

Federal fiscal arrangements in Canada: An analysis of incentives

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Abstract

This paper reviews the major federal–provincial transfer programs in Canada, comprising grants-in-aid under the Canada Health and Social Transfer (CHST) and transfers in respect of differences in provincial tax capacities under the Equalization program. The incentive effects of the transfer programs on provincial tax and spending policies are discussed. In particular, it is shown that equalization grants effectively compensate recipient governments for a portion of the deadweight loss associated with taxes, and consequently the grants may tend to increase the distortionary tax rates chosen by those governments. This may be the case even when equalization is confined to tax bases which are themselves non-distortionary, such as the taxation of pure economic rents.

1 Introduction

Federal–provincial fiscal transfers in Canada have two large-scale components.¹ The federal government makes grants available to provincial governments in respect of a broad class of expenditures related to social programs under the Canada Health and Social Transfer program (CHST). The CHST, introduced in 1996 to replace earlier programs, is a lump-sum grant that is currently allocated to provinces on the basis of historical shares in federal transfers. (The precise allocation formula is discussed below.) The federal government also addresses disparities in provincial revenue capacities through an Equalization program, which calculates transfers to provinces with revenue deficiencies on the basis of the representative tax system (RTS) approach.

This paper reviews the structure of these major transfers, focussing on the incentives they provide to provinces in the design of tax and spending policies. We briefly discuss incentive issues that are relevant to CHST, and then we examine Equalization in greater detail. CHST broadly provides provinces with appropriate incentives to control the growth of their own spending in the relevant program areas. The decision of the federal government to revamp the earlier transfer arrangements, which used a combination of lump-sum and matching grants, was clearly influenced by its desire to reduce its own expenditures, but seems likely to have salutary effects on provincial incentives for expenditure control as well. Improved incentives have, however, been achieved at the expense of reduced sensitivity of the transfer formula to differences in provincial need and reduced responsiveness to changes in need over time.

In contrast, incentive considerations have received little attention in the design of the revenue equalization program. This has been a potentially costly oversight. Equalization acts very much like a system of redistributive taxation, targetting transfers to low-revenue regions and, implicitly, taxing high-revenue regions.² As such, it may induce provincial governments to raise tax rates in order to induce transfers from the federal government.

The potential for Equalization to distort tax policy incentives of subnational governments is particularly clear when transfers are based on the representative tax system (RTS) approach.³ Under the RTS approach to equalization, eligible provinces are compensated from federal revenues for the difference between a standard level of tax revenues and the revenue the province is deemed to be able to raise, if it were to apply national average tax rates to its tax bases. Thus the program aims to equalize differences in tax revenue, but implements transfers through an indirect formula, based on differences in observed tax bases. When all provinces choose identical tax rates, the formula does indeed result in revenue equalization. But to the extent that local tax bases are elastic with respect to distortionary tax rates, recipient provinces can induce larger equalization transfers by increasing tax rates. The additional federal transfers partially offset the deadweight losses resulting from higher tax rates and the consequent distortions. Equalization thus reduces the notional elasticity of tax bases used by welfare-maximizing governments in calculating second-best distortionary tax rates, and tax rates can rise in consequence.

The salient features of Canada’s major transfer programs are summarized in Section 2 of the paper. Section 3, the main part of the paper, examines incentives for provincial tax authorities

¹This discussion ignores several less important federal–provincial transfers (Treff and Cook, 1995). Discussion of the extensive overlapping of federal and provincial tax bases is postponed to Section 3.3 of the paper.

²We do not discuss here the possible rationales for such redistribution between governments in a federal state (Dahlby and Wilson, 1994).

³The RTS approach to Equalization, as proposed by the U.S. Advisory Commission on Intergovernmental Relations (ACIR, 1962), is the basis for equalization in, for instance, Australia, Denmark and Switzerland (Ahmad and Thomas, 1996), as well as a number of developing countries (Shah, 1994). Similar systems are employed by several U.S. states to equalize local government revenues (Ladd and Yinger, 1994).

under the Equalization program. We consider a partial equilibrium model of a single government that is a recipient of equalization transfers and chooses tax and spending policies to maximize utility of a representative agent, taking the parameters of the equalization formula as given. We explore cases in which the substitution effect of equalization is dominant, so that distortionary tax rates of the receiving province must rise as a result of equalization. We conclude that equilibrium with equalization results in a lower level of welfare of the representative consumer than would a lump-sum transfer to the province of an equal amount. In this sense, Equalization as implemented in Canada may be an inefficient means of redressing differences in revenue capacity. Section 4 concludes with a discussion of the prospects for decentralization and fiscal arrangements in Canada.

2 The major transfers in Canada

In this section, we discuss the principal features of Canada's major transfer programs and sketch their recent evolution. While some important aspects of the programs are omitted for the sake of brevity, we focus in particular on the incentives these programs create for distortions in provincial government policies.

2.1 Canada Health and Social Transfer

The Canada Health and Social Transfer was introduced in the federal budget of 1995 and first implemented in April 1996. The CHST provides grants in aid of a broad class of social expenditures, and is a block fund of approximately C\$26.9 billion for fiscal year 1996-97, which is allocated among provinces on the basis of relative per capita transfers in 1995-96.⁴The program is large relative to both federal transfers and to provincial revenues: transfers under CHST this year will equal approximately 27 per cent of provincial expenditures in the relevant program areas. (See Table 1.) While expenditure policies in the program areas are the responsibility of the provinces, the federal government has mandated a very small number of general "national standards" to which provincial policies must adhere. For social assistance, provinces are constrained not to impose minimum residency requirements on program recipients, while the Canada Health Act requires that provinces guarantee comprehensive coverage of non-elective health-care services, uniform access to all residents, and a few other conditions.

