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FEDERAL-PROVINCIAL TAX EQUALIZATION: AN EVALUATION

by

T. J. Courchene and D. Beavis**

I. Introduction

Federal-Provincial tax equalization, authorized under the Federal Provincial Fiscal Arrangements Act, represents one of the most controversial issues in Canadian federalism. And the controversy is likely to continue since the present agreements have recently been extended through to 1974. Both net donor and beneficiary provinces appear at times to be unsatisfied. Of the donor provinces, British Columbia has been the most vocal in airing its dissatisfaction with the scheme: recently the Attorney General of British Columbia suggested abolishing the equalization scheme and replacing it by a nation-wide negative income tax.¹ At the base of much of this dissatisfaction is that fact that these payments go unconditionally to provincial governments and not to individuals, so that their disbursement reflects the spending priorities of the recipient governments. The "have-not" or recipient

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** The authors are at the University of Western Ontario and the St. Lawrence Seaway Authority, respectively. Note that responsibility for any controversial views relating to the operations of, or implications deriving from this analysis of, the equalization scheme must rest with T.J. Courchene, as he is entirely responsible for the drafting of the paper in the present form.

¹"B.C. will test Ottawa in court on equalization payment issue," The Globe and Mail, Tuesday, February 15, 1972, p. 1.

provinces also from time to time express their misgivings with the details of the scheme. New Brunswick, for example, would like the scheme enlarged to include equalization of property taxes since it has now taken over this tax base from the municipalities.

The purpose of this paper is to analyze, and derive some implications from, tax equalization both for the current legislation and for several alternative schemes that have been proposed either formally or informally. Most of the paper will be devoted to an analysis of the scheme itself and not to the broader philosophical and economic underpinnings of the concept of equalization. Nonetheless, it should provide a firm background for future discussion of these more interesting and profound issues.

In outline form, the paper proceeds as follows. Section II presents alternative but equivalent versions of the present tax-equalization formula and also the actual equalization payments arising out of the Act for fiscal year 1968-1969. Section III embarks on a sensitivity analysis (on both an analytical and empirical level) of the equalization program to establish the effect on equalization payments of changes in various tax rates and tax bases for selected provinces. Also included in this section is an example of a type of provincial revenue strategy that the present formula could encourage. In Section IV we investigate some possible alternative formulations for tax equalization, including the oft-mentioned proposal of equalizing revenue to the average of the revenues of the richest three provinces rather than to the overall Canadian average. The important question of the funding of the scheme is treated in Section V. Even though this involves several strong assumptions, the inclusion of the funding provision allows us to approximate the "net" subsidy to each province as a result of the equalization program. Some final comments and implications complete the paper.

II. The Equalization Formula

The most efficient approach to describing the present tax equalization formula is to quote directly from The National Finances:²

"In contrast to the equalization formula for 1962-67 which took into account only the three "standard" taxes and natural resource revenue, the new formula is based on the sixteen provincial revenue sources listed below:

- Personal income tax
- Corporation income tax
- Succession duties and shares of estate tax
- General sales tax
- Motor fuel tax
- Motor vehicle revenues
- Alcoholic beverage revenues
- Forestry revenues
- Oil royalties
- Natural gas royalties
- Sales of Crown leases and reservations on oil and natural gas lands
- Other oil and gas revenues
- Metallic and non-metallic mineral revenues
- Water power rentals
- Other taxes
- Other revenues

For each revenue source a base is chosen which is as close as possible to the actual base of the revenue source in all provinces. Then for each revenue source a "national average provincial revenue rate" is calculated by dividing the total revenue for all provinces by the total base for all provinces. This national average rate is multiplied by the base in each province and divided by the population of the province to give the per-capita yield of a "tax" levied at the national average rate. To obtain the equalization payment for the particular revenue source in the province, if the population of the province is multiplied by the difference between the per-capita yield in all provinces and the derived per-capita yield in the province at the

²Readers interested in the historical development of Federal-Provincial fiscal arrangements can consult A. Milton Moore, J. Harvey Perry and Donald I. Beach, The Financing of Canadian Federation: The First Hundred Years, Toronto: The Canadian Tax Foundation, 1966, or The National Finance, 1970-71, Toronto: The Tax Foundation, 1970, Chapter 10.

national average rate. The total equalization payment for the province is the sum of entitlements, positive and negative, for each revenue source.

There is a simpler method of calculating this payment. The percentage of total base attributed to a particular province is calculated as well as the percentage of the total population in the province. The difference between the percentage of the base and the percentage of the population multiplied by the total revenue in all provinces from a source gives the equalization payment for the revenue source in the province. Again the total payment is the sum of the payments for each source of revenue". (3)

The first method of calculation referred to in the quotation can be expressed algebraically as follows:

$$(1) \quad E_i = P_i \sum_{j=1}^{16} t_{cj} \left[\frac{B_{cj}}{P_c} - \frac{B_{ij}}{P_i} \right]$$

where

E_i = the dollar equalization payment to province i

P_i = the population of province i

t_{ij} = the tax rate in province i for revenue source j

t_{cj} = the "national average provincial revenue rate" for tax source j . This rate is calculated for each source as the total revenue yield divided by the total base i.e.,

$$t_{cj} = \frac{\sum_{i=1}^{10} t_{ij} B_{ij}}{\sum_{i=1}^{10} B_{ij}}$$

for each source j .

B_{ij} = the tax base of province i for revenue source j

³The National Finances, op. cit., pp. 146-7.

B_{cj} = the total tax base for Canada for revenue source j , i.e.,

$$B_{cj} = \sum_{i=1}^{10} B_{ij}$$

P_c = population of Canada, i.e.,

$$P_c = \sum_{i=1}^{10} P_i$$

i = subscript referring to province

j = subscript referring to tax source

For each tax source, then, the province is entitled to a positive subsidy if its per-capita base is less than the national average per capita base, i.e., if $\left[\frac{B_{cj}}{P_c} - \frac{B_{ij}}{P_i} \right]$ is positive, and a negative subsidy if $\left[\frac{B_{cj}}{P_c} - \frac{B_{ij}}{P_i} \right]$ is negative. For each tax source the dollar grant or subsidy is proportional to the national tax rate, t_{cj} , and, of course, the province's population.

