A Portfolio Balance Approach to Monetary and Fiscal Policies in a Small Open Economy

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Précis: Monetary and fiscal policies are examined in a steady-state small open economy model. Complete price taking behaviour implies that domestic output is supply determined and invariant to domestic shocks. Balanced budget fiscal policy does, however, alter equilibrium real disposable income. As the terms of trade do not vary with the exchange rate regime the effectiveness of macro policies are similar under both fixed and flexible exchange rates.

I INTRODUCTION

This paper considers the role of monetary and fiscal policies in a steady-state model of a small open economy. Steady-state, or portfolio balance, is defined as a situation in which stocks of assets, including real capital, are constant and willingly held. The domestic economy is assumed to be small in the sense that it is a price taker in commodity and asset markets. The paper concludes that, regardless of the exchange rate system, neither open market operations nor balanced budget fiscal policies can affect domestic output. Fiscal policy does alter the equilibrium level of real disposable income under both fixed and flexible exchange rates but the sign of the balanced budget multiplier is always negative: with total output constant, increased government purchases simply reduce the amount available to the private sector.

These results are in contrast to those obtained by Mundell (1968) and McKinnon and Oates (1966). The reason for this divergence is that the present paper gives explicit attention to the conditions under which it is profitable to change the supply of domestic output. Given that the supply of labour is either constant or an increasing function of the real wage it

follows that macro policies can be effective only if they alter the price of domestic output relative to the price of capital goods.[1] However, if all commodities are traded then relative prices must be invariant to domestic shocks. It follows that domestic utilisation of labour and capital cannot be influenced by macro policies.

II A PORTFOLIO BALANCE MODEL

Portfolio balance is defined as a situation in which stocks of assets are constant and willingly held. The model has four assets and three sectors — domestic private sector, foreign sector and the domestic central bank. The assets are, outside money (M) issued by the central bank, domestic government bonds (S) which consist of perpetuities paying a fixed coupon rate equal to one unit of domestic currency, exchange reserves (R) and equity (V) defined as claims to the ownership of real capital (K). Table 1 describes the portfolio structure of each sector.

Table 1: *Portfolio structure by sector*

Asset	*Private sector*	*Foreign sector*	*Central bank*
Money	$+H$	0	$-H$
Bonds	$+S^D/i$	$+S^F/i$	$+S^M/i$
Exchange reserves	0	$-R$	$+R$
Equity	$+V^D$	$+V^F$	0

Where i is the market yield on domestic government bonds. The last column of Table 1 gives the money stock identity as,

$$H = S^M/i + R \qquad (1)$$

Private sector asset demands are assumed to depend upon relative rates of return and real disposable income (Y).

$$\frac{H}{P} = f_H(i, k, Y)$$

$$\frac{S^D}{iP} = f_S(i, k, Y) \qquad (2)$$

$$V^D = f_V(i, k, Y)$$

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1. Assuming that domestic output is produced with two factors.

Where P = domestic price level and k = market yield on equity. Real disposable income is included in the money demand function to account for the transactions demand. It is assumed that changes in transactions demand are financed by trading bonds. That is,

$$\frac{\partial f_H}{\partial Y} > 0 \quad \text{and} \quad \frac{\partial f_H}{\partial Y} = -\frac{\partial f_S}{\partial Y} \tag{3}$$

which implies $\partial f_V / \partial Y = 0$ (Tobin, 1969). Following Niehans (1978) there are no wealth effects in the asset demand functions. If wealth is defined as $A = H/P + S^D/iP + V^D$ and included in (2) then given the implicit function theorem this system can be solved to give (2).[2]

For asset stocks to be constant the following three conditions must hold.

(a) The government deficit must be zero. That is,

$$PG + (1 - t)S^D + S^F - tPQ = 0 \tag{4}$$

Otherwise H and/or S, the total stock of government bonds, must be changing. G = real government expenditures, t = tax rate and Q = real domestic output. An important property of portfolio-balance models is that for given values of P and Q (4) requires that one of the policy variables must be endogenous. For example, if the monetary authority controls $(S - S^M) = (S^D + S^F)$ then the fiscal authority cannot determine both t and G. We assume that the tax rate is a policy controlled variable and G adjusts to maintain the deficit equal to zero.