Payments to provinces under CHST are a combination of direct cash transfers and "tax point transfers," through which the federal government has agreed to reduce its levies on personal and corporate income, leaving additional tax "room" to be occupied by the provincial governments if they so choose. Tax points are equalized using the formula described in the following subsection, so that provinces with below-average revenue capacity are compensated for the lower value of their tax abatements. Since provincial income taxes are generally collected by the federal government on behalf of the provinces, and provincial tax rates exceed the value of the abatements, the distinction between tax point transfers and cash is more political than economic. While the federal government can withhold cash payments if provinces do not uphold the "national standards" mandates,⁵ the recovery of tax point transfers would be far more difficult. Since the cash portion of the transfers has been declining since the early 1980s, for reasons explained below, provincial governments have

⁴These amounts are not equal on a per capita basis because of earlier changes to transfer arrangements, described below. "Capitation" of transfers (i.e. equality of transfers in per capita terms) is to be phased in gradually during the 1998-2002 period.

⁵For example, user charges for publicly provided health care services are to be offset, dollar for dollar, by reductions in the CHST payment received by the offending province.

increasingly resented federal “interventions” with respect to program design, which has resulted in growing concern by some about the erosion of federal power to enforce national standards.

The CHST replaces the earlier Established Programs Financing (EPF) arrangement, which funded spending on health care and post-secondary education, and the Canada Assistance Plan (CAP), which funded social assistance expenditures. Like CHST, EPF was a block fund which compensated provinces through a combination of cash transfers and tax point transfers. In contrast, CAP was designed as a matching fund, under which the federal government was responsible for 50 per cent of eligible provincial expenditures for social assistance programs.⁶

The decision to replace EPF and CAP with CHST, although clearly motivated by federal fiscal exigencies, had three important consequences, two of which might be regarded loosely as pertaining to incentives for provincial governments, and the third to inter-provincial equity. First, by raising the marginal tax price of social assistance expenditures to the provinces, the “blocking” of transfers under CHST should provide greater incentive to control the growth of expenditures than did the matching formula of CAP.⁷ Second, the consolidation of EPF and CAP transfers in a single block fund increases the cash component of the transfer and thus preserves the ability of federal authorities to provide financial incentives to maintain the aforementioned mandates, which had been eroding due to the declining cash component of EPF transfers.⁸ Thus while the federal government might be thought to be pursuing a strategy of greater devolution through the “blocking” of social assistance transfers and the consolidation of the two conditional grant programs, it has shown no intention of relaxing its control of “national standards” in health and, to a lesser extent, social assistance.⁹

Finally, to some extent, the introduction of CHST may be seen as redressing significant differences among provinces in per capita transfers that had evolved as a result of the previous formulas and earlier, ad hoc attempts to control expenditures. Table 1 shows cash and tax-point transfers under EPF and CAP to the ten provinces in 1995-96, both on a per capita basis and as a percentage of the relevant program expenditures. The table reveals considerable variation in both provinces’ program expenditures and, to a lesser degree, in the associated federal transfers. The transfer arrangements prior to CHST were moderately redistributive. As a consequence of earlier policy initiatives, transfers were largest in per capita terms to provinces with below-average per capita income. Indeed, per capita transfers were below average only for the three provinces—Ontario, Alberta, and British Columbia—with above-average income. The equalization effect is less pronounced, though still discernible, when transfers are expressed as a percentage of the relevant program expenditures, as

⁶Prior to 1977, EPF also resembled a matching formula, inasmuch as the growth rate of transfers was tied to the average growth rate of eligible provincial expenditures.

⁷Whether a reduction of such expenditures in a federation is desirable is, of course, debatable. In theoretical terms, when citizens are mobile among member states in a federation, such transfers may induce socially wasteful migration to recipient states. Under alternative assumptions about local policy formation, however, such transfers may correct existing distortions in migration decisions. See, e.g., Wildasin (1991) for a recent contribution to the debate over redistribution in a federation. We abstract from issues of migration throughout this paper but discuss related issues of fiscal externalities in Section 3.3 below.

⁸Because the growth of overall EPF transfers had been held to less than the rate of GDP growth since the early 1980s, tax point transfers have grown in relative value and cash, determined as a residual, has declined. The cash component has declined from 50 per cent of the total EPF transfer in 1982 to approximately 46 per cent in the three fastest-growing provinces of Ontario, Alberta and British Columbia. Because Quebec receives special tax-point transfers under EPF, its cash payment had declined to only 23 per cent of the transfer. If the status quo arrangements had been maintained, the national average cash transfer was projected to decline to zero early in the next century.

⁹Interestingly, there has never been any vestige of “national standards” with respect to post-secondary education, presumably largely because of Quebec’s adamant position on this subject, even though it is probably easier to make a conventional economic argument for “matching” (spillover) transfers in this field than for the other two covered by CHST.

Table 1: Social expenditures^a and federal transfers, 1995-96

Province	Program expenditures (\$ per capita)	EPF/CAP transfers:		
		cash transfers	total transfers ^b	total as share of expenditures (per cent)
Newfoundland	3738	842	1055	28.2%
P.E.I.	3225	777	1008	31.3%
N.S.	3210	757	1029	32.1%
N.B.	3444	755	1006	29.2%
Quebec	4161	520	1111	26.7%
Ontario	3546	556	961	27.1%
Manitoba	3410	727	1015	29.8%
Saskatchewan	2921	708	965	33.1%
Alberta	3408	539	930	27.3%
B.C.	4370	580	966	22.1%
Canada	3740	578	979	26.2%

Source: Public accounts and authors' calculations.

^aExpenditures on health, post-secondary education, and social assistance.

^bTotal includes cash and tax-point transfers.

in column 4 of the table.¹⁰ Column 4 indicates that the percentage reimbursement rate was above average for six of seven provinces with below-average per capita income.

While the capitation of transfers appears to some to be a natural goal for the reforms, one result may be a lesser degree of interprovincial equity. This is particularly true to the extent that higher spending of some provinces reflects greater expenditure need due to factors that are arguably exogenous to government policy choices, such as demographics. Shah (1996) provides some evidence for the proposition that expenditure needs differ substantially among provinces. He estimates the contribution of demographic and environmental factors to provincial-local expenditures, partially controlling for the discretionary decisions of governments, and argues that exogenous factors explain a substantial component of expenditure differences. By this definition, expenditure need for social services, for example, is estimated to vary between 95 and 108 per cent of the national average for the ten provinces and to be particularly high for the provinces of Ontario and Quebec. Need varies even more widely for health and post-secondary education according to Shah's calculations: for example, Ontario's calculated needs are 33 and 39 per cent above the national average, respectively, for the two categories.

