Howard 2001). This was precipitated in part by an unexpected reduction in federal–provincial transfers as a result of the federal government's deficit-reduction strategy of the mid-1990s. The Commission on Fiscal Imbalance argued that to avoid unexpected changes in transfers as well as to limit the ability of the federal government to use its transfers to influence provincial spending priorities, the size of the fiscal gap should be reduced by turning more tax room over to the provinces. The distinction between the fiscal gap and fiscal imbalance is inherently ambiguous. Boadway and Tremblay (2006) define a fiscal imbalance as a deviation from the optimal fiscal gap and analyze the deviations that can arise when the federation is subject to economic shocks. Hetttich and Winer (1987) instead define a fiscal imbalance as the deviation from the ideal in the allocation of resources between the federal and provincial governments and the private sector as determined by a public choice mechanism.

Canadian economists have formalized the notion of the optimal fiscal gap by modelling the decisions of both levels of government and the interactions between their decisions using non-cooperative game theory. Typically, provinces are assumed to act as Nash competitors towards each other and the federal government, whereas the federal government is assumed to be the first mover or Stackelberg leader and anticipates the decisions of the provincial governments. Both provide public goods to their respective populations and the federal government chooses how much to transfer to the provinces. The optimal fiscal gap for a given region is taken to be the level of transfers needed to achieve the same outcome as when a unitary national government can take coordinated decisions for both levels of governments but is still constrained by the mobility of individuals. Generally, the vertical fiscal gap would be positive implying transfers from the federal government to the provinces. Boadway and Keen (1996) show, however, that if the provinces and the federal government both use a distortionary tax on a common tax base, the optimal fiscal gap can be negative. The overlap in federal and provincial tax bases gives rise to a vertical tax externality. As the first mover, the federal government will set a negative tax rate to ensure provinces internalize the social costs of their revenue-raising. This implies, under reasonable circumstances, transfers from the provinces to the federal government for pure efficiency reasons. This concept of an "optimal vertical fiscal gap" has also been extended to allow for both vertical and horizontal fiscal externalities between and across governments (Boadway and Tremblay 2006, 2010). Boadway et al. (1998) obtain the optimal transfers when both horizontal and vertical fiscal externalities apply and when provinces also engage in redistributive taxation. Sato (2000) develops a general analysis of federal–provincial transfers in a federation with various fiscal externalities and distorting tax instruments.

An alternative way to formalize the notion of the optimal fiscal gap has been proposed by Dahlby and Wilson (2003) using the concept of the marginal cost of public funds (MCPF). The MCPF is the social cost of raising an additional dollar of tax revenues and exceeds unity because of the marginal deadweight cost of increasing the tax rate (Dahlby 2008). The fiscal gap is optimized when the ratio between the marginal benefits of provincially provided public goods/services and federally provided public goods/services is equal to the ratio between their respective MCPFs. The optimal vertical gap in this setting minimizes the efficiency cost of raising revenues by both levels of government combined. Given differences in MCPFs across the different levels of government, lump-sum intergovernmental transfers can be used to ensure the optimal fiscal gap is obtained. Achieving the optimal fiscal gap for all provinces will not, however, be possible if intergovernmental transfers are chosen by majority rule (Dahlby and Rodden 2013).

When provincial governments do not have to rely on own-source revenues to finance expenditures, a soft-budget constraint can arise in which provinces strategically anticipate federal aid, if needed (Vigneault 2007, Breuillé and Vigneault 2010, Akai and Sato 2008). Formally, this happens as a consequence of assuming different timing of government decision making with the federal government choosing its policies after the provinces. The federal government cannot commit to not helping out the provinces when needed. Anticipating the federal government's inability to commit to its transfer policy, provinces have incentives to engage in excessive risk-taking or overspending, and such inefficiencies must then be addressed by the optimal ex post transfers. This moral hazard problem can be mitigated to some extent with greater decentralization of revenue-raising ability to provinces when there is ex post bargaining over transfers between the federal and provincial governments (Sato 2002). At the other extreme, a federal government as "first mover" may put provinces at a disadvantage. For example, the federal government may shift its deficit to provinces (Boadway and Tremblay 2006). In addition, Mitsui and Sato (2001) consider the implications of individuals making migration decisions prior to the determination of any government policies. This can lead to inefficient migration, with households concentrating themselves excessively in one or more province.

