

REDISTRIBUTION, RISK, AND INCENTIVES IN EQUALIZATION: A COMPARISON OF RTS AND MACRO APPROACHES*

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1 INTRODUCTION

Equalization is sometimes called the “glue” that holds the Canadian federation together. Perhaps, but those bonds have been loosening in recent years. The program has been subject to an unparalleled degree of scrutiny (and indeed criticism) in the media, and the political tug-of-war over the program has intensified since its last renewal. According to its critics, Equalization is unnecessarily complex and non-transparent, and most importantly it creates perverse incentives for provincial governments, changing the way they tax economic activity and foster economic development, to the detriment of all Canadians. To this list one might add the argument (elaborated below) that Equalization payments are unnecessarily volatile, inhibiting stabilization of revenues and making fiscal planning more difficult for provincial governments.

If these critiques are valid, then what is to be done? Since the inception of the program, transfers have been calculated on the basis of the “representative tax system” (RTS) approach, in which payments to each province reflect the deficiency, relative to a standard, in the revenues it could collect from each measured base, if it

levied the average of all provinces’ tax rates. Increasingly, it appears that the common critiques of Equalization relate to the mechanics of the RTS approach, and the incremental reforms of previous years may no longer be sufficient to satisfy the critics. An alternative is a wholesale reform, in which the RTS approach is abandoned, and transfers are calculated on the basis of a single, “macro” indicator of each province’s deficiency in economic activity.

Would a macro approach to equalization successfully address the current critiques, and what other problems might arise with the new formula? To answer these questions, this paper proceeds in two parts. In the first part, I provide a brief assessment of the current program. I describe its likely effects on incentives of provincial governments—through the so-called “tax-back problem”—and I use historical data to assess its role in redistributing and stabilizing provincial revenues in Canada. In brief, I argue that Equalization has been an extraordinarily effective tool for redistributing revenue capacity among the provinces—that is, for eliminating predictable, average differences in capacity of the provinces. As a tool for stabilizing provincial finances—that is, smoothing year-to-year changes in revenue capacity—however, the

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program has been far less successful. I argue that the RTS system by its nature actually introduces new fiscal risks for the receiving provinces rather than eliminating existing ones. This is unfortunate, since federal revenue sharing systems, if correctly designed, can serve an important "insurance" function, pooling the risks that governments face and creating gains for all. The stabilization function seems particularly important in the Canadian context, given the high costs—both political and economic—of deficit finance for the provinces.

In the second part of the paper, I attempt an assessment of a particular macro formula, in which transfers to each province are based on the deficiency in its per capita income (defined as GDP at market prices) relative to the national average. I argue that in such a formula income should be regarded as merely a proxy for revenue capacity, and not a target *per se*. That is, the goal of provincial equalization should remain equalization of revenue capacity of governments, and not redistribution of income among individual Canadians, but this would be done indirectly, through the income measure. The chief gain from the reform would be improvements in provincial government incentives—that is, a reduction in the "tax-back" problem—which would plausibly lead over time to decreases in provincial tax rates and increases in regional development to the benefit of all. Arguably, the reform would increase the *political* stability of the program as well.

How good a proxy is income for revenue capacity? On the basis of historical data, I argue that the macro formula would replicate the redistributive function of the RTS fairly well. During the 1982-98 period, a formula that paid provinces 17.5 cents for each dollar its per capita GDP fell below the national average would have given most provinces an average transfer very close to actual levels. However, this formula would have had the unfortunate side effect of *worsening* revenue volatility. This reflects the fact that provincial products are considerably more volatile than the aggregate of tax bases,

since provinces tend to tax more heavily those components of GDP (such as personal income and consumption) that are more stable over time. Reasonable revenue stability could be obtained from a formula that paid provinces only about 10 cents in the dollar for income differences, but large lump-sum grants would be needed if provinces were to be compensated for the loss in expected transfers.

In summary, the macro approach could reduce the tax-back problem, but at the cost of less redistribution or less stabilization than the current formula. This highlights the existence of a tradeoff, common from other areas of the economics literature, between redistribution or insurance in any transfer scheme and the incentives it creates for transfer recipients. Which factor is more important depends on the objectives of the interested parties, but the case for a macro formula appears strong enough to warrant further investigation.

2 PROBLEMS WITH THE RTS APPROACH

This section provides an assessment of the current approach to Equalization, as prelude to the case advanced below for macro formula. First, I describe the mechanics of the RTS formula, and then I review the "tax-back" effect and the incentives it creates for provinces in setting tax rates and fostering economic development. (For a more detailed treatment, see Boadway and Hobson (1993).) Finally, I provide an assessment of the role of RTS equalization in redistributing and stabilizing provincial revenue capacities, based on historical data for the period since 1982.

2.1 How it works

The RTS system is designed to allow provinces to obtain the same fiscal resources ("comparable" is the Constitutional term) when they levy the same tax rates, despite differences in the sizes of their tax bases. It pays provinces an amount in respect of each measured tax base equal to the

deficiency, relative to the standard level, in the revenues it could collect from each measured base, if it levied the average of all provinces' tax rates. At present, this calculation is done for 37 separate revenue sources, and the standard tax base is set equal to the population-weighted average of tax bases in the five standard provinces. (This Representative Five Province Standard (RFPS) was introduced in 1982, replacing the similar but more comprehensible Representative National Average Standard (RNAS).) Equalization entitlements are then summed over the 37 categories (with some adjustments for the "generic solution" to tax-back, discussed below) and, if the total is positive, the province is paid its entitlement, subject to the "ceiling" and "floor" provisions that are intended to smooth changes in payouts for both federal and provincial governments.

