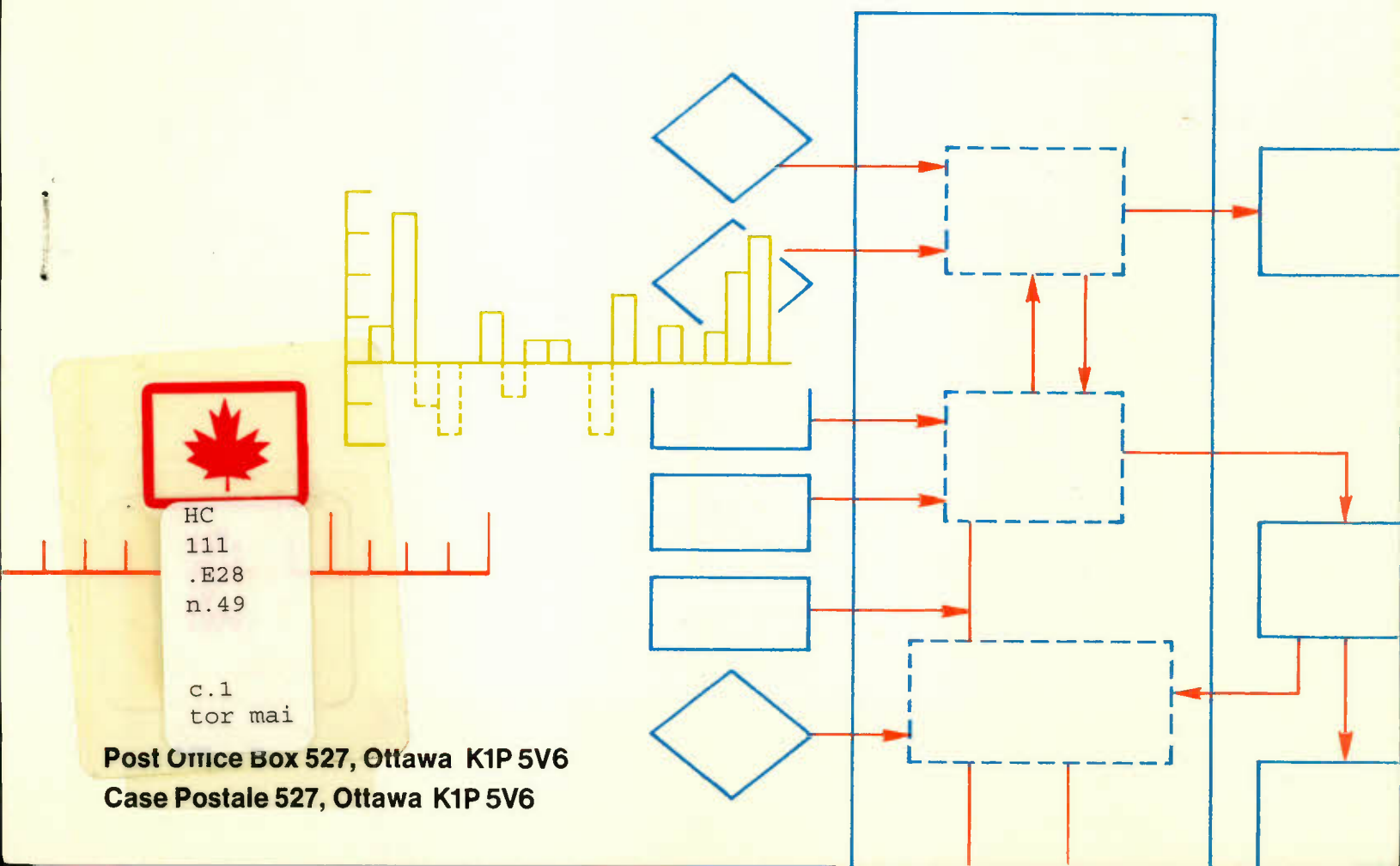
Economic Council of Canada
Conseil économique du Canada

[redacted]



Post Office Box 527, Ottawa K1P 5V6
Case Postale 527, Ottawa K1P 5V6

DISCUSSION PAPER NO. 49

Consequences of the Interdependency of Government Budget Restraints in a Federal State

by Stanley L. Winer

This paper is based on the second chapter of the author's Ph.D. dissertation submitted to the Johns Hopkins University. The author is indebted to his advisors, Carl Christ and Louis Maccini. W. Irwin Gillespie and J. C. R. Rowley commented most helpfully on an earlier draft of the paper. Financial support of the Canada Council is gratefully acknowledged.

February 1976

RÉSUMÉ

Dans un état fédéral, ni le gouvernement fédéral ni les autres paliers de gouvernement ne sont en mesure de déterminer de façon indépendante la valeur de chacune des variables de leurs politiques, étant donné l'équilibre qu'il faut respecter entre les sources et les affectations de fonds pour chaque période, à chaque niveau de gouvernement. Les restrictions budgétaires du gouvernement sont donc inter-dépendantes en ce sens qu'une variable de politique apparaissant dans la restriction budgétaire de chaque niveau de governement est déterminée en même temps au niveau macroéconomique. Le présent document analyse, dans le cadre de cette interdépendance, le rôle macroéconomique des variables de politique en ce qui a trait aux transferts intergouvernementaux dans un état fédéral.

ABSTRACT

Neither federal nor non-federal governments in a federal state are free to choose independently the values of all their policy variables, since sources and uses of funds must be equal in every period at each government level. Government budget restraints are therefore interdependent in the sense that one policy variable appearing in the budget restraint of each level of government is simultaneously determined in the macroeconomy. This paper analyzes the macroeconomic role of policy variables related to intergovernmental flows in a federal state, in view of this interdependency.