To the extent that demographic and economic factors are regarded as exogenous to provincial government decisions, then, this analysis argues strongly in favour of transfers which are partially responsive to differences in provinces' expenditures and to changes in expenditures over time. In this view, block funding of transfers may exacerbate interprovincial inequities, relative to the matching formula adopted under CAP. An additional adverse incentive effect arising from the move to block funding is discussed in Section 3.3 below.

¹⁰These figures should be interpreted with care, however, as they do not include spending by local governments, which is quantitatively more significant in some provinces.

Table 2: Own-source revenue and equalization transfers per capita, 1995-96

Province	Own-source revenue	Equalization transfer
Newfoundland	3400	1607
P.E.I.	3794	1393
N.S.	3148	1096
N.B.	4126	1185
Quebec	4465	481
Ontario	3870	–
Manitoba	4149	830
Saskatchewan	4872	529
Alberta	5239	–
B.C.	5489	–
Canada	4371	273

Source: Treff and Cook (1995).

2.2 Equalization

The second pillar of fiscal federalism in Canada is the Equalization program. Under Equalization, the federal government makes transfers to provinces with below-average revenue capacity. Such transfers were valued at C\$8.7 billion in 1995-96, or less than half the size of the cash component of CHST. Table 2 shows per capita transfers to the provinces under Equalization in 1994-95, as well as per capita own-source revenues of the provinces.

Equalization entitlements are presently calculated for each of 37 separate revenue categories. A province’s per capita entitlement in a revenue category is equal to its per capita tax base “deficiency” in the category, relative to a per capita standard for the category, multiplied by the calculated national average tax rate for the category.¹¹ Equalization entitlements are summed over all revenue categories; provinces with positive calculated entitlements receive a transfer from the federal government equal to the entitlement,¹² whereas provinces with negative calculated entitlements receive a net transfer of zero. Thus equalization is an asymmetric revenue sharing scheme, raising revenues of deficient provinces to the standard level, but not taxing provinces with larger-than-average tax bases, as would a symmetric scheme.

To discuss the analytics of the formula, define X_{pj} as the measured tax base of province p in revenue category j . Let P represent an index set of all provinces and $S \subset P$ represent an index set of standard provinces. Let n_p represent the population of province p and $n = \sum_{p \in S} n_p$. Then the per capita equalization entitlement of province p for category j is

$$\begin{aligned}
 e_{pj} &= \bar{t}_j \left(\frac{\sum_{i \in S} X_{ij}}{n} - \frac{X_{pj}}{n_p} \right) \\
 &= \bar{t}_j (\bar{x}_j - x_{pj}),
 \end{aligned} \tag{1}$$

¹¹Under the current Representative Five Province Standard (RFPS) system, standard tax bases are calculated as the weighted average per capita tax base of the five “standard” provinces of Quebec, Ontario, Manitoba, Saskatchewan, and British Columbia. The RFPS was instituted in 1982, replacing the earlier national average standard. This change was effected largely to remove the more volatile energy revenues of Alberta from the formula.

¹²Since 1982, the cumulative growth rate of total transfers to provinces under Equalization cannot exceed the rate of GNP growth.

where

$$\bar{t}_j = \frac{\sum_{i \in P} t_{ij} X_{ij}}{\sum_{i \in P} X_{ij}} \quad (2)$$

is the national average tax rate and \bar{x}_j is the weighted-average per capita base of standard provinces and x_{pj} is the per capita base of province p for the category. Consider the case of a receiving province; viz. one for which the sum of entitlements in all revenue categories is positive. The per capita total revenue of p in category j , net of equalization transfers is

$$\begin{aligned} R_{pj} &= t_{pj} x_{pj} + e_{pj} \\ &= \bar{t}_j \bar{x}_j + (t_{pj} - \bar{t}_j) x_j. \end{aligned} \quad (3)$$

Because receiving provinces' tax rates and bases influence national average tax rates and, for standard provinces $p \in S$, representative standard bases as well, local tax policies interact to influence equalization entitlements in complicated ways. In particular, when a receiving province has a large share of national revenues in a category, tax rates have strong effects on equalization transfers and receiving provinces have perverse incentives in choosing tax policies. Such "accounting" effects of the equalization formula were first analyzed by Courchene and Beavis (1973) and have been stressed by Bird and Slack (1990) and Boadway and Hobson (1993), among others. This paper, in contrast, is primarily concerned with the *economic* effects of equalization resulting from the elasticity of tax bases with respect to tax rates, and we analyze incentives when \bar{t}_j and \bar{x}_j are invariant to the receiving province's tax rate t_{pj} , so that, unlike the earlier papers, this analysis applies equally to provinces that are small relative to the federation (and which therefore have only negligible effect on national averages) and to large provinces. A formal model of provincial tax policy incentives under the equalization formula is set out in the following section of the paper.

3 Tax policy incentives under equalization

Consider a local economy with two private goods, consumption x and labour l , and a single public good g . The local government levies a distortionary tax on consumption at specific rate t in order to finance public sector expenditures, and chooses tax and fiscal policy to maximize welfare of a representative consumer.¹³ Suppose that utility of the representative agent is additively separable in g ,

$$U(x, l, g) = u(x, l) + b(g), \quad (4)$$

where u is increasing in x , decreasing in l , and concave in both its arguments, and b is increasing and concave in g . The assumption of separability in (4), while probably excessively restrictive, permits an analysis of governmental transfers that is not complicated by the existence of direct substitution effects between private and public consumption.

Normalize the wage and producer price of consumption to unity and define the agent's indirect utility from private consumption conditional on tax policy as

$$v(t) = \max u(x, l) \quad \text{s.t.} \quad (1+t)x = l. \quad (5)$$

Let $(x(t), l(t))$ solve (5). Note that v is non-increasing and concave in t by standard arguments.