The mechanics of the basic formula are most easily understood by judicious use of algebra: Consider a single tax base, for which each province i has a measured tax base X_i and collects revenues subject to equalization R_i . Let N_i be the population of each province, and let $R = \sum R_i$, $X = \sum X_i$, and $N = \sum N_i$ be the corresponding aggregates of provincial revenues, tax bases, and population. The RTS system calculates the national average effective tax rate $\bar{t} = R/X$ and determines the standard per capita tax base \bar{x} .¹ The entitlement of each province i in respect of the tax base is then

$$E_i = N_i \bar{t} \left(\bar{x} - \frac{X_i}{N_i} \right)$$

That is, each province's entitlement equals its deficiency in per capita tax base, multiplied by the national average tax rate and by its population. Thus if all receiving provinces do levy the national average tax rates, then their revenues after equalization will indeed be equal.

But even this extended summary of the system hides important complexities in the determinants of actual transfers. Most important of these is measurement of actual tax bases X_i . Since in the absence of tax collection agreements

for most bases provinces can and often do define their own bases quite differently, there is apt to be little agreement on the measurement of deficiencies (Boadway, 1998). Furthermore, for many revenue sources there is no natural definition of the base (lottery revenues, municipal property taxation, and the sale of rights to oil on Crown lands are a few that have caused difficulties), so that proxy measures must be agreed upon and adopted.

Further complexity arises from the proliferation of revenue sources incorporated separately in the formula, up from just three at the inception of the program in 1957 to the current 37.² The profusion of bases—and, in particular, separate calculations of entitlements for a number of closely related bases—may be perplexing to outside observers. When an existing category is separated in two, entitlements of a receiving province increase if it has a smaller measured deficiency on the new category with the lower average tax rate; entitlements decrease if the opposite is true. What principles determine how narrowly categories should be defined? Loosely, if it is feasible and appropriate to tax two categories in similar ways and at similar rates, then the two are comparable sources of fiscal capacity and should be combined in the calculation. When the two are non-comparable—for example, when efficiency considerations dictate that one category be taxed at a substantially lower rate—then separate calculation may be called for. One suspects, however, that actual decisions about categories often depend on implications for the "bottom line" of Equalization, as much as on such abstract principles. The issue is important, because separate calculation for component bases that exist in only a few provinces (such as the offshore oil categories) exacerbate the incentive problems associated with tax-back. I return to this below.

Doubtless, the complexity of the formula has contributed to the view that Equalization is "non-transparent" and therefore less subject to democratic accountability than other government

policies. It is sometimes suggested that non-transparency is desirable, in that it sublimates political conflict and negotiation over the size of intergovernmental transfers. To an outsider, this argument is unconvincing. Interested parties may easily calculate the effect of changes in program parameters on entitlements, and the complexity of the formula gives scope for unlimited conflict over transfers disguised as debate over technical changes. Thus a significant advantage of the macro approach is that it focusses debate on a single parameter, the extent to which provincial income differences should be compensated through transfers.

2.2 The tax-back problem

Since RTS equalization is designed to transfer revenue capacity to have-not provinces, it is not at all surprising that increases in a receiving province's own-source revenues tend to decrease its equalization entitlements. But this "tax-back" phenomenon has struck many in the governments of receiving provinces as excessively punitive. And it has led others to worry that the program distorts fiscal policy incentives for receiving governments, just as a redistributive income tax might be held to create work disincentives for individual taxpayers. There are two aspects of the problem, called "rate tax-back" and "base tax-back," which I describe in turn.

Rate tax-back. Because RTS equalization is calculated on the basis of deficiencies in *tax bases* multiplied by national average tax rates, the program creates no direct incentive for provinces to reduce their tax rates, as would a system that equalized own-source revenues, such as Germany's *Finanzausgleich* (see Barette, Huber, and Lichtblau, 2000). But such a "tax effort" disincentive does arise for individual revenue categories in which most or all of the tax base is in a single receiving province.³ In these cases, the national average tax rate changes nearly proportionately to changes in the province's own tax rate (in the limit the two are equal), so that increases in own-source revenues cause dollar-for-dollar decreases in equalization

entitlements. If the province is not in the standard (the obvious example is the offshore oil categories), the problem is extreme: since the standard base is equal to zero, the province will receive zero net revenue from the base, regardless of what tax rate it levies. Certainly, this creates incentives for changes in provincial tax mix—with higher tax rates on categories in which the province records a base deficiency, or in which the province's share of the base is small, compensated by lower tax rates where the rate tax-back effect is in operation.

While cases of this are rare, they do occur, especially given the tendency to establish new revenue categories in the formula for bases which receiving provinces tend to tax at rates below the national average. (The alternative of folding the bases into broader categories would substantially reduce the rate tax-back problem but, as discussed above, would have a very negative effect on the entitlements of affected provinces.) Since 1993, the federal government has adopted the "generic solution" to the problem, which applies when 70 per cent of any base accrues in a single province. In such cases, only 70 per cent of revenues in the category are subject to equalization. In effect, the tax-back rate is thus reduced from 100 to 70 per cent.

Base tax-back. While the rate tax-back problem is rare, the base tax-back problem is pervasive, and it has the potential to create much more serious harms in provincial taxation decisions. Courchene (1994) pointed out that, since RTS equalization pays provinces for the deficiency in tax bases, multiplied by national average rates, an increase in the tax base of a receiving province is also taxed back through the formula. If the province levies the national average rate on its own base, the effective rate of tax-back as a percentage of revenues is exactly 100 per cent. If the provincial rate is below the national average, however, then tax-back even exceeds 100 per cent. Thus, Courchene argued, the RTS formula deters governments in receiving provinces from attracting new investment and developing new revenue sources. As such, the program may

create a “cycle of dependency” for receiving governments. He proposed that the generic solution of partial equalization be extended to all bases to deal with the disincentive problem.

