DO FIXED EXCHANGE RATES FETTER MONETARY POLICY?

A CREDIT VIEW

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The problem [with fixed exchange rates or exchange-rate targeting] is that with capital mobility the targeting country no longer can pursue its own independent monetary policy and so loses its ability to use monetary policy to respond to domestic shocks that are independent of those hitting the anchor country. Frederic S. Mishkin [2004, 490]

INTRODUCTION

The quote above reflects the widely accepted proposition that monetary authorities in small open economies cannot engage in independent monetary policy actions while simultaneously adhering to a fixed exchange rate regime. Fixed exchange rates, such as found under a gold standard or exchange-rate targeting, impede the ability of the monetary authorities to stabilize the macro economy [Eichengreen, 1992, 2002]. Expansionary monetary policy actions, for example, produce balance of payments deficits that require equal and offsetting contractionary monetary policy actions in order to maintain the fixed exchange rate. This proposition is perhaps most clearly illustrated in the standard Mundell-Fleming model. The elimination of monetary policy as a stabilization tool under fixed exchange rates is a primary factor leading many economists to support flexible exchange rate regimes. Support for this view comes from the improved economic performance of those countries that abandoned the gold standard during the Great Depression and were thus able to engage in independent monetary stabilization actions.[1]

In this paper, we combine the Mundell-Fleming model with a credit channel model developed by Bernanke and Blinder [1988] to show that monetary policy is not entirely fettered under a fixed exchange rate regime.[2] Following Bernanke and Blinder, we assume that bank loans and bonds (the two earning assets in the model)

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are not perfect substitutes and we ignore credit rationing.[3] Monetary policy is potent in our model, although in a limited way. Monetary policies that influence the money multiplier can affect aggregate demand, while those (e.g., open-market operations) that alter only the monetary base remain impotent. In the next section, we discuss the models and the relevant comparative static findings. We then develop a model simulation to investigate whether the effects we hypothesize can be non-trivial.

THE MODEL

The Mundell-Fleming (M-F) model is an open-economy IS-LM model with a fixed exchange rate ($\pi*$) and fixed price level (P^*). The traditional version of the model assumes no wealth (or Pigou) effect and perfect capital mobility that fixes the interest rate on bonds, i, at i^*, the world interest rate. As is the case for the closed-economy IS-LM model, M-F is a pure demand model; aggregate supply is assumed perfectly elastic at the fixed price level and merely adjusts to changes in demand. The M-F model is represented by two equations with two unknowns:

$$E(y, i^*, \pi^*) = y \tag{1}$$

$$L(y, i^*) = m \text{ x } B / P^* \tag{2}$$

Simplifying, by deleting the exogenous variables:

$$E(y) = y \tag{3}$$

$$L(y) = m \text{ x } B \tag{4}$$

Equation (1) or (3) represents the goods market equilibrium (the traditional IS curve) where aggregate expenditure (E) equals aggregate output (y). Equation (2) or (4) represents the money market equilibrium (the traditional LM curve). The right-hand side of equation (2) or (4) is the money supply, expressed as the product of the money multiplier, m, and the monetary base, $\boldsymbol{B}$. The unknowns in M-F are equilibrium output, y, and the money supply, m x B, or simply B if m is assumed exogenous.

Following standard assumptions, the money multiplier is a function of banks' required reserve ratio, r, their excess reserve ratio, e, and the non-bank public's currency to deposit ratio, c:

$$m = m(r,e,c),$$

where partials m_r , m_e , $m_c < 0$. For simplicity, we assume that all three variables affecting the money multiplier are exogenous. This assumption is reasonable given that the interest rate, the primary determinant of the multiplier in most money supply models, is exogenous. In accordance with Walras' Law, we drop a third equation for financial assets (bonds) from the model.

