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Money Versus Credit in the Determination
of Output for Small Open Economies

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Abstract

It is well known that in a small open economy where there is perfect substitutability between domestic and foreign assets and costless portfolio adjustment, the monetary authorities cannot control the money supply, but can influence the balance of payments through the use of domestic credit. It has been argued that domestic credit is therefore the relevant variable in output determination as well. However, this paper demonstrates, using a "new classical" structural model, that under the conditions that render the money supply uncontrollable, neither money nor domestic credit affects output. If either has a significant effect in empirical tests, it implies that the assumption of perfect capital mobility is not satisfied.

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Summary

Several authors have argued that the appropriate monetary policy variable in explaining short-run output determination for small open economies is domestic credit rather than the overall money supply. The rationale for this view is that in such economies the monetary authorities can control the stock of domestic credit, but not the money supply.

This assertion is not generally true, however. The controllability of the money supply in small open economies depends on the degree of substitutability between domestic and foreign assets and on the costs of adjusting portfolios. Monetary autonomy will be lost when domestic and foreign assets are perfect substitutes and portfolio adjustment is costless. This paper demonstrates, using a "new classical" structural model, that under these conditions neither money nor domestic credit belong in reduced-form output equations. This is because the conditions that make money uncontrollable in the short run simultaneously make credit policy powerless to affect aggregate demand. Neither anticipated nor unanticipated changes in the stock of domestic credit influence the level of real output under these conditions. Changes in the stock of credit, whether anticipated or otherwise, affect only the stock of foreign exchange reserves. Empirical evidence that changes in either monetary aggregate exert short-run effects on prices and real output in small open economies therefore supports the view that such economies possess at least some degree of short-run monetary autonomy.

Evidence presented here for a sample of 12 developing countries over the period 1962-86 indicates that past changes in domestic financial aggregates do help predict nominal GDP. This suggests that the perfect capital mobility assumption is not valid for these countries. Moreover, at least for this group of countries, money seems to be a better predictor of nominal GDP than credit, therefore indicating that for these countries and this sample period, the relevant monetary policy variable has more often been money, rather than domestic credit.

I. Introduction

The endogeneity of the money supply in a small open economy under fixed exchange rates is a central feature of the monetary approach to the balance of payments (see Frenkel and Johnson (1976)). When domestic and foreign interest-bearing assets are perfect substitutes and portfolio adjustment is costless, the monetary authorities lose short-run control over the money supply. Thus, the only available monetary policy variable in a small open economy with perfect capital mobility is the domestic component of the money supply--domestic credit.

While there is little debate about the appropriate monetary policy variable under these circumstances insofar as the balance of payments is concerned, the issue is far from settled when it comes to output determination. In explaining the deviation of output from its normal level in developing countries many authors have used a variant of the Barro (1976) reduced-form methodology. 1/ Barro's original closed-economy formulation considered money (M1) to be the relevant monetary policy instrument, and others have done likewise in the developing-country setting. A number of authors have argued, on the other hand, that since the money supply cannot be considered to be under the control of the authorities in a small open economy which pegs its exchange rate, even in the short run, the appropriate monetary policy variable should be domestic credit (Blejer and Fernandez (1980), Edwards (1983a) and (1983b)).

How then should Barro-type reduced-form output equations be specified for small open economies under fixed exchange rates when perfect substitutability and costless portfolio adjustment render the money supply uncontrollable in the short run? This paper demonstrates that, contrary to what has been claimed, it is not appropriate to replace money with domestic credit in reduced-form output equations under these circumstances. The reason is a familiar Mundellian one--under fixed exchange rates and perfect capital mobility, monetary policy is powerless to affect output (Mundell (1963)). Under these circumstances, output is shown to deviate from its normal level not in response to domestic credit shocks, but rather as a result of surprises about world interest rates, prices of traded goods, and domestic fiscal policy. 2/ The distinction between anticipated and unanticipated changes in the supply of domestic credit proves to be immaterial in this setting. Whether anticipated or not, changes in the stock of domestic credit simply result in offsetting

1/ A list of references is given in Chopra and Montiel (1986).