These payments are then

summed over all 16 sources and if the sum, E_i , is positive, then the value of the equalization payment to province i is E_i . If E_i is negative, payment is set at zero.

From (1), we can take P_i into the brackets yielding

$$(2) \quad E_i = \sum_{j=1}^{16} t_{cj} \left[\frac{P_i B_{cj}}{P_c} - B_{ij} \right]$$

Noting that $t_{cj} = \frac{\sum_{i=1}^{10} t_{ij} B_{ij}}{\sum_{i=1}^{10} B_{ij}}$,

replacing t_{cj} by this expression, and bringing the denominator of the expression (which equals B_{cj}) into the bracket yields:

$$(3) \quad E_i = \sum_{j=1}^{16} \left[\sum_{i=1}^{10} t_{ij} B_{ij} \right] \left[\frac{P_i}{P_c} - \frac{B_{ij}}{B_{cj}} \right]$$

which is the alternative formulation mentioned in the above quote. This is perhaps more obvious when it is recognized that

$$\sum_{i=1}^{10} t_{ij} B_{ij}$$

is the total Canadian revenue from tax source j . In words, equation (3) indicates that for each tax source j , provinces will get a positive share of total revenue for that source if their ratio of total population, $\frac{P_i}{P_c}$ is greater than their share of the tax base for the particular source B_{ij}/B_{cj} . Again, these equalization payments, positive and negative, for each source are summed for each province and a positive value of E_i is the equalization payment for province i . A negative value for E_i means that the payment is zero for that province.

An Intuitive View of Equalization

With a few further assumptions, we can reduce the equalization formula to a very intuitive level. Assume, first, that the total revenue, R_i , of each province is the sum of the province's own revenue plus the equalization payment it receives⁴ where the former can be expressed as $\sum_{j=1}^{16} t_{ij} B_{ij}$. If we further assume that all provincial tax rates for a given revenue base are equal (i.e., $t_{ij} = t_{cj}$ for all i), then total revenue for province i from each source becomes

$$(4) \quad R_{ij} = P_i \left[\left(t_{ij} \frac{B_{ij}}{P_i} \right) + t_{ij} \left(\frac{B_{cj}}{P_c} - \frac{B_{ij}}{P_i} \right) \right]$$

⁴This distorts reality in several ways. For example, revenues from federal-provincial shared-cost programs must be added in. Furthermore, some provinces tax more than the 16 revenue sources. However, the formula can account for those provinces which tax less than the 16 sources because either the E_{ij} or the B_{ij} can take on a zero value.

where the second term represents the equalization payment formula (1) above with the assumption that $t_{ij} = t_{cj}$. For the poorer provinces, this formula reduces to

$$(5) \quad R_{ij} = P_i \left(t_{ij} \frac{B_{cj}}{P_c} \right)$$

so that the have-not provinces are, in effect, able to tax the national average per-capita base, $\frac{B_{ij}}{P_c}$ rather than their own base $\frac{B_{ij}}{P_i}$. Since we are assuming that $t_{cj} = t_{ij}$ we can also interpret (5) as a national tax on a national tax base, the revenues from which are apportioned to the provinces according to their share of the population.

Naturally, to the extent that these simplifications are invalid (e.g., to the extent that the t_{ij} differ from the t_{cj}) equation (5) will also be invalid. Nevertheless, it does provide a revealing picture of the essential principle underlying the equalization scheme.

Prior to presenting data relating to the schedule of equalization payments from fiscal years 1968-69, we should emphasize that these payments come out of general federal revenue and not directly from the treasuries of Canada's richest provinces. We shall return to the important question of the funding of the equalization scheme later in the paper.

Equalization Payments for 1968-1969

Table I presents summary data relating to the level of equalization payments in 1968-69 and to total revenue for the various provinces both before and after equalization. Column (1) lists the population figures used for the calculations. Columns (2) and (3) present revenue data for "own" provincial revenues, i.e.,

$$\sum_{j=1}^{16} t_{ij} B_{ij}$$

in both dollar and per-capita terms. Alberta and British Columbia have per-capita own revenue levels substantially above levels for other provinces. Not surprisingly, the Atlantic provinces have lowest per-capita yields from their own revenue sources. Columns (4) and (5) are provincial revenues calculated by applying the national average provincial tax rate to the revenue bases in each province, i.e.,

$$\sum_{i=1}^{16} t_{cj} B_{ij} .$$

Differences between these two columns and columns (2) and (3) reflect differences between t_{ij} and t_{cj} . The all-Canada figure for per-capita revenue is \$343.35. Equalization payments (following equation (1) above) are easily calculated from these data. The per-capita deficiency is equal to \$343.35 minus the relevant $\sum_{i=j}^{16} t_{cj} B_{ij} / P_i$, i.e., the figure in column (5). These are presented in column (7). Dollar values of equalization payments appear in column (6), and are the product of columns (7) and (1). Three provinces do not qualify for equalization: British Columbia, Ontario, and Alberta. Naturally, these provinces have per-capita yields at national average tax-rates that are greater than the national average, i.e., greater than \$343.35. While Quebec's equalization payment per-capita is only \$66.17, it garners substantially more than half of the total dollar value of the equalization payments because of its large population. Total equalization payments amounted to slightly over \$700 million in 1968-69. The final two columns of Table I present figures for total revenue (own revenue plus equalization) for each of the provinces. Looking at the per-capita data for total revenue (the last column in the table) the impact of the equalization payments is to push the revenues for all provinces except Nova Scotia well over the \$300 per-capita figure. Indeed, all provinces except Nova Scotia now have revenue per capita figures

