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RESTRICTING THE SCALE OF GOVERNMENT IN A SMALL OPEN ECONOMY

by

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1. Introduction

It is the purpose of this paper to compare, in the context of a small open economy, the impact of reductions in various categories of tax-financed government expenditures on real private sector output and on the balance of payments.[1/] The comparisons are performed within the framework of a tradable-nontradable model where the interaction between labor supply decisions, taxation and the composition of tax-financed government expenditures is captured. This interaction is introduced through the labor supply function, which is assumed to depend on the level of the real after-tax wage, relative prices and the level of real money balances.[2/]

The basic motivation for this endeavor derives from the recent efforts by the central governments of Germany, Japan, the Netherlands, Sweden, the United Kingdom, and the United States to institute policies that limit

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1/ All real variables are expressed in terms of the tradable goods price.

2/ Recently, Joines (1977), Canto, Laffer, and Odogwu (1978), Canto, Joines, and Laffer (1978), and Evans (1978) have used labor supply functions that are sensitive to government taxation and expenditures. These authors do so to show that a rise in taxes to finance government expenditures will lead to an output offsetting increase in leisure taking or nonmarket activity on the part of workers. In the present context this type of labor supply function is used to better capture the effect on private sector activity, in particular the effect on the balance of payments, of lower taxes. Changes in taxation will affect taxpayer behavior, and hence, economoc activity in the private sector. Taxpayers respond to higher taxes through increased tax evasion, tax shifting through the tax and wage system, and reduced work effort.

Tax push inflation occurs when demands for wage increases are formulated after allowing for the consequent increase in taxation, i.e., bargaining on the real after-tax wage. Bacon and Eltis (1978) argue that tax shifting by workers has become deeply entrenched in Britain and has been growing in importance in Canada. Tax shifting through tax push inflation and reduced work effort are the most important and widespread reactions to higher taxation. In this paper tax shifting and reduced hours of work are not seen to be independent. An increase in taxes in the present context leads to a reduction in hours worked and a consequent increase in the real before tax wage. For further discussions of these behavioral responses see Public Expenditure Trends (1978).

government expenditure as a proportion of real GNP.[3/] There are many ways, however, to achieve the desired result of a lower ratio of real government expenditures to real GNP, for example, the government can reduce its expenditures solely on nontraded goods or traded goods, or on the government wage bill.[4/] Each one of these expenditure cuts will have a distinct impact on the rest of the economy. Since the main purpose of the government's expenditure limitations or reductions is to leave more resources to the private sector, policymakers must examine and compare the effects of reductions in different categories of official expenditures in order to chose a method of action which is feasible and has the most positive effect on the level of private sector production.

3/ Similar policies have been proposed in Canada and discussed in Italy. These policy actions came in response to growing internal political pressure by voters in these countries against the continued rapid expansion of the government's command over the economy's resources. This expansion has been documented by Nutter (1978) and by the OECD in Public Expenditure Trends (1978).

The government's command over resources is generally measured as the percent of GNP, or of some other income aggregate, represented by total government expenditures and transfers to the public. As Nutter argues, this method of measuring government size does not take into account the full scope of activities that fall within its purview. For example, it does not take into account the control the government has as a result of laws and regulation. However, this concept is broader in scope than the notion of the direct government use of resources, i.e., the percent of GNP represented by government purchases of goods and services, and can be used as a useful first approximation of the government's size.

4/ More generally, the government can reduce expenditures by category of expenditure and by the level of government where the expenditure will ultimately take place. Reducing government spending in this fashion can be called "expenditure shifting". When it is done by level of government it becomes the reverse of the usual revenue-sharing system. That is general expenditures are shifted from the federal to sub-central governmental units without corresponding revenues to finance them. For example, a central government that provides needed local public goods via revenue-sharing can force up taxes or the deficit at the local level if it were to reduce the amount of intergovernmental transfers. Paradoxically, such shifts may have the effect of increasing total public sector expenditures, since central governments usually borrow under more favorable terms than do sub-central governments. An example of shifts by compositional category of government expenditure occurs when the government increases the proportion of its expenditures on current goods and services at the expense of investment spending. If this were to occur much of the burden of reduced government expansion would fall on the shoulders of future generations. In the present context all of these different forms of expenditure shifting are collapsed into shifts amongst the government wage bill and official purchases of traded and nontraded goods.

The basic conclusions of this paper are that there are two effects of a reduction in tax-financed government expenditures. The first effect, which is a tax effect, results from the effect of lower taxes on the household sector's labor supply decision. Lower taxes will induce more labor force participation and, thus, will lead to higher levels of private sector output and a short-run surplus in the balance of payments. The second effect, which is the composition effect, stems from the direct impact on the commodities and labor markets of reductions in specific forms of government spending. These expenditure specific effects will have additional impacts on the level of private sector production and will lead to ambiguities as to the initial impact on the balance of payments.