(b) The current account of the balance of payments must be zero. That is,

$$PX - S^F - kV^F = 0 \tag{5}$$

Otherwise R must be changing. X = real net exports and $S^F + kV^F$ = total interest payments to foreigners.

(c) The capital stock must be valued at replacement cost. That is,

$$V^D + V^F = qK \tag{6}$$

$$\text{and} \quad q = PK/P = 1 \tag{7}$$

2. This is equivalent to Archibald and Lipsey's (1958) result that wealth effects do not matter in stock/flow equilibrium. We also assume that government bonds are perceived by their holders as net wealth, i.e., bond holders do not take into account in accessing their wealth the taxation which must be levied on them to finance bond premiums.

where PK = price of capital goods (Tobin, 1969). Given these three conditions portfolio balance implies that,

$$Pf_H (i, k, Y) = R + S^M /i \tag{8}$$

$$Pf_S (i, k, Y) + S^F /i = (S - S^M)/i \tag{9}$$

$$f_V (i, k, Y) + V^F - K = 0 \tag{10}$$

The steady state demand for domestic output is given by,

$$Q^D = C + uK + G + X \tag{11}$$

Where C = real domestic consumption and u = depreciation rate on K. Domestic output is produced with two factors, K and N (labour),

$$Q^S = Q(N, K); Q_i > 0, Q_{ii} < 0, Q_{ij} > 0 \tag{12}$$

$$(i, j = N, K).$$

Equilibrium in the commodity market requires,

$$Q^D = Q^S \tag{13}$$

$$Q_N (N, K) = W/P \tag{14}$$

$$Q_K (N, K) = k + u \tag{15}$$

where W = money wage. We assume that all prices are flexible and that N is constant at full employment. Equation (15) states that given N, capital is utilised up to the point at which its marginal product equals the market yield on equity plus depreciation. The equity yield is given by Tobin, (1969),

$$k = Q_K /q - u \tag{16}$$

As portfolio balance requires that q = 1 then given u, profit maximising producers will equate the marginal product of capital to the market yield on equity.

The domestic economy is assumed to be a price taker in all markets. Hence the steady-state values of P, PK, i and K are determined by their respective "World" levels. That is,

$$P = eP* $$

$$PK = ePK^* \tag{17}$$

$$i = i^*$$
$$k = k^*$$

Where $*$ indicates the external value and e = exchange rate, domestic price of one unit of foreign currency. The final equation defines steady state consumption as being equal to real disposable income less depreciation on K and real payments on foreign equity holding. That is,

$$C = Y - uK - kV^F/P \tag{18}$$

Substituting (11) and (12) into (13) and using (4), (5) and (18) to eliminate G, X, C and uK gives,

$$Y = (1 - t) (Q(N, K) + if_s(i^*, k^*, Y)) \tag{19}$$

which together with the portfolio balance Equations (8) – (10) and Equations (17) and (15) gives a system of five equations to determine the steady-state values of Y, K, S^F/i, V^F and R or e (see Appendix). The money wage W is determined by (14).

III MONETARY AND FISCAL POLICIES

An important feature of the model is that domestic output is supply determined in the sense that domestic producers utilise factors of production up to the point at which their marginal products equal their unit costs. Given N it follows that macro-economic policy can alter Q if, and only if, it leads to a change in the cost of capital relative to capital's marginal product. Or, changing the capital stock is profitable only if the domestic price level P changes relative to the cost of capital goods PK. The price taking assumptions imply that the relative price of capital goods $q = PK^*/P^*$ and is therefore invariant to domestic shocks. It follows that for any given exchange rate system neither monetary nor fiscal policy can alter the steady-state values of K and Q. This result does not depend upon the assumption of a constant N. An alternative specification is to treat N as a variable and write the labour supply as an increasing function of the real wage. In this case macro policy could affect N and Q by shifting the labour demand curve at any given real wage. But this would require a change in the equilibrium capital stock ($Q_{NK} > 0$) which is clearly ruled out by the price taking assumptions. It follows that the effectiveness of macro policy must be

defined in terms of its impact on the steady-state values of real disposable income and real domestic consumption.