3.1. Political economy of decentralization

Political economy approaches to decentralization emphasize that need to account for institutions in which policy decisions occur and for the motivation of politicians. Early Canadian contributors were Breton and Scott (1978), who emphasized the role of administration and coordination costs, and Hettich and

Winer (1987), who emphasized the role of special interest groups. Under Oates' decentralization theorem, a trade-off between benefit spillovers and heterogeneity of preferences for provincial public goods is generated by the assumed uniform provision (and financing of provincial public goods) under centralization. Such a trade-off also exists within a political economy setting, but for quite different reasons than those proposed by Oates, as shown by Besley and Coate (2003). With non-uniform provision of provincial public goods under centralization, decisions both on public good provision in each province and on how the cost of provision will be shared among the provinces must be made. Having both of these decisions taken by a legislature of locally elected representatives generates conflict of interests from heterogeneity in local preferences across provinces and results in inefficiencies in public good provision. Improved coordination of benefit spillovers arising from centralization must now be traded off with increased heterogeneity in local preferences, which affects the legislative outcomes. Whether there is policy centralization might itself be determined by a political outcome, and the assumed political process might affect this outcome. Redoano and Scharf (2004) show that delegating policy coordination decisions to an elected representative can act as a commitment device and is more likely to result in policy centralization than under direct democracy. Further, political institutions in which centralized policy decisions are taken can also affect the formation of federations (Hickey 2013).

Alternate political economy approaches have stressed the benefits of decentralization as a discipline device or as a way to limit government corruption and improve the quality of macroeconomic governance (Shah 2006a, 2006b). Underpinning this view is the idea that unconstrained politicians will act in their own self-interest and not make decisions in their constituents' interest. Hickey (2015) highlights the strategic role of intergovernmental transfers when federal politicians facing term limits are concerned with being re-elected. Imperfect information between voters and politicians can worsen government accountability and strengthen the argument for decentralization. Joanis (2014) focuses on shared expenditure responsibilities between different levels of government, justified by complementarities in the spending on the public good by both levels of government, and assumes voters are imperfectly informed about each level of government's expenditure share. The degree of expenditure decentralization will then be determined endogenously, in part by the degree to which each level of government can affect political outcomes through its public spending. This approach has found some empirical support (Jametti and Joanis 2014).

4. Intergovernmental transfers

Federal–provincial transfers are an inevitable feature of federations and arise for several reasons. The notion that the case for decentralizing expenditures is stronger than that for decentralizing taxes leads to intergovernmental transfers simply to close the vertical fiscal gap. In some federations, this is done by a formulaic approach using revenue-sharing schemes, while in others the use of transfers to close the fiscal gap is interwoven with other arguments. There are three main rationales for intergovernmental transfers in their own right. One is to equalize differences in the ability of provinces to provide comparable public services, which in Canada is a constitutional principle informing equalization (*Constitution Act*, 1982, Section 36(2)). The second is to enable the federal government to encourage the provinces to take account of national principles of efficiency and equity in the economic and social union in designing their policies. Examples include achieving harmonization of taxes and other programs; pursuing agreed standards in social programs; coordinating areas of overlapping jurisdiction such as immigration, training and communications; and reducing barriers to interprovincial trade, investment and labour mobility. A third is to provide an incentive for provinces to implement programs with spillover benefits to other provinces. Naturally, the use of federal–provincial transfers for these purposes can be controversial, given that they impinge on provincial decision making responsibilities and that they may affect accountability. We focus on three areas of Canadian contributions: equalization, unconditional block transfers and conditional grants.