¹³The case of a government maximizing a concave welfare function of the utilities of many heterogeneous consumers is a straightforward but unedifying extension. Alternatively, under some additional conditions, the representative consumer can be regarded as the median voter in the province, who is decisive in choosing tax policies under majority rule.

3.1 Optimal tax policy

As a benchmark for the analysis of equalization, consider initially second-best tax policies for a province receiving a lump-sum, unconditional grant $\bar{e} > 0$. Define $R(t) = tx(t)$ as local own-source revenue. A tax optimum solves

$$\max v(t) + b(g) \quad \text{s.t.} \quad g = R(t) + \bar{e}. \quad (6)$$

The first-order condition to (6) describing the optimal tax and spending policy (t^0, g^0) is

$$-\frac{v_t}{b_g} = x(t^0) \left(1 - \frac{t^0}{1+t^0} \epsilon(t^0) \right), \quad (7)$$

where $\epsilon = -\partial \log x / \partial \log(1+t)$ is the elasticity of demand for x . By Roy's identity, $v_t = -\lambda x$, where λ is the marginal utility of private income. Hence

$$\frac{\lambda}{b_g} = 1 - \frac{t^0}{1+t^0} \epsilon. \quad (8)$$

At the optimum, the marginal rate of substitution between public and private spending is set equal to the marginal cost of public funds (MCPF). This is the standard Samuelson optimality condition, modified to reflect the fact that the public good is financed through distortionary taxation.

Consider, however, the introduction of a program of revenue equalization that pays the local government a transfer

$$e(t, \bar{t}) = \bar{t}(\bar{x} - x(t)). \quad (9)$$

The transfer is financed externally to the province, and the local tax authority is assumed to regard \bar{t} and \bar{x} as exogenous parameters, invariant to t . In the presence of equalization, the province's optimal tax policy again maximizes welfare of the representative agent, subject to the modified budget constraint that public spending equal own-source revenue plus the equalization transfer. Thus a tax optimum under equalization solves

$$\max v(t) + b(g) \quad \text{s.t.} \quad g = R(t) + e(t, \bar{t}). \quad (10)$$

The optimal tax and spending policy (t^*, g^*) now is characterized by

$$\frac{\lambda}{b_g} = 1 - \frac{t^* - \bar{t}}{1+t^*} \epsilon. \quad (11)$$

Comparing (11) to (8), it is evident that equalization induces a substitution effect which lowers the effective marginal cost of public funds, if $\epsilon > 0$ and $\bar{t} > 0$, and leads to *ceteris paribus* increases in local tax rates. Intuitively, the decline in tax bases associated with distortionary taxation is partially offset through transfers, lowering the burden to local taxpayers of taxation. The effect of equalization on the effective MCPF is particularly clear when $t = \bar{t}$: in this event, the right-hand side of (11) reduces to unity, so that the effective marginal excess burden of local taxation is zero when the local tax rate is set equal to the standard level \bar{t} . Hence equalization tends to raise tax rates above the chosen standard level.

We formalize this intuition with the following proposition. Proofs of this and other results are in an appendix.

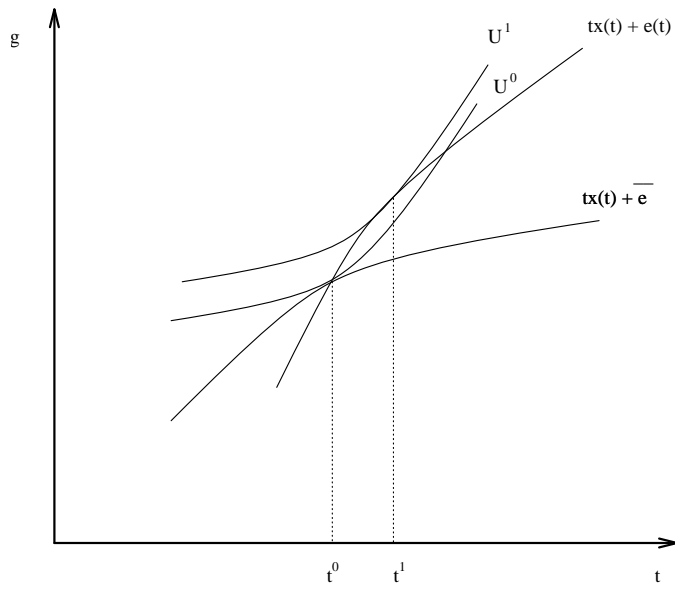


Figure 1: Increase in distortionary taxation under an equalization grant

Proposition 1 *Let t^0 solve (6) for some \bar{e} , and suppose that $e(t^0, \bar{t}) = \bar{e}$. Then $t^* \geq t^0$ if $x(t)$ is non-increasing in t .*

The proposition is illustrated in Figure 1. The line labelled $tx(t) + \bar{e}$ represents the provincial government budget constraint given the lump-sum grant \bar{e} . The line labelled $tx(t) + e(t)$ represents the corresponding budget constraint in the presence of the RTS equalization grant. Since $x(t)$ is non-increasing, this budget constraint is everywhere the steeper of the two, so that the optimal tax rate t^* , given by the point of tangency with an indifference curve, lies above and to the right of the optimum t^0 in the case of the lump-sum grant.

Inspection of Figure 1 also indicates that equalization diminishes welfare of the representative citizen, relative to the equivalent lump-sum grant, due to the additional deadweight loss associated with the higher provincial tax rate.¹⁴ To show this formally, define a measure of willingness to pay for the equalization grant by

$$T(w, \bar{t}) = \min_{(t, g)} g - \bar{t} \cdot \bar{x} - (t - \bar{t}) \cdot x(t) \quad \text{s.t.} \quad v(t) + b(g) \geq w. \quad (12)$$

$T(w, \bar{t})$ defines the net lump-sum transfer to the local government required to achieve social welfare w , given that an equalization standard \bar{t} is in place and that local tax rates are chosen optimally. The function T plays the same role in the analysis as does the consumer expenditure function in the standard analysis of optimal personal tax policies of a single government. It is possible to exploit this analogy to establish that equalization creates additional deadweight loss, in the sense that the representative citizen's willingness to pay for the equalization grant is less than the value of the transfer. This is stated formally in the following proposition.