2/ Other factors--such as terms of trade changes and agricultural supply shocks--would undoubtedly figure prominently in empirical reduced form output equations derived from a "new classical" model for a typical developing country. For evidence on the role of such factors, see, for example, Edwards (1983a, 1983b), Sheehy (1984), and Cozier (1986). Since the focus of this paper, however, is on the role of macroeconomic policy variables in the reduced-form output equation when monetary autonomy is absent, the model presented in Section II holds constant other factors, such as those mentioned above, which are not themselves affected by domestic macroeconomic policies.

changes in the monetary authority's stock of foreign exchange reserves, with no effect on prices or output. To the extent that money or domestic credit turn out to be statistically significant determinants of domestic prices or output in empirical tests--a result confirmed by our own tests here--this implies that the assumptions underlying the classical small open economy with perfect capital mobility are not satisfied. Consequently, there is no a priori reason for preferring domestic credit over the money supply.

The theoretical points are made below by analyzing the properties of a simple new classical model of a "dependent" economy which operates a fixed exchange rate under conditions of perfect substitutability between domestic and foreign interest-bearing assets and costless portfolio adjustment. While the model is quite simple, it incorporates two features which have been found in other contexts to enhance the power of monetary policy. These are:

- a. The adoption of a "dependent economy" framework. In such a framework, it has been shown elsewhere (Montiel (1986)) that, contrary to the closed-economy results, both anticipated and unanticipated monetary policy have real output effects when costless portfolio adjustment and perfect substitutability are not assumed.
- b. The assumption that agents forming expectations about the real interest rates can observe current aggregate information. Turnovsky (1980) and Buiter (1980) have shown that systematic monetary policy can have real output effects in this case by altering the information content of price signals.

Since these features of the model "stack the deck" in favor of finding real output effects of monetary policy, they serve to underline the generality of the results derived.

The empirical tests involve the estimation of vector autoregressions (VARs) for 12 developing countries. These VARs basically examine the relationship among nominal GDP, international reserves, and alternatively money and domestic credit variables. The empirical analysis provides a test of whether monetary policy variables help to predict nominal GDP, and if they do, which particular variable--money or domestic credit--is the relevant one for the sample of countries under consideration.

The analysis is organized as follows: a simple model with a "new classical" structure and perfect capital mobility is presented in the next section. The model is solved in Section III and its reduced-form output equations are derived and analyzed. Section IV examines the determination of the stock of foreign exchange reserves in this model, with an emphasis on the role played by the stock of domestic credit. The empirical exercises are contained in Section V, and a brief summary of the main conclusions appears in Section VI.

II. The Model

The open-economy classical model to be described here can be viewed as a successor to the "dependent economy" model developed by Blejer and Fernandez (1980) and modified by Montiel (1986). The present version differs from its predecessors only in its specification of aggregate demand. This section describes the structure of the model, treating the supply side first.

1. The supply specification

Since the supply side of the model is identical to that in Blejer and Fernandez (1980) and Montiel (1986), the description here will be brief. More detailed expositions are available in the papers cited.

Production takes place in two sectors, which consists of traded and nontraded goods. Output in each sector is produced under conditions of diminishing marginal returns. The short-run production functions are:

$$y^{T,S} = a_0 + a_1 \ell^T + \varepsilon^T \quad (1)$$

$$y^{N,S} = b_0 + b_1 \ell^N + \varepsilon^N, \quad (2)$$

where $a_0, b_0 > 0$ and $0 < a_1, b_1 < 1$. $y^{i,S}$ and ℓ^i are the logs of output and employment in sector i respectively; and ε^i is a serially uncorrelated random productivity shock with zero mean and finite variance. ^{1/} The symbol ε , with various superscripts, will be used throughout the paper to denote stochastic variables with these properties. Short-run profit maximization yields the labor demand functions:

$$\ell^T = \ell^{T0} - (1-a_1)^{-1} (w-p^T) + a_1^{-1} \varepsilon^T \quad (3)$$

$$\ell^N = \ell^{N0} - (b-b_1)^{-1} (w-p^N) + b_1^{-1} \varepsilon^N. \quad (4)$$