4.1. Equalization

The economic rationale for equalization originated with Buchanan (1950, 1952) who first recognized the relevance of differences in the ability of provinces to provide comparable levels of public goods at comparable tax rates. These differences provide an incentive for inefficient migration of households and result in horizontal inequity of otherwise identical households who did not migrate. An equalization system that undid the fiscal disparities, or differences in net fiscal benefits, arising in a decentralized federation would improve both migration efficiency and horizontal equity. These arguments were developed in more detail by Flatters et al. (1974), Boadway and Flatters (1982a, 1982b), Myers (1990), Mieszkowski and Musgrave (1999) and others and are related to the idea of optimal population suggested by Hartwick (1980). The fiscal federalism literature influenced various policy proposals such as those by the provinces' Council of the Federation (2005), the Federal Expert Panel on Equalization and Territorial Formula Financing (2006), the Commission on Fiscal Imbalance (2002) in Quebec and the Royal Commission on Renewing and Strengthening our Place in Canada (2003) in Newfoundland.

Differences in net fiscal benefits naturally arise from fiscal decentralization whose purpose as mentioned is to improve efficiency, innovation and accountability in the provision of public services. From this perspective, Boadway (2001) argues that equalization can be viewed through the prism of the hypothetical unitary nation benchmark in which a common tax system applied nationwide and financed a common set of public services. Decentralization would instead result in different provinces not being able to provide common levels of public services. A transfer system that equalized the fiscal capacities of provinces would facilitate decentralization by counteracting its adverse effects. It would give provinces the potential to provide similar public services, but instead of compelling uniformity it would allow them to choose tax and expenditure policies that better fit their preferences without affecting their equalization entitlements.

Equalization also provides insurance to provinces against adverse shocks, the presumption being that it would be more costly for the provinces to self-insure by intertemporal smoothing. Bucovetsky (1997) suggests that insuring provinces can induce a form of moral hazard as provinces take advantage of it through policies that exacerbate the risk or as self-insurance is crowded out. Moreover, equalization intended to insure provinces can have destabilizing effects for other provinces, as shown by Smart (2004) and Boadway and Hayashi (2004). Courchene (2005) argues that equalization fulfils a more fundamental role than economic efficiency, equity and insurance. It is the "glue" that binds the nation together and reflects the role of equalization in fostering social citizenship.

There has been a large Canadian literature on the appropriate design of equalization and its consequences. Much of the early literature as well as Canada's experience with equalization is summarized in Courchene (1984). Equalization in Canada has two essential features. First, equalization transfers are based on the revenue-raising capacity of provinces relative to the national average, the so-called representative tax system (RTS) approach. Second, the equalization program consists of federal–provincial transfers that are paid to provinces with below-average revenue-raising capacity; it does not apply to above-average provinces. Equalization principles developed in the literature differ from this in several ways. In analytical approaches, equalization is typically applied symmetrically to all provinces. Positive entitlements of recipient provinces are balanced by negative entitlements of above-average provinces, referred to as net equalization and rarely applied in practice. Boothe (1998) has proposed a net equalization system in which all revenue sources are aggregated into a single revenue pool, and Courchene (2005) has proposed that net equalization be applied separately to natural resource revenues via a revenue-sharing pool. Furthermore, with a net scheme, the role of the federal government is minimal. Myers (1990) has exploited this to show that voluntary interprovincial equalization transfers will lead to efficient migration when the latter is costless. Voluntary transfers internalize differences in benefits from migration, with some provinces in effect purchasing migrants from others. Mansoorian and Myers (1993) extended the argument to show that voluntary transfers can also result in efficient migration when migration costs exist and take the form of "attachment to home." Their use of attachment to home as a characterization of migration costs has subsequently been widely used in the literature.

Other papers have stressed that equalization based on the RTS approach is too narrow since net fiscal benefits arise from expenditures requirements as well as revenue capacity. The needs for public services will differ across provinces with differing compositions of their population (young versus old, working versus long-term unemployed, ill versus healthy, etc.). Studies by Shah (1996) and

Gusen (2012) have found that needs differences can be substantial enough to warrant incorporating a needs component into equalization. Vaillancourt and Bird (2005) have outlined the ways in which need could and should be incorporated into equalization, and Gusen has presented a prototype scheme for doing so. In addition, Courchene (2013) has argued that equalization should take account of differences in the cost of providing public services, especially those attributable to differences in wage costs. Failure to do so implies that equalization favours low-cost provinces at the expense of high-cost ones, like Ontario. Albouy (2012) has developed a formal model of federalism in which provinces can differ in wage costs arising from not only productivity differences, but also differences in amenities associated with living in different provinces. Better amenities cause wage rates to be lower as a result of pressures of migration. Applying his model to Canada based on estimated values of amenities, he finds that equalization to many recipient provinces is inefficiently high.