Smart (1998) argues that the adverse incentive effects of Equalization are even more extensive and potentially harmful. Under an RTS formula, receiving provinces have a financial incentive to set tax rates too high, above efficient levels. Intuitively, high tax rates tend to depress tax bases, as economic activity shifts to other provinces or to other, more lightly taxed forms. In the absence of Equalization, provinces bear the full consequences of this “elasticity effect” in the form of lower revenues. But RTS equalization increases transfers to a province when tax bases decline, in effect compensating provinces for some of the deadweight loss created by high tax rates. (Since one way governments may attract new investment is by offering tax cuts and other financial incentives, this argument is really just a concrete example of how Courchene’s disincentive effect might operate.) This effect is clearest when considering a receiving province with a tax rate equal to the national average for the base: At this point, further increases in the rate will appear to create no deadweight loss to the province, as the increase in Equalization transfers exactly compensates for the losses in own-source revenue. Thus Equalization tends to drive tax rates in receiving provinces above the national average. As well, Equalization creates incentives to change the *tax mix*: provinces can increase federal transfers by relying more on tax bases that are very elastic or which have high national average tax rates, and less on other bases.

While these arguments are advanced today by many, there is little hard evidence that the structure of the program has actually influenced provincial decisions about tax rates and tax bases. Hayashi and Boadway (2001), examining average effective business tax rates, find some evidence that receiving provinces respond less to tax rate changes by their neighbours than do non-receiving provinces (cf. Cavlovic and

Jackson, 2001). This is consistent with the notion that Equalization insulates receiving provinces from the pressures of tax competition and so allows them to set higher rates.⁴ However, the evidence is quite indirect, and more work on this is needed.

Less formally, there is anecdotal but convincing evidence that, in a small number of cases, Equalization considerations have largely determined some provincial policy decisions. The recent and protracted negotiations over development of the Voisey’s Bay nickel deposit is an apposite case. It seems plausible to think that there is some effective tax rate on royalties from the project at which both Inco and the Government of Newfoundland and Labrador would prefer to see the project undertaken. But the current formula drives a wedge between the rate that is paid by Inco and the rate received by Newfoundland—the difference being the national average rate for the base that is effectively paid to the federal government through the tax-back effect.

2.3 Risk and redistribution in Equalization

Even if one comes to the issue not to praise Equalization but perhaps to bury it, it seems important to have a firm understanding of how the RTS formula operates and what it achieves. This section offers a brief analysis of how Equalization performs on two criteria that are important to any intergovernmental transfer system: redistribution of revenues among provinces and stabilization of revenue changes over time.

The redistributive function. In principle, the current program should by the nature of the formula completely equalize revenue capacities of the seven “have-not” provinces. But this ignores the ceiling and floor provisions, the periods when Saskatchewan’s entitlements were negative so that it was not subject to Equalization, and most importantly the fact that the program does not operate on a “net” basis, equalizing provinces above the standard level. To

Table 1: Transfers and redistribution

	coefficient	standard error	R^2
1. Equalization transfers			
Receiving provinces	-0.89	0.02	0.97
All provinces	-0.39	0.02	0.67
2. Total federal transfers			
Receiving provinces	-1.04	0.04	0.86
All provinces	-0.45	0.03	0.60

Notes: Estimates of model (1): regressions of transfers on revenue yields and year fixed effects for the 1982-98 period.

gain some sense of the actual effects of the program, I provide some basic regression analysis of actual transfers and revenues for the Canadian provinces in the 1982-98 period. Throughout the following analysis, I employ data on provincial gross domestic products at market prices, provincial government revenues, and total federal transfers to provincial governments from the Provincial Economic Accounts of Statistics Canada, and data on measured provincial tax rates and tax rates, provincial population, and actual Equalization transfers obtained from the federal Department of Finance. In all cases, nominal variables are deflated using the national implicit price index for GDP at market prices and expressed in 1999 dollars.

To evaluate the redistributive function of transfers, I estimate an equation of the form

$$e_{it} = \alpha_t + \beta(r_{it} - \bar{r}_t) + \epsilon_{it} \quad (1)$$

where e_{it} is real transfers per capita to province i in year t , r_{it} is a measure of real per capita own-source provincial revenues, and \bar{r}_t is the weighted average of the r_{it} variables for all ten provinces. In equation (1), β measures the extent to which differences in provincial revenues are compensated through transfers, and is the main parameter of interest to be estimated. The

parameters α_t are “year fixed effects,” capturing the extent to which unobserved events over time to lead to changes in transfers received by all, which are independent of revenue differences. Thus the estimated β captures the degree to which transfers redistribute horizontally, averaged over the 17 years in the sample. An obvious objection to using actual provincial revenues on the right-hand side of (1) is that these reflect differences in tax rates as well as tax bases, which Equalization was never intended to compensate. For this reason, I replace revenues by the “yield” of each province’s bases—that is, the sum of its measured tax bases in each category subject to Equalization, multiplied by the national average rate for that base and year.

Table 1 reports estimates of β for a number of cases. In the first part of the table, the left-hand side variable is actual Equalization transfers, and the regression is performed first for the seven receiving provinces and then for all provinces. In the first case, the estimate is -0.89 , indicating that 89 per cent of differences among the receiving provinces are equalized by the program.⁵ The very high R^2 for the regression indicates that the redistributive function has operated consistently over time and among provinces. The second estimate is -0.39 ,