The M-F model is solved recursively. The goods market equation (3) alone determines equilibrium aggregate demand and output, y. Monetary policy tools are impotent as the money supply is endogenously determined. An attempt by the monetary authority to increase B, for example, eventually leads to offsetting actions to decrease B in order to maintain the fixed exchange rate. Likewise, changes in the required reserve ratio that affect the money multiplier require offsetting movements in B leaving the money supply unchanged. This yields the well-known M-F implication that monetary policy is impotent at affecting aggregate demand under a fixed exchange rate regime.

We now expand the traditional M-F model to allow for the inclusion of another financial asset, bank loans, that carry their own interest rate, ρ. Following Bernanke and Blinder's [1988] version of the credit-view model for a closed economy, we assume that bank loans and bonds are imperfect substitutes. Further, we assume that, while bonds trade internationally with perfect mobility, information costs and other market imperfections prevent bank loans from trading internationally.[4] We modify the goods market equation and add equation (6):

$$E(y, \rho, \alpha) = y \tag{5}$$

$$Z(y, \rho) = \lambda(\rho, \beta) \times (m - 1) \times B \tag{6}$$

Equation (5) alters the traditional goods market equation by incorporating the interest rate on bank loans, ρ, as a determinant of the demand for goods. The variable α is an autonomous shock variable. Equation (6) is the equilibrium equation for bank loans. The demand function for bank loans is Z. It depends on y, i, and ρ (in this equation, the exogenous variable, i^*, is dropped). The right-hand side of equation (6) represents bank loan supply, which depends on bank credit, $(m - 1) \times B$, and the share of bank credit allocated to bank loans (as opposed to bonds), λ. The share of bank loans depends on both the rate on loans, ρ, and the exogenously determined rate on bonds (dropped from the λ function). The variable β is another autonomous shock variable. The bank credit multiplier, $m - 1$, is easily derived from the bank balance sheet.[5] The revised model consists of equations (4), (5), and (6).[6] The variables y, ρ, and B are endogenous. We assume the usual signs for the partial derivatives. In addition, following Bernanke and Blinder [1988], $E_\rho<0$, $Z_y>0$, $L_\rho<0$, $\lambda_\rho>0$.

In this model, we are assuming that bonds trade in international markets with perfect mobility at the world determined interest rate, i^*, while the second earning asset, bank loans, only trades domestically or imperfectly internationally.[7] The "closed economy" assumption regarding bank loans is most likely to hold for those countries whose bank loans have little liquidity and where information costs for outsiders are high. This assumption and resulting model might also apply in a historical context to the developed countries prior to innovations in bank-loan securitization.

As in the traditional Mundell-Fleming model, an open-market operation or a change in the discount rate (holding all exogenous variables constant) that leads to a change in B cannot be maintained under the fixed-exchange rate regime. Since B is an endogenous variable, it must return to its original value in order to return the model to equilibrium at the original exchange rate. Thus, open market operations and discount rate changes that attempt to alter the monetary base are impotent tools.

In contrast, no such impotence befalls policies that alter the money multiplier, m. The reserve requirement, r, for example, regains its role as an aggregate demand management tool. Taking the total derivatives of equations (4), (5) and (6) and applying Cramer's Rule to compute the change in y arising from an autonomous change in m (such as that caused by a change in r), we obtain[8]

(7) $$dy/dm = -(\lambda E_{\rho} B)/\mathbf{D} > 0$$

where,

(8) $$\mathbf{D} = -E_{\rho} m Z_{y} + (Z_{\rho} - (m-1)B\lambda_{\rho})(m)(E_{y} - 1) + \lambda(m-1)L_{y}E_{\rho} > 0.$$

Dynamic stability conditions require a positive sign on **D** (see Appendix A for details). In this modified model, an autonomous increase in the money multiplier produces an increase in aggregate demand. For example, a decrease in reserve requirements (causing an autonomous increase in the multiplier) leads to an increase in bank loans, a lower equilibrium bank loan rate, ρ, and a higher aggregate demand, y. Inspection of equation (2) reveals that the higher y (and, consequently, higher money demand) must yield a higher money supply in the new equilibrium. If the desired excess reserve ratio is influenced by the discount rate, changes in the discount rate will also affect the money multiplier and aggregate demand. In contrast to the standard Mundell-Fleming model, the induced change in the endogenous monetary base fails to offset fully the change in the money multiplier. The reason that the change in the multiplier is no longer neutral in this credit view model centers on the differential effect of the multiplier change on the money supply and on bank loans. A change in the monetary base alone cannot bring the money and loan markets both back into equilibrium simultaneously. Hence, changes in the other endogenous variables are needed to reestablish overall equilibrium.