Other authors have proposed alternatives to the RTS system for equalizing revenue-raising capacity of provinces. Dahlby and Wilson (1994) propose distributing the tax burden across the federation so as to minimize the social cost of raising revenue. This approach abstracts from issues of fiscally induced migration and fiscal equity and requires equalizing the MCPF across provinces. Usher (1995) is critical of equalization based on equalizing net fiscal benefit differences. He points out that equalization can implicitly redistribute from the poor in high-income provinces to the rich in low-income provinces, can give adverse incentives to the provinces and is excessively complex. While in principle he favours a system that equalizes the MCPF of raising revenues across provinces, on simplicity grounds he proposes a macro-formula approach. Also recommended by Boothe and Hermanutz (1999), this approach redistributes income among provinces based on a single indicator such as per capita personal income.

Gravel and Poitevin (2006) develop an argument for progressive equalization payments, that is, they are decreasing in per capita wealth of the representative provincial resident. They argue that the per capita tax cost of providing the public good within a province depends on its population. If this tax price affects the marginal social value of income or wealth, then the optimal equalization system can result in redistribution from low- to high-wealth provinces as it attempts to equalize the marginal social values across them. Optimal equalization will be progressive for all distributions of wealth and population if and only if the objective function of the federal government is additively separable in provincial per capita wealth and population.

One final issue is the incentive effect of equalization on provincial fiscal behaviour, which was first pointed out in a paper in this journal by Courchene and Beavis (1973). Under the RTS system, a province's equalization entitlements are based on the amount of revenues it would raise by applying national average provincial tax rates to the provincial tax base for each tax type. Provinces with below-average ability to raise revenues from all sources receive equalization payments. While provinces have limited ability to affect the national average tax rates, they might be able to influence the size of their own tax bases through development, taxation and macroeconomic policies. Some have argued that long-term reliance on federal transfers leads to a state of "transfer dependency," to use the terminology of Courchene (1981), whereby low-income provinces choose not to enact pro-development provinces that would reduce their equalization transfers. A version of the debate is found in the conflicting views of McMahon (1996) and Hobson et al. (1997). Smart (1998) and Bucovetsky and Smart (2006) argue that equalization reduces the MCPF of raising revenues in a province since equalization compensates for any reduction in the size of a tax base from an increase in the provincial tax rate. This encourages provinces to set tax rates that are too high. Empirical evidence in Smart (2007) confirms that provincial tax rates respond positively to equalization, while Egger et al. (2010) find that local business taxes in Germany increase with equalization.

4.2. Unconditional block grants

Federal–provincial grants combined with the division of expenditure and revenue-raising responsibilities determine the size of the vertical fiscal gap. The literature examining the vertical fiscal gap studies the optimal use of federal–provincial transfers to mitigate the effect of various fiscal externalities in a federation as discussed above. Another literature emphasizes the positive effects of transfers on provincial taxation and spending decisions. The standard approach argues that unconditional transfers should have an equivalent effect on public spending as an increase in personal income. However, empirical studies show that unconditional transfers simulate spending more than do increases in personal income, a phenomenon know as the *flypaper effect*, surveyed in Hines and Thaler (1995). Early evidence of this effect is in Winer (1983) who explained it by provincial voters perceiving lower tax prices of public spending when provincial expenditures are financed in part by federal grants. More recently, Ferede and Islam (2016) have studied the flypaper effect in Canada by estimating the effect of federal block grants on provincial education spending. While many explanations for the flypaper effect rely on political economy or bureaucratic arguments, Dahlby (2011) has rationalized it using the MCPF concept. The argument is that intergovernmental grants have a price effect by allowing a lower-level government to reduce its tax rate, which lowers its MCPF. The empirical validity of this argument has been investigated by Dahlby and Ferede (2016).