I. Introduction

A prominent feature of the recent history of federal states such as Canada or the United States has been the growth of intergovernmental flows of funds, primarily from federal to non-federal governments.[1] Important intergovernmental flows of this kind include shared federal tax revenue, federal conditional and unconditional grants to non-federal governments, and federal payments for the purchase of non-federal governments' bonds. These flows of funds have become a serious political issue because they may alter the relative degree of control over economic resources exerted by different levels of government. However this paper is not concerned with the political aspects of these large and growing flows, but rather with whether or not they may have important macroeconomic consequences, beyond the issue of the centralization of revenues and expenditures at one or the other level of government.[2] Indeed, we shall show that intergovernmental flow policy variables will in general influence both the dynamic behaviour and long-run equilibrium of the economy as a whole. This is so regardless of the reasons for which intergovernmental flows occur.

The device used here to integrate intergovernmental flows into macroeconomic theory is the government budget restraint, the importance of which has earlier been demonstrated for unitary states by Christ (1968), Silber (1970), Blinder and Solow (1973) and others.[3] It is no less important in a federal state; neither federal nor non-federal governments are free to choose independently the values of all their policy variables, since sources and uses of funds must

be equal in every period at each government level.[4] In any macroeconomic model of a federal state each government budget restraint (sources of funds equals uses of funds) operates together with the behavioural equations of the private sector - and the budget restraints of the other government levels - to determine endogenously the value of one policy variable in that restraint once the values of the rest of the policy variables in the restraint have been chosen by the appropriate authorities. Government budget restraints in a federal state are therefore interdependent. This paper analyzes the macroeconomic role of intergovernmental flow variables in view of the consequences of this interdependency.[5]

II. A Simple Macroeconomic Model of a Federal State

The model characterizes an economy with rigid prices and is an adaptation of a simple IS-LM model allowing for two levels of government and flows of funds between them.[6] The federal level of government consolidates both the central government and the central bank, and all non-federal governments have been consolidated into a second government sector, or representative non-federal government.[7] The banks and the non-bank private sectors are also consolidated so that the stock of money as usually defined (currency outside banks plus demand deposits) does not appear as a variable. Only the monetary base is present since it is the net holdings of money by the private sector.

For simplicity, the model exhibits only some of the intergovernmental flows that may exist in a federal state; shared federal tax revenue, federal open-ended conditional grants to

assist either non-federal purchases or transfers to persons, and federal unconditional, or untied, grants to non-federal governments.[8]

The total value of open-ended grants is determined by the non-federal governments. They set the level of the non-federal purchase or transfer to persons assisted by open-ended conditional grants but finance only a given proportion of that total.[9] The proportion to be financed by the federal government is regarded as being exogenously determined outside the model by the interplay of a constitution and federal-non-federal negotiation. The proportion of federal income tax shared with non-federal governments and the level of unconditional grants are also exogenously determined in this manner, but the total amount of tax revenue actually transferred depends on the level of income.[10]

Although in a federal state each level of government may not levy the same kind of taxes or purchase the same commodities, this model does not exhibit such detail. The usual manner in which the effect of fiscal policy variables are assumed to differ by government level, because of differential influences on aggregate demand, has been ignored.[11] There is, however, asymmetry in the treatment of the two levels of government since non-federal governments do not provide grants or transfer revenue to the federal level, and since the non-federal level cannot (directly) change the monetary base.

Notation, Classification of Variables and Some Inequality Constraints

In unitary states it is customary to classify the variables appearing in the government budget restraint as being either monetary

or fiscal instruments, and to distinguish between the macroeconomic influences of them. In federal states it is of interest to distinguish also the influence of intergovernmental flow policy variables, at least because some of these, including those in the present model, would not ordinarily enter into any of the behavioural equations in the private sector of a macroeconomic model. Therefore, in this paper a distinction is maintained between these intergovernmental flow variables, the related (and sometimes identical) intergovernmental flows, and other policy variables.

The following three intergovernmental flow variables are regarded as having been determined by the interplay of a constitution and federal-non-federal negotiation: a_F, the proportion of federal income taxes-less-transfers to persons transferred to non-federal governments, where $0 \leq a_F < 1$; b_F, the proportion of non-federal expenditures Q^e_{NF} and Q^{tr}_{NF} financed by open-ended conditional grants from the federal government, where $0 \leq b_F \leq 1$; and T^{nc}_F, federal unconditional grants to non-federal governments.

Since intergovernmental flow variables are considered to be exogenously determined, one each of the following three federal and four non-federal policy variables are endogenous.

Federal policy variables are: G_F, federal purchases; H, the monetary base (currency held by the public plus unborrowed bank reserves); and v_F, the federal marginal (and average) rate on income sensitive taxes-less-transfers to persons, where $0 < v_F < 1$.

Non-federal policy variables include: G_{NF}, non-federal purchases not assisted by federal conditional grants; Q^{e}_{NF}, non-federal (open-ended) grant-assisted purchases; Q^{tr}_{NF}, non-federal (open-ended) grant-assisted transfers to persons; and v_{NF} which is analogous to v_F, where $0 < v_{NF} < 1$ and $0 < v_F + v_{NF} < 1$.