2. The Model

2.1 Assumptions

The economy consists of firms, a government and households. Households are the basic decision making unit for the supply of man-hours and for the demands for net additional real cash balances. Households are assumed to be identical, and for expositional purposes it is assumed that each household supplies some labor to the government and to firms.

The population of workers is assumed fixed; however, the amount of labor that a given population of workers will supply will depend to some degree on worker choice.[5/] In practice choices would be made regarding the number of hours worked, the rate of labor force participation, the supply of effort, and the amount and form of human capital investment. In this model, these choice variables are

5/ There are many factors that affect the short-run competitive supply of labor. The amount of labor supplied to the economy depends on factors such as nutrition, health, and the age distribution of the population. These factors affect the actual size of the population of workers. Throughout the anlaysis these factors will be held constant, and hence, the population of workers is assumed fixed.

collapsed into one simple labor-leisure choice.[6/] We also assume that the productivity of workers is independent of the length of the work day and that there are no costs to the firm outside of wages for the employment of workers.

In addition, the exchange rate is assumed fixed and the usual assumptions of the tradable-nontradable model of a small open economy are maintained. Also assume that production in the nontraded goods sector is labor intensive.

2.2 Firms

The private sector of the economy consists of competitive firms in the traded and nontraded goods industries. The industry supply functions and the private sector labor demand function may be written as follows:

(1) $X_T^S = X_T^S(\underset{-}{W})$,

(2) $X_N^S = X_N^S(\underset{-}{W}, \underset{+}{P})$, and

(3) $L_p^d = Lp(\underset{-}{W}, \underset{+}{P})$,

where W represents the real wage and P represents the relative price of nontradables (P_N) to tradables (P_T).

Assume that sectoral profit incomes are the residuals after workers in each sector are paid, i.e.,

(4) $\pi_T = X_T^S - WL_T$ and

(5) $\pi_N = PX_N^S - WL_N$

where L_T and L_N are the amounts of labor employed in the tradables and private nontradables sectors respectively. It is also assumed that these profits are distributed to the household sector.

6/ Human capital decisions are excluded from this labor-leisure choice because of the short-run nature of the analysis.

2.3 Government

The government is assumed to tax only labor and to manipulate this tax rate (t) so as to maintain balance between its tax revenues and its predetermined real expenditures. The government budget constraint can be written as follows:

$$(6) \quad tWL^S = G_L + G_N + G_T$$

where G_L represents its real wage bill, G_N represents its real expenditures on nontraded goods and G_T represents its real expenditures on traded goods.[7/]

Since the government predetermines its real wage bill and then it enters the labor market to hire workers at the competitively determined market wage the government's demand for labor (Lg) may be written as follows:

$$(7) \quad Lg = G_L/W \ .$$

2.4 Households

In this section, an analytical framework is developed that allows households to respond to changes in taxation by altering the amount of labor supplied relative to the amount of their leisure taking activities. Assume that the household sector possesses the following utility function:

$$U = U(X_T^d, X_N^d, \bar{H} - L^s, M+m),$$

where X_T^d represents the quantity of traded goods consumed by households; X_N^d represents the quantity of nontraded goods consumed; $\bar{H} - L^s$, which represents leisure, is the difference between the total amount of man-hours available to the household sector ($\bar{H}$) and the total amount of labor supplied to the economy (L^s); M represents the initial stock of real cash balances; and m represents the desired net additions to

7/ In general, the relationship between t and the various government expenditures will be non linear because both W and L^s will be affected by a higher t.

real cash balances. Since money is the only asset in the model M also represents the initial wealth position of households and m represents the amount of household saving.

The household sector is assumed to face the following budget constraint:

$$X_T^d + PX_N^d + m = W(1-t)L^s + \pi_T + \pi_N. \quad 8/$$

Utility maximization by households subject to the budget constraint represented by equation 8 yields the following household sector labor supply and commodity and saving demand functions:

$$(9)\quad L^s = L^s(\underset{+}{W}(1-t), \underset{-}{P}; \underset{-}{M}; \underset{-}{\pi}),$$

$$(10)\quad X_T^d = X_T^d(\underset{+}{W}(1-t), \underset{+}{P}; \underset{+}{M}; \underset{+}{\pi}),$$

$$(11)\quad X_N^d = X_N^d(\underset{+}{W}(1-t), \underset{-}{P}; \underset{+}{M}; \underset{+}{\pi}),$$

$$(12)\quad m = m(\underset{+}{W}(1-t), \underset{+}{P}; \underset{-}{M}; \underset{+}{\pi}),$$

where π is equal to the sum of the sectoral profit incomes.

The signs on the above partial derivatives require some explanation. It should first be noted that the demand functions for commodities and saving or additional real money balances do not include income in the usual sense because the amount of man-hours offered for employment is a decision variable. It is W and not income that is the relevant variable for these functions since income is simultaneously determined with commodity and money demands.

8/ The sectoral profit incomes are assumed given to each individual hence, it shows up as exogenous for the household sector as a whole. It should be noted that as long as each individual worker derives only a small portion of its nonlabor income from the firm in which he works, taxation of labor at a different rate than nonlabor income will not result in workers taking all their income in the form of nonlabor income. Also note that in order to focus solely on government expenditure composition effects government output is assumed to have zero value.