^{1/} Evidence presented by Cozier (1986) indicates that serially correlated supply shocks may have an empirically important role to play in developing countries. Although it would be straightforward to allow for such shocks in this model, they are neglected for simplicity, since their presence would not affect the conclusion about domestic macroeconomic policies derived below.

here w is the log of the nominal wage, and p^T and p^N are the logs of domestic prices of traded and nontraded goods respectively. The aggregate demand for labor is approximated in log-linear form by:

$$\ell^D = \ell^0 - c_1 (w - p^T) - c_2 (w - p^N) + \varepsilon^{LD} \quad (5)$$

where:

$$\ell^0 = (L^{T0} + L^{N0})$$

$$c_1 + (1-\gamma)/(1-a_1) > 0$$

$$c_2 = \gamma/(1-b_1) > 0$$

$$\varepsilon^{LD} = c_1 \varepsilon^T + c_2 \varepsilon^N,$$

where $\gamma = L^{N0}/(L^{T0}+L^{N0})$ with $0 < \gamma < 1$ and L^{T0} and L^{N0} are initial levels of employment in the traded and nontraded goods sectors, respectively.

Workers are assumed to negotiate a labor supply schedule one period ahead based on the price level they expect to prevail during that period. The aggregate supply of labor is therefore:

$$\ell^S = \ell^0 + d_1 (w - p_{-1,0}^e) + \varepsilon^{LS} \quad (6)$$

where $d_1 > 0$ and $p_{-1,0}^e$ is the expectation of the current (time zero) price level p formed last period (time -1). ^{1/} The notation $z_{i,j}^e$ will be used below to denote the expectation formed at time i of the value of the variable z expected to prevail at time j . All expectations are assumed to be formed Muth-rationally, so that:

^{1/} The labor-supply schedule in (6) is a generalization of the Fischer (1977b) and Gray (1976) wage-contracting approach. This generalization was mentioned by Fischer (1977a, p. 195), and can be interpreted as specifying overtime payments. This specification is adopted here for consistency with Blejer and Fernandez. The implications of replacing (6) with a perfectly-elastic Fischer-Gray labor supply schedule can be derived by letting α_1 go to infinity. In this case (6) takes the familiar form $w = p_{-1,0}^e$ and the labor-supply shock ε^{TS} , of course, disappears from the model. No substantive results are affected by this change.

$$z_{i,j}^e = E(z_j | I_i), \quad (7)$$

where E is the mathematical expectations operator and I_i denotes the set of information available at time i .

Finally, the aggregate price level is the weighted average of the prices of traded and nontraded goods:

$$p = (1-\theta) p^T + \theta p^N, \quad (8)$$

with constant weights $(1-\theta)$ and θ given by domestic expenditure shares on traded and nontraded goods respectively.

Blejer and Fernandez (1980) show that the supply side of the model can be summarized by the two equations:

$$y^{TS} = y^{T0} + \alpha_1(p^T - p^N) + \alpha_2(p^T - p_{-1}^e) + \epsilon^{TS} \quad (9)$$

where:

$$y^{T0} = a_0 + a_1 l^{T0} > 0$$

$$\alpha_1 = \frac{a_1 c_2 / (1 - a_1)}{c_1 + c_2 + d_1} > 0$$

$$\alpha_2 = \frac{a_1 d_1 / (1 - a_1)}{c_1 + c_2 + d_1} > 0$$

$$\epsilon^{TS} = \epsilon^T + a_1 \frac{c_2(\epsilon^T - \epsilon^N) + d_1 \epsilon^T + \epsilon^{LS}}{(1 - a_1)(c_1 + c_2 + d_1)}$$

and:

$$y^{NS} = y^{NO} - \alpha_3 (p^T - p^N) + \alpha_4 (p^N - p_{-1,0}^e) + \varepsilon^{NS}, \quad (10)$$

where:

$$y^{NO} = b_0 + b_1 y^{NO} > 0$$

$$\alpha_3 = \frac{b_1 c_1 / (1 - b_1)}{c_1 + c_2 + d_1} > 0$$

$$\alpha_4 = \frac{b_1 d_1 / (1 - b_1)}{c_1 + c_2 + d_1} > 0$$

$$\varepsilon^{NS} = \varepsilon^N + b_1 \frac{c_1 (\varepsilon^N - \varepsilon^T) + d_1 \varepsilon^N + \varepsilon^{LS}}{(1 - b_1) (c_1 + c_2 + d_1)}$$

Thus, output of traded goods responds positively and output of nontraded goods negatively to a depreciation of the real exchange rate (an increase in $p^T - p^N$). An increase in each sector's price relative to the expected aggregate price level, on the other hand, is associated with an increase in output in both sectors.