It should be noted that money multiplier changes arising from actions by the non-bank public that change c or actions by the banks that change e now produce aggregate demand shocks. These shocks cannot be offset by open-market operations that affect B, as B is endogenous, but can be offset by policies that return the money multiplier to its prior level (e.g., using reserve requirement changes) or by fiscal policies.

Figure 1 presents graphically the effect of an increase in the money multiplier on y and ρ. We solve equation (4) for B and insert this function into equation (6). The model is now reduced to two equations and two unknowns, y and ρ. The endogenous variable B is suppressed and determined at the intersection of the remaining two functions. The modified equation (6) (and curve in Figure 1) is labeled FA, denoting the overall "financial asset market." At every point on the FA curve the money and loan markets clear. An increase in the money multiplier—for instance, from a reduction in reserve requirements--shifts the FA curve downward and to the right causing the equilibrium y to rise and ρ to fall, as the equilibrium moves from intersection 1 to intersection 2 in the figure.

Table 1 reports how various shocks affect income, the rate on bank loans, the monetary base, and the money supply. Among other results, the comparative static analysis reveals that an autonomous rise in λ, the percentage of bank assets held in loans, increases equilibrium y. This result is consistent with the findings from the Bernanke-Blinder closed-economy model. The next section discusses a simulation model used for estimating the impact of a change in the reserve requirement on aggregate demand.

FIGURE 1
Effect of an increase in the money multiplier

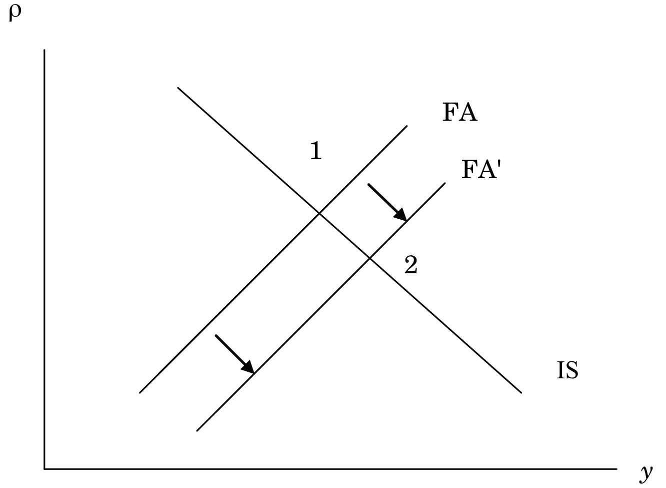


TABLE 1
Effects of Shocks on Endogenous Variables

Exogenous change in:	Income (y)	Loan rate (ρ)	Monetary base (B)	Money supply (mB)
Money multiplier (m)	+	-	?	+
Loan ratio (β)	+	-	+	+
Goods demand (α)	+	+	+	+

SIMULATION

The foregoing analysis of the credit-view model indicates that changes in reserve requirements affect aggregate demand, even in a setting with fixed exchange rates. However, without empirical evidence we cannot say whether the connection between bank reserve requirements and aggregate demand is economically significant. However, in an effort to shed at least some light on this issue, we assume plausible values (explained in detail in Appendix B) for the variables and parameters in equations (7) and (8) and simulate the change in real output (i.e., aggregate demand) that would result from a specific change in the reserve requirement. We do not presume that these simulations are empirically accurate predictions. Obviously, the transmission mechanism for monetary policy and bank lending is much more complex than described by our simple model or by the simple IS-LM framework upon which our credit-view model is based. Careful empirical work is needed to answer definitively whether or not money multiplier shocks produce non-trivial aggregate demand shocks in fixed exchange rate regimes. All we seek to establish here is whether money multiplier shocks arising from changes in the reserve requirement can generate non-trivial demand shocks under plausible conditions.