Changes in W will have income and substitution effects. An increase in W increases the real income or earning capacity of any amount of man-hours. Assuming that leisure, goods, and cash balances are all normal, this rise in income will lead to an increase in expenditures on commodities, an increase in saving or additional cash balances demand, and a decrease in man-hours offered for employment. This effect is the income effect of an increase in W. The substitution effect of an increase in W raises the cost of leisure relative to consumption and hence induces increases in commodity demands and labor supply.

The total effect of an increase in W on commodity demand and saving is positive. In the case of the supply of labor the effect of an increase in W is ambiguous because the substitution and income effects work in opposite directions. It will be assumed that the substitution effect dominates the income effect.

An increase in P, with P_T unchanged, will make nontraded goods more expensive with respect to traded goods and leisure. Thus, the household will substitute more of the cheaper traded goods and leisure for the now more expensive nontradables. In this case an increase in P will lead to an increase in saving. This result differs from the usual assumption that relative price changes have no effect on saving because a change in P also changes the price level in the same direction, given the rigidity of P_T.

An increase in the level of real cash balances M will make households more wealthy and will lead to an increase in the demand for commodities. However, because a rise in M represents an increase in wealth we would expect the supply of man-hours by households to fall. Also, a rise in M increases net wealth and thus decreases the demand for additional cash balances or saving.

A rise in government expenditures requires an increase in taxation (t) for the household sector as a whole. Hence, an increase in any form of government expenditure will lower the net after-tax real wage which will then lead to a fall in the supply of labor and a fall in commodity and saving demands.

An increase in nonlabor income (π) will lead to an increase in commodities and saving demands. The higher nonlabor income will also increase households' demand for leisure taking activities, and hence will result in a fall in the supply of man-hours to the economy.

2.5 Equilibrium

Now that the supply and demand conditions for all the agents in the economy have been presented, the market clearing conditions may be established. Equations 6 and 9 may be combined to determine the government's tax rate (t). When this is done we get:

$$(13) \quad t=t(\underset{-}{W},\underset{+}{P};\underset{+}{M};\underset{+L}{G};\underset{+N}{G};\underset{+T}{G}).^{9/}$$

A rise in W will increase taxable income, which will result in an increase in government revenues. If the government does not raise its expenditures it must lower t in order to maintain a balanced budget. A rise in either P or M will serve to increase leisure taking activities and hence will lead to a

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9/ It is assumed that an increase in W will lower π and an increase in P will raise π.

reduction in the supply of labor to the economy. When the supply of labor falls, tax revenues will also fall, therefore t must be increased to keep the government's budget in balance. An increase in any form of government expenditure, with W, P and M unchanged, will require more tax revenues and thus t must be raised.

Equilibrium in the labor market obtains when the demands for labor in the private and government sectors equals the total supply of man-hours, i.e.,

$$(14) \quad L_p^d + Lg - L^s = 0$$

Money wages are assumed to adjust immediately so as to always maintain equilibrium in the labor market. Given this assumption equation 13 in combination with equations 3,5,6,7, and 9 may be used to solve for W. Once this is done we have;

$$(15) \quad W = W(\underset{+}{P}, \underset{+}{M}; \underset{+}{G_L}; \underset{+}{G_N}; \underset{+}{G_T}).$$

A rise in P leads to an increase in the demand for labor at the same time that it induces some fall in the supply. The end result will be a rise in W to clear the labor market. An increase in M increases real household wealth and hence serves as a disincentive for working. Thus, the supply of man-hours

will fall, creating an excess demand for labor which forces W to rise to clear the market. An increase in the wage bill of the government sector will have two effects. The first effect is the "tax effect" which leads to a fall in after-tax wages, and therefore, a fall in labor supplied by households. The same effect is produced by an increase in any form of government expenditure. The second effect of a rise in G_L is due to the effect of such an increase on the demand for labor in the government sector. These two effects work in the same direction forcing W to rise in this case by more than it would under increases in alternative government expenditures.

Equilibrium in the commodity markets obtains when there are zero excess demands for tradable and nontradable goods. The total domestic demands for traded goods and for nontraded goods, respectively, may be written as follows:

(16) $X_T = X_T^d + G_T$ and

(17) $PX_N = PX_N^d + G_N$.

Equations 1,2,10,11,15,16 and 17 may be combined to yield the following commodity markets equilibrium conditions:

$$B = X_T^s - X_T^d - G_T = 0 \text{ and}$$
$$N = PX_N^d + G_N - X_N^s = 0, \text{ or}$$

(18) $B = B(\underset{-}{P}, \underset{-}{M}; \underset{-}{G_L}; \underset{-}{G_N}; \underset{-}{G_T}) = 0$ and

(19) $N = N(\underset{+}{P}, \underset{+}{M}; \underset{+}{G_L}; \underset{+}{G_N}; \underset{+}{G_T}) = 0$.