Proposition 2 *The representative citizen's compensating variation for the introduction of equalization is never less than the associated transfer. Moreover, the compensating variation equals the actual transfer if and only if the tax base $x(t)$ is completely price-inelastic.*

It is in this sense that equalization unambiguously increases the distortionary effect of local government taxes and reduces welfare of the representative citizen.

Proposition 1 states that equalization induces substitution toward higher rates of distortionary taxation by welfare-maximizing local governments. It follows that equalization creates welfare losses relative to a benchmark program paying equal unconditional grants, as stated in Proposition 2. Proposition 1 does not however generate empirical predictions about the effect of equalization on observed local tax rates, as the transfers also induce income effects which can lead to reductions in distortionary taxation. In some restrictive cases, however, it is possible to state unambiguously that income effects do not offset the substitution effect identified in Proposition 1. The most immediate such case occurs when local social welfare is quasi-linear in public spending, so that by assumption there are no income effects. The following proposition states that, in the quasi-linear case, equalization results in a higher local tax rate than would be chosen for any level of the lump-sum grant \bar{e} .

Proposition 3 *Suppose that $b(g) = \theta g$, for some $\theta > 0$. Then $t^* \geq t^0$ for all \bar{e} if x is non-increasing in t .*

The argument we have presented may be somewhat reminiscent of Feldstein's (1975) analysis of local government incentives in a system of intergovernmental transfers. Feldstein studied a transfer

¹⁴This assumes no tax exporting. See Section 3.3.

formula known as “direct power equalization” (DPE), under which the transfer to a local government is proportional to its fiscal deficiency and to its own tax rate, so that in our notation a DPE transfer is

$$d = t(\bar{x} - x(t)).$$

(In contrast, in an RTS system, the transfer is proportional to a standard or national average tax rate; cf. equations (1) and (9).) He showed that, because of diversity in local preferences for public spending, a DPE system in general will not achieve its ostensible goal of “wealth neutrality”—that is, the equalization of local expenditures irrespective of the size of the local tax base. This observation was established in a simple model in which local tax bases were inelastic with respect to tax rates. In contrast, our analysis of incentives under RTS equalization depends crucially on elasticities, as local governments raise rates in order to depress calculated fiscal capacity and induce larger transfers through the equalization formula. In a more general model than that considered by Feldstein (1975), it can be established that both RTS and DPE systems create incentives for local governments to impose more distortionary tax policies. It is difficult to rank the systems with respect to their distortionary effects, however. The relative size of distortions under the two systems depends on the elasticity of tax bases and the parameters of the equalization formulas, and qualitative conclusions are difficult to derive.

3.2 Resource taxes

Theoretical literature studying federal fiscal equalization has frequently given special attention to resource tax bases or, more generally, taxation of rents accruing to fixed factors of production within a province. From the perspective of equalization policy, such taxes have two special features. First, taxation of economic rents is in principle non-distortionary. Thus it might be expected that the tendency for equalization transfers to enhance the distortionary effects of local taxation would not apply to such taxes. Second, resource revenues are source-based taxes. To the extent that the magnitude of source-based tax revenue differs and workers are mobile among provinces, labour may be misallocated in decentralized equilibrium, as migrants move in response to differences in net fiscal benefits, rather than differences in the gross marginal product of labour. This observation has led some analysts to adduce efficiency arguments in favour of equalization of source-based taxes in particular (Boadway and Hobson, 1993).

When the tax policy decisions of local governments are regarded as endogenous to the equalization policy, this conclusion may be reversed. Equalization has the potential to correct fiscal externalities associated with interprovincial differences in net fiscal benefits, but the greater excess burden of taxation associated with the policy may more than offset the welfare gains resulting from improved interprovincial allocation. This observation remains true even when equalization is confined to source-based resource revenues, and we adopt the (probably extreme) assumption that such taxes are non-distortionary.

To establish this, consider again the three-good model of Section 3.1, extended to incorporate equilibrium producer surplus, which may be interpreted as resource rents. The representative citizen in the local province chooses consumption x and labour supply l to solve

$$v(\tau, w) = \max_{(x,l)} u(x, l) \quad \text{s.t.} \quad x = (1 - \tau)wl \tag{13}$$

given the gross wage rate w and income tax rate τ . Let $l((1 - \tau)w)$ solve (13). The competitive production sector hires labour to produce the consumption good with the decreasing-returns-to-scale technology $y = f(l)$, so that $f' > 0$ and $f'' < 0$ by assumption. Profit-maximizing labour

demand $l^d(w)$ solves

$$F(w) = \max_l f(l) - wl. \quad (14)$$

Producer surplus $F(w)$ accrues in the first instance as a rent to owners of a fixed factor of production, but all the rent is taxed by the local government to finance a portion of public spending g . Notice that this fixed-factor levy is *per se* non-distortionary, and that it is always optimal for a welfare-maximizing government to tax away 100 per cent of the rent.

A competitive private market equilibrium given tax policy τ is therefore described by a labour supply function $l((1 - \tau)w)$ and demand function $l^d(w)$ solving (13) and (14) respectively, and a gross wage rate $w^*(\tau)$ such that

$$l((1 - \tau)w^*(\tau)) = l^d(w^*(\tau)). \quad (15)$$

Let $l^*(\tau) = l((1 - \tau)w^*(\tau))$ be equilibrium labour supply and $F^*(\tau) = F(w^*(\tau))$ be the equilibrium fixed-factor tax base. Observe that

$$\frac{dF^*(\tau)}{d\tau} = -l^*(\tau) \frac{dw^*(\tau)}{d\tau} \leq 0 \quad \text{if and only if} \quad \frac{dw^*(\tau)}{d\tau} \geq 0. \quad (16)$$

so that local increases in income tax revenue “crowd out” fixed-factor tax revenue.