First, as a small initial step, we identified various features of an economy that would make reserve requirement changes more effective. Inspection of equations (7) and (8) reveals several factors that have unambiguous impacts on the effectiveness of reserve requirement changes (that is, on dy/dm). Reserve requirement decreases would have relatively greater stimulative effects, *ceteris paribus*, in economies with the following features:[9]

1) a relatively large and interest-insensitive bank loan supply (i.e., a high λ, B, and m (caused perhaps by low c and e) and a low λ_ρ);[10]

2) bank loan demand relatively sensitive to lending rates but not to income (i.e., a high Z_ρ and a low Z_y);

3) money demand relatively sensitive to income (i.e., a large L_y); and

4) demand for goods that is relatively sensitive to both bank lending rates and income (i.e., a high E_ρ and E_y).[11]

Secondly, in order to provide some admittedly rough approximations to the quantitative relevance of reserve requirement changes under differing circumstances, we conducted a series of simulations (described in Appendix B) based upon equations (7) and (8). The specific objective of the simulations is to provide some indication of the responsiveness of aggregate demand to a small reserve requirement change, under various plausible assumptions about the parameters in the three markets in our model (i.e., the markets for goods, money, and bank loans).

To conduct a simulation with equations (7) and (8), we clearly need values for 1) the variables m, λ and B; and, 2) the coefficients λ_ρ, Z_ρ, Z_y, L_y, E_ρ and E_y. As explained more fully in Appendix B, we derived values for the coefficients from an assumed set of reasonable values for their corresponding elasticities. This step required further assumptions about values for the following variables appearing in the elasticities: ρ, E $(= y)$, L, and Z. We assume constant elasticities within the relevant range.

In selecting baseline values for the various variables and elasticities, we paid close attention to the above-described features that create an economic environment responsive to reserve requirement changes. While we wanted to avoid a set of values that would doom reserve requirements to failure as a policy instrument, we likewise wanted to avoid those values that would inevitably make reserve requirements look highly effective. In other words, we make conservative assumptions about the values for variables and elasticities. We report results of sensitivity analyses to show the importance of these various assumptions.

The key values underlying the baseline simulation are shown in Table 2 (ε_{ij} denotes the elasticity of variable i with respect to variable j). We suggested above that reserve requirement reductions would be more stimulative in economies with 1) relatively high values for λ, B, m, $\varepsilon_{Z\rho}$, ε_{Ly}, $\varepsilon_{E\rho}$ and ε_{Ey}; and 2) relatively low values for ε_{Zy} and $\varepsilon_{\lambda\rho}$. With one apparent exception, the values shown in Table 2 are, we believe, both plausible and conservative (in the sense of neither being relatively large or small). The apparent exception is $\varepsilon_{E\rho} = 0.05$, a small elasticity indeed. Nevertheless, this value is still a (very) conservative one, since a small $\varepsilon_{E\rho}$ tends to reduce the potency of reserve requirement changes. Further, as we note in Appendix B, there is ample reason to expect that $\varepsilon_{E\rho}$ is, in fact, rather small.

TABLE 2
Baseline Simulation Results

Variable or Elasticity	Baseline Values	Δ in Overall Impact of a ceteris paribus 10% increase (decrease) in variable or elasticity[a]	
$E(=y)$	10	[b]	
m	3.25	[c]	
c	0.3	-.0080%	(.0096%)
r	0.1	[d]	
λ	0.4	.0798%	(-.0634%)
B^e	1	[b]	
ρ	.05	[b]	
$\varepsilon_{\lambda\rho}$	0.5	-.0386%	(.0554%)
$\varepsilon_{Z\rho}$	-0.5[a]	.0494%	(-.0422%)
ε_{Zy}	1.0	-.0057%	(.0060%)
ε_{Ly}	1.0	.0060%	(-.0057%)
$\varepsilon_{E\rho}$	-0.05[a]	.0494%	(-.0422%)
ε_{Ey}	0.3	.0211%	(-.0181%)