B represents the balance of trade and N represents the excess demand for nontraded goods.

An increase in P is expected to reduce the excess demand for nontradables and to lead to an incipient deficit in the balance of trade; while an increase in M is expected to increase the excess demand for nontradables and to lead to an incipient deficit in the balance of trade. An increase in any of the various tax-financed government expenditures is likely to lead to an incipient balance of trade deficit, and an excess demand for nontraded goods.[10/]

It is important to note that the size of the impact of the different forms of government expenditures will differ. Among the types of expenditures, G_T will have the strongest effect on B and G_N will have the greatest impact on N.[11/] The effect of G_L on B and N should be greater than that of G_N and G_T, respectively, because, as argued earlier, the impact of G_L on W will be greater than that of G_N or G_T, and hence the supply effect will be stronger.

The economy achieves short-run equilibrium when the nontraded goods market clears, while long-run equilibrium obtains when N, B, and m are all equal to zero. Assuming that P_N adjusts so that the nontraded goods market always clears and given that the government always maintains a balanced budget, then the demand for saving or net additional real cash balances will be equal to the balance of trade surplus, i.e.,

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10/ There is some ambiguity associated with the effect of changes in these tax-financed expenditures on the demand for tradables and nontradables. This ambiguity is primarily the result of the interaction of the direct effects of changing tax levels on commodities demands and the indirect effect of such tax changes which affect these demands through altering W and π . It is clear, however, that the change in the supply of man-hours and the consequent change in real wages that results from changes in taxation will serve to reduce supplies of both commodities. It is assumed that this supply effect will determine the direction of the overall impact of these expenditure changes on B and N.

11/ In these cases the changes in government spending dominate the demand effect and move in the same direction as the supply effect on B and N.

(20) m=B.

Since money is the only asset, the balance of trade and the balance of payments are identical.

The condition for long-run equilibrium to obtain is that there be no additional saving. Equations 18 and 19 fully describe the equilibrium conditions for the system.[12/] In Figure 1, Q_0 represents the long-run equilibrium for the economy. Along the BB schedule, B=0 and along the NN schedule, N=0. Points above the BB(NN) schedule are points of excess demand (supply).