2. Demand specification

The law of one price is assumed to hold continuously for traded goods. Since the economy in question is small, this means that demand for traded goods is given by:

$$p^T = s + p^{T*}, \quad (11)$$

where s is the log of the exchange rate (the domestic currency price of foreign exchange) and p^{T*} is the world price of traded goods in foreign currency.

Domestic demand for nontraded goods is a function of their relative price, of the real demand rate, and of real government spending on nontraded goods:

$$y^{ND} = y^{NO} + e_1(p^T - p^N) - e_2 r + e_3 g^N + \epsilon^{ND}, \quad (12)$$

with $e_1, e_2, e_3 > 0$. Equation (12) is in the form of a conventional IS curve, except for the inclusion of the relative price term. 1/ The real interest rate is denoted r and g^N is the log of government spending on nontraded goods.

The model's LM curve is:

$$m - p = f_0 - f_1 i + f_2 y + \epsilon^M, \quad (13)$$

where $f_1, f_2 > 0$, i is the nominal interest rate, and y denotes the log of aggregate real output, measured in terms of the consumption bundle. y is in turn approximated by:

$$y = y_0 + (1-\theta) y^T + \theta y^N, \quad (14)$$

where y_0 is a constant, and it is assumed that output shares of traded and nontraded goods are initially equal to domestic expenditure shares. The supply of money can be derived from the balance sheet of the banking system as:

$$m = m_0 + \psi n + (1-\psi)d, \quad (15)$$

where m_0 is a constant and n is the log of net foreign assets (assumed positive), while d is the log of domestic credit. The fraction ψ denotes the initial proportion of the domestic money stock backed by foreign exchange reserves.

To complete the description of financial equilibrium, the link between the real and nominal interest rates is given by the Fisher relation:

$$r = i - (p_{0,1}^e - p), \quad (16)$$

1/ Note that (12) does not incorporate a real balance effect. The consequences of including such an effect are described in Section II.

i.e., the real interest rate is the difference between the nominal interest rate and the expected rate of inflation. Note that in forming expectations of inflation individuals are assumed to observe the current price level and to utilize current information to form expectations about next period's prices, following Turnovsky (1980) and Buiter (1980). This is in contrast to the use of last period's information in the labor market. This asymmetry arises because the use of last period's information in the labor market does not result from an information lag, but rather from the existence of one-period non-contingent wage contracts. Thus individuals in all markets have access to current information, but workers cannot alter their current labor supply schedules based on this information, because they are bound by preexisting contracts. For a similar formulation in a closed-economy context, see Turnovsky (1980).

Finally, with domestic and foreign assets considered to be perfect substitutes, and costless portfolio adjustment, the arbitrage relationship:

$$\begin{aligned} i &= i^* + (s_{0,1}^e - s) \\ &= i^* \end{aligned} \tag{17}$$

must hold at every instant, where i^* is the world nominal interest rate. The second equality holds on the assumption that the exchange rate is pegged by the authorities and that the initial level of reserves and the stance of policies are such as to make the existing peg credible. Under these conditions, $s_{0,1}^e = s$.

The model is closed with the "classical" assumption that the market for nontraded goods must clear in every period.

$$y^{NS} = y^{ND}. \tag{18}$$

III. The Reduced-Form Output Equations

Barro's (1976) methodology for testing that only unanticipated policy matters involves estimating reduced-form output equations and testing whether anticipated policy changes contribute significantly as explanatory variables. This section will show that domestic monetary policy variables--anticipated or otherwise--do not enter the reduced-form output equations in the present model. Output in both sectors depends instead on government spending on nontraded goods, on the world real interest rate, and on the domestic price of traded goods.