Overall Impact: %Δ in E from a 10% cut in r = 0.25%

a. For reasons explained in Appendix B, $\varepsilon_{Z\rho}$ and $\varepsilon_{E\rho}$ vary in tandem.

b. Variation in variable works through variation in associated elasticities.

c. m varies as a result of changes in c (or r); it does not vary independently. The money multiplier and c are connected, in the simplest money multiplier model, by the equation:

$$m = (1 + c)/(c + r).$$

d. Variation in r is what produces the overall impact shown at the bottom of the table.

e. B is arbitrarily set equal to 1; all other monetary values are scaled accordingly.

The overall impact of a 10 percent reduction in reserve requirements on E (= y) is calculated from an estimate of the elasticity of real spending with respect to the reserve requirement: $\varepsilon_{Er} = [((dy/dm)(dm/dr))(r/y)]$, where $dm/dr = -(1+c)/(c+r)^2$. Applying the baseline values in Table 2 to equations (7) and (8) yields $dy/dm = 0.314$, or $\varepsilon_{Em} = 0.102$. The value for dm/dr is -0.813, or $\varepsilon_{mr} = -0.25$. Combining these results gives us $\varepsilon_{Er} = -0.025$ (= -0.25*0.102). Accordingly, a 1-point reduction in r — for instance, from 10 percent of deposits to 9 percent — yields a 0.25 percent increase in E for our baseline simulation.

The last column in Table 2 shows how small (*ceteris paribus*) changes in selected key variables or elasticities alter the estimated overall impact of a change in r on E. For instance, if λ increased to 0.44 from 0.4, the overall impact of changes in r on E would increase by 0.08 percentage points, from 0.25 percent to 0.33 percent. Among the elasticities, $\varepsilon_{E\rho}$, $\varepsilon_{Z\rho}$ and $\varepsilon_{\lambda\rho}$ appear to have the largest influence on the overall impact of r on E. As far as we can establish, little or nothing is known about the actual empirical magnitudes of these elasticities. And this may be especially true for small developing economies, where data availability is often problematic. So, an effort to establish the empirical magnitudes of these elasticities appears fruitful.

CONCLUDING REMARKS

If we focus on the United States, we might conclude that fixed-exchange rates and reserve requirement changes are things of the past. Global data reveal a different picture. Shatz and Tarr [2000] report that over 45 percent of 185 countries surveyed adhered to some type of pegged exchange rate. While the reserve requirement is no longer a monetary policy tool of choice in the United States, the reserve requirement remains an active policy tool in various other countries.[12] As examples, Brazil, China, Ghana, Moldova, and Mexico recently have announced changes in their reserve requirements to affect monetary aggregates (sources: various news media).

The open-economy credit-view model with fixed exchange rates provides various predictions that deviate substantially from the predictions of the traditional Mundell-Fleming model. Most importantly, the credit-view model indicates that an independent monetary policy is possible despite adherence to a fixed exchange rate regime. Monetary policy tools that affect the money multiplier affect aggregate demand. Autonomous changes in the other determinants of the money multiplier also produce changes in real aggregate demand. This finding suggests, for example, that a country adhering to a fixed-exchange rate regime and experiencing an increase in its currency-to-deposit ratio would encounter an adverse demand shock despite equilibrating increases in the monetary base. Second, consistent with the Bernanke-Blinder closed-economy model, autonomous bank portfolio shifts between bonds and loans affect aggregate demand and are a potential source of instability in the economy. Thus, our analysis reveals several previously unidentified determinants of aggregate demand for small, open economies and suggests new areas for empirical research.