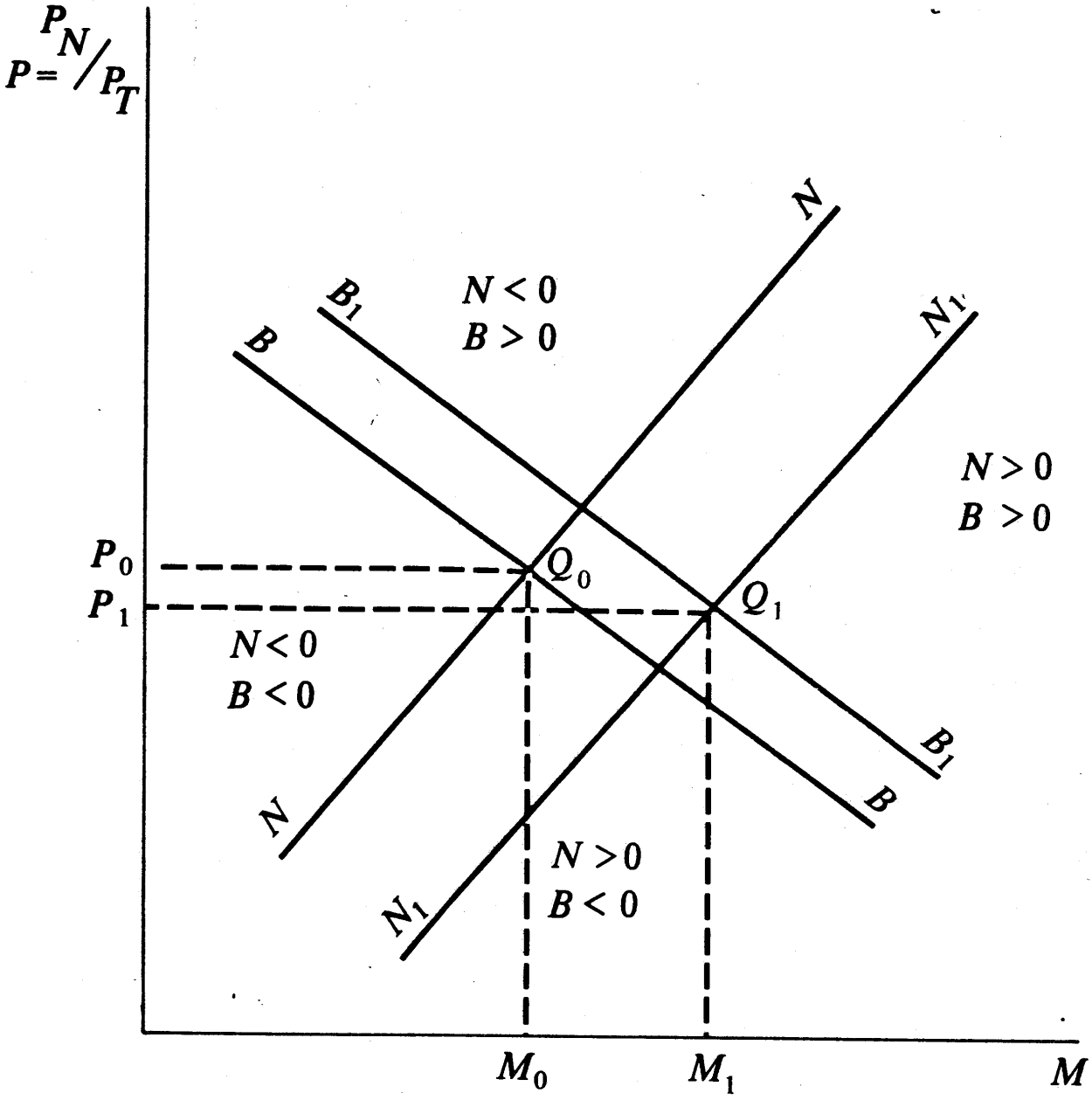
3. Impact Effect Comparisons

In this section the impact effects of a reduction in various categories of tax-financed government expenditures are compared. There are two separate effects of a change in the scale of government expenditures. One effect is due to the increased work incentive of the higher real after-tax wage. This induces increased labor force participation or man-hours offered by the household sector. The increased supply of labor will help reduce the real wage and therefore will result in increased private sector employment and output. Also since disposable income has risen the demand for saving will rise and will be reflected in a balance of payments surplus.

The other effect comes as a result of a reduction in the particular category of government expenditure. In order to separate this effect from the tax reduction effect, which is common to all categories of government expenditure, it would prove useful to examine the impact of a reduction in one category of government spending. Once this is done a comparison of the effects

12/ Given Walras' law equation 20 becomes redundant.

Figure 1



of shifting the expenditure reductions, with taxes remaining unchanged, to the other categories of government spending can be made.

A reduction in the real value of the public sector wage bill will be presented first in order to facilitate the exposition of the comparison of the category specific effects of cutbacks in the scale of government. The lower G_L will lead to a decrease in the supply of government sector job slots at the initial real wages, relative prices and level of real money balances. This results in an increase in the supply of labor to the private sector. Since this effect and the tax effect both serve to increase the supply of labor to the private sector there will be a tendency for W to fall.

The fall in W will lead to an increase demand for labor in the private sector which will result in increased supplies of both tradables and nontradables.

As mentioned earlier, supplies in traded goods and the nontraded goods sectors are expected to rise by more than the demand in these sectors. Thus, there will be an incipient surplus in the balance of trade and a fall in the price of nontraded goods. The balance of trade surplus will be reflected in an increase in the demand for net additional real cash balances or an increase in saving.

In Figure 1, point Q_o is the initial long-run equilibrium. Given the initial P and M, as W falls there will be an excess supply of nontraded goods and an excess supply of traded goods. The NN schedule will shift down to N_1N_1 and the BB curve will shift up to B_1B_1 because at the initial stock of real money balances the excess supply of nontradables will be diminished by a fall in P while the excess supply of tradables would be diminished by a rise in P.

The nontraded goods market will clear instantaneously. The economy will then adjust along the N_1N_1 curve until saving is zero and the new long-run equilibrium Q_1 is reached. The new level of real cash balances held by households

will be higher at Q_1 than at Q_o. The NN curve should shift more than the BB curve, and hence, P should be lower.[13/] In summary, a reduction in G_L will lead to a rise in private sector output, a short-run surplus in the balance of payments and a fall in W and P.

The initial effect of a shift in expenditures from official purchases of nontraded goods to direct government employment will be to force W to rise. The rise in W results from the increased employment opportunities in the government sector induced by the rise in G_L. The expenditure shift will lead to an excess supply of nontradables and an excess demand for tradables.