The endogenous variables are: E, private expenditure net of depreciation; F_F and F_{NF}, total federal conditional grants provided to non-federal governments for purchases and for transfers to persons, and total non-federal expenditures matching these grants; r, the rate of interest; T_F and T_{NF}, total federal and total non-federal taxes from own sources (i.e. excluding shared revenue at the non-federal level), less transfers to persons excluding at the non-federal level grant-assisted transfers; Y, net national product; as well as <u>one</u> federal and <u>one</u> non-federal policy variable listed above.

<u>The Model</u>

The nine equations of the model, given below, are linearized for convenience. The parameters of the model are all assumed to be positive except perhaps h_0 and e_0.

Product and money market equilibrium are given respectively by

$$Y = E + G_F + G_{NF} + Q^{e}_{NF} , \tag{1}$$

and

$$H = h_0 + h_1 Y + h_2/r . \tag{2}$$

The parameters e_1 and e_2 of the net private expenditure function (3) may be different because while income and taxes-less-transfers

affect consumption by equal but opposite amounts, they may have different effects on investment:

$$E = e_0 + e_1 Y - e_2 (T_F + T_{NF} - Q_{NF}^{tr}) + e_3/r \ . \tag{3}$$

The definitions of federal open-ended conditional grants, for purchases and for transfers to persons, and of non-federal expenditures matching open-ended conditional grants are:

$$F_F = b_F (Q_{NF}^{e} + Q_{NF}^{tr}) \ , \tag{4}$$

and

$$F_{NF} = (1-b_F)(Q_{NF}^{e} + Q_{NF}^{tr}) \ . \tag{5}$$

Thus it is assumed that the proportions of grant-assisted non-federal purchases and of transfers to persons financed by the federal government are the same. Federal taxes-less-transfers to persons are:

$$T_F = v_F \cdot Y \ , \tag{6}$$

while non-federal taxes from own sources, less transfers to persons excluding conditional grant-assisted transfers are given by:

$$T_{NF} = v_{NF} \cdot Y \ . \tag{7}$$

Finally, the federal budget restraint is:

$$F_F + G_F = (1-a_F) T_F - T_F^{nc} + \Delta H \ , \tag{8}$$

and the non-federal restraint is:

$$F_{NF} + G_{NF} = T_{NF} + a_F T_F + T_F^{nc} \ . \tag{9}$$

Note that conditional grants to the non-federal governments to assist their purchases and transfers to persons enter the non-federal budget restraint as both a source and a use of funds and so have been omitted from (9).

Equations (1), (3) and (4) through (7) constitute the usual IS curve while the LM curve is represented by equation (2). With the addition of the budget restraint (8), the model becomes dynamic. Long-run equilibrium cannot be reached unless all governments are in stock-flow equilibrium.[12]

Impact and Long-run Income Multipliers

Before it is possible to investigate the effect on the macroeconomy of step changes in any policy variable, a choice must be made as to which policy variable from each level of government is to be determined endogenously. Since there are three federal and four non-federal policy variables there are 12 pairs of policy variables as candidates. Three pairs will be investigated. It is important to note that all three cases may be consistent with the same federal constitution.[13]

case 1 : H and v_{NF} endogenous

This represents a situation in which increases in flows of funds from the federal government are financed by money creation. Non-federal tax (-less-transfer) rates, may be lower than in the absence of these increased flows. The non-federal policy represents a balanced budget policy, which in a federal state with revenue sharing must be understood to include shared revenue $a_F T_F$ as a part of the means by which the non-federal budgets are balanced.

case 2 : G_F and v_{NF} endogenous

If case 1 represents an expansionary method of financing federal flows, this is a contractionary foil to that situation. Increases in intergovernmental flows are financed at the 'expense' of federal purchases.

case 3 : v_F and v_{NF} endogenous

In this case increases in federal government flows are financed by an increase in federal tax rates. In contrast to the previous two cases, the endogenous policy variables have the same macroeconomic role at each government level.

Corresponding to cases 1, 2 and 3 regarding choices of pairs of endogenous policy variables, Table 1 presents impact and long-run income multipliers for step increases in the intergovernmental flow variable T_F^{nc} and the non-federal policy variables Q_{NF}^{e} and Q_{NF}^{tr}, when all other variables are held constant. The intergovernmental flow variables a_F and b_F appear as parameters of income multipliers for case 1 and 2 choices of endogenous policy variables. It must be emphasized that these multipliers are appropriate for expositional purposes only, because of the assumption that prices are fixed and the implicit assumption that capacity output is never reached. Their derivation when case 1 applies will be illustrated.

In temporary equilibrium the model in case 1 reduces to four equations in Y, r and the two policy variables H and v_{NF}. These equations will not be stated here. The equilibrium is temporary because the federal government is not necessarily in stock equilibrium. During the process of adjustment of the economy to an increment in a non-federal or intergovernmental flow policy variable, federal sources of funds may be altered. To keep uses and sources of funds equal at the federal level then requires a change in the monetary-base.

The reduced form difference equation from which impact and long-run income multipliers may be calculated is found by solving these four equations as amended for Y. The reduced form equation for Y in case 1 is then

$$Y[\alpha+\beta\gamma/\theta] = (e_2+\beta)T_F^{nc} + (1-e_2)[G_{NF}+(1-b_F)Q_{NF}^e] + (1+\beta)(G_F+b_F Q_{NF}^e)$$
$$+ (e_2+\beta)b_F Q_{NF}^{tr} + \{\alpha_{-1}Y_{-1} - e_2(T_{F_{-1}}^{nc} + b_{F_{-1}} \cdot Q_{NF_{-1}}^{tr})$$
$$- (1-e_2)[G_{NF_{-1}} + (1-b_{F_{-1}})Q_{NF_{-1}}^e] - (G_{F_{-1}} + b_{F_{-1}} \cdot Q_{NF_{-1}}^e)\} \qquad (10)$$

where the positive quantities introduced in (10) are

$$\alpha = 1 - e_1 + e_2(1-a_F)v_F + e_3/\theta$$
$$\beta = e_3/h_2$$
$$\gamma = \theta(1-a_F)v_F$$
$$\theta = h_2/h_1 .$$

The term $1/(\alpha+\beta\gamma/\theta)$ is the basic impact multiplier, and $1(\beta\gamma/\theta)$ is the basic long-run multiplier.