An optimal local tax policy equates the marginal rate of substitution between public and private consumption to the effective marginal cost of public funds, given the transfer formula, so that

$$\frac{v_\tau}{b_g} = \frac{dg}{d\tau}. \quad (17)$$

Consider first the case of an unconditional lump-sum transfer \bar{e} to the local province. The government budget constraint is

$$g(\tau) = \tau w^*(\tau) l((1 - \tau)w^*(\tau)) + F(w^*(\tau)) + \bar{e}. \quad (18)$$

Total differentiation of (15) yields

$$\frac{dw^*(\tau)}{d\tau} = \frac{w}{1 - \tau} \frac{\epsilon^s}{\epsilon^s + \epsilon^d} \quad (19)$$

where ϵ^s and ϵ^d are the wage elasticities of supply of and demand for labour, respectively.

Differentiating (18) and substituting (19) leads to the following expression for marginal tax revenue under the lump-sum federal grant:

$$\frac{dg}{d\tau} = wl \frac{\epsilon^d}{\epsilon^s + \epsilon^d} \left(1 - \frac{\tau}{1 - \tau} \epsilon^s \right). \quad (20)$$

In this case, optimal tax policy takes account of the effect of the wage tax on fixed-factor rents accruing to the local government, and the MCPF is scaled up, inversely proportionally to $\epsilon^d/(\epsilon^s + \epsilon^d)$.

When fixed-factor rents are equalized among provinces in the federation, the feedback from distortionary local taxes to rents is eliminated, the effective MCPF is reduced, and distortionary tax rates may rise in consequence. Consider a transfer formula $e(\tau) = \bar{F} - F(w^*(\tau))$, which equalizes source-based taxes at some exogenous level \bar{F} . The government budget constraint is

$$g(\tau) = \tau w^*(\tau) l((1 - \tau)w^*(\tau)) + \bar{F}. \quad (21)$$

Differentiating (21) and substituting (19),

$$\frac{dg}{d\tau} = wl \left(\frac{\epsilon^d}{\epsilon^s + \epsilon^d} \left(1 - \frac{\tau}{1 - \tau} \epsilon^s \right) + \frac{\epsilon^s}{\epsilon^s + \epsilon^d} (1 - \tau) \right). \quad (22)$$

Comparing (20) and (22), it can be seen that equalization increases the tax-responsiveness of net local revenues, relative to the lump-sum federal grant, and decreases the effective marginal cost of public funds. Hence, compensating for income effects, equalization results in higher optimal tax rates than an equivalent lump-sum grant. The techniques applied in the proof of Proposition 1 also establish the following formal statement of the result. Let τ^0 maximize welfare subject to (18) and τ^* maximize welfare subject to (21).

Proposition 4 *Suppose that $e(\tau^0) = \bar{e}$. Then $\tau^* \geq \tau^0$ if $l((1 - \tau)w)$ is non-increasing in τ and $l^d(w)$ is non-increasing in w .*

When labour is elastically supplied and demanded, the income-compensated effect of equalization is to increase distortionary taxes. This is so even if equalization is confined to a revenue category, such as rents to fixed factors of production, which is itself non-distortionary.

3.3 Fiscal externalities

The analysis of the paper has been conducted in a partial equilibrium context of a single local province and a federal authority. In this environment, undistorted local government tax policy is second-best optimal, so that an equalization grant results in welfare losses, relative to an equivalent lump-sum grant. More generally, interactions among governments may lead to equilibrium tax policies that are inefficient in decentralized equilibrium. In such circumstances, the welfare implications of the analysis may be undermined and possibly reversed.

Dahlby (1996) has recently analyzed the direct and indirect fiscal externalities that can occur in a federation, taking into account both the “horizontal” interdependencies between provinces (e.g. tax exporting and tax competition) and the “vertical” interdependency between federal and provincial governments (e.g. overlapping tax bases, deductibility, piggy-backing).¹⁵ In the presence of such externalities, the marginal cost of public funds (MCPF) perceived by different governments will deviate from the total or social MCPF, and Nash equilibrium tax rates will be non-optimal. Dahlby (1996) suggests that in a federation relying on distortionary taxes a matching transfer is needed to equalize the MCPF across governments by adjusting tax rates through transfers in a manner which depends upon both the elasticities of tax bases and rates and distributional goals.¹⁶ For example, leaving aside the distributional issue, when producer prices are fixed, the matching rate with respect to tax exporting (assuming no interdependence between local tax sources) should be equal to the (negative) proportion of the taxed good consumed by non-residents. (That is, there would be no matching if all the tax burden is exported.) With tax competition, the appropriate matching rate

¹⁵Dahlby (1996) defines “direct” fiscal expenditures to be those directly affecting the utility functions of non-residents and “indirect” externalities to be those that affect the budget constraints of other governments. The former (called “private consumption effects” by Mintz and Tulkens, 1986) are always horizontal; the latter (called “public consumption effects” by Mintz and Tulkens, 1986) may be either horizontal or vertical.

¹⁶In this framework, an optimal expenditure matching grant would be one that both incorporates benefit spillovers (as in the traditional approach) and any net revenue spillovers (i.e., revenue generated in other provinces by the expenditures in question). As Dahlby and Wilson (1995) have noted, the move away from matching to per capita transfers in financing Canada’s social programs—see Section 2 above—seems particularly undesirable from this perspective with respect to spending on post-secondary education, where both sorts of spillovers seem most likely to be important.

is the additional revenue accruing to other provinces when province i raises an additional dollar from taxing a commodity. And when there is vertical tax base overlap, the (negative) matching rate equals the reduction in federal tax revenues when province i raises an additional dollar from the common tax base.¹⁷

What does this analysis imply for Canada? Both provincial and federal governments derive most of their revenues from corporate and personal income taxes and sales and excise taxes. Tax exporting and tax competition seem likely to be significant sources of horizontal fiscal externalities. Dahlby and Wilson (1995) suggest, for example, that greater tax competition among provinces may be one reason why corporate income taxes are lower in Canada than in Australia (where only the federal government levies such a tax). Tax base overlap between federal and provincial governments is equally prevalent, however, and has the opposite effect, reducing the perceived MCPF of “shared” taxes and hence inducing provinces (to the extent they are not restrained by horizontal competition for mobile tax bases) to levy higher taxes.