To derive the reduced-form equation for output of nontraded goods, use equation (8) to express (10) and (16) in terms of the prices of traded and nontraded goods:

$$y^{NS} = y^{NO} - \alpha_3(p^T - p^N) + \alpha_4[p^N - (1-\theta)p_{-1,0}^{Te} - \theta p_{-1,0}^{Ne}] + \epsilon^{NS} \quad (10a)$$

$$r = i - [(1-\theta)p_{0,1}^{Te} + \theta p_{0,1}^{Ne} - (1-\theta)p^T - \theta p^N] \quad (16a)$$

Substituting (17) into (16a) and the result into (12) allows the "IS curve" to be written as:

$$\begin{aligned} y^{ND} = y^{NO} + e_1(p^T - p^N) - e_2\{i^* - [(1-\theta)p_{0,1}^{Te} + \theta p_{0,1}^{Ne} - (1-\theta)p^T - \theta p^N]\} \\ + e_3g^N + \epsilon^{ND}. \end{aligned} \quad (12a)$$

Finally, substitution (10a) and (12a) into the market-clearing condition (18) and solving for the market-clearing price p^N produces:

$$\begin{aligned} p^N = \frac{\alpha_4\theta}{\phi_o} p_{-1,0}^{Ne} + \frac{e_2\theta}{\phi_o} p_{0,1}^{Ne} + \frac{\alpha_3 - e_2(1-\theta) + e_1}{\phi_o} p^T \\ - \frac{e_2}{\phi_o} i^* + \frac{e_3}{\phi_o} g^N + \frac{\alpha_4(1-\theta)}{\phi_o} p_{-1,0}^{Te} + \frac{e_2(1-\theta)}{\phi_o} p_{0,1}^{Te} + \epsilon^{NP} \end{aligned} \quad (19)$$

where:

$$\epsilon^{NP} = (\epsilon^{ND} - \epsilon^{NS})/\phi_o$$

$$\phi_o = \alpha_3 + \alpha_4 + e_2\theta + e_1 > 0.$$

Taking expectations conditioned on information available last period yields:

$$p_{-1,0}^{Ne} = \frac{e_2^\theta}{\phi_1} p_{-1,1}^{Ne} + \frac{e_3}{\phi_1} g_{-1,0}^{Ne} - \frac{e_2}{\phi_1} i_{-1,0}^{*e} \\ + \frac{\alpha_3 + \alpha_4(1-\theta) - e_2(1-\theta) + e_1}{\phi_1} p_{-1,0}^{Te} + \frac{e_2(1-\theta)}{\phi_1} p_{-1,1}^{Te},$$

with $\phi_1 = \alpha_3 + \alpha(1-\theta) + e_2\theta + e_1 > 0$. It is convenient to write this as:

$$p_{-1,0}^{Ne} = \frac{e_2^\theta}{\phi_1} p_{-1,1}^{Ne} + \frac{e_3}{\phi_1} r_{-1,0}^{*e} - \frac{e_2^\theta}{\phi_1} p_{-1,1}^{Te} + p_{-1,0}^{Te} \quad (20)$$

where $r^* = i^* - (p_{0,1}^{Te} - p^T)$ is the external real interest rate. This is a first-order nonhomogeneous difference equation in $p_{-1,0}^{Ne}$. Its solution is:

$$p_{-1,0}^{Ne} = \lim_{t \rightarrow \infty} \left(\frac{e_2^\theta}{\phi_1} \right)^t p_{-1,t}^{Ne} + \sum_{t=0}^{\infty} \left(\frac{e_2^\theta}{\phi_1} \right)^t \left[\frac{e_3}{\phi_1} g_{-1,t}^{Ne} - \frac{e_2}{\phi_1} r_{-1,t}^{*e} \right. \\ \left. - \frac{e_2^\theta}{\phi_1} p_{-1,t+1}^{Te} + p_{-1,t}^{Te} \right]$$

Since $e_2\theta/\phi_1 < 1$, ruling out "bubbles" in p^N permits us to write:

$$p_{-1,0}^{Ne} = \sum_{t=0}^{\infty} \left(\frac{e_2^\theta}{\phi_1} \right)^t \left[\frac{e_3}{\phi_1} g_{-1,t}^{Ne} - \frac{e_2}{\phi_1} r_{-1,t}^{*e} - \frac{e_2^\theta}{\phi_1} p_{-1,t+1}^{Te} + p_{-1,t}^{Te} \right].$$