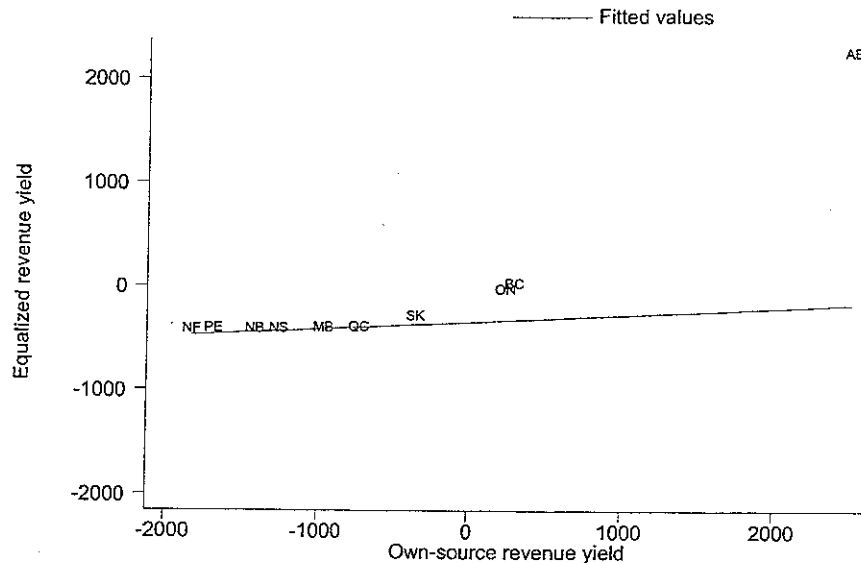


Figure 1: The redistribution function of equalization

indicating the exclusion of the three non-receiving provinces from the formula significantly reduces the average degree of redistribution among the provinces. The second half of Table 1 presents results for the same regressions when the left-hand side variable is total federal transfers to provinces. Estimates of β are slightly higher in these cases, indicating the redistributive nature of other federal fiscal arrangements, but R^2 is lower, indicating that the redistributive effect is less systematic.

Figure 1 presents the results graphically. In the figure, each point marked by an abbreviated province name plots the province's deficiency or excess in tax base yields for the period on the horizontal axis against the corresponding deficiency or excess in yields after Equalization on the vertical axis. The solid line is the regression line for the model estimated for the seven receiving provinces; one minus the slope of this line corresponds to the estimate of β in Table 1.⁶ This line is nearly horizontal, indicating a large β and hence the strong redistributive nature of the program.

The stabilization function. While Equalization was conceived of and operates primarily for redistribution to have-not provinces, it also plays a role in stabilizing provincial own-source revenues. Since Equalization is a kind of revenue-sharing system, it acts to "insure" governments against cyclical, adverse fiscal conditions that affect some but not all provinces. This is a very desirable property of intergovernmental transfers, since stable net revenues aid governments in fiscal planning exercises and reduce the costs (whether economic or political) of short-run deficit finance. The stabilization function creates gains for all provinces, in contrast to the redistributive function, which creates predictable "winners" and "losers" among provinces over time.⁷

To evaluate the stabilization function of transfers, I estimate an equation of the form

$$e_{it} - e_{it-1} = \gamma_i + \beta(r_{it} - r_{it-1}) + \epsilon_{it} \quad (2)$$

where the notation is as in equation (1). In this case, β measures the average extent to which annual changes in a province's revenue yields at national average tax rates are compensated by

Table 2: Transfers and stabilization

	coefficient	standard error	R^2
Equalization	-0.28	0.06	0.15
Total federal transfers	0.10	0.12	0.02

Notes: Estimates of model (2): regressions of one-year change in transfers on one-year change in revenue yields and provincial fixed effects for the 1982-98 period.

increases in federal transfers. Since the regression includes province fixed effects γ_i , the estimate is not affected by province-specific trends in transfers that may be correlated with revenue changes. Table 2 presents estimates of β in model (2) for a sample of the seven receiving provinces over the 1983-98 period. When the left-hand side variable is equalization payments, the estimated β is -0.28 , indicating that, on average, a fall in per capita yields of one dollar is compensated by 28 cents in federal transfers. For this specification, R^2 is 0.15, indicating considerable annual volatility in payments. The data are plotted together with the regression line in Figure 2. When the left-hand side variable is total transfers, the estimated coefficient is positive and insignificantly different from zero.

Are these effects large or small? Certainly, the results suggest that total federal transfers serve no role in stabilizing provincial revenues, but the effect of Equalization alone is significant. To place the estimates in perspective, it is useful to compare the stabilizing effects of other transfer systems. Using a model similar to equation (2), von Hagen and Hepp (2000) examine Germany's *Finanzausgleich* (FA), which pays federal transfers to states with per capita revenue below the national average. They estimate that the program compensates states for 88 per cent of annual per capita revenue changes, far more than the 28 per cent estimate for Canada. This is perhaps unsurprising, since FA is a revenue pooling program, calculating transfers on the basis of actual state revenues, rather than

indirectly on the basis of fiscal capacity as in Canada.

2.4 Summary

The representative tax system approach has been the basis for equalization in Canada for nearly 50 years. As a mechanism to equalize differences in fiscal capacity and permit comparable service provision among provinces, the RTS approach is unparalleled in its directness, comprehensiveness, and responsiveness to changes in the fiscal environment. But, as I have argued, the RTS approach has significant drawbacks as well. The current system has the potential to create severe disincentives for provinces to raise tax revenues in an efficient manner, and to attract new investment and develop new revenue sources. Moreover, the asymmetric nature of Equalization and the greater volatility of revenues in non-receiving provinces lead the formula to have a destabilizing effect on the finances of recipients. Lastly, as provincial tax systems have become more extensive and heterogeneous, the current system of Equalization has become more complex and arguably less well related to true differences in fiscal capacity.

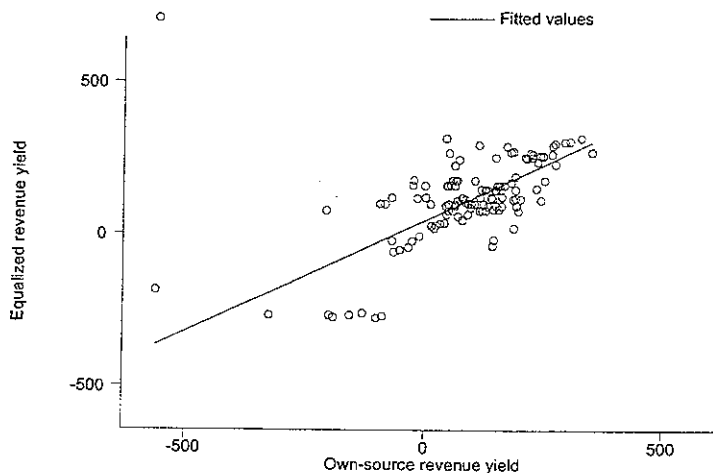


Figure 2: The stabilization function of equalization

3 TOWARDS A MACRO FORMULA FOR EQUALIZATION

Based on these considerations, it may be that the time has come to consider a fundamental change in the structure of Equalization in Canada. Many of the problems with the current system could be addressed if equalization transfers were calculated based on provincial differences in a single aggregate variable that served as a proxy for fiscal capacity as currently measured. Such a “macro approach” to Equalization has long been considered in Canada, and has been analyzed in detail by Courchene (1984), Usher (1995), and Boothe and Hermanutz (1999), among others.