APPENDIX A

Let α and β be autonomous shift parameters. The model is:

$$E(y, i^*, \rho, \alpha) = y \tag{1}$$

$$L(y, i^*) = mB \tag{2}$$

$$Z(y, i^*, \rho) = (i^*, \rho, \beta)\,(m - 1)B \tag{3}$$

Proof that dy/dm > 0

Total differentiation of the model and arranging exogenous variables on the right-hand side yields:

$$(E_y - 1)dy + E_\rho d\rho = -E_\alpha d\alpha \tag{1'}$$

$$L_y dy - mdB = Bdm \tag{2'}$$

$$Z_y dy + (Z_\rho - (m\text{-}1)B\lambda_\rho)d\rho - \lambda(m\text{-}1)dB = \lambda Bdm + (m\text{-}1)B\lambda_\beta d\beta \tag{3'}$$

The denominator for Cramer's Rule is

$$\begin{vmatrix} E_y - 1 & E_\rho & 0 \\ L_y & 0 & -m \\ Z_y & Z_\rho - (m-1)B\lambda_\rho & -\lambda(m-1) \end{vmatrix}$$

or,

$$D = E_\rho(-m)\, Z_y + (Z_\rho - (m-1)B\lambda_\rho)m(E_y - 1) + \lambda(m-1)\, L_y E_\rho$$

The sign for **D** is ambiguous as the first two terms are positive while the last term is negative. Dynamic stability, however, requires that **D** > 0 (shown below).

The matrix numerator for *dy/dm* is

$$\begin{vmatrix} 0 & E_\rho & 0 \\ B & 0 & -m \\ \lambda B & Z_\rho - (m-1)B\lambda_\rho & -\lambda(m-1) \end{vmatrix}$$

or,

$$-mE_\rho \lambda\, B + \lambda(m-1)BE_\rho$$

This reduces to

$$-E_\rho \lambda\, B > 0$$

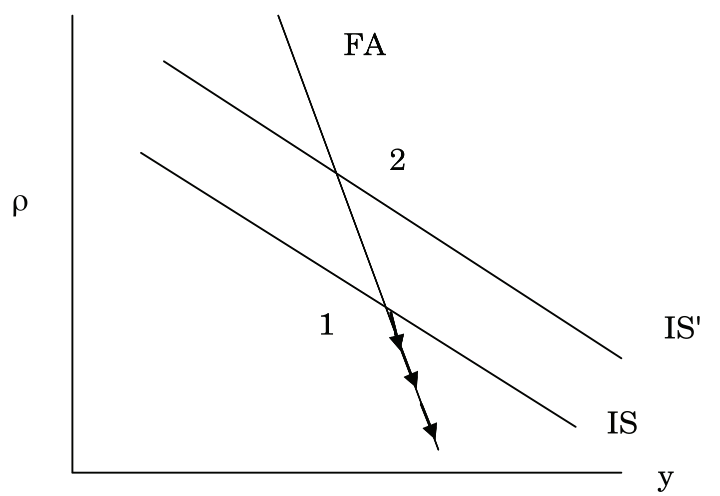
Thus, *dy/dm* is unambiguously positive if **D** > 0.

Proof that D > 0

The solution to the numerator matrix for *dy/dα*is $-mE_\alpha(Z_\rho - (m-1)B\lambda_\rho)$. This is unambiguously positive. Thus, an autonomous rise in the demand for goods can lower y if and only if **D** < 0. This, however, is a dynamically unstable possibility. Solve equation (2) for *B* and substitute into equation (3). We now have one equation in two unknowns, ρ and *y*. When this new equation (designated FA) holds, the money and loan markets clear. The FA curve may be upward or downward sloping. However, if it is downward sloping, it must be flatter than the IS curve for dynamic stability.

Figure A-1 below shows what happens if the FA curve is steeper than IS and an autonomous increase in goods expenditures occurs. The comparative static prediction is that income (*y*) falls. In the figure, the equilibrium moves from point 1 to 2. If we make the dynamic assumption that the money and loan markets always clear, then the economy will always be positioned on the FA curve. A rightward shift in IS will leave the economy on the FA curve, but below the IS curve (point 1). This represents excess demand in the goods market causing an increase in y and a movement away from the predicted comparative static equilibrium at point 2. Thus, when FA is more steeply sloped than IS, the model predicts a fall in y when autonomous expenditure demand increases. This is a dynamically unstable case and is rejected. This case only occurs if **D** < 0, since the numerator for dy/dα is unambiguously positive. As a result, **D** < 0 is rejected and **D** is signed positive.