TABLE I

Summary Data Relating to Tax Equalization 1968-69

Province	Population (1)	Own Tax Revenue ¹ (\$000) (2)	Yield at National Average Tax Rate ² Per Capita (\$000) (3)	Yield at National Average Tax Rate ² Per Capita (\$000) (4)	Equilization Payment (\$000) (5)	Equilization Payment Per Capita % (6)	Total Revenue (\$000) (7)	Total Revenue Per Capita (\$000) (8)	Total Revenue Per Capita (9)
NFLD	507000.	106766.	210.58	101101.	199.41	72977.	143.94	179743.	354.52
PEI	110000.	22016.	200.15	21641.	196.74	16127.	146.61	38143.	346.76
NS	760000.	146304.	192.51	181507.	238.83	79437.	104.52	225741.	297.03
NB	624000.	159420.	255.48	143536.	230.03	70713.	113.32	230133.	368.80
QUE	5927000.	1872948.	316.00	1642802.	277.17	392219.	66.17	2265167.	382.18
ONT	7306000.	2738330.	374.81	2783307.	380.96	0.	0.00	2736330.	374.81
MAN	971000.	287688.	296.28	286574.	295.13	46816.	48.21	334504.	344.49
SASK	960000.	322214.	335.64	299305.	311.78	30309.	31.57	352523.	367.21
ALTA	1526000.	629776.	412.70	803926.	526.82	0.	0.00	629776.	412.70
BC	2007000.	821146.	409.14	842909.	419.98	0.	0.00	821146.	409.14
CAN	20698000.	7106608.	343.35	7106608.	343.35	708598.	34.24	7815206.	377.58

Source: Department of Finance

Notes: Figures in these tables may differ from actual equalization payments because of rounding error, etc. But the differences are very small.

1. $\sum_{i=1}^{16} t_{ij} B_{ij}$, for the dollar column

2. $\sum_{i=1}^{16} t_{cj} B_{ij}$, again for the dollar column

above the original Canadian average figure of \$343.74.

Table II presents the equalization payments that arise from each revenue source. The sixteen sources listed in the table correspond exactly to the sixteen sources listed in the first paragraph of this section. A positive entry in a cell implies that the province receives a positive equalization payment from that revenue source and vice versa. Recall that one way of interpreting E_{ij} is that it is the product of the difference between $\frac{P_i}{P_c}$ and $\frac{B_{ij}}{B_{cj}}$ and the total revenue from tax source j . Therefore positive entries imply that for that revenue source the particular province has a lesser share of the tax base than it does of population. When summed for each column these figures yield the totals as presented in the second last row of the table. These totals are the equalization payments for provinces whose totals are positive. Negative totals imply a zero level of equalization (see the last line of the table).

We now turn to an analysis of some of the more interesting features and implications of Canada's tax equalization plan.

III A Sensitivity Analysis of the Equalization Scheme

The purpose of this section of the paper is to examine the effect on equalization payments of changes in the tax bases and tax rates of various provinces. Initially, the sensitivity analysis will be conducted on an analytical level. Later in this section, however, we shall present some empirical results for changes in specific tax bases and rates.

Changing the t_{ij}

For purposes of the sensitivity tests we shall again consider the total revenue accruing to province i to be the sum of the revenue from its own sources

TABLE II

Equalization By Revenue Source: 1968-69

(\$, 000)

Province Revenue Source	NFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	BC
1	21263.	5065.	21906.	22302.	59038.	-147083.	11621.	23525.	5658.	-23294.
2	8590.	2326.	12005.	10508.	38854.	- 70121.	4661.	12735.	- 4229.	-15328.
3	3721.	584.	891.	3624.	3806.	- 22540.	2445.	3972.	4305.	- 809.
4	7708.	1896.	6630.	7869.	76302.	- 53752.	3252.	4208.	- 25025.	-29088.
5	8597.	562.	5387.	3230.	23664.	- 28600.	3416.	-2212.	- 11096.	- 2947.
6	2964.	194.	1857.	1114.	8159.	- 9860.	1178.	- 763.	- 3826.	- 1016.
7	5966.	359.	1375.	1392.	44270.	- 34295.	-145.	1996.	- 3400.	-17517.
8	- 620.	671.	3978.	-897.	8264.	26511.	4593.	3626.	4070.	-50195.
9	2541.	551.	3808.	3126.	29701.	36260.	3140.	-18115.	- 65505.	4493.
10	742.	161.	1112.	907.	8671.	10173.	1421.	781.	- 25067.	899.
11	3826.	830.	5736.	4709.	44733.	55140.	7215.	- 1914.	-118107.	- 2169.
12	1670.	348.	2503.	2055.	19523.	23542.	3013.	- 5549.	- 42696.	- 4410.
13	-4028.	293.	1572.	676.	1934.	- 3215.	-570.	- 506.	3999.	- 154.
14	- 119.	222.	1316.	768.	-7146.	2832.	- 46.	1392.	2747.	- 1966.
15	6877.	1397.	6338.	6316.	21966.	- 40620.	1098.	4828.	- 1221.	- 6978.
16	3281.	667.	3024.	3013.	10479.	- 19379.	524.	2304.	- 583.	- 3329.
Total	72977.	16127.	79437.	70713.	392219.	-274810.	46816.	30309.	-279977.	-153811.
Equalization Payments	72,977	16,127	79,437	70,713	392,219	0	46,816	30,309	0	0

and the equalization payment; i.e.,

$$(6) \quad R_i = \sum_{j=1}^{16} t_{ij} B_{ij} + \sum_{j=1}^{16} \left[\sum_{i=1}^{10} t_{ij} B_{ij} \right] \left[\frac{P_i}{P_c} - \frac{B_{ij}}{B_{cj}} \right]$$

where the second term is the equalization payment adopted from equation (3).