The basic structure of a macro formula is simple. A province’s entitlements under the system are equal to the province’s deficiency in the chosen macro indicator, multiplied by a common scaling factor that serves to control the overall size of the program and its responsiveness to national economic conditions. Symbolically, the formula is

$$\begin{aligned} &\text{Per Capita Transfer to Province } p \text{ in Year } t \\ &= (\text{Scale Factor in Year } t) \\ &\times (\text{Per Capita Macro Deficiency} \\ &\quad \text{of Province } p \text{ in Year } t) \end{aligned}$$

Notice that the current system calculates the entitlement for each revenue source in exactly this way, where the deficiency variable is the level of tax base and the scale factor is the national average tax rate. In what follows we consider mainly a macro formula in which the deficiency variable is provincial GDP at market prices per capita, and the scale factor is a constant. This is the approach taken in Boothe and Hermanutz (1999). As well, we consider a formula that again uses per capita GDP but scales transfers by the fraction of provincial total revenues in national GDP. This is essentially a revenue sharing scheme along the lines considered by Courchene (1984).

3.1 What a macro formula can and cannot do

The macro approach has been proposed by a number of authors, and different arguments have been proposed for its virtues over the RTS approach. In what follows, I offer a brief but opinionated survey of the arguments.

1. **A macro formula can redistribute revenue effectively, while improving provincial incentives.** This point is at the heart of the argument that the intent of the

program should not change, even if the formula were reformed significantly. For most provinces, there is a strong relationship between revenue capacity as measured with the RTS and aggregate income measures like GDP; thus a macro indicator may serve as an effective proxy for fiscal capacity. On the basis of results presented below, I argue that the macro formula would replicate the redistributive function of the RTS fairly well. On the other hand, provincial incentives under a macro formula would improve. Since average tax rates do not enter the macro formula, the “rate tax-back” problem is eliminated entirely. Moreover, I show below that the current pattern of average transfers could be replicated by a formula that equalized about 17.5 per cent of differences in GDP per capita. This would attenuate the “base tax-back” problem somewhat, and it would eliminate incentives to change the tax mix entirely.

2. **A macro formula, unless carefully designed, may destabilize provincial revenues.** However, a macro formula that matched the redistributive function of RTS equalization would have the unfortunate side effect of *worsening* revenue volatility. This reflects the fact that provincial products are considerably more volatile than the aggregate of tax bases, since provinces tend to tax more heavily those components of GDP (such as personal income and consumption) that are more stable over time. This highlights the existence of a tradeoff, common from other areas of the economics literature, between redistribution or insurance and incentives in any transfer scheme.
3. **A macro formula cannot redistribute individual income effectively.** For some authors, an additional advantage of such an income-based macro approach is that it ties transfers more closely to “true” regional inequalities—those associated with income differences among residents. This

argument seems unconvincing.

Equalization exists as a system for redistributing fiscal capacity among provinces and ensuring equal access to public services for residents of all provinces. That is, equalization is intended to enhance horizontal equity for residents of different provinces, but is not directed at vertical equity among taxpayers.⁸ If income redistribution were the goal of the system, that would clearly be better achieved through a system of direct transfers to persons rather than transfers to governments. As argued by Boadway (1998, 54), “The problem with this argument is that it confuses the purpose of equalization [treating] it as if it were a program for redistributing income, when it is really a program for redistributing the ability to provide public services. . . . Income redistribution is obviously better achieved by redistributive taxes combined with transfers to individuals.”

3.2 Evaluating the macro approach

These suggests to us that an income-based macro formula for equalization should be assessed on its ability to link transfers to observed differences in fiscal capacities, while reducing the incentive and insurance problems associated with the current system. In what follows, I show how successfully different macro formulas could have reproduced the actual pattern of Equalization transfers over the 1982-98 period. In other words, I use regression analysis to design hypothetical macro formulas that are as close to “fiscally neutral” as possible, replicating the same transfers as provinces would have received under RTS equalization.

An income formula. The baseline formula fits the general structure of a macro formula outlined above and uses differences in per capita GDP at market prices as the deficiency variable,⁹ while the scale factor is chosen through regression analysis to fit actual Equalization transfers as closely as possible. Thus the estimating equation

Table 3: Alternative transfer formulas

	Income Formula	Revenue Sharing Formula	Stabilization Formula
Scale Factor	-0.175	-0.970	-0.115
Average shortfall in simulated transfers (\$ per capita):			
Newfoundland	6	-6	586
Prince Edward Island	-6	-12	533
Nova Scotia	-61	-70	348
New Brunswick	42	37	469
Quebec	54	51	245
Manitoba	266	260	464
Saskatchewan	-116	-117	42
Standard deviation of change in net revenues (\$ per capita)			
	172	177	149

Notes: "Income formula" refers to the transfer system that is proportional to differences in GDP per capita which fits historical transfers as closely as possible. The "revenue sharing formula" is analogous, except that transfers are further scaled by the ratio of provincial revenues to GDP for each year. The "stabilization formula" is again based on GDP differences alone, but the scale factor is adjusted to minimize the sum of provincial variances in annual changes in net revenue. See the text for details.

is

$$e_{it} = \beta(\bar{y}_t - y_{it}) + \epsilon_{it} \quad (3)$$

where e_{it} is actual Equalization payments and y_{it} is per capita GDP in province i at year t , \bar{y}_t is national average per capita GDP, and β is the scale factor to be estimated.