FIGURE A
1- Dynamically unstable case (D < 0)



APPENDIX B
Assumptions Underlying the Simulation

The simulations require values for the following variables and partial derivatives (see equations (6) and (7)): λ, B, m, L_y, Z_y, Z_ρ, λ_ρ, E_y, and E_ρ. To derive values for the partial derivatives, we also need values for the levels of several other variables, namely L, Z, ρ, and E $(= y)$. Some of the values we use are supported by empirical evidence (see below). Unfortunately, empirical estimates are not available for every parameter required to simulate dy/dm. So, some values are supported simply by informed "guesses" about plausible but conservative magnitudes.

A. Values and Justifications for λ, B, and m

λ = 0.4 We assume that 40 percent of bank assets are in loans with the remainder being in bonds (i.e., marketable securities). This is a conservative assumption as Barajas, et al. [2005] report that λ exceeds 0.5 for Africa and Latin America. If banks held a larger percentage of assets in loans, dy/dm would be larger.

B = 1.0 We arbitrarily normalize B to 1.0. Other dollar-denominated variables (discussed below) are in plausible proportion to B.

m = 3.25 The money multiplier is computed using the formula,

$$m = (1+c)/(r+c)$$

We assume a reserve requirement, r, of 0.1 and a currency to deposit ratio, c, of 0.3. These values are consistent with those reported by Garcia-Herrero [1997] for several small open economies.

B. Values and Justifications for the Partial Derivatives

L_y = 0.325. We derive values for the six partial derivatives needed to estimate dy/dm by assuming plausible values for relevant elasticities and for levels of variables and then computing the partial derivatives. For example, we compute the partial L_y by assuming first the value for the income elasticity of money demand The formula for the elasticity is: $\varepsilon_{Ly} = L_y*(y/L)$.

If we select reasonable values for the elasticity and for L and y, we can solve for a plausible value for L_y. As is commonly the case for the income elasticity of money demand, we assume that $\varepsilon_{Ly} = 1$. (For supporting examples of studies of money demand in small open economies, see Cuevas [2002] and Treichel [1997].) We set y equal to 10 times the monetary base, B (or $y = 10$). This relationship between B and y is consistent with those of many countries, according to information provided to us by the World Bank (available from the authors upon request). Further, $L = mB$, so $L = 3.25*1 = 3.25$. It follows that $L_y = 0.325$ as a baseline value.

Z_y = 0.09. To calculate this partial, we assume that the income elasticity of loan demand is 1.0, implying that a one-percent increase in income would raise loan demand by one percent. For Z $(=\lambda*(m-1)*B)$, the value implied by the RHS variables is 0.9. So, the implied value for Z_y is 0.09 (= $\varepsilon_{Zy}*(Z/y) = 1*(0.9/10)$).

Z_ρ = -9.0. To calculate this partial, we assume a value for the elasticity of loan demand with respect to the bank loan rate (ρ) equal to -0.50. So, borrowing is taken as relatively inelastic with respect to the bank lending rate. This follows from a presumption that bank-dependent firms do not generally have good substitute sources of credit. The formula to calculate Z_ρ is $-\varepsilon_{Z\rho} * (Z/\rho) = -0.5*(0.9/.05) = -9.0$.

λ_ρ = 4. As ρ increases, banks adjust their portfolios by substituting more of the less-liquid loans for the more liquid bonds. In the absence of any direct empirical evidence on the responsiveness of portfolio shifts to changes in ρ, we assume a baseline elasticity equal to 0.5 for deriving λ_ρ. The relatively low elasticity value is in keeping with the idea that bank loans may entail considerable risk. So, a substantial increase in loan quantity would need to be accompanied by a very substantial increase in bank loan rates, other things the same. Given $\varepsilon_{\lambda\rho} = 0.5$, $\lambda = 0.4$ and $\rho = 0.05$, then $\lambda_\rho = 4$.