This can be simplified to:

$$p_{-1,0}^{Ne} = p_{-1,0}^{Te} + \sum_{t=0}^{\infty} \left(\frac{e_2^\theta}{\phi_1} \right)^t \left[\frac{e_3}{\phi_1} g_{-1,t}^{Ne} - \frac{e_2}{\phi_1} r_{-1,t}^{*e} - \frac{e_2^\theta}{\phi_1} p_{-1,t+1}^{Te} \right] \\ + \sum_{t=0}^{\infty} \left(\frac{e_2^\theta}{\phi_1} \right)^t \frac{e_2^\theta}{\phi_1} p_{-1,t+1}^{Te}$$

$$\begin{aligned}
 &= p_{-1,0}^{Te} + \sum_{t=0}^{\infty} \left(\frac{e_2^{\theta}}{\phi_1} \right)^t \left[\frac{e_3}{\phi_1} g_{-1,t}^{Ne} - \frac{e_2}{\phi_1} r_{-1,t}^{*e} \right] \\
 &= p_{-1,0}^{Te} + \sum_{t=0}^{\infty} (e_2^{\theta}/\phi_1)^t x_{-1,t}^e,
 \end{aligned} \tag{21}$$

where the exogenous demand variable X is defined as:

$$X = (e_3/\phi_1)g^N - (e_2/\phi_1)r^*,$$

to simplify notation. Equation (21) is the reduced-form equation for last period's expectation of the current price of nontraded goods. It depends on last period's expectation of the current price of traded goods and on the entire expected future paths of the real variables g^N and r^* . Note that the expected future evolution of traded goods prices is absent from this equation.

By analogy to (21), we can write:

$$p_{0,1}^{Ne} = p_{0,1}^{Te} + \sum_{t=0}^{\infty} \left(\frac{e_2^{\theta}}{\phi_1} \right)^t x_{0,t+1}^e. \tag{22}$$

Equations (21) and (22) can now be substituted into (19) to derive the reduced-form expression for p^N . After some algebra, this reduced-form expression can be shown to be:

$$\begin{aligned}
 p^N &= p_{-1,0}^{Te} + x_{-1,0}^e + (1 + \frac{\alpha_4^{\theta}}{\phi_0}) \sum_{t=0}^{\infty} (e_2^{\theta}/\phi_1)^{t+1} x_{-1,t+1}^e \\
 &+ (1 - \alpha_4/\phi_0)(p_{-1,0}^T - p_{-1,0}^{Te}) + (1 - \alpha_4^{\theta}/\phi_0)(x_{-1,0} - x_{-1,0}^e) \\
 &+ \sum_{t=0}^{\infty} (e_2^{\theta}/\phi_1)^{t+1} (x_{0,t+1}^e - x_{-1,t+1}^e) + \epsilon^{NP}.
 \end{aligned} \tag{23}$$

According to this expression, the price of nontraded goods depends on the price of traded goods, on current and anticipated future values of exogenous demand, and on the composite random shock ϵ^{ND} .

The effects on p^N of the current values of p^T and X depends as usual on whether these values were anticipated in the previous period. As is common in "new classical" models, the price effects of anticipated shocks exceed those of unanticipated shocks. 1/ Anticipated changes in traded goods prices change the prices of nontraded goods pari passu (the coefficient of $p_{-1,0}^T$ in (23) is unity). An unanticipated increase in traded goods prices, on the other hand (i.e., an increase in $(p - p_{-1,0}^T)$) increases the price of nontraded goods only by a factor of $1 - \alpha_4/\phi_0 < 1$. Similarly, the coefficient of anticipated exogenous demand $(X^e - X_{-1,0}^e)$ exceeds that of unanticipated demand $(X - X_{-1,0}^e)$, since $1 - \alpha_4\theta/\phi_0 < 1$. Finally, the third and sixth terms on the right-hand side of (23) divide the effects of expected future demand into the component which was expected last period and a component which reflects revisions of last period's expectations based on "news"--i.e., information revealed during the current period. As can be seen from (23), since $\alpha_4\theta/\phi_0 > 0$, the effects on p^N of the previously anticipated component exceed those of the "surprise" component. 2/