After the first period, following a given policy change, all lagged and current values of non-endogenous policy variables are equal and equation (10) becomes a linear first difference equation with constant coefficients. Stability of the time path of Y then requires[14]

$$|\alpha/(\alpha+\beta\gamma/\theta)| < 1 . \qquad (11)$$

Within $a_F < 1$, β, γ and θ are positive because of the previous assumption about the sign of parameters of the model. Thus a sufficient condition for (11) to hold, and which is hereafter assumed, is

$$\alpha > 0 . \qquad (12)$$

Table 1: Impact and Long-Run Income Multipliers for Case 1, 2 and 3 Choices of Endogenous Policy Variables*

	Impact Multipliers (time interval: 1)						Long-Run Multipliers (time interval: + ∞)					
	case 1	$\gtrless 0$	case 2	$\gtrless 0$	case 3	$\gtrless 0$	case 1	$\gtrless 0$	case 2	$\gtrless 0$	case 3	$\gtrless 0$
$\Delta Y/\Delta Q^{e}_{NF}$	$\frac{(1-e_2)+(e_2+\beta)b_F}{A_1}$	+	$\frac{(1-e_2)(1-b_F)}{A_2}$	+	$\frac{1-e_2}{A_3}$	+	$\frac{b_F}{(1-a_F)v_F}$	+	$\frac{(1-e_2)(1-b_F)}{A_2}$	+	$\frac{(1-e_2)}{A_3}$	+
$\Delta Y/\Delta Q^{tr}_{NF}$	$\frac{(e_2+\beta)b_F}{A_1}$	+	$\frac{-(1-e_2)b_F}{A_2}$	-	0		$\frac{b_F}{(1-a_F)v_F}$	+	$\frac{-(1-e_2)b_F}{A_2}$	-	0	
$\Delta Y/\Delta T^{nc}_{F}$	$\frac{(e_2+\beta)}{A_1}$	+	$\frac{-(1-e_2)}{A_2}$	-	0		$\frac{1}{(1-a_F)v_F}$	+	$\frac{-(1-e_2)}{A_2}$	-	0	

* Notes to Table 1.

(i) case 1: $A_1 = \alpha + \beta\gamma/\theta$ is positive by assumption (12).

(ii) case 2: $A_2 = \alpha - \gamma/\theta$ is assumed to be positive; i.e., it is assumed $0 \leq e_1 + (1-e_2)(1-a_F)v_F \leq 1$.

(iii) case 3: $A_3 = (1-e_1) + e_3/\theta$ is assumed to be positive; i.e., it is assumed $0 \leq e_1 \leq 1$.

(iv) If $b_F = 0$, $\Delta Y/\Delta Q^{e}_{NF} = \Delta Y/\Delta G_{NF}$. If $b_F = 1$, $\Delta Y/\Delta Q^{e}_{NF} = \Delta Y/\Delta G_{F}$.

Impact multipliers are found by partially differentiating (10) with respect to the current values of policy variables. Long-run multipliers may be found by first setting all lagged values of policy variables equal to current values and solving (10) as amended for the long-run equilibrium value of income, and then by calculating the difference in long-run equilibrium income before and after a given policy change.[15]

In the following three sections these multipliers, and the corresponding multipliers for cases 2 and 3, will be used to show the influence of T_F^{nc}, a_F and b_F on aggregate income. Our approach will be to view the macroeconomic influence of any policy variable as being a result of the interdependency of government budget restraints.

III. Some Consequences of the Interdependency of Government Budget Restraints

Consider a step increase in the level of unconditional grants T_F^{nc}. In case 1, ΔT_F^{nc} is financed by money creation; each period the federal government must increase the monetary base unless the increased grant level results in an increase in federal sources of funds less funds transferred to non-federal governments equal to ΔT_F^{nc}. At the non-federal level, tax rates are lowered to offset the increase in sources of funds. If $a_F = 1$ all increases in federal tax revenue due to a rise in income as a result of the lowering of non-federal tax rates and the increase in the monetary-base are transferred to the non-federal level, which again reduces its tax rates to offset both increases in shared revenue as well as the income induced increase in tax revenue from our sources.

Consequently, the federal government must continue forever to print money in order to finance the increase in T_F^{nc}, and thus income will continue to grow.[16] If $a_F < 1$, the change in federal revenue transferred to the non-federal level would be less than the induced increase in federal income tax revenue in each period, and so income would eventually reach a higher but finite equilibrium level. This new equilibrium level will be higher, the greater the value of a_F.

The response of the macroeconomy would be quite different if ΔT_F^{nc} occurred in case 2. In that situation, increases in T_F^{nc} result in a decrease in federal purchases, and this decrease offsets the effect on income of the decrease in non-federal tax rates for the usual reason. Income falls.

The importance of the choice of endogenous policy variables in determining the consequences of the interdependency of government budget restraints, and therefore the response of the macroeconomy to exogenous shocks, is worth stressing.