Suppose we assume that province 3 increases its tax rate on revenue source 6.

Then for province 3 we have:

$$(7) \quad \frac{\partial R_3}{\partial t_{3,6}} = B_{3,6} + B_{3,6} \left[\frac{P_3}{P_c} - \frac{B_{3,6}}{B_{c,6}} \right]$$

Revenues for province 3 from its own source of revenue will increase by $B_{3,6}$ times $\partial t_{3,6}$ and its equalization payment will also increase if the bracketed term is positive, i.e., if province 3 has a share of the base for revenue source 6 which is less than its share of the total population. In other words if province 3 is a relatively poor province in terms of revenue source 6 it will garner an increase in its subsidy. If not, its subsidy will decrease. Therefore, the total change in revenue to province 3 as a result of a tax rate change will be greater than the change in its own revenue if it is a "poor" province for revenue base six.

For the impact on the provincial revenues of other provinces as a result of a tax change in provinces 3 we are left only with the equalization term, i.e.,

$$(8) \quad \frac{\partial R_i}{\partial t_{3,6}} = B_{3,6} \left[\frac{P_i}{P_c} - \frac{B_{i,6}}{B_{c,6}} \right] \quad \text{for } i \neq 3.$$

If province i is relatively poor in terms of base 6 (i.e., the bracketed term is positive) then its equalization payment will increase. Otherwise it will fall, or remain at zero. Therefore, the effect of a tax rate change by province

i on source j will increase the equalization payments for all provinces who are relatively "poor" in terms of revenue base j. Intuitively, this result can be explained in terms of equation (1) since an increase in the tax rate $t_{3,6}$ will increase $t_{c,6}$. These results can be generalized by replacing 3 and 6 by i and j.

Changing the B_{ij}

The effect on provincial equalization payments of a one unit change in B_{ij} is somewhat more complicated. Assuming again that the province and base in question are 3 and 6 respectively, we have, from partially differentiating equation (6):

$$(9) \quad \frac{\partial B_3}{\partial B_{3,6}} = t_{3,6} + t_{3,6} \left[\frac{P_3}{P_c} - \frac{B_{3,6}}{B_{c,6}} \right] - \left[\sum_{i=1}^{10} t_{i,6} B_{i,6} \right] \left[\frac{B_{c,6} - B_{3,6}}{(B_{c,6})^2} \right]$$

and

$$(10) \quad \frac{\partial B_i}{\partial B_{3,6}} = t_{3,6} \left[\frac{P_i}{P_c} - \frac{B_{i,6}}{B_{c,6}} \right] + \left[\sum_{i=j}^{10} t_{i,6} B_{i,6} \right] \left[\frac{B_{i,6}}{(B_{c,6})^2} \right]; \quad i \neq 3.$$

The interpretation of (9) and (10) is quite straightforward, however. From (9), a province will naturally generate an increase in its own revenue from changing $B_{3,6}$ and this increase is represented by $t_{3,6}$ times its tax rate on revenue source 6. There are two components to the change in the equalization payments as a result of changing $B_{3,6}$ and these are represented by the last two terms of (9). As a result of changing $B_{3,6}$ there is now more total Canadian revenue associated with revenue source 6 and this will be allocated in the same manner as the previous revenue. This is captured by the middle term of (9): if province 3 has a percentage of the total base for source 6 smaller than its percent of total population, then on this count its equalization payment will increase as a result of the change in its base, $B_{3,6}$. On the other hand, province 3 now has a larger share of the total base for source 6 than it had

before the change in its base. On this count it will find that its equalization payment falls because it now is eligible for a smaller share of the total revenue $\sum_{i=1}^{10} t_{i6} B_{i6}$ than previously. This is the third term in (9) and it must be negative, since $(B_{c,6} - B_{3,6})$ is positive. For a province which has a relatively low percentage of a particular revenue base 6, the impact on the equalization payments it receives of changing the revenue base is indeterminate. One could work out the conditions under which it will be either positive or negative, but we will defer to a numerical example on this point.

For the other provinces, any change in revenue from having province 3 alter its tax base will occur only in the equalization payments. The first term in (10) is similar to the second term in (9): a relatively rich province will lose some equalization and vice versa. The second term will always be positive and reflects the marginal decrease in the size of province j 's ($j \neq 3$) share of the base for revenue source 6, i.e., each of the other 9 provinces will now have a smaller $\frac{B_{i6}}{B_{c6}}$ ratio because their B_{i6} remained the same while $B_{c,6}$ increased as a result of the increase in the base province 3.

Therefore, equalization payments in all provinces are affected by changes in either the tax rate or tax base in a particular province. Naturally, this may not show up in the final values for equalization payments for the richer provinces, e.g., as a result of a tax increase in Saskatchewan, the equalization subsidy accruing to Alberta for the relevant revenue source would increase, but since the sum of all such subsidies will in all likelihood still remain negative, Alberta will still get a zero value for its final equalization payment.

Other types of experiments are also possible. For example, one could look at the impact of internal migration (or any other factor that alters P_i or $\sum_{i=1}^{10} P_i$) on provincial equalization payments. And the analytical solutions

to some of these alternative experiments can often be quite obvious. Consider, for example, a 5% increase in all the bases (for each province and for each source). From equation (3) it is clear that the term in square brackets will remain invariant to equal percentage changes in all the bases while the term that premultiplies it will increase by 5% (assuming that tax rates are all proportional to income). This implies that the impact of a 5% increase in all bases is to generate a 5% increase in all equalization payments. We now turn to some numerical examples of the sensitivity of these payments to changes in both tax bases and tax rates.