4.3. Conditional grants

In Canada and many other federations, equalization and largely unconditional transfers including revenue-sharing make up the bulk of federal–provincial transfers, though the traditional fiscal federalism literature emphasized the role of conditional matching grants. Conditional grants are used for specific purposes, such as highways and other infrastructure projects, and are much more widely used at the provincial–municipal level. (For summaries of issues in provincial–municipal fiscal arrangements, see Kitchen 2002 and McMillan 2008.) As Dahlby (1996) has discussed, conditional matching grants are relevant for correcting fiscal spillovers among provinces. Snoddon and Wen (2003) provide a theoretical characterization of the different types of grants as the outcome of a non-cooperative game among the federal government and the provinces. Bucovetsky et al. (1998) incorporate asymmetric information as a constraint on choosing conditional grants by assuming that information about provincial government preferences for public goods are private.

As well as analyzing the design of conditional grants, economists have studied their effects. Some Canadian examples include the effect of matching grants on social assistance expenditures (Baker et al. 1999), the effect on provincial health and education spending of replacing matching grants with bloc grants for provinces (Coyte and Landon 1990), the impact of the same shift on the net distribution of revenues across provinces (Snoddon 1998) and the effect of conditional grants on spending by municipalities (Brett and Tardif 2008).

5. Fiscal competition

A recurring theme in fiscal federalism is that there are important benefits from decentralizing independent fiscal responsibility to provincial governments, but the exercise of independent authority creates fiscal externalities unless decisions are coordinated. The fiscal competition literature studies the consequences of independent but interdependent governments making taxation and expenditure decisions non-cooperatively. The focus is typically on situations where non-cooperative behaviour leads to inefficiency, although as we have noted, fiscal competition can also have desirable outcomes if it encourages better governance, accountability and innovation. We begin with the case of non-cooperative interactions between provinces, and then we consider interactions among the provinces and the federal government.

5.1. Horizontal fiscal externalities: Tax competition

The decentralization of revenue-raising ability to provinces can result in tax competition given provincial non-cooperative behaviour and can lead to potential inefficiencies in both the provision of provincial public goods and the allocation of resources across provinces. An efficient allocation is one in which the Samuelson condition is satisfied for provincial public goods and the marginal products of mobile resources are equalized across regions. Much of the tax competition literature has focused on capital tax competition. Capital is more mobile across provinces than households and can be influenced by provincial fiscal policies. Firm location can also be influenced by the benefits of public spending programs, like infrastructure and communications, by business subsidies and by differential provincial business tax rates. As mentioned earlier, Bazel and Mintz (2016) document the sizeable differences in marginal effective tax rates among Canadian provinces in 2015 and earlier work by Mintz and

Smart (2004) document substantial income shifting by firms operating in multiple provinces.

The canonical capital tax competition model was developed by Canadian economist Mieszkowski and his co-author in Zodrow and Mieszkowski (1986). Its fairly short set of assumptions is sufficient to illustrate the famous "race to the bottom" result. Provinces have constant returns to scale production in capital and a local fixed factor (e.g., land or labour), the stock of capital is fixed in the federation and is freely mobile across provinces, and provinces provide a public good financed by source-based capital taxes and take the net return to capital as given. An increase in a province's capital tax encourages capital to move into other provinces raising the tax revenue of these provinces. This effect is ignored by the province when it chooses its tax rate. Given this positive fiscal externality, provinces set inefficiently low tax rates and provincial public goods are under-provided relative to the efficient level. Provinces perceive a more elastic tax base than they would face if they behaved cooperatively. With symmetric provinces, all provinces set the same sub-optimal tax rate and no capital moves in the Nash equilibrium, so there is no inefficiency in the allocation of capital. Provincial coordination of tax rates at a higher level would correct for the under-provision of public goods. Alternatively, the federal government could use a Pigouvian corrective device to induce provinces to internalize the fiscal externality arising from their choice of capital tax rate.