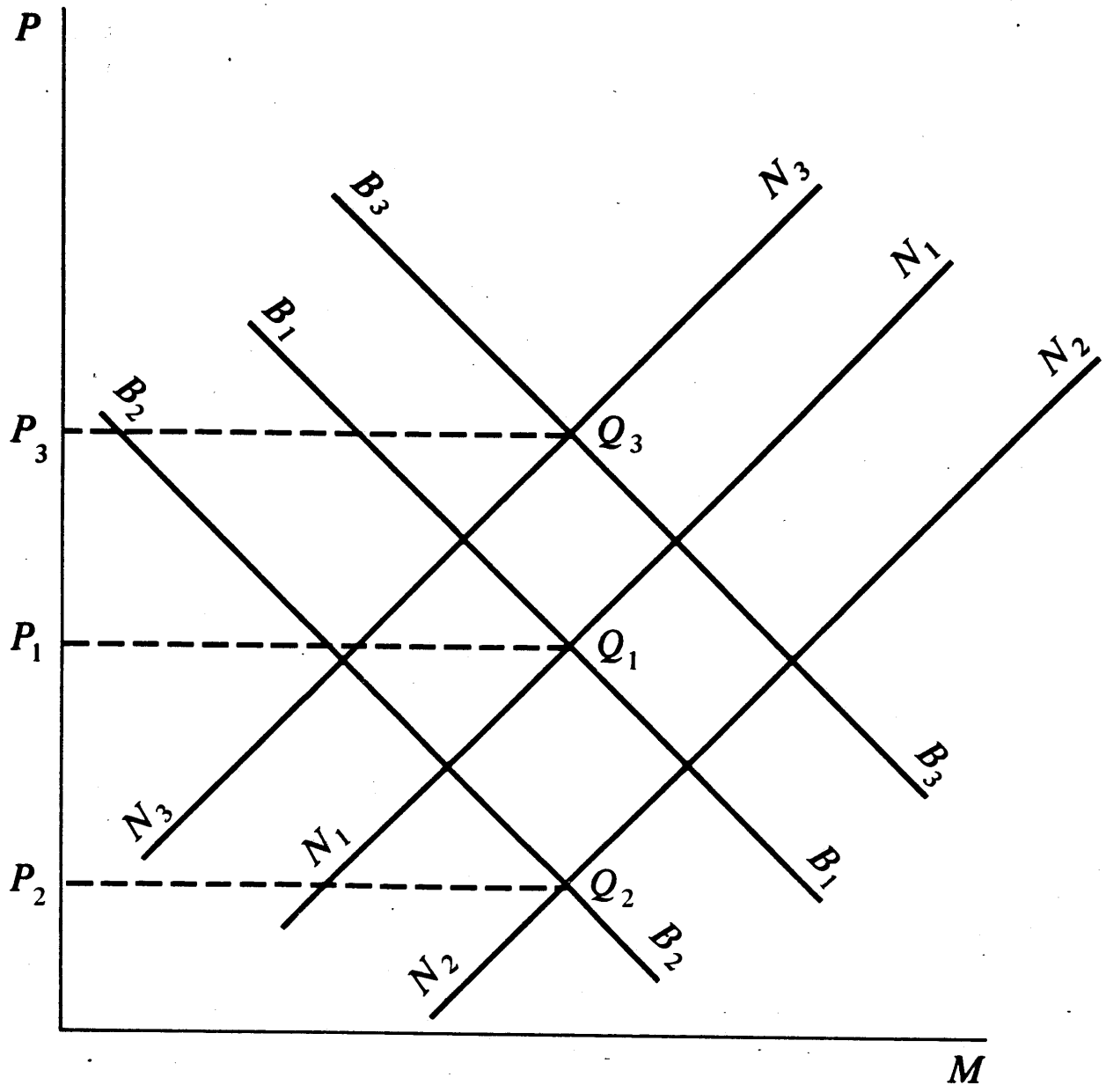
In Figure 2, Q_1 represents the initial equilibrium. The excess supply of nontradables will lead to a downward shift in the NN curve to N_2N_2. The BB curve will also shift downward to B_2B_2. In the new equilibrium P will be lower; however, it is unclear as to whether M will be higher or lower than it was before the expenditure switch.

The fall in P will force firms in the nontraded goods sector to reduce their demands for labor, which will bring downward pressure on W. The impact of the expenditure switch on W will be ambiguous, as it depends on whether the government's demand for labor rises more than the demand for labor in the nontradable goods sector falls. It also depends on the effects of the lower P on the total supply of labor.

Given the shift in expenditures it is likely that private sector employment and output will be lower. This is because the level of government sector employment will be higher. In summary, an increase in G_L and a decrease in G_N will result in a lower private sector output, and a fall in P, while the direction of impact on W and the balance of payments will be unclear.

13/ This requires that the supply effects of lower taxes dominate the demand effects for each commodity.

Figure 2



A shift from a reduction in the government wage bill to a reduction in the official purchases of tradable goods will initially result in upward pressure on W, analogous to the case of a lower G_N. The shift between G_L and G_T will lead to an excess demand for nontraded goods and an excess supply of traded goods. In Figure 2, the excess demand for nontradables will lead to a shift in the NN curve from N_1N_1 to N_3N_3. The excess supply of tradables will lead to the BB curve shifting from B_1B_1 to B_3B_3. In the new equilibrium, P will be higher; however, in this case the initial effects of this form of expenditure switching on the balance of payments will be ambiguous.

The rise in P will allow firms in the nontradable goods sector to increase, or in the face of the initial upward pressure on W, attempt to maintain its demand for labor. Although the supply of labor to the economy will increase the net effect on private sector employment and output of the expenditure switch will be unclear. The direction that private sector output moves will depend solely on how much the supply of labor increases relative to the increased government sector demand. It is clear, however, that private sector output will be higher in this case than in the case where G_N was reduced because the demand for labor and hence W will be higher. The higher W will encourage an increase in the supply of man-hours to the economy. In summary, an increase in G_L and a decrease in G_T will result in a higher P, a higher W and a higher output than in the case of a reduction in G_N. It should also be noted that an expenditure shift by the government away from tradable goods will not necessarily result in a higher relative short-run balance of payments surplus.