Some Numerical Tests of Sensitivity

See Clark p 44-56

Table III contains data relating to the impact on the equalization grants of selected changes in the rate and base parameters for various provinces. We shall restrict our comments on the results to noting a few of the more interesting findings. Detailed analysis of the Table is left to the reader. Column (1) merely recopies from Table I, for comparison purposes, the actual level of equalization payments in 1968-69. The next three columns show the impact of changes in tax rates for selected provinces - a one percentage point increase in sales tax in Nova Scotia in column (2), a one percentage point hike in Ontario's corporate income tax rate in column (3), and the imposition of a sales tax in Alberta at a 3% rate. The last row of the Table gives the change in the own revenue of the provinces in which the tax or base changes are made.

The result of the increase in Nova Scotia's sales tax rate results in all the provinces (except Ontario, Alberta and B.C.) increasing their equalization payment, including Nova Scotia. As a result of Ontario's corporation income tax increase (note that we are assuming an across-the-board increase in the income tax rate) total equalization payments increase by approximately

T A B L E III
 The Impact on Equalization Payments of Selected Changes in Provincial
 Tax Rates and Tax Bases, 1968-69
 (\$,000)

PROVINCE	Original Equalization Payment 1968-69	+ 1 per centage point in Sales tax in N.S.	+ 1 per centage point in Ontario Corp. income tax	+ 3% Sales tax in Alberta	+ 5% on Sales tax base in N.S.	+ 5% in personal income tax base in BC	+ 5% Sales tax base in Quebec	+ 1 per centage point in Personal income tax rate in Quebec	Increase in Water Power Rental Rate in Quebec by 44.62%
NFLD.	72,977	73,016	73,342	73,301	73,014	73,178	73,491	73,153	72,941
P.E.I.	16,127	16,137	16,226	16,207	16,135	16,171	16,240	16,169	16,193
N.S.	79,437	79,471	79,947	79,716	77,855	79,740	80,175	79,619	79,827
N.B.	70,713	70,753	71,159	71,044	70,760	70,961	71,335	70,898	70,940
Quebec	392,219	392,607	393,870	395,428	392,682	394,609	379,237	392,709	390,103
Ontario	0	0	0	0	0	0	0	0	0
Manitoba	30,309	46,833	47,014	46,953	46,892	47,207	47,725	46,913	46,803
Sask.	0	30,330	30,850	30,486	30,382	30,693	31,214	30,504	30,721
Alberta	0	0	0	0	0	0	0	0	0
B.C.	0	0	0	0	0	0	0	0	0
TOTAL	708,598	709,147	712,408	713,134	707,720		699,416	709,964	707,528
Increase in Relevant Province's Own Revenue		8,029	28,050	67,362	1,467	8,090	29,379	12,359	12,359

4 million dollars (compare columns (1) and (3) for the second last row).

Ontario's revenue increases by just over \$28 million. Therefore, equalization payments arising out of this tax rate change amount to approximately 14% of the increase in Ontario's revenue.

Columns (4), (5), and (6), present results for changes in tax bases. A five percent increase in the tax base in Nova Scotia leads to a decrease in Nova Scotia's equalization payments, by some \$1.528 million. It is extremely significant to note that its own revenue increases by only \$1.467 million as a result of the sales tax base increase. Therefore, the result of a change in Nova Scotia's sales tax base is to make the provincial treasury worse off! As a result of this base change, all of the other "have-not" provinces register increases in their equalization payments, as they do for the experiments in columns (5) and (6) as well. In terms of our analytical section, this implies that equation (10) has a positive value for the "other" provinces.

As a result of having a 5% greater sales tax base, Quebec's revenue increases by nearly 30 million dollars. Its equalization payment falls by about \$15 million. As a result of the base increase, therefore, Quebec is able to garner only half of what the sales tax change would yield in the absence of an equalization scheme.

The Role for Provincial Strategies under the Equalization Scheme

The results we have analyzed in Table III clearly suggest that there is plenty of room for strategy on the part of the provinces with regard to their taxation programs. If a province were to raise a given amount of revenue and it is indifferent as to the revenue source from which it is to be derived, then it makes good sense for it to raise the revenue in a manner that will lead to an increase in its equalization payment. In Table II we presented a matrix of

equalization payments (positive and negative) by province and source. If a province wants to increase tax rates it will also increase its overall equalization payment if it levies the increased tax on a source for which the entry in Table II is positive. In fact it should increase tax rates on the revenue source which has the highest positive value for $\left[\frac{P_i}{P_c} - \frac{B_{ij}}{B_{cj}} \right]$. To levy a tax on a revenue source for which it has a negative entry in Table II (equivalently, for which $\frac{B_{ij}}{B_{cj}} > \frac{P_i}{P_c}$) will result in a decrease in the equalization grant.

It would have been possible to carry out extensive numerical experimentation in order to understand better the implications arising from this feature of the equalization program. We have restricted ourselves, in this paper, to two examples, the results of which appear in the last two columns of Table III. In the second last column we increased the personal income tax in Quebec by one percentage point (for all tax brackets). This generated an increase in its own revenue of 12.359 million dollars and increased Quebec's equalization payments by \$490,000. In the last column we calculated the required percentage increase in the tax rate on the Water Power Rentals revenue source to again yield \$12,359 million (i.e., 44.62%). As a result of raising an identical amount of its own revenue, the equalization payments accruing to Quebec fall by \$2,116,000. Naturally, the Quebec entry in Table II for Water Power Rentals is negative (revenue source 14). This is a highly interesting result. The impact of the equalization plan is to bias provincial preference in the direction of raising revenues from those tax sources for which they have a relatively small share of tax base.

We now turn our attention to some proposals for modifying the current tax equalization plan.

IV Alternative Equalization Formulations

There are many possible ways in which the present tax equalization scheme could be altered. For purposes of this section we shall focus on only two modifications to the formula, both of which have received some attention either in the theoretical literature relating to the general topic of revenue sharing or in the public discussions relating to the Canadian equalization plan. The first modification is to replace the Canadian average provincial tax rate t_{cj} in the equalization formula by the province's own tax rate t_{ij} . The second modification has to do with replacing the Canadian average per-capita tax base for each source, $\frac{B_{cj}}{P_c}$, by an average that relates to, say, the highest five or highest three provinces. We shall deal with each of these in turn.