The first column of Table 3, labelled "Income formula," presents results of the calculation. From the baseline formula, the estimated scale factor is -0.175 . That is, each \$1000 increase in per capita GDP in a receiving province leads to a reduction of Equalization transfers of \$175 per capita. The remaining rows of the column describe how well the formula performs relative to the redistributive and stabilization function of Equalization. I report the average shortfall (or, if negative, excess) in simulated per capita transfers for each province over the sample period, relative to actual

transfers. The average level of actual and simulated transfers for each province is also represented graphically in Figure 3. In brief, the results show that actual transfers could be replicated quite closely for the Atlantic provinces and Quebec, but less successfully for the Western receiving provinces. This reflects the very different mix of tax bases, and so of deficiencies in fiscal capacity, between eastern and western receiving provinces. This is particularly clear for the province of Saskatchewan, for which a surplus in high-yield resource tax bases led to a measured aggregate fiscal capacity in excess of the standard during the early 1980s, despite the fact that GDP per capita remained below the national average. To reinforce this point, the contribution of the major tax bases to each province's equalization entitlement is presented in Table 4.

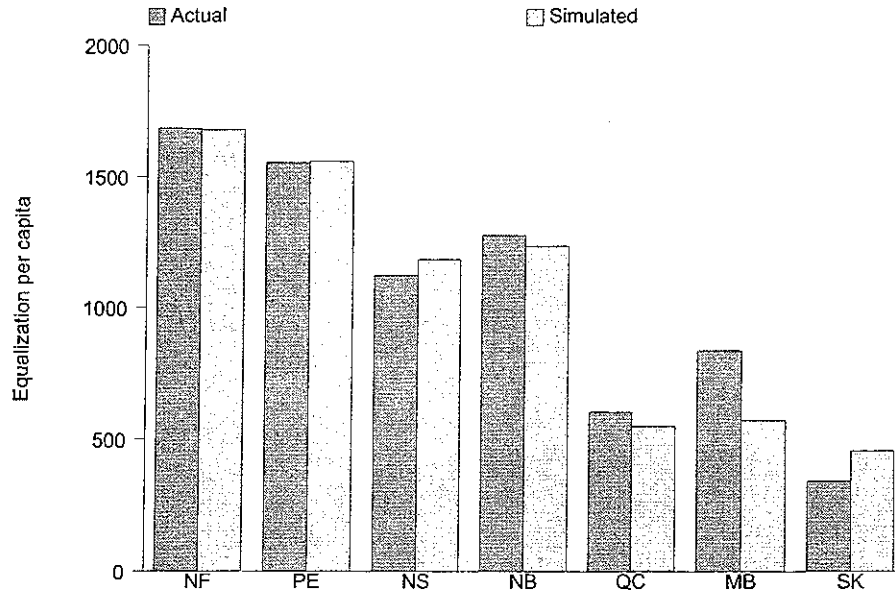


Figure 3: Actual and simulated average transfers

A revenue-sharing formula. As another indication of how well the macro formula performs, Figure A1 plots actual and simulated net revenues of each province for the full sample period.¹⁰ Inspection of the figure shows that simulated transfers are consistently higher than actual transfers early in the sample period, but lower later in the sample period. This reflects the fact that average provincial tax rates were trending up over the period, increasing RTS entitlements, but the income formula uses a constant scale factor to transform income differences into entitlements in each period. This might be regarded as a desirable or undesirable feature of the simulated formula. The trends in tax effort are better captured by an alternative macro formula that multiplies provincial income differences by a single effective tax rate, defined as aggregate provincial revenues as a percentage of national GDP, and then applies a scale factor to calculate transfers. In this case, the scale factor β is estimated from the regression equation

$$e_{it} = \beta \frac{\bar{r}_t}{\bar{y}_t} (\bar{y}_t - y_{it}) + \epsilon_{it} \quad (4)$$

where \bar{r}_t is aggregate provincial revenues subject to equalization per capita in each year, and the

other notation is as before. This is essentially the revenue sharing formula proposed by Courchene (1984), augmented by a scale factor to match actual transfers more closely.¹¹

Results for this case are presented in column 2 of Table 3. The estimated scale factor in this case is -0.97 ; that is, the best fit to actual transfers is obtained when 97 per cent of provincial revenues are notionally pooled and transfers from the pool are paid on the basis of percentage differences in per capita income. The remaining rows of the column show that the revenue sharing formula fits the average pattern of transfers over the sample period about as well as the income formula of column 1.

The best-fit scale factor here is insignificantly different from one, indicating that essentially all of provincial revenues should be subject to equalization under a fiscally neutral macro formula.¹² Consequently, the effective tax-back rate under a macro formula would remain very close to the average of tax-back rates for all bases in the existing RTS approach. However, provincial government incentives would improve in a number of ways: the rate tax-back problem

Table 4: Percentage distribution of equalization entitlements, 1980-99

Province	PIT	Tax base:			
		Business taxes	Sales taxes	Property taxes	Resource taxes
Newfoundland	36.4	10.7	10.1	21.1	1.5
PEI	35.2	11.2	9.8	18.7	8.2
Nova Scotia	32.3	15.0	5.5	21.5	10.2
New Brunswick	36.9	11.4	8.6	22.4	2.8
Quebec	38.5	2.5	11.9	18.9	8.3
Manitoba	37.2	16.2	11.4	13.3	6.1
Saskatchewan	80.5	25.3	10.7	21.9	-62.9

and incentives to distort provincial tax mix would be eliminated entirely under the macro formula.