Equation (23) can be used to derive an expression for the real exchange rate $p^T - p^N$:

$$p^T - p^N = X_{-1,0}^e - \left(1 + \frac{\alpha_4\theta}{\phi_0}\right) \sum_{t=0}^{\infty} \left(\frac{e_2\theta}{\phi_0}\right)^{t+1} X_{-1,t+1}^e + \frac{\alpha_4}{\phi_0} (p^T - p_{-1,0}^T) \quad (24)$$

$$- \left(1 - \frac{\alpha_4\theta}{\phi_0}\right) (X - X_{-1,0}^e) - \sum_{t=0}^{\infty} \left(\frac{e_2\theta}{\phi_1}\right)^{t+1} (X_{0,t+1}^e - X_{-1,t+1}^e) - \epsilon^{NP}$$

Since p^T is determined exogenously, aggregate demand shocks--present or future, anticipated or unanticipated--will affect the real exchange rate only through their effects on p^N . Thus each exogenous demand variable enters (24) in the same form as it does (23), but with the opposite sign. Anticipated changes in traded goods prices do not affect the real exchange rate since, as mentioned above, the prices of nontraded goods will change in proportion. Hence $p_{-1,0}^T$ does not appear on the right-hand side of

1/ This is discussed at length in a framework similar to the present one in Montiel (1986).

2/ If agents forming expectations of real interest rates do not have access to current information or observe the current price level, the only modification required to the results of this section is that the expectations-revision term would not appear in reduced-form equations such as (23).

(24). Unanticipated increases in traded goods prices (e.g., an unanticipated nominal devaluation) raise the prices of nontraded goods less than in proportion ($1 - \alpha_4/\phi_0 < 1$ in (23)) and thus are associated with a real devaluation (an increase in $p^T - p^N$) in (24).

As a final step before deriving the reduced-form output equations, note that the expected price level $p_{-1,0}^e$ can be written as:

$$\begin{aligned} p_{-1,0}^e &= (1-\theta) p_{-1,0}^{Te} + \theta p_{-1,0}^{Ne} \\ &= p_{-1,0}^{Te} + \theta X_{-1,0}^e + \theta \sum_{t=0}^{\infty} \left(\frac{e_2}{\phi}\right)^{t-1} X_{-1,t+1}^e. \end{aligned} \quad (25)$$

Thus, the expected price level depends on expected traded goods prices and expected demand shocks during the next and all future periods.

We can now write down the reduced-form equation for output of traded and nontraded goods. To solve for nontraded goods output, substitute (23), (24), and (25) into the supply equation (10). After simplifying, this yields:

$$\begin{aligned} y^N &= y^{NO} + \Pi_1 X_{-1,0}^e + \Pi_2 \sum_{t=0}^{\infty} \left(\frac{e_2}{\phi_1}\right)^{t+1} X_{-1,t+1}^e + \Pi_3 (p^T - p_{-1,0}^{Te}) \\ &\quad + \Pi_4 (X - X_{-1,0}^e) + \Pi_5 \sum_{t=0}^{\infty} \left(\frac{e_2}{\phi_1}\right)^{t+1} (X_{0,t+1}^e - X_{-1,t+1}^e) + \varepsilon^{NR}, \end{aligned} \quad (26)$$

where:

$$\Pi_1 = (\alpha_3 + \alpha_4) - \alpha_4 \theta > 0$$

$$\Pi_2 = (\alpha_3 + \alpha_4) \left[1 - \theta \frac{\alpha_4}{\alpha_3 + \alpha_4} \left(1 - \frac{\alpha_3 + \alpha_4}{\phi_0} \right) \right] > 0$$

$$\Pi_3 = \alpha_4 \left(1 - \frac{\alpha_3 + \alpha_4}{\phi_0} \right) > 0$$

$$\Pi_4 = (\alpha_3 + \alpha_4) \left(1 - \frac{\alpha_4 \theta}{\phi_0}\right) > 0$$

$$\Pi_5 = \alpha_3 + \alpha_4 > 0$$

$$\epsilon^{NR} = (