In his pioneering paper on revenue sharing, R. A. Musgrave (5) suggested that equalization payments to province i should reflect tax effort by province i . If a province wishes to receive a larger equalization payment it must be willing to subject its citizens to higher tax rates. Under the present scheme, the subsidy to province i can go up as a result of a tax increase in province j . This would be precluded under a Musgrave-type scheme. This alternative is very easily incorporated into our notational framework. Specifically, in equation (1) we replace t_{cj} by t_{ij} and obtain

$$(11) \quad E_i = P_i \sum_{j=1}^{16} t_{ij} \left[\frac{B_{cj}}{P_c} - \frac{B_{ij}}{P_c} \right] .$$

⁵R. A. Musgrave, "Approaches to a Fiscal Theory of Political Federalism" in Public Finance Needs, Sources, Utilization, National Bureau of Economic Research (Princeton: Princeton University Press, 1961) pp. 97-122.

Thus, for a given tax source, a province with a positive value for $\frac{B_{cj}}{P_c} - \frac{B_{ij}}{P_i}$ can increase its payment by raising its own tax rate on that revenue source, i.e., raise t_{ij} . While there are some advantages to this formulation, it is important to note that it does have the disadvantage of encouraging further any strategy that might exist under the present plan. Under the philosophy embodied in (11) it is clear that the provinces would have an incentive to increase tax rates on revenue sources for which the differences between $\frac{B_{cj}}{P_c} - \frac{B_{ij}}{P_i}$ are large and decrease the t_{ij} on those sources for which this difference is smaller or negative. Much more could be said concerning this alternative to the present scheme, but we shall restrict ourselves to a few further comments later in this section when we discuss the results for 1968-69 of this and the following alternatives to the present revenue sharing plan.

Averaging to the Highest N Province

The most commonly suggested alternative to the present scheme is that revenues should be equalized, not to the Canadian average tax base for each source, but rather to the average tax base of Canada's N richest provinces where N is say 3 or perhaps 5. Unfortunately this is not a very straightforward modification because there are several ways to interpret what is meant by averaging to the highest three provinces. One possibility is that for each tax source we choose the richest three provinces and calculate the resulting equalization payments. This would mean that the highest three provinces would differ from tax source to tax source. We rule out this interpretation because a) we feel that this is not what is generally meant by averaging to the highest three provinces, and b) the levels of equalization payments will be extremely large and it is even theoretically possible for all provinces to be eligible for equalization payments.

Even requiring that the same three provinces will be used for each revenue source still leaves us with at least two alternative versions, both of which appear worthy of analysis. The first version simply involves replacing $\frac{B_{ci}}{P_c}$ in equation (1) by $\frac{B_{ci}^3}{P_c^3}$ assuming that the averaging is taking place over the top three provinces,⁶ i.e.,

$$(12) \quad E_i = P_i \sum_{j=1}^{16} t_{cj} \left[\frac{B_{ci}^3}{P_c^3} - \frac{B_{ii}}{P_i} \right]$$

where $\frac{B_{ci}^3}{P_c^3}$ = the average per-capita base for the three richest provinces.

Since $\frac{B_{ci}^3}{P_c^3}$ will obviously be greater than $\frac{B_{ci}}{P_c}$ this modification will result in larger equalization payments.

This version still assumes that the per-capita deficiency is multiplied by the national average tax rate, t_{cj} . It is possible to argue that it is more appropriate to multiply the deficiency the the average tax rate in the three (or more generally, the N) chosen provinces rather than by t_{cj} . This would convert the formulation to:

$$(13) \quad E_i = P_i \sum_{j=1}^{16} t_{cj}^3 \left[\frac{B_{ci}^3}{P_c^3} - \frac{B_{ii}}{P_i} \right]$$

It is not clear that (13) will result in larger overall equalization payments than will (12), i.e., it is quite possible for t_{cj} to be greater than t_{cj}^3 .

⁶The highest province is defined as that province which has the highest value for $\sum_{j=1}^{16} \frac{t_{cj} B_{ii}}{P_i}$, etc.

We now present the impact on the equalization payments for 1968-69 of these three alternative schemes, as represented by equations (11), (12), and (13).

Results for the Alternative Proposals

Table IV presents results for modifying the existing scheme along the lines of equation (12), i.e., the provinces receive a payment (positive or negative) from each source depending on the product of the national average provincial tax rate, t_{cj} , and the difference between the per-capita base for the top N provinces and the per-capita base for the province in question. Table IV presents figures for N=5, 3, and 2. While it is possible to use several criteria for selecting the N provinces, our procedure was simply to use the data in column 5 of Table I to rank the provinces. On this basis (i.e., per-capita revenue yield at national average tax rates), Alberta, British Columbia, Ontario, Saskatchewan, and Manitoba, are the ordered top five richest provinces. In Table I the overall level of equalization payments is just over \$700 million. As a result of averaging to the highest 5 provinces, equalization payments jump to \$1,282 million (see the entry in the last row of left panel of Table IV. In Table I, the national average value of revenue per-capita (appropriately summed over the 16 revenue sources) is \$343.35 per person. For N=5 this figure (not shown) is \$392.79. The interesting feature is that Ontario now is entitled to a subsidy - at the rate of \$11.84 per person, or \$86,470. If the averaging is carried out over the 3 highest provinces, equalization payments run to over 1 1/2 billion dollars - more than double the equalization in Table I (see the middle panel of Table IV). For the case where Alberta and British Columbia provide the standard (i.e., N=2) the total