Monetary Policy — Fixed Exchange Rate

A pure monetary policy is defined as a change in S^M/i given S/i. With the exchange rate fixed open market operations by the central bank produce Mundell-type results; $dS^F/dS^M = dR/dS^M = -1$, $dY/dS^M = 0$ (see Appendix). For example, an open market purchase ($sD^M/i > 0$) implies that the central bank must reduce i relative to i* leading to portfolio imbalance and a capital outflow which continues until the domestic interest rate re-adjusts to its externally determined level. As the equilibrium levels of i, k and Y are unaffected it follows that the increase in central bank bond holdings must reflect an equivalent fall in foreign bond holdings. Total interest payments on government debt will, however, be reduced. For the portfolio balance to be maintained it follows that real government expenditures must increase and real net exports must decline.[3] That is, $dG/dS^M = 1$, $dX/dS^M = -1$.

Monetary Policy — Flexible Exchange Rates

With a flexible exchange rate an open market purchase leads to a rise in e (depreciation of the domestic currency) rather than to a fall in R. The price of domestic output will rise but the relative price of capital goods remains constant implying that the equilibrium values of K and Q do not change. The nominal flow of interest payments to the domestic sector will increase as domestic bond holders attempt to restore the real value of their bond stocks (S^D/iP), but the real value of these receipts remains constant. It follows that both real output and real disposable income are invariant to monetary policy even when the exchange rate is flexible. A flexible exchange rate restores the central bank's ability to control the nominal money stock but not the real money stock. From the multipliers derived in the Appendix we have,

$$\frac{d(H/e)}{dS^M} = \frac{e - H/f_H}{e^2} \ , \ \text{for } P^* = 1$$

As $e = H/f_H$ then $d(H/e)/dS^M = 0$, the real money stock is unaffected. Given that K remains constant it follows that real domestic bond holdings (S^D/iP) and real interest-receipts (S^D/P) must also be constant.

The decline in external bond holdings implies a corresponding decline in net exports to ensure current account balance, and the rise in central bank

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3. It is assumed that reserves do not earn a rate of return. An alternative specification is that R is held as foreign bonds. If such bonds are perpetuities paying a fixed coupon equal to one unit of foreign currency then minus eR must be added to the LHS of (4) and plus eR to the LHS of (15). These terms would then net out in the derivation of (19) and the conditions for portfolio balance would be met without changing G and X as $dS^F/dS^M = dR/dS^M = -1$, with e = 1.

bond holdings implies a rise in nominal government expenditures to keep the government deficit equal to zero.

Fiscal Policy — Fixed Exchange Rates

Fiscal policy is interpretated as a change in the tax rate financed by a corresponding change in government expenditures $(dt(Q + ifs) = dG)$ — the balanced budget multiplier. A rise in t reduces disposable income at any given Q, leading to an excess supply of money and an excess demand for bonds. The domestic private sector restores portfolio balance by increasing their bond holdings and by reducing the real money stock. As domestic output remains constant the rise in government expenditures merely "crowds out" an equivalent amount of consumption expenditure and net exports. It follows that the equilibrium level of real disposable income must fall.

Fiscal Policy — Flexible Exchange Rates

The balanced budget multiplier on real disposable income is exactly the same as under a fixed exchange rate (see Appendix).

$$\frac{dY}{dt} = \frac{(Q + f_s)}{1 - (1 - t)f_{sY}} < 0$$

An increase in t will again reduce real disposable income at any given Q. The resulting excess demand for bonds produces an excess supply of domestic currency and a rise in e. Portfolio balance is restored via a fall in external bond holdings and a decline in the real money stock generated by a higher domestic price level rather than a fall in R. As the relative price of capital goods is constant the equilibrium values of K and Q do not change, it follows that real disposable income must decline.

IV CONCLUSION

The results derived in the proceeding section stem from extreme price-taking assumptions. If small open economies are complete price takers then it follows that long-run output must be supply determined. In this type of model macro policies must alter relative prices if they are to affect domestic output. Complete price taking implies that relative prices are exogenously determined and that macro policy is therefore ineffective as a means of altering *per capita* output. Finally, as exchange rate variations do not alter the terms of trade facing a price taking economy then the effectiveness of both monetary and fiscal policies must be invariant with respect to the exchange rate regime.