Consider the role of a_F in the automatic stabilizing influence of the total (combined federal and non-federal) government sector. For a given autonomous shock, say an increase in T_F^{nc}, it is possible to calculate the long-run per cent reduction or increase in the change in income due to this shock because of the existence of revenue sharing. This per cent reduction is given by $d = 1 - \Delta Y_{a_F} / \Delta Y$, where ΔY is the change in income due to the stipulated shock when $a_F = 0$ and ΔY_{a_F} is the change in income following the same shock but with $a_F > 0$.[17] It is, in case 1,

$$d_H = 1 - 1/(1-a_F) \ , \tag{13}$$

and in case 2,

$$d_{G_F} = 1 - \pi/[1-e_1-(1-e_2)(1-a_F)v_F+e_3/\theta] \ , \tag{14}$$

where $\pi = (1-e_1-(1-e_2)v_F+e_3/\theta)$ is independent of a_F and is assumed to be positive.

In case 1, $d_H < 0$ and decreases as a_F increases. In case 2, $d_{G_F} > 0$ and increases as a_F increases. In case 1, compared to the situation in which $a_F = 0$, an increase in T_F^{nc} results in a greater reduction in non-federal taxes the greater is a_F and a larger increase in the money stock, since the income induced increase in federal sources of funds is reduced by the value of the shared revenue. Therefore the long-run response is more expansionary when a_F is non-zero. In case 2 the same comparison shows that an identical increase in T_F^{nc} results in a smaller decrease in federal purchases the greater is a_F, which outweighs the effect of the smaller decrease in non-federal tax rates. Consequently, the long-run equilibrium fall in income is less than when a_F is zero.

It is the difference in the means of financing deficits at the federal level that distinguishes the results in case 1 from those in case 2.

IV. Further Consequences

As a result of the simultaneous determination of the values of endogenous policy variables of federal and non-federal governments, changes in the exogenously set levels of policy variables of one government affect the endogenous policy variables of both.

For example, even though non-federal governments do not have the constitutional right to print money, in case 1 an increase in an open-ended grant-assisted purchase Q^e_{NF} or transfer to persons Q^{tr}_{NF} will result in a change in the monetary base and an increase in non-federal tax rates if, as in case 1, the federal authorities are in every period financing their deficits by printing money and non-federal governments are balancing their budgets.

The exact non-federal influence on the money stock due to an increase in Q^e_{NF} , for example, may be calculated using the reduced form difference equation for H in case 1:

$$\begin{aligned} H[(\alpha+\beta\gamma/\theta)/\alpha] = {} & (b_F Q^e_{NF}+G_F) + b_F Q^{tr}_{NF} + T^{nc}_F - (1-a_F)v_F/\alpha \\ & \cdot \{e_0-h_0\beta+e_2 b_F Q^{tr}_{NF}-T^{nc}_F+(b_F Q^e_{NF}+G_F) \\ & + (1-e_2)[(1-b_F)Q^e_{NF}+G_{NF}]+H_{-1}\} \quad . \end{aligned} \tag{15}$$

One period after a specified policy change this is, as is (10), a first difference equation with constant coefficients. As it is for (10), the stability of (13) is assumed by assumption (12). Note that ΔH_{-1} is not in general zero following a change in an exogenously set policy variable. Assuming the intitial position is one in which all governments are in stock-flow equilibrium, the change required in H immediately following an increase in Q^e_{NF} is then

$$\Delta H/\Delta Q^e_{NF} = [\alpha b_F-(1-a_F)v_F \cdot (b_F+(1-e_2)(1-b_F))]/A_1 \quad . \tag{16}$$

As b_F decreases, the federal government finances a smaller proprotion of any increase in Q^e_{NF} . Thus

$$\frac{\partial}{\partial b_F}(\Delta H/\Delta Q^e_{NF}) > 0 \quad .$$

When $b_F = 0, \Delta Q^e_{NF}$ is equivalent to an increase in a non-grant-assisted, non-federal purchase, and in this situation $\Delta H/\Delta Q^e_{NF}$, or equivalently $\Delta H/\Delta G_{NF}$, is negative. The straightforward reason is that the increase in G_{NF}, financed by an increase in non-federal tax rates, causes income and so federal income tax revenue to rise. Induced tax revenue creates a federal surplus which the federal government eliminates by reducing the money stock. An income induced increase in shared revenue also occurs, but this will not offset the non-federal influence on H unless $a_F = 1$. In that extreme situation induced increases in federal tax revenue have no influence on the change in H required to equate federal sources and uses of funds since any such increases are transferred to the non-federal level.

It is possible that this response of the endogenous policy variable of the federal level to step increases in the values of exogenously determined non-federal policy variables may in the long-run either offset or reinforce the initial impact on income of the change in the non-federal policy variable.