TABLE IV

Equalization Payments Based on Averaging to the Richest N Provinces

PROVINCE	RICHEST 5		RICHEST 3		RICHEST 2	
	(\$000)	\$/CAP	(\$000)	\$/CAP	(\$000)	\$/CAP
NFLD.	98048.	193.39	106122.	209.31	135227.	266.72
P.E.I.	21567.	196.06	23318.	211.99	29633.	269.39
NOVA SCOTIA	117019.	153.97	129122.	169.90	172751.	227.30
NEW BRUNSWICK	101569.	162.77	111507.	178.70	147329.	236.10
QUEBEC	685307.	115.62	779696.	131.55	1119947.	188.96
ONTARIO	86470.	11.84	202819.	27.76	622234.	85.17
MANITOBA	94832.	97.66	110295.	113.59	166037.	171.00
SASK.	77781.	81.02	93069.	96.95	148180.	154.35
ALBERTA	0.	0.00	0.	0.00	0.	0.00
B.C.	0.	0.00	0.	0.00	92612.	46.140
CANADA	1,282,591	392.79*	1555947.	408.72*	2,633,950	468.13*

* This is the per-capita Canadian average yield at the national average tax rate, corresponding to \$343.45 in Table I.

value of equalization payments soars to 2.6 billion dollars. Furthermore, British Columbia now receives an equalization payment (92.6 million). Compared to the actual 1968-69 payments, this represents nearly a four-fold increase in the total equalization grants. Figures for provinces presently receiving grants do not show this large a percentage increase because part of the increases are taken up by the grants that now go to Ontario and British Columbia. Oddly enough, the figures for total revenue (i.e., own revenue plus equalization) per-capita for $N=2$ (the last column) indicate that Alberta, the richest province and the only one not receiving an equalization payment ends up with the lowest per-capita total revenue.⁷ This results because the "tax effort" (i.e., t_{ij}) in Alberta is the lowest of all the provinces. We leave to the reader the job of completing the analysis of Table IV.

Embodied in this table is the assumption that even though we are equalizing around the highest N provinces, it is still appropriate to use the national average provincial tax rate, t_{cj} , for each revenue source. As mentioned above, it is also reasonable to require that this average tax rate be the average for each source of the same N provinces used in the equalization procedure. In other words, it is reasonable to use equation (13) rather than equation (12) when attempting to modify the present formula to average around the highest N provinces. The results for the equalization payments derived from applying equation (13) appear in Table V for the case of $N=3$, and $N=2$. The equalization payments in Table IV for $N=3$ are, except for Ontario, larger than those in column (1) of Table V and the payments in Table IV for $N=2$ are, except for British Columbia, larger than

⁷These data are not shown in the table, but are available upon request.

T A B L E V
Averaging to Highest N Provinces
Equation (3)
(\$,000)

Province	THREE Highest Provinces	TWO Highest Provinces
NFLD	102,408	124,041
P.E.I.	22,449	27,651
N.S.	125,048	163,207
NB	107,042	137,199
Quebec	751,264	1,055,500
Ontario	213,932	652,823
Manitoba	107,337	158,911
Sask.	86,516	136,303
Alberta	0	0
B.C.	0	95,325

those in column (2) of Table V. What this suggests is that the national average tax rate t_{cj} is, on average and over all revenue sources, greater than the average rate calculated either over the top three or top two provinces. As a result of this, equalization payments are lower for formulation (13) than for formulation (12). This should not surprise us since we noted earlier that Alberta has the lowest "tax effort".

The modification first mentioned in this section related to introducing tax effort into the equalization scheme. Specifically, the difference between the national average per-capita base and the provincial base for each source is multiplied not by t_{cj} but rather by t_{ij} . See equation (11). The values for equalization payments based on this formula turn out to be considerably lower than those from the existing scheme. Rather than presenting these results in a manner similar to the results in say, Table IV, we opted for a format that revealed the reasons why the level of equalization turns out to be lower. Refer to Table VI which gives the equalization payments by province and by source, i.e., it is identical in format to Table II. Across the bottom of Table VI are the equalization payments. Except for Saskatchewan, all provinces' subsidies would be less than they are under the present scheme. In order to see why this occurs, let us take Quebec as an example. Comparing the equalization subsidy for personal income tax (row 1) for Tables VI and II, we note that Quebec receives a greater payment under the tax effort scheme (Table VI). This is so because its tax rate on personal income tax is greater than the national average rate t_{c1} . However, for four revenue sources Quebec's subsidy is zero (revenue sources 9 to 12 which relate to oil and gas revenues) because its tax rate is zero. In turn its tax rate is zero because it probably has no tax base for these sources. Despite the fact that Quebec is a province with a relatively high "tax effort", it comes out worse under a tax effort type of scheme because

T A B L E VI

A "Tax Effort" Approach to Equalization: Results
for Formulation (11)

(\$,000)

	WFLD	PEI	NS	NB	QUE	ONT	MAN	SASK	ALTA	EC
1	19313.	4739.	19597.	20966.	67637.	-135526.	12896.	28364.	5341.	-22469.
2	9352.	2072.	10981.	9133.	47720.	-70462.	4397.	13949.	-3905.	-9303.
3	2220.	374.	704.	3513.	4176.	-25793.	1903.	3290.	3349.	-629.
4	9794.	1617.	3704.	3035.	119364.	-48260.	5599.	4364.	0.	-29107.
5	10330.	637.	5324.	3590.	25462.	-29049.	5509.	-2257.	-9555.	-2197.
6	2741.	157.	1704.	979.	7943.	-16906.	1071.	-676.	-3147.	-1003.
7	12630.	559.	1727.	1697.	56306.	-58217.	-167.	2557.	-3707.	-15592.
8	-26.	0.	1744.	-707.	6553.	26673.	2312.	1214.	2747.	-50502.
9	0.	0.	0.	0.	0.	0.	750.	-13196.	-70542.	5323.
10	0.	0.	0.	0.	5453.	0.	0.	379.	-24191.	1531.
11	0.	0.	0.	0.	0.	0.	6700.	-1143.	-122254.	-2062.
12	0.	546.	0.	0.	0.	25542.	5015.	-5542.	-42696.	-4410.
13	-2130.	0.	1506.	189.	2445.	-20335.	-499.	-596.	14635.	-193.
14	0.	0.	323.	27.	-10366.	2163.	-33.	1055.	1343.	-207.
15	1497.	257.	1280.	13572.	13761.	-34537.	611.	4863.	-591.	-7646.
16	4935.	1745.	5250.	3714.	6443.	-14421.	567.	5653.	-741.	-6559.
	71129.	13014.	52343.	64753.	320162.	0	41135.	42170	0	0

because the equalization payments are calculated for each revenue source rather than on an aggregate basis.