Later Canadian contributions have examined the implications for efficiency and the needed corrective policies of both relaxing the standard assumptions and considering additional assumptions regarding the public good/service provided, the production technology or the tax instruments. We highlight some of these key contributions in the development of the tax competition literature. First, Bucovetsky (1991) considers non-price taking behaviour by provinces and shows that it give rise to strategic tax competition. By taxing capital, provinces affect the net return to capital, which in turn affects other provinces' tax revenue—a consequence that non-cooperative provinces do not take into consideration when setting their own taxes. A province has an incentive to tax (subsidize) capital when importing (exporting) capital to make the net return to capital more favourable. Consequently, even with access to either a tax on the local fixed factor or a residence-based tax on capital both of which are effectively lump-sum taxes in a single-period model (Bucovetsky and Wilson 1991), provinces would try to manipulate the terms of trade and there there will be inefficiencies in both the provision of the public good and the allocation of capital with asymmetric provinces. This occurs even with symmetric regions if there is increasing returns to scale in the production technology (Burbidge and Cuff 2005). This pecuniary externality must also now be corrected to achieve efficiency (DePater and Myers 1994). If available capital for investment arises from individuals' savings decisions, then access to a residence-based tax on capital is needed to restore efficiency in the absence of this pecuniary externality (Bucovetsky and Wilson 1991). Sufficiently mobile workers might also undo the inefficiencies arising in the Nash equilibrium when regions only have access to a source-based capital tax (Burbidge and Myers 1994b).

Asymmetries across provinces can generate both fiscal and pecuniary externalities. If provinces differ in population size, then the smaller province perceives a more elastic tax base and sets a lower tax rate and achieves higher welfare for its residents, than the larger region, in the Nash equilibrium. In this sense, the smaller province wins the tax competition game. This small-province advantage, however, can have consequence for the ability of provinces to coordinate their tax policies (Bucovetsky 1991, 2009) and has been used to examine issues in international tax coordination.

Provincial governments also provide goods and services that can enter directly as an input into production, so the marginal product of capital will now depend on the amount of public good provision. A higher tax rate affects both the marginal cost, as given by the net return to capital, and the marginal benefit of utilizing capital in the province. Whether equilibrium tax rates of symmetric provinces are inefficiently high, so there is over-provision of public goods, or low, so under-provision, will now depend on the strength of the production complementarity between capital and the public good (Dhillon et al. 2007). Over-provision of public inputs might also arise if there are scale economies (Bucovetsky 2005). Finally, given that businesses benefit directly from such public services, a tax on production can mimic a benefit-related tax and therefore, can result in more efficient provision of public services than with a tax on capital (Gugl and Zodrow 2015).

Firms' capital investments are far from homogenous and such heterogeneity can give rise to preferential tax treatments. Preferentially treatment would be granted to the types of capital that can move more easily (Gugl and Zodrow 2004). Preferential tax regimes might discriminate based on the ownership of capital (i.e., by residents or non-residents) given that foreign-owned capital might be more mobile (Mongrain and Wilson 2014), or they might discriminate on some other characteristic of capital that relates to its ability to move. Whether the elimination of such preferential tax regimes is desirable depends on the effect the harmonization of taxes has on a province's overall tax revenue. Restricting such preferential tax treatment could reduce revenue as a lower tax rate is likely to apply to the less mobile tax base (Bucovetsky and Haufler 2007) or it may increase revenue by avoiding the fierce tax competition on the mobile base (Marceau et al. 2010). Which effect dominates depends on the assumed elasticity of aggregate capital (Janeba and Smart 2003).

Other contributions explicitly recognize the role of mobile firms in the economy. For example, mobile firms may earn rents and with partial ownership of firms by non-residents, a tax-exporting effect can come into play (Burbidge et al. 2006). Alternatively, governments may choose to bargain individually with each firm over its tax rate (Han and Leach 2008). The rents to be earned in each province might themselves be subject to private information by firms, which would affect the tax competition outcome (Scoones and Wen 2001). Provinces might want to attract firms for their positive effect on employment when provinces are faced with frictional unemployment (Boadway et al. 2002) or if there are localization economies and a firm's production costs decrease with total output (Boadway et al. 2004).