For example, in the short-run, $\Delta Y/\Delta Q^e_{NF}$ is positive in case 1, even if $b_F = 0$. However, in the long-run

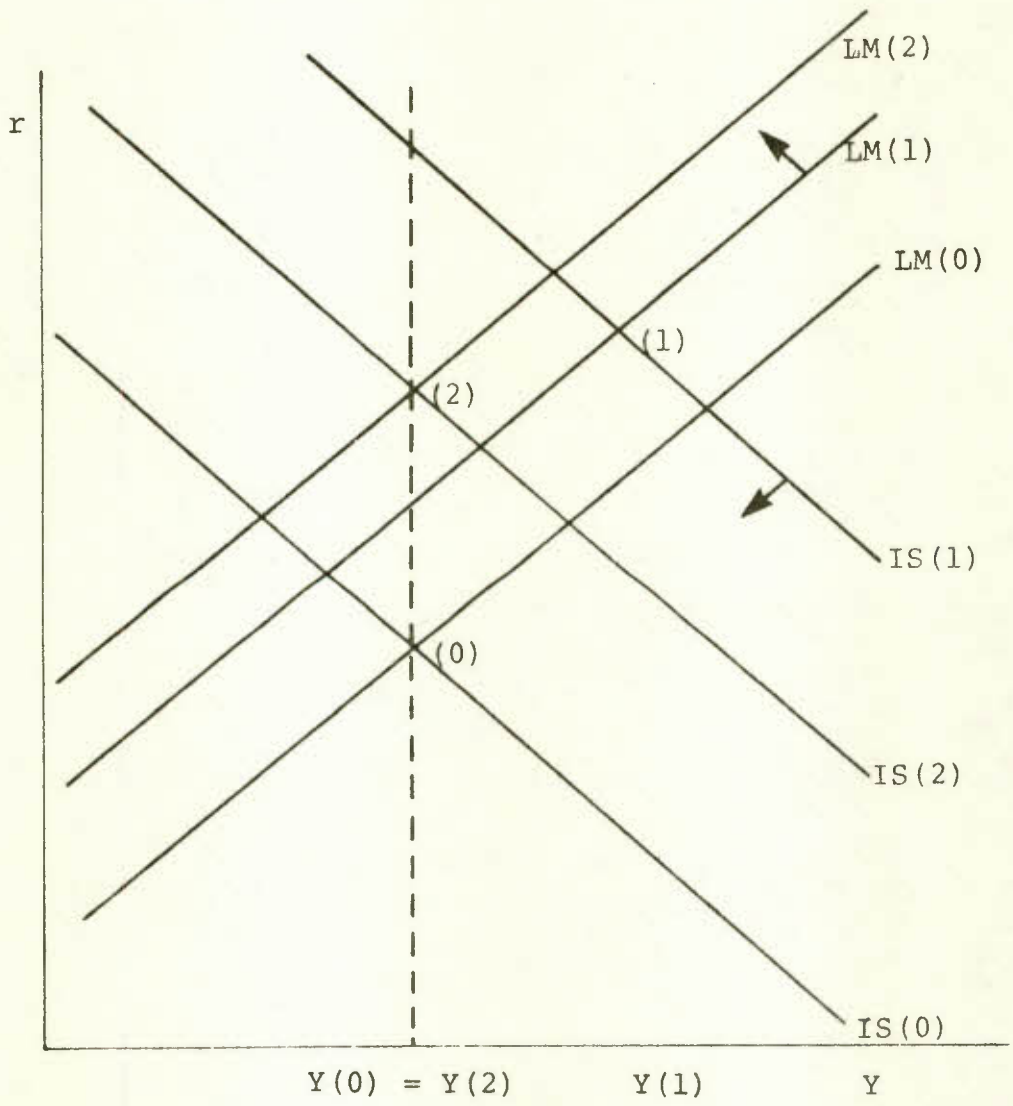
$$\Delta Y/\Delta Q^e_{NF} = b_F/(1-a_F)v_F \ , \tag{17}$$

and is zero if b_F is. This long-run balanced budget multiplier at the non-federal level is the analogy in a federal state to Christ's finding in a unitary state of $1/v_F$ for the long-run income multiplier of a money financed step increased in government purchases.[18] As b_F approaches 0, and the federal government finances a progressively smaller share of the shared-cost program Q^e_{NF}, $\Delta Y/\Delta Q^e_{NF}$ approaches 0. When $b_F = 0$, $\Delta Y/\Delta Q^e_{NF} = \Delta Y/\Delta G_{NF}$. Since such an increase in the non-federal policy variable G_{NF} which stimulates income above an initial

stock-flow equilibrium level induces a federal surplus, the (endogenously determined) stock of money will be reduced until federal sources and (unchanged) uses of funds are again at their original levels. But this can only occur if income is once again at its initial level. Figure 1 illustrates. The impact effect of the increase in non-federal purchases shifts the IS curve rightwards to IS(1). But since the federal government finds itself with a surplus, the money stock is reduced and so the LM curve shifts simultaneously leftwards to LM(1). As long as income exceeds Y(0) the federal surplus persists and the money stock is again reduced. But any further decrease in the stock of money reduces income below Y(1) and thus non-federal taxes from own sources as well as shared tax revenue. The result is higher non-federal tax rates than those required initially to finance ΔG_{NF}, and a further fall in income as IS(1) shifts leftwards, and so on. Long-run equilibrium is reached at the original level of income and a higher rate of interest.

On the other hand, in cases 2 and 3 the same increase in Q^e_{NF} results in an increase in long-run income, even if b_F is zero. The response of the endogenous federal policy variable does not completely offset the initial increase in income resulting from the change in the non-federal policy variable as long as $b_F < 1$. In fact, exactly the opposite is true if $b_F = 0$. In response to an increase in G_{NF} (or in Q^e_{NF} when $b_F = 0$) the induced increase in federal income tax is matched in case 2 by an increase in federal purchases or, if case 3 applies, a cut in federal taxes. Both responses are expansionary. Long-run equilibrium is therefore attained at a higher level of federal purchases (case 2) or with a lower federal income tax rate (case 3).

Figure 1



Effect of an increase in G_{NF}, or Q^{e}_{NF} when $b_F = 0$: H and v_{NF} are endogenous. Long-run equilibrium income remains unchanged.

In general, in cases 1 and 2, the short and long-run influences on income of an increase in Q_{NF}^{e} or Q_{NF}^{tr} depend upon the size of the federally financed share of this shared-cost program. The effect on income of the non-federal purchase is either more completely offset (case 1) or less completely offset (case 2) by the response of the federal endogenous policy variable, the smaller the size of b_F .

V. Symmetry vs. Asymmetry in the Macroeconomic Role of Endogenous Policy Variables of Different Levels of Government

To see the last result of the previous section from a different viewpoint, consider whether or not the endogenous policy variable at each level of government plays the same macroeconomic role.

When income tax rates are endogenously determined at each level of government (case 3) the results of Table 1 indicate that the effect of an increase in Q_{NF}^{e} or Q_{NF}^{tr} does not depend on b_F . The proportion of such a jointly financed expenditure that is financed by a particular level of government has no consequences for the level of income, or macroeconomic activity in general, in the model presented here, if each government finances its share in exactly the same manner.[19]

It is also in (the symmetrical) case 3 that a change in T_F^{nc} will not influence income in the short or long-run.[20]

VI. Conclusions

In the present, and in any, macroeconomic model of a federal state, one policy variable in the budget restraint of each government level must be endogenously determined in each period. The choice of which policy variables are to be considered endogenous determines the manner in which intergovernmental flows are to be financed, the consequences of the interdependency of government budget restraints, and therefore the macroeconomic importance of intergovernmental flow policy variables. Only when all governments finance deficits or surpluses created by the intergovernmental flow in the same manner (when endogenous policy variables are the same except for the subscript) will intergovernmental flow variables influence neither the dynamic behaviour nor the long-run equilibrium of the economy as a whole. The intuitive reason for this result is that in the present macroeconomy in which it is only the aggregate government sector that influences private behaviour, a change in an intergovernmental flow variable will influence economic activity only if this change affects either the level of aggregate, federal plus non-federal, government purchases or taxes, or the size of the monetary base. But if endogenous policy variables are identical at all levels of government only the federal-non-federal composition of aggregate purchases or taxes will be altered, and not the level of these aggregates or the size of the monetary base, when flows of funds between governments occur.[21]

Such similarity in the endogenous policy variables of different levels of government is a very demanding requirement in a federal state composed of several jurisdictions, especially since it is customary for only one jurisdiction to have the authority to create money. Consequently in such a federation, arguments over the sharing of tax revenues, the share of jointly financed expenditure programs to be financed by each government level, and the level of unconditional grants, will in general have important macroeconomic consequences beyond the issue of the centralization of expenditures and revenues at one or the other level of government.

[1] These flows have been mainly in response to the following three factors: (i) a lack of correlation between expenditure responsibilities and revenue sources at the different levels of government, with the former growing faster than the latter at the non-federal levels, (ii) differences in the fiscal capacities of non-federal governments at identical levels in the federal system to provide the same amounts of goods and services per capita, and, (iii) a growing desire by federal governments to promote the provision of certain goods and services on a national basis.

[2] This issue has been raised before, for example by Maxwell (1952) in his study of the relationship between federal grants and the business cycle in the U.S.

[3] See also Christ (1973). The importance of the government budget restraint to a study of monetary-fiscal influences in unitary states has also been acknowledged by Ritter (1955-56), Hansen (1958), Musgrave (1959), Enthoven (1960), Lindbeck (1963) and Ott and Ott (1965). Parizeau (1970) provides some useful information on the nature of budget restraints in a federal state although he does not state them as such.

[4] By a federal state is here (and hereafter) meant any macroeconomy in which (i) there are at least two government sectors, a federal or central government and at least one non-federal sector composed of two or more non-federal governments, and in which (ii) each government sector has discretionary authority to vary the value of at least two policy variables in the budget restraint that sector faces. (Two policy variables must be autonomously controlled by a given level of government for it to have one degree of freedom in setting the values of the policy variables nominally under its control.)

[5] Put differently, we may say that the purpose of the paper is to explore some essential macroeconomic aspects of federal states not also found in unitary states.

[6] See for example the model employed by Christ (1968). Government bonds and wealth effects are omitted from this model for expositional clarity. For a similar analysis of a model with privately held government bonds and wealth effects, see Winer (1975).

[7] For an analysis of a macroeconomic model containing separate budget restraints for a consolidated government sector and a central bank see Hansen (1973).

[8] It is a simple matter to generalize the model to embrace whatever type of intergovernmental flow that is desired, including flows which are from non-federal to federal governments. However, the general consequences of the interdependency of budget restraints in the present model remain the same in any macromodel of any federal state as long as that model contains two or more government budget restraints.

[9] For example, the federal government in Canada finances 50 per cent of the operating expenditures of provincial post-secondary educational institutions.

[10] In Canada the term 'revenue sharing' refers to the transfer to the non-federal level of a proportion of tax revenue collected by the federal level. In the United States this term typically refers to the transfer of federal resources to the non-federal level via conditional or unconditional grants. The former and more explicit, tax related, sense of this term will be used in this paper.

[11] It may seem that this assumption is not consistent with the existence of intergovernmental flows. However, they may exist at least for the second of the reasons given in footnote 1 above. Aggregation over non-federal tax revenues, for example, does not preclude the possibility that the components are not equal. Moreover, in Canada and the U.S. at least, non-federal jurisdictions exercise their access to the income tax and the sales tax, as does the federal government. In any case, we wish to establish minimum conditions under which intergovernmental flow variables will influence economic activity, regardless of the reasons for which intergovernmental flows have arisen.

[12] In the present model, stock-flow equilibrium of the government sectors and of the economy as a whole are not necessarily coincident. If the capital stock is allowed to change, stock-flow equilibrium of government, herein called long-run equilibrium, is only a necessary condition for a long-run equilibrium of the macroeconomy to obtain.

[13] It is assumed that the following endogenous policy pairs are endogenous in all periods following an exogenous change in any other policy variable, not just in the initial period. After an exogenous policy change all policy variables are held constant except the two which vary so as to keep sources and uses of funds in balance at each level of government. The endogenous policy variables during each period of the adjustment process need not be the same as the two which are endogenous in the initial period, but we do not study that case. Also, we note that these policy pairs do not represent an exhaustive description of how intergovernmental flows have been financed in the past.

14 In cases 2 and 3, because there are no lagged flow variables in the model, the model adjusts to a step change in a policy variable instantly. Thus in the simple model presented here, impact and long-run multipliers are identical in cases 2 and 3. This is a text-book illustration of the importance of a distinction between stocks and flows. The adjustment to long-run equilibrium following a change in a policy variable occurs more quickly if the policy variables endogenously determined by the government budget restraints are flows, than if one or more are stocks.

15 As Steindl (1971) shows, some long-run multipliers may be calculated directly from the government budget restraint. For example, in case 1 following a step change in Q^e_{NF}, stock-flow equilibrium of the federal government requires $b_F \Delta Q^e_{NF} = (1-a_F)v_F \cdot \Delta Y$. Thus in the long-run, $\Delta Y/\Delta Q^e_{NF} = b_F/(1-a_F)v_F$, as given in Table 1. However if none of the endogenous policy variables are stocks, as in case 3, this approach cannot be used since then there are enough budget restraints to determine simultaneously only two of the three endogenous variables, v_F, v_{NF} and Y, which appear in these restraints.

16 Note that when $a_F = 1$, (11) becomes $|\alpha|(\alpha+\beta\gamma/\theta)| = 1$ and so in case 1 an equilibrium of the present model is not stable, as this example illustrates.

17 This is an application of the method of Musgrave and Miller (1948). d_H and d_{G_F} are calculated using the appropriate long-run values of $\Delta Y/\Delta T^{nc}_F$, with an without a_F set equal to 0, that are given in Table 1.

18 Christ (1968, p. 56). As $\Delta Y/\Delta T^{nc}_F$ in case 1, and for the same reason, this multiplier approaches $+\infty$ as a_F approaches 1.

19 This is no longer true in the present model if the taxes of each level of government affect net private expenditure differently.

20 Moreover, $\Delta Y/\Delta a_F$ and $\Delta Y/\Delta b_F$ are also zero in case 3 (and non-zero in cases 1 and 2) in both short and long runs.

21 If the model had included wealth as a determinant of the demand for money, and federal and non-federal privately held bonds (regarded by the private sector as perfect substitutes), then intergovernmental flow variables will influence private activity if they alter the bond-money ratio in or absolute scale of aggregate government debt (including the monetary base) privately held. But this cannot occur if endogenous policy variables are identical.

Blinder, A. S. and R. M. Solow, 1973, Does Fiscal Policy Matter? Journal of Public Economics 2, 319-337.

Christ, C. F., 1968, A Simple Macroeconomic Model with a Government Budget Restraint, Journal of Political Economy 75, 53-67.

_____, 1973, Dynamic Macroeconomic Policy Effects on Income and Prices under the Government Budget Restraint (Working Papers in Economics No. 6, Department of Political Economy, The Johns Hopkins University).

Enthoven, A. C., 1960, A Neo-Classical Model of Money, Debt and Economic Growth. Mathematical Appendix to: Money in a Theory of Finance by J. G. Gurley and E. S. Shaw. (The Brookings Institution) 305-359, esp. 315ff.

Hansen, B., 1958, The Economic Theory of Fiscal Policy. Translated by P. E. Burke. (Harvard University Press) Chp. 3.

_____, 1973, On the Effects of Fiscal and Monetary Policy: A Taxonomic Discussion, American Economic Review 63, 546-571.

Lindbeck, A., 1963, A Study of Monetary Analysis (Stockholm Economic Studies, New Series III. Almqvist and Wicksell) 144, 146-147.

Maxwell, J. A., 1952, Federal Grants and the Business Cycle (National Bureau of Economic Research).

Musgrave, R. A. and M. H. Miller, 1948, Built-In Flexibility, American Economic Review 38(1), 122-128.

_____, 1959, The Theory of Public Finance (McGraw-Hill, New York) Chp. 22.

Ott, D. J. and A. F. Ott, 1965, Budget Balance and Equilibrium Income, Journal of Finance 20, 71-77.

Parizeau, J., 1970, Federal Provincial Economic Co-ordination in: Officer L. H. and L. B. Smith, eds., Canadian Economic Problems and Policies (McGraw-Hill, Toronto) 81-92.

Ritter, L. S., 1955-6, Some Monetary Aspects of Multiplier Theory and Fiscal Policy, Review of Economic Studies 23, 126-131.

Silber, W. L., 1970, Fiscal Policy in IS-LM Analysis: A Correction, Journal of Money Credit and Banking 2, 461-472.

Steindl, F. G., 1971, A Simple Macroeconomic Model with a Government Budget Restraint: A Comment, Journal of Political Economy 79, 675-679.

Winer, S. L., 1975, Monetary-Fiscal Influences in a Federal State: With Application to the Post-War Canadian Economy (Unpublished Ph.D. dissertation, The Johns Hopkins University).