Stabilization under the macro formula. The final consideration in evaluating the macro formulas is how they would affect the volatility of provincial net revenues. As a summary measure of volatility, Figure 4 shows the standard deviation of annual changes in equalized net revenues for each province, given both the actual transfers and the simulated transfers for the income formula of equation (3). The figure shows that the simulated transfers would have increased volatility in all provinces; the difference is greatest for Saskatchewan, where revenues are subject to the greatest annual variability. This reflects the fact that GDP per capita is more volatile than provincial tax bases. The simple average of provincial standard deviations is reported in the last row in Table 3. The average standard deviation under the income formula is \$172 per capita; the corresponding figure for actual transfers (not reported in the table) is \$133 and for the revenue sharing formula is \$177.

Because year-to-year changes in provincial GDP are more variable than changes in revenue capacity, a macro formula that replicates the average degree of interprovincial redistribution of the RTS formula, as in column 1 of the table, must necessarily increase the volatility of net revenues. To give a sense of how large this effect is, column 3 of the table presents results for an alternative formula, for which transfers are again based on deviations in per capita GDP, but the

scale factor is adjusted to minimize the resulting volatility in net revenues.¹³ In this case, the scale factor falls to -0.115 : only 11.5 per cent of per capita income differences are equalized under a minimum variance formula. Since this would result in far less equalization of average capacity differences than the RTS formula, province-specific block transfers would be needed to guarantee fiscal neutrality for all recipients under the formula. Column 3 reports these block grants in per capita terms for all provinces, and Figure 4 shows the resulting volatility measure for each province.

4 CONCLUSION

RTS equalization has been the basis for redistributive intergovernmental transfers for nearly 50 years. Without a doubt, the program has been extraordinarily effective in meeting its stated objective, equalization of fiscal capacities among provinces. In recent years, however, the consensus supporting RTS equalization as the basis for federal transfers appears to have been unravelling. Critics of the program have emphasized its complexity and non-transparency, and have argued that it creates undesirable fiscal incentives for receiving governments that in some circumstances hamper economic development in Canada and income convergence among the provinces.

Analysis of the pattern of provincial revenues and transfers since 1982 confirms the impression that Equalization has been successful

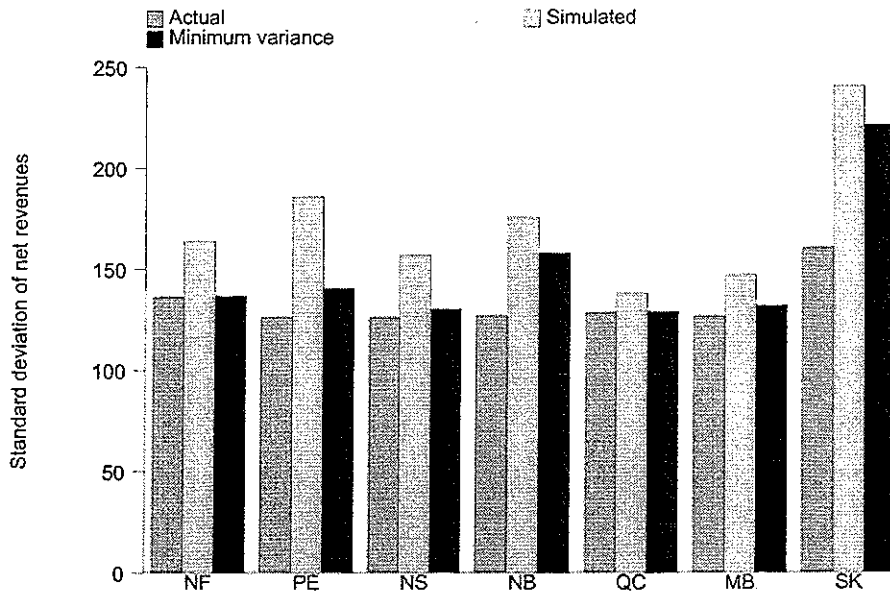


Figure 4: Volatility of actual and simulated net revenues

in eliminating capacity differences among receiving provinces. But the program has done far less to equalize differences between receiving and non-receiving provinces, and has had only limited effectiveness in smoothing short-run variations in provinces' fiscal positions. With respect to these two criteria—redistribution and stabilization—a macro formula performs reasonably well, while going some distance in reducing “tax-back” incentives in the program.

Notes

¹Under a national average standard, $\bar{x} = X/N$, while under the current RFPS the summations are over only the five standard provinces—which exclude Alberta and the Atlantic provinces.

²In fact, 43 separate bases have been in use at various times since 1982, and there have been major changes in measurement for several of them over that time.

³Courchene (1984) explains these considerations at length. Since even a province with a small share of the national base can exert some influence on the national average rate, these incentives

exist throughout the system, but they are probably small enough in most cases to be ignored—perhaps even for Quebec. Thus I focus on the extreme case.

⁴The point is that RTS equalization may increase tax rates as in Smart (1998), but from levels that would otherwise be too low because of tax competition. However, there are theoretical reasons to believe that, even in the presence of tax competition, RTS equalization leads to tax rates that are higher than desirable. See Bird and Smart (1997) for further discussion.

⁵This estimate would be exactly 100 per cent if equalization entitlements before the special provisions were used in place of actual payments, and Saskatchewan were excluded from the sample in the years it did not receive Equalization.

⁶Formally, the regression line is for the “between” estimator of the fixed effects model (1), based on provincial averages, rather than the “within” estimator presented in Table 1. The estimate of β in this case is 0.93 instead of 0.89.

⁷This argument simplifies matters by ignoring

the federal government, which pays Equalization transfers to recipients in Canada's "gross" system of equalization, rather than non-recipients, as in a "net" system. The difference is not central to the argument, however. Even in a gross scheme, uncorrelated shocks to fiscal positions of the receiving provinces will tend to average out, so that the federal government can provide insurance at a relatively stable total cost. The degree of insurance would however be far greater in a net scheme.

⁸There are also important efficiency reasons for equalizing fiscal capacities, well known from Boadway and Flatters (1982).