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APPENDIX

The five equation system is,

$$Y - (1 - t)(Q(N, K) + if_S(i^*, k^*, Y)) = 0$$

$$eP^*f_H(i^*, k^*, Y) - R = S^M$$

$$eP^*f_S(i^*, k^*, Y) + S^F = S - S^M \qquad (A1)$$

$$f_V(i^*, k^*) + V^F - K = 0$$

$$Q_K(N, K) = k^* + u$$

The endogenous variables are Y, K, S^F, V^F and R or e.

(I) Fixed Exchange Rate, $de = 0$. Let $i^* = k^* = e = P^* = 1$

Totally differentiating (A1) gives,

$$
\begin{bmatrix}
1-(1-t)F_{SY} & -(1-t)Q_K & 0 & 0 & 0 \\
f_{HY} & 0 & 0 & 0 & -1 \\
f_{SY} & 0 & 1 & 0 & 0 \\
0 & -1 & 0 & 1 & 0 \\
0 & Q_{KK} & 0 & 0 & 0
\end{bmatrix}
\begin{bmatrix}
dY \\ dK \\ dV^F \\ dR \\ dR
\end{bmatrix}
=
\begin{bmatrix}
-(Q+f_S)dt \\ dS^M \\ -dS^M \\ 0 \\ 0
\end{bmatrix}
$$

where $f_{SY} = \partial f_S / \partial Y$ etc.

The determinant of the coefficient matrix is,

$$J = Q_{KK}(1 - (1 - t)f_{SY}) < 0$$

(i)   *Open-market Operations*

$$\frac{dS^F}{dS^M} = \frac{dR}{dS^M} = -1$$

$$\frac{dY}{dS^M} = \frac{dK}{dS^M} = \frac{dV^F}{dS^M} = 0$$

(ii) *Fiscal Policy* $(dG = (Q + S^D)dt)$

$$\frac{dY}{dt} = -\frac{Q_{KK}(Q+f_S)}{J} < 0: \quad \frac{dS^F}{dt} = \frac{Q_{KK}(Q+f_S)f_{SY}}{J} < 0$$

$$\frac{dR}{dt} = \frac{-Q_{KK}(Q+f_{SY})f_{HY}}{J} < 0: \quad \frac{dK}{dt} = \frac{dV^F}{dt} = 0$$

(II) Flexible Exchange Rate, $dR = 0$

Totally differentiating (A1) with $dR = 0$ and e endogenous gives,

$$\begin{bmatrix} 1-(1-t)f_{SY} & -(1-t)Q_K & 0 & 0 & 0 \\ f_{HY} & 0 & 0 & 0 & f_H \\ f_{SY} & 0 & 1 & 0 & f_S \\ 0 & -1 & 0 & 1 & 0 \\ 0 & Q_{KK} & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} dY \\ dK \\ dS^F \\ dV^F \\ de \end{bmatrix} = \begin{bmatrix} -(Q+f_S)dt \\ dS^M \\ -dS^M \\ 0 \\ 0 \end{bmatrix}$$

The determinant of the coefficient matrix is,

$$E = -f_H Q_{KK}(1 - (1 - t)f_{SY}) > 0$$

(i) *Monetary Policy*

$$\frac{dS^F}{dS^M} = \frac{Q_{KK}(f_H + f_S)(1-(1-t)f_{SY})}{E} = \frac{-(f_H + f_S)}{f_H} < 0$$

$$\frac{de}{dS^M} = \frac{-Q_{KK}(1-(1-t)f_{SY})}{E} = \frac{1}{f_H} > 0$$

$$\frac{dY}{dS^M} = \frac{dK}{dS^M} = \frac{dV^F}{dS^M} = 0$$

(ii) *Fiscal Policy* $(dG = (Q + f_S)dt)$

$$\frac{dY}{dt} = \frac{f_H Q_{KK}(Q+f_S)}{E} < 0$$

$$\frac{dS^F}{dt} = \frac{Q_{KK}(Q+f_S)(f_S f_{HY} - f_H f_{SY})}{E} < 0$$

$$\frac{de}{dt} = \frac{-Q_{KK}(Q+f_S)f_{HY}}{E} > 0: \quad \frac{dK}{dt} = \frac{dV^F}{dt} = 0$$