As we have argued in Sections 3.1 and 3.2, the present Equalization system in effect reinforces this tendency. On the other hand, when tax bases are mobile among provinces in a federation, local government tax policies have external effects on residents of other provinces, as each province’s choices of tax rates influence the level and tax responsiveness of revenues in other provinces. In some circumstances, it can be established that Nash equilibrium tax rates of the decentralized game are below second-best levels. When this is the case, RTS equalization may conceivably reduce the effective tax responsiveness of local government revenues, raise equilibrium tax rates, and result in welfare gains, relative to the decentralized Nash equilibrium. In effect, equalization serves partially to “cartelize” local governments, inducing them to internalize a portion of the fiscal externalities resulting from local tax policy. This observation echoes the casual argument of many authors (e.g. Brennan and Buchanan, 1980) that intergovernmental transfers in federal systems tend to centralize authority in a federation and may result in higher levels of taxation.¹⁸ What this paper demonstrates, however, is that this phenomenon can be attributed to the direct substitution effects of an equalization grant.

Our analysis also suggests that there be little reason for policy analysts to be sanguine about the ability of the central government to implement transfer policies that correct the fiscal externalities that Dahlby (1996) describes. While it might in principle be possible to calculate matching rates which equate private and social MCPFs at the optimum, it need not follow that the optimum could in fact be implemented through such linear taxes and subsidies. Instead, such a transfer system would simply create further opportunities for provinces to “game” the system through the kinds of tax-policy distortions we have analyzed above.¹⁹

Much clearly remains to be explored concerning the interaction of fiscal externalities and the tax policy incentives of Equalization. Only three additional points will be mentioned here. First, it is far from clear that it is reasonable to expect Nash behaviour in a “small-numbers” federation like Canada, with only ten provinces, especially when a single province (Ontario) accounts for 40 per cent of the economy. In these circumstances, some form of explicit or implicit cooperative

¹⁷See Boadway and Keen (1996) for a further discussion of this case when the federal government can move first in setting its tax rates.

¹⁸For a very different analysis suggesting that the role of equalization transfers is essentially to achieve “competitive stability” in a federation by allowing provincial governments to compete on a more equal basis, see Breton (1996). The present paper follows the dominant tradition of fiscal federalism analysis in assuming that the federal government is, so to speak, the fount of welfare knowledge, although it is, as argued in Bird and Chen (1996), unlikely that this model has much explanatory power with respect to federal–provincial fiscal relations in Canada.

¹⁹For a discussion of some practical and theoretical problems in the design of implementable transfer policies, see Smart (1996).

behaviour seems likely to occur. Second, the distortions arising from vertical fiscal externalities reinforce the more traditional “political accountability” arguments for disentangling provincial and federal revenues.²⁰ Third, despite the increased attractiveness of tax separation, both fiscal capacity (Dahlby and Wilson, 1994) and factor mobility (Boadway and Flatters, 1982) arguments suggest that an Equalization scheme constitutes an inherent part of any “optimal” fiscal federal structure. If so, the arguments in the present paper suggests strongly that more attention needs to be paid to the effects of such transfers on tax policy incentives.

4 Conclusion

In a federation in which fiscal decisions are decentralized to local governments but significant revenue powers remain in the control of the central government, transfer policies should ideally be designed to take into account the incentives they create for local governments, as well as their implications for horizontal fiscal equity. If such transfers are horizontally redistributive, then a conflict inevitably arises between inter-jurisdictional equity and the efficiency of incentives provided to local governments. In this respect, the optimal design of a fiscal federal system must address an equity–efficiency trade-off analogous to that existing in systems of personal taxation. In Canada, federal transfers in respect of provincial social policy expenditures have been evolving toward a system of equal per capita lump-sum transfers. Except for income effects, such a system should in principle leave provincial spending policies undistorted, which may be desirable in some circumstances. Such a policy is not, however, responsive to differences in expenditure need. Horizontal imbalances in Canada are redressed in part through a system of revenue equalization based on the representative tax system approach. But this formula may induce higher levels of distortionary taxation in receiving provinces than is optimal. By raising the rates applied to elastic tax bases, provinces can depress the base and induce larger transfers through the Equalization formula. In effect, a portion of the marginal excess burden of taxation is compensated by transfers and tax rates are too high in consequence.

²⁰Note that similar, albeit less serious, problems arise when state or local taxes are deductible for federal tax purposes or when (as in many countries) fixed percentages of specific federal levies are channelled to state and local governments.

Appendix

Proof of Proposition 1. Since t^0 is optimal for (6),

$$v(t^0) + b(t^0 x(t^0) + \bar{e}) \geq v(t) + b(tx(t) + \bar{e})$$

for all $t \leq t^0$. Since x is non-increasing in t by assumption, e is non-decreasing in t by (9). Hence $\bar{e} = e(t^0, \bar{t}) \geq e(t, \bar{t})$ for all $t \leq t^0$, so that

$$v(t^0) + b(t^0 x(t^0) + e(t^0, \bar{t})) \geq v(t) + b(tx(t) + e(t, \bar{t}))$$

for all $t \leq t^0$. It follows that if t^* solves (10) then $t^* \geq t^0$. \square

Proof of Proposition 2. Define $(t^c(w, \bar{t}), g^c(w, \bar{t}))$ as the solution to the minimization problem (12) defining T . Two properties of T , analogous to properties of the expenditure function in the analysis of consumer demand, are important in what follows. First, if T is differentiable, by the envelope theorem,

$$\frac{\partial T(w, \bar{t})}{\partial \bar{t}} = x(t^c(w, \bar{t})) - \bar{x} \quad (23)$$

Hence T is decreasing in \bar{t} if and only if the province is deficient in the tax base, given its optimal policy. Second, T is concave in \bar{t} . The proof of this is standard. Choose any \bar{t}_1 and \bar{t}_2 and let $\bar{t}_0 = \lambda \bar{t}_1 + (1 - \lambda) \bar{t}_2$ for $\lambda \in [0, 1]$. Let (t_i, g_i) solve (12) for \bar{t}_i , $i = 0, 1, 2$. By definition of T ,

$$g_i - \bar{t}_i \cdot \bar{x} - (t_i - \bar{t}_i) \cdot x(t_i) \leq g_0 - \bar{t}_i \cdot \bar{x} - (t_0 - \bar{t}_i) \cdot x(t_0)$$

for $i = 1, 2$. Multiplying and summing the two inequalities,

$$\lambda T(w, \bar{t}_1) + (1 - \lambda) T(w, \bar{t}_2) \leq g_0 - \bar{t}_0 \cdot \bar{x} - (t_0 - \bar{t}_0) \cdot x(t_0) = T(w, \bar{t}_0),$$

so that T is concave.

Let w^0 be social welfare in the absence of equalization and $t^0 = t^c(w^0, 0)$ be the associated tax rate. By definition, $T(w^0, \bar{t})$ is the net transfer to the region required to attain benchmark welfare level w^0 . Equivalently, $T(w^0, \bar{t})$ is the consumer's compensating variation for the introduction of equalization at standard tax rates \bar{t} . The actual transfer to the local government under equalization is

$$\bar{t} \cdot (\bar{x} - x(t^c(w^0, \bar{t}))) = \bar{t} \cdot \frac{\partial T(w^0, \bar{t})}{\partial \bar{t}}.$$

Since T is concave in \bar{t} and $T(w^0, 0) = 0$ by construction,

$$\bar{t} \cdot \frac{\partial T(w^0, \bar{t})}{\partial \bar{t}} \leq T(w^0, \bar{t}) \quad (24)$$

for all $\bar{t} \geq 0$. Conversely, suppose that the distortionary effects of taxation are not higher under equalization, so that (24) holds as an equality for all \bar{t} . Then $\partial T / \partial \bar{t}$ is independent of \bar{t} , so that (23) implies x is independent of t . Thus equalization does not result in higher deadweight loss than the lump-sum transfer only if market demands for commodities are perfectly inelastic with respect to prices. \square

Proof of Proposition 3. By the definitions of the tax optima (6) and (10) for the case of quasi-linear preferences for public spending,

$$\begin{aligned} v(t^0) + \theta(t^0 x(t^0) + \bar{e}) &\geq v(t^*) + \theta(t^* x(t^*) + \bar{e}) \\ v(t^*) + \theta(t^* x(t^*) + e(t^*, \bar{t})) &\geq v(t^0) + \theta(t^0 x(t^0) + e(t^0, \bar{t})), \end{aligned}$$

which implies, given (9),

$$\theta \bar{t}(x(t^0) - x(t^*)) \geq 0.$$

Hence if x is non-increasing in t then $t^* \geq t^0$. \square

References

- ACIR (ADVISORY COMMISSION ON INTERGOVERNMENTAL RELATIONS) (1962): *Measures of State and Local Fiscal Capacity and Tax Effort*, Washington: U.S. Government Printing Office.
- AHMAD, E. AND R. THOMAS (1996): "Types of transfers: A general formulation," in *Financing decentralized expenditures: An international comparison of grants*, ed. E. Ahmad, Aldershot UK: Edward Elgar.
- BIRD, R. AND D. CHEN (1996): "Federal finance and fiscal federalism: Two worlds of Canadian public finance," Discussion paper, International Centre for Tax Studies, University of Toronto.
- BIRD, R. AND E. SLACK (1990): "Equalization: The Representative Tax System Revisited," *Canadian Tax Journal*, 38, 913–927.
- BOADWAY, R. W. AND F. R. FLATTERS (1982): "Efficiency and Equalization Payments in a Federal System of Government: A Synthesis and Extension of Recent Results," *Canadian Journal of Economics*, 15, 613–633.
- BOADWAY, R. W. AND P. A. HOBSON (1993): *Intergovernmental Fiscal Relations in Canada*, Toronto: Canadian Tax Foundation.
- BOADWAY, R. W. AND M. KEEN (1996): "Efficiency and the Fiscal Gap in Federal Systems," *International Tax and Public Finance*, 3, 137–155.
- BRENNAN, G. AND J. BUCHANAN (1980): *The Power to Tax*, Cambridge UK: Cambridge University Press.
- BRETON, A. (1996): *Competitive Governments*, Cambridge UK: Cambridge University Press.
- COURCHENE, T. J. AND D. A. BEAVIS (1973): "Federal-Provincial Tax Equalization: An Evaluation," *Canadian Journal of Economics*, 6, 483–502.
- DAHLBY, B. (1996): "Fiscal externalities and the design of intergovernmental grants," *International Tax and Public Finance*, 3, 397–412.
- DAHLBY, B. AND L. WILSON (1994): "Fiscal Capacity, Tax Effort, and Optimal Equalization Grants," *Canadian Journal of Economics*, 27, 657–672.
- DAHLBY, B. AND L. WILSON (1995): "Tax assignment and fiscal externalities in a federal state," Discussion paper, University of Alberta.

- FELDSTEIN, M. S. (1975): "Wealth neutrality and local choice in public education," *American Economic Review*, 65, 75–89.
- LADD, H. F. AND J. YINGER (1994): "The case for equalizing aid," *National Tax Journal*, 47, 211–224.
- MINTZ, J. AND H. TULKENS (1986): "Commodity Tax Competition Between Member States of a Federation: Equilibrium and Efficiency," *Journal of Public Economics*, 29, 133–172.
- SHAH, A. (1994): "The Reform of Intergovernmental Fiscal Relations in Developing and Emerging Market Economies," Discussion Paper 23, The World Bank Policy and Research Series.
- SHAH, A. (1996): "A fiscal need approach to equalization," *Canadian Public Policy*, 22, 99–115.
- SMART, M. (1996): "Taxation incentives and deadweight loss in a system of intergovernmental transfers," Discussion paper, University of Toronto.
- TREFF, K. AND T. COOK (eds.) (1995): *Finances of the Nation*, Toronto: Canadian Tax Foundation.
- WILDASIN, D. E. (1991): "Income Redistribution in a Common Labour Market," *American Economic Review*, 81, 757–774.