It should be pointed out that the results in Table VI are not too meaningful because if this particular version of an equalization program were in effect, the provincial tax rates t_{ij} , would probably not have the values they currently do.

V. Funding the Equalization Scheme

Up to this point we have neglected entirely the fact that the scheme has to be funded. We have mentioned that the equalization payments come out of general revenue rather than from the coffers of the richer provinces. This means that the financial costs of the plan are borne by all tax-paying Canadians. And it also means that it will be fruitful to look at the costing of the equalization scheme and attempt to construct a "net benefit" to each province as a result of the total impact (costing plus payments) of the equalization scheme. The purpose of this section is to attempt such an analysis,

The first issue to be tackled is the allocation of federal revenue by province. Specifically, on average, what proportion of total federal revenue is borne by the residents of, say, Ontario? Ideally, one would like the provincial allocation for each federal revenue source. Unfortunately, such data are not presently available. The alternative we opt for is to look at the total base in each province for two of the main federal revenue sources, namely the personal income tax base and the corporate income tax base. Next we allocate to each province its share of these taxes. These figures appear in the first column of Table VII. It is important to recognize that these ratios are only estimates of the provincial shares of total federal revenue. However, it is also important to note that they are probably reasonably good estimates.

T A B L E VII

Funding Estimates by Provinces

Province	Share of Total Federal Revenue Obtained from Province *	Share of 1968-69 Equalization Received by Province
NFLD.	1.092	10,312
P.E.I.	0.185	2,276
N.S.	2.011	11,209
NB.	1.466	9,978
Quebec	23.618	55,343
Ontario	45.581	0
Manitoba	3.952	6,606
Sask.	2.866	4,276
Alberta	7.557	0
B.C.	11.676	0

* Estimated on the basis of the provincial shares of the personal and corporate income tax base.

For example, Ontario has 45.58% of the total income tax base. It would be quite surprising indeed if the actual proportion of federal revenue collected from residents of Ontario (direct and indirect) was not within, say, 5 percentage points of 45%.

Column (2) of Table VII contains the percentage of total equalization received by each province for the 1968-69 period. Consider the province of Quebec. It receives approximately 55% of total equalization payments. But its residents will have to pay for about 24% of the cost of the total scheme. The net benefit to the province (treating the provincial government and the residents as a single entity) is the differences between these two figures or about 31% of total equalization. For Ontario, since it gets no payment, the cost to the province is about 45% of the total payment. It is even possible for a province to receive a grant and still be worse off as a result of equalization. This is nearly the case for Saskatchewan under the 1968-69 calculation. Were Saskatchewan to become somewhat better off relative to the Canadian average it is entirely feasible for its percentage of the equalization payments to fall below its share in the cost of total equalization. It is worthwhile mentioning again that the benefits of equalization go to the province while the cost of equalization is borne not by the province directly, but rather by the residents of the province. Nevertheless, it seems to us that too often public statements from various sources concerning equalization payments fail to recognize that residents of all provinces and not only the "have" provinces contribute to the funding of the equalization scheme.

Many interesting calculations can be undertaken using these cost estimates. For example, we can investigate the net cost to British Columbia residents as a result of an increase in the tax rate in Ontario for any given revenue source. British Columbia will receive no equalization payment as a result of

this tax change, but its residents will bear about 12% of the total value of the increased equalization payments resulting from the tax change in Ontario. It would be also interesting to calculate net benefits by province for the various changes in Table III. We leave this, and other such calculations, to the reader.

VI. Conclusion

In the above sections we attempted not only to outline the present tax equalization program but as well to highlight some of its more interesting implications. In addition the paper also delved into the features of some of the possible alternatives or modifications of the present scheme. Obviously much more analysis can be done both on the current program as well as on the various suggested alternatives. However, one has to exercise some care in recommending alternatives because even slight changes in the equalization scheme can alter the conceptual underpinnings of the program. For example, as we suggested above, Musgrave would probably opt for the modification embodied in equation (11) rather than the present scheme, i.e., he would prefer rewarding "tax effort". If a province wants a larger subsidy, it has to be willing to tax its own residents more. Under this modification a "have-not" province would not garner, as it currently does, an increased subsidy simply because some other province increases its tax rates. Yet if the purpose of equalization is to ensure that no province has to levy unduly high tax rates in order to supply some "standard" level of services, the "tax effort" modification may not be desirable since it could encourage very high tax rates in the poorer provinces.

Nonetheless, there are a few areas in which improvements could be made.⁸ Perhaps the most obvious is the incentive, under the present scheme, for provinces to tax less heavily those revenue sources with which they are relatively well-endowed and vice versa. We have no idea of the degree to which provinces react to this incentive but as our example for Quebec in Table III indicated, the dollar values involved can be quite substantial.

Finally it is important to emphasize that a complete analysis of the role of equalization payments must also encompass the myriad of other federal and provincial policies and policies that affect the incomes both of provincial governments and the residents of the various provinces. Our goal was a more narrow one--that of evaluating in isolation some aspects of, and potential modifications to, the equalization component of the Federal-Provincial Fiscal Arrangements Act.

⁸For example, it may be more costly, per capita, to provide a "standard" level of public goods and services. This is not brought into the equalization formula.