An individual's decision to move can also be affected by provincial income taxes, particularly for higher-skilled workers, resulting in provincial "brain drains." Migration of higher-skilled workers may be efficient if provinces also differ in their productivity and productivity gains can be redistributed back through interprovincial transfers. Enacting more progressive income taxes in the less productive province is one way to induce such efficient migration given both the generally accepted inability of governments to tax based on skill level and to control directly individuals' migration decisions (Bucovetsky 2003a). If provinces are strategic and policies are enacted by self-interested voters, then competition for high-skilled workers can result in more progressive taxes in the more productive province as a way to expropriate the income of high-skill migrants (Bucovetsky 2003b). For income-earning ability that is independent of the province of residence, any redistribution between workers of differing ability through the use of an optimal non-linear income tax will result in redistribution between provinces (Blackorby et al. 2007), and the competition for perfectly mobile workers by strategic governments choosing optimal nonlinear income tax schedules can have severe consequences for the amount of redistribution that can be achieved (Bierbrauer et al. 2013).

Provincial competition for mobile consumption tax bases can also occur when provinces have access to commodity taxes. Both a positive fiscal externality, as higher commodity taxes induce consumers to shop across provincial borders thereby increasing the tax revenue of other provinces, and a tax-exporting effect, as provinces will want to set higher commodity taxes on non-resident shoppers, can arise in such models. The net effect will depend on the relative strength of these two types of fiscal externalities (Mintz and Tulkens 1986). Of course, provinces would ideally like to be able discriminate between resident and non-resident shoppers. As highlighted by Kanbur and Keen (1993), provincial population differences worsens the inefficiencies arising from commodity tax competition and makes tax coordination more difficult.

Addressing the inefficiencies generated by fiscal competition generally calls for some form of policy coordination. This can require the harmonization of tax rates if provinces are identical, but may also require differential taxes across provinces when there are provincial differences in size, technology or preferences. A central government may be able to ensure such coordination across asymmetric lower-level governments, but coordination problems can arise between such competing governments without any central intervention. Exacerbating such coordination issues are also possible asymmetries in information regarding the differential characteristics of provinces (Dhillon et al. 1999). Marchand et al. (2003) show that with two mobile tax bases, coordinating tax rates on one base can in fact be welfare-worsening relative to no policy coordination at all. Constraining a government's ability to use one tax instrument might make it compete more fiercely using its other available tax instruments. A somewhat similar intuition is given in Boadway et al. (2002) although in quite a different context. In this paper, allowing provinces to compete for mobile firms ensures efficient redistribution policies and is socially preferred to constraining the provinces' choice of firm taxes.

The tax competition literature has generally been normative in assuming that governments are benevolent, and typically tax competition is viewed as having adverse consequences. If, instead, governments were rent-seekers, tax competition might act as a discipline device and be beneficial as mentioned earlier. The degree of decentralization given tax competition would trade-off these two effects if governments cared about both (Sato 2003). The formation of jurisdictions themselves might be also be affected by tax competition when policies are chosen by majority voting after constitutional choices are made and there are scale economies in the provision of provincial public goods (Perroni and Scharf 2001). Increased mobility of factors or the economic integration of provincial markets can also affect the desirability of integration under the political determination of taxes and redistribution policies when provinces use source-based taxes on the mobile factor (Kessler et al. 2002, 2003). Economic integration can also affect the political determination of policy (de)centralization (Leite-Monteiro and Sato 2003).

A key element in all of the work on tax competition is the responsiveness of the tax base to provincial tax rates, both how the provinces' tax base responds to its own tax rate and that of other provinces. The elasticity of tax bases with respect to the tax rate influences the provinces' choices of tax rates. Recently, Dahlby and Ferede (2012) have empirically estimated the elasticities of the three major sources of provincial tax revenue—corporate income, personal income and sales—with respect to provincial tax rates in Canada. They find that the provincial corporate tax base is significantly more elastic reflecting its greater mobility across provinces than the other two tax bases. Whether there has in fact been a "race to the bottom" in the taxation of business capital in Canada is still an open question (McKenzie 2011).

5.2. Other fiscal externalities

Non-cooperative behaviour of provincial governments might also extend to other relevant fiscal decisions, such as debt issue when there are both national and regional economic shocks. The short-term benefit of provincial debt is concentrated solely on current residents, but with mobile individuals the long-term cost of debt is taken to apply to the entire population. This difference then encourages non-cooperative provinces to issue too much debt than is optimal from a national perspective, reinforcing the view that the federal government should play a key role in debt issue (Bruce 1995). Provincial governments might also invest in projects that have spillovers to other provinces. With political bargaining between different levels of government, optimally designed matching grants and moral hazard in the project, decentralization might achieve the first best (Lülfesmann et al. 2015).

Fiscal externalities also exist between levels of government. The federal and provincial governments share the various major tax bases—corporate, personal and sales. These tax base overlaps can give rise to a negative fiscal externality when governments act non-cooperatively. Similar to a common resource problem, both the federal and the provincial governments will underestimate the marginal cost of public funds of raising revenue from the shared tax base since they each ignore the effect their tax rate has on the tax base of the other level of government (Dahlby 1996). Consequently, both levels will set tax rates that are inefficiently high. The implications of such vertical interaction for intergovernmental transfers was discussed above. Additionally, Dahlby and Wilson (2003) show that vertical tax externalities may be positive if the provincial provision of a public input increases output and both levels of government tax wages and profits. Again, some form of federal–provincial cooperation will be needed to internalize these positive vertical tax externalities. Even if the federal government can take into account how its taxes affects provincial revenue, inefficiencies from general equilibrium effects when the tax bases of the two levels of government do not fully overlap can still arise and provides another efficiency rationale for tax harmonization within the federal system (Blackorby and Brett 2000).

How important and large these vertical and horizontal externalities actually are is an empirical question, but there is some evidence of lower-level governments responding to taxes set on the same base by a higher-level government (Brett and Pinske 2000) and of both vertical and horizontal corporate tax interactions in Canada (Hayashi and Boadway 2001). Brülhart and Jametti (2006) find that for Switzerland the empirical effect of vertical tax externalities dominates that of horizontal tax externalities, but whether the same holds in Canada is an outstanding question.

6. Concluding remarks

This survey is testament to the extensive and ongoing interest of Canadian economists in fiscal federalism. Our survey has touched on the main contributions of a wide array of these economists focusing mostly on work since 1982. As such, it is selective rather than exhaustive. Contributions have included fundamental innovations in the international literature as well as research aimed primarily at Canadian issues including topics such as equalization, tax harmonization and vertical fiscal balance. Some Canadian policy innovations such as approaches to fiscal decentralization, equalization and the system of tax harmonization have been very influential abroad, including in developing and transitional economies. We also did not include the many contributions of Canadian economists such as Richard Bird, Harry Kitchen, Melville McMillan and Enid Slack to local government or municipal finance policy.

Canadian research has influenced the scholarly literature on fiscal federalism and it has also been important in policy debates in Canada and abroad.

Economists have participated in royal commissions and expert panels that have addressed fiscal federalism issues, such as the federal Royal Commission on the Economic Union and Development Prospects for Canada, Newfoundland's Royal Commission on Renewing and Strengthening our Place in Canada, the federal Expert Panel on Equalization and Territorial Formula Finance, Quebec's Commission on Fiscal Imbalance and the Council of the Federation advisory panel on fiscal imbalance. They have also been engaged in working with various think tanks including the C.D. Howe Institute, the Institute for Research on Public Policy, the Fraser Institute, the Mowat Centre, the Atlantic Institute for Market Studies, the Canada West Foundation, the Atlantic Provinces Economic Council, the Canadian Tax Foundation, the Institute of Intergovernmental Relations and various university-based policy schools. Finally, the influence of Canadian economists on federations elsewhere in the world has been felt through organizations such as the World Bank, the International Monetary Fund, the International Institute of Public Finance, the National Bureau of Economic Research and the CESifo network.

Indications are that fiscal federalism will continue to be a vibrant research area in Canada. It is well represented among new Canadian scholars, and the problems remain current and relevant both domestically and internationally. Specific topics that deserve future research include: incorporating the political and institutional environments that federations operate within; establishing dynamic frameworks capturing the repeated interactions between levels of government to potentially identify the factors influencing the formation, and dissolution, of federations over time; and better connecting established fiscal federalism models to other areas of economics, such as trade, labour and environmental, in which provincial and federal government policies play important roles.

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