⁹The choice of deficiency variable has received considerable attention in the previous literature, and there are arguments, based on assorted principles, in favour of GDP at factor cost and of personal income, either with or without various adjustments. Here I argue that any chosen indicator should merely be regarded as a proxy for fiscal capacity, so that the only relevant principle is statistical goodness of fit. See below. Of course, variables other than GDP at market prices might give better fit in the regressions, but I leave this for future work.

¹⁰Net revenues are again defined as the yield of each province's tax bases at national average rates plus actual or simulated equalization transfers. Thus the calculations remove the effect of changes in provincial tax rates, allowing us to focus on changes in fiscal capacity alone.

¹¹That this formula is a revenue sharing arrangement can be seen more clearly by rewriting (4) to express total entitlements of a province as

$$\hat{E}_{it} = \beta R_t \left(\frac{N_{it}}{N_t} - \frac{Y_{it}}{Y_t} \right)$$

where Y_{it} and Y_t are GDP aggregates for the province and nation, respectively. Thus the formula pays each province a share of total provincial revenues R_t equal to the difference between its share of national population and its share of national GDP, multiplied by the scale factor. The expression for the income formula (3) is analogous, except that aggregate provincial revenue R_t

is replaced by national GDP Y_t , and the scale factor is adjusted accordingly.

¹²Although the regression analysis is designed to replicate exactly the average level of actual transfers to the provinces, the scale factor could in principle be significantly greater than or less than one, depending on whether base deficiencies of receiving provinces are larger or smaller for bases with high national average tax rates. It turns out that deficiencies and tax rates are nearly uncorrelated, so that the scale factor is near one.

¹³Formally, β is chosen in this case to minimize the simple of average of provinces' variances of annual changes in equalized revenues. The algebraic expression for the minimum variance scale factor is

$$\beta = \frac{\sum \text{cov}_i(r_{it} - r_{it-1}, y_{it} - y_{it-1})}{\sum \text{var}_i(y_{it} - y_{it-1})}$$

where the summation is over the seven receiving provinces. Equivalently β can be obtained as a weighted average of estimated coefficients from province-by-province regressions of revenues on per capita income.

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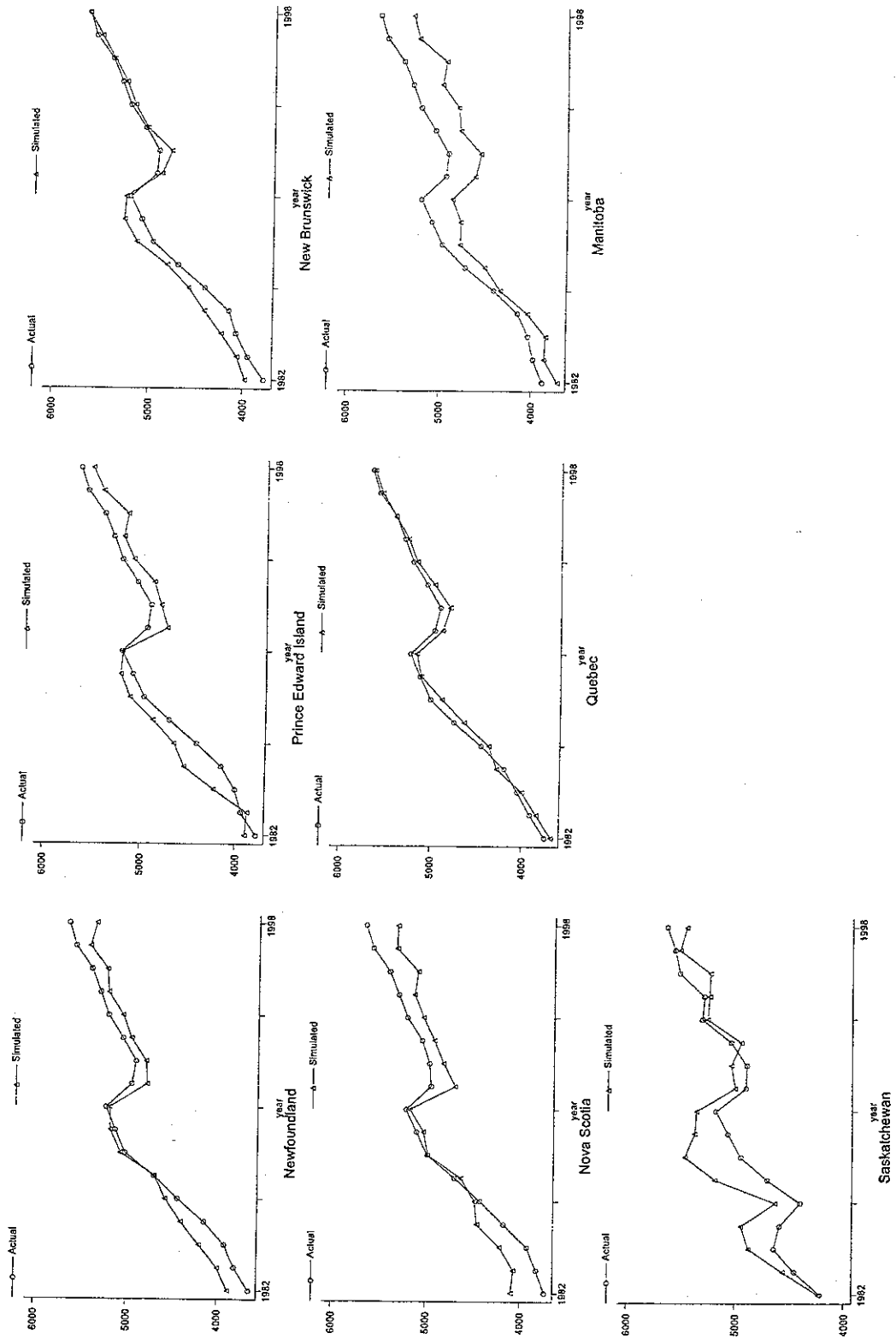


Figure A1: Actual and simulated net revenues, receiving provinces