Conclusions

This paper focussed on a comparison of the impact of reductions in various tax-financed government expenditures on private sector output and the balance of payments. This was done within the framework of a tradable-nontradable model of

a small open economy in which the supply of labor was sensitive to government taxation and the composition of government spending. It was found that lower taxes would result in increased labor force participation, and therefore would serve to lower the real wage and enable firms to increase employment and output. The higher output and employment would result in an increase in the demand for saving which would be reflected in a short-run balance of payments surplus. It was also found that the composition of the government spending reductions played an important role in determining the level of private sector output, however, their specific relative impacts on the balance of payments were seen to be ambiguous.

The comparisons suggest that reductions in the government wage bill would have the most positive effects on the level of private sector production, with reductions in the purchases of tradable goods and nontraded goods following in order of magnitude of effect. However, two aspects of the analysis raise questions as to whether this ranking is the best one. First, the analysis assumes that money wages and the price of nontradables are flexible. If there is some downward rigidity in wages and prices then the above ordering would have to be altered such that reductions in tradables purchases would head the list, and cutbacks in the government wage bill would be moved to the bottom of the list. Second, the analysis ignores the use of the government produced public good. The way the above ordering would change if these goods were included depends on whether the public good were a consumption or production good and whether it was tradable or nontradable.

In conclusion, it seems that the time has come for the governments in the industrial economies to confront the issue of their rapid expenditure growth. In so doing, however, policymakers must develop programs and strategies that are

based on private sector output and balance of payments goals. Such policies by their very nature must be based on the effects of changes in the disaggregated rather than aggregate government expenditures relative to a real GNP target. In essence, planning and analysis must govern decisions surrounding future changes in the scale of government.

REFERENCES

Bacon, R. and Eltis, W. Britain's Economic Problem: Too Few Producers. London: The Macmillan Press Ltd. Second Edition, 1978.

Canto, V.A., Joines, D.H. and Laffer A.B. "An Income Expenditure Version of the Wedge Model". Department of Economics, University of Southern California, 1978. (mimeograph).

Canto, V.A., Laffer, A.B., and Odogwu, O. "The Output and Employment Effects of Fiscal Policy in a Classical Model". Department of Economics, University of Southern California, 1978. (mimeograph).

Evans, P. "Fiscal Policy and the Supply of Labor". Department of Economics, Stanford University, 1978. (mimeograph).

Joines, D.H. "A Neoclassical Model of Fiscal Policy, Employment, and Capital Accumulation". Department of Economics, University of Southern California, 1977. (mimeograph).

Nutter, G.W. Growth of Government in the West. Washington, D.C.: American Enterprise Institute for Public Policy Research. 1978.

Public Expenditure Trends. Paris: OECD Studies in Resource Allocation. No. 5, 1978 (June).

Appendix 1

Given:

$t = G/WL^S(\underline{W}(1-t),\underline{P};\underline{M};\underline{\pi})$,

where $G = G_L+G_N+G_T$. Upon total differentiation of the above equation we get;

$$dt = 1/(WL^S)^2\left[WL^S dG-G((L^S+W\partial L^S/\partial W)dW+W(\partial L^S/\partial t\ dt+\partial L^S/\partial P\ dP+\partial L^S/\partial M\ dM+\partial L^S/\partial\pi d\pi))\right],$$

which may be solved for dt as follows

$$dt\quad \Delta_1/(WL^S)^2=1/(WL^S)^2\left[WL^S dG-G(L^S+W(\partial L^S/\partial\ +\partial L^S/\partial\pi\partial\pi/\partial W)dW+W(\partial L^S/\partial P+\partial L^S/\partial\pi\partial\pi/\partial P)dp\right.$$
$$\left.+\ W(\partial L^S/\partial M\ dM)\right]\quad \text{or}$$

$$dt =1/\Delta_1\ \left[WL^S dG-G((L^S+W(\partial L^S/\partial W+\partial L^S/\partial\pi\partial\pi/\partial W)dW+W(\partial L^S/\partial P+\partial L^S/\partial\pi\partial\pi/\partial P)dP+\right.$$
$$\left.W(\partial L^S/\partial M\ dM)\right],$$

where Δ_1 represents $(WL^S)^2+WG\ \partial L^S/\partial t$. It is assumed that Δ_1 is positive. This assumption holds as long as $WL^S \geq G$ and $1> \xi_t$, where ξ_t represents the elasticity of the supply of labor with respect to t. The first condition requires that government expenditures be less than or equal to total taxable income. This condition is guaranteed by the balanced budget restriction that has been placed on the government sector. The second condition requires that an increase in the taxation of labor will be less than totally passed through to profit income, i.e., a rise in t will not result in a general strike.