E_y = 0.30 *(the marginal propensity to consume domestic output)*. The partial is calculated by assuming a marginal propensity to consume domestic or foreign goods and services from disposable income (MPC) of 0.90, an income tax rate (t) of 0.33 and a marginal propensity to import out of gross income (π) of 0.3. The MPC_d for domestic output (or E_y) is therefore ($MPC*(1 - t) - \pi$) = 0.30. These assumptions produce a relatively small expenditure multiplier (1.42), which serves to dampen any expenditure impact from loan sector shocks. The MPC selected is lower than that for the U.S., but higher than that for South Korea; the tax rate suggests a reasonably sized government sector and the marginal propensity to import suggests a fairly open economy (substantially more open than the U.S., for example).

$\boldsymbol{E_\rho}$ **= -9.0.** This partial derivative is derived differently from the others. To fix ideas, consider a decline in ρ. This change encourages additional expenditures (a higher **E**) financed by borrowing from banks. In other words, the demand for bank loans is derived from the desire to spend more because of a lower borrowing cost. We make the very conservative assumption that any additional spending represented by E_ρ is fully financed by additional bank borrowing, implying that $E_\rho = Z_\rho = -9.0$. (An alternative assumption is that some of the additional spending is financed with non-bank funds, such as retained earnings. If so, then $E_\rho > Z_\rho$.) With $E_\rho = -9.0$, the implied elasticity for E with respect to ρ is $\varepsilon_{E\rho} = 0.045 = -(-9)*(0.05/10)$. Assuming a larger value for E_ρ increases the magnitude of dy/dm, so our assumption of a small E_ρ is indeed a conservative one.

NOTES

The authors thank anonymous referees of this journal for many helpful comments.

1. Eichengreen [2002] reviews the various papers supporting this view.
2. The Bernanke and Blinder [1988] model and the adaptation of their approach to the Mundell-Fleming model undertaken in this paper fall into the literature arguing that assets markets and financial intermediaries can have aggregate demand effects that go well beyond those envisioned by a simple LM curve. See, Gertler [1988] for a review of the literature broadening the channel of financial market effects.
3. For the early work using these assumptions see Tobin [1970] and Brunner and Meltzer [1972].
4. See Hubbard [1998] for an extensive review of the literature surrounding capital-market imperfections and "bank-dependent" borrowers and their implications for monetary and fiscal policy.
5. Bank assets are reserves (R) + bank credit (BC) while liabilities are deposits, D. D equals the money supply, M, minus currency held outside the banks, C. $R + BC = M - C$, so BC $= M - R - C$. Since $B = R + C$, $BC = M - B$. And since $M = mxB$, BC = (m - 1) x B. See also the seminal work by Brunner and Meltzer [1968].
6. Following Bernanke and Blinder [1988], money demand continues to depend only on the bond interest rate. This represents the opportunity cost for holding money as the public only holds bonds and cannot own bank loans.
7. The model that we develop formally here is consistent with a model presented by Driscoll [2004]. He also applies the Bernanke-Blinder model to small, open economies and tests it with data for the U.S. states.
8. See Appendix A for details.
9. With the exception of λ, magnitudes for all of the following factors may be constrained by stability considerations for the model. That is, stability requirements assure that dy/dm > 0. While one could select parameter values that would force $dy/dm < 0$, we rule out such possibilities.
10. The money multiplier, m, depends on the currency-to-deposit ratio, c, the reserve requirement, r, and the excess reserve ratio, e. A high m requires a low combined value for c, e, and r.
11. Mathematically, an increase in E_ρ, under certain conditions, may cause dy/dm to fall. However, a simulation analysis (described in Appendix B) suggests that such an outcome would not occur for any set of reasonable values for the parameters defining dy/dm (see equations (7) and (8)).
12. Changes in U.S. reserve requirements since 1980 have furthered equity and efficiency objectives (e.g., uniformity across various classes of financial intermediaries) rather than serving as a tool for aggregate demand management.

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