Given the above assumption the partial derivative signs of t with respect to all the other variables can be determined. They are

$$\partial t/\partial W = -\frac{G(L^S+W(\partial L^S/\partial W+\partial L^S/\partial\pi\ \partial\pi/\partial W))}{\Delta_1}\ ?$$

$$\partial t/\partial P = -\frac{G}{\Delta_1} W(\partial L^S/\partial P + \partial L^S/\partial \pi \; \partial \pi/\partial P) \quad ?$$

$$\partial t/\partial M = -\frac{G}{\Delta_1} W(\partial L^S/\partial M) > 0$$

$$\partial t/\partial G = WL^S/\Delta_1 > 0$$

The signs of $\partial t/\partial W$ and $\partial t/\partial P$ depend on the signs of $\partial \pi/\partial W$ and $\partial \pi/\partial P$ respectively. Note that from equations 3, 4 and 5 of the text π may be written as,

$$\pi = X_T^S + X_N^S - WL_p^d .$$

If we take the total derivative of π we get;

$$d\pi = (\partial X_T^S/\partial W + \partial X_N^S/\partial W)dW + \partial X_N^S/\partial P \; dp - (L_p^d + W \; \partial L_p^d/\partial W)dW - W\partial L_p^d/\partial P dP.$$

Therefore,

$$\partial \pi/\partial W = (\partial X_T^S/\partial W + \partial X_N^S/\partial W) - (L_p^d + W\partial L_p^d/\partial W) < 0, \text{ and}$$

$$\partial \pi/\partial P = (\partial X_N^S/\partial P) - W\partial L_p^d/\partial P > 0.$$

A sufficient condition for $\partial \pi/\partial W$ to be less than zero is for $\eta_W \geq -1$, where η_W is the elasticity of private sector labor demand with respect to a change in W. It is assumed that $\partial \pi/\partial P > 0$, i.e., it is assumed that the value of nontraded goods output rises by more than the total private sector wage bill. Given these signs it becomes evident that $\partial t/\partial W < 0$ and $\partial t/\partial P > 0$.

Appendix 2

Equilibrium in the labor market holds when

$$L^d_P(W,P) + (G_1/W) - L^s(W,P;M;G_L;G_N;G_T) = 0,$$
$$(-,+) \qquad\qquad (+,-,-,-,-,-)$$

where the L^s function is the result of substituting the function $t(W,P;M;G_L,G_N,G_T)$
$(-,+;+,+,+,+)$

for t. If we totally differentiate the labor market equilibrium condition and solve for W we get;

$$(\partial L^d_P/\partial W - G_L/W^2 - \partial L^s/\partial W)\, dW + (\partial L^d_P/\partial P - \partial L^s/\partial P)dP - (\partial L^s/\partial M dM + (\partial L^s/\partial G_L - \tfrac{1}{W})dG_L +$$

$$\partial L^s/\partial G_N dG_N + \partial L^s/\partial G_T) = 0$$

$$\text{(ii)}\quad dW = (1/\Delta_2)(\partial L^d_P/\partial P - \partial L^s/\partial P)dP - (\partial L^s/\partial M)dM + (\partial L^s/\partial G_L - 1/W)dG_L +$$

$$\partial L^s/\partial G_N dG_N + \partial L^s/\partial G_T dG_T),$$

where $\Delta_2 = G_L/W^2 + \partial L^s/\partial W - \partial L^d_P/\partial W > 0$.

We may use equation (ii) to determine the relationship between W and the other variables.

$$\partial W/\partial P = (\partial L^d_P/\partial P - \partial L^s/\partial P)/\Delta_2 > 0$$

$$\partial W/\partial M = -(\partial L^s/\partial M)/\Delta_2 > 0$$

$$\partial W/\partial G_L = (1/W - \partial L^s/\partial G_L)/\Delta_2 > 0$$

$$\partial W/\partial G_N = -(\partial L^s/\partial G_N)/\Delta_2 = -(\partial L^s/\partial G_T)/\Delta_2 > 0 \quad \text{but} < \partial W/\partial G_L.$$

Appendix 3

The commodities market equilibrium conditions are as follows:

$B=X_T^S(\underline{W})-X_T^d(\underline{W}(1-t),\underline{P};\underline{M};\overline{T})-G_T=0$ and

$N=X_N^d(\underline{W}(1-t),\underline{P};\underline{M};\overline{T})+G_N-X_N^S(\underline{W},\underline{P})$

Once we substitute for t and W in the above equations and assuming $\partial W/\partial P < 1$, we would expect the following signs to hold:

$B=B(\underline{P};\underline{M};\underline{G}_L;\underline{G}_N;\underline{G}_T)$ and

$N=N(\underline{P},\underline{M};\underline{G}_L;\underline{G}_N;\underline{G}_T)$.

The effect of changes in P,M,G_L,G_N, and G_T on the private sector demands for tradables and nontradables will be ambiguous because of the effects of changes in these variables on profit income. However, the effects of changes in these variables on the supplies of these two commodities are unambiguous. It will be assumed that these supply effects dominate the ambiguitiies that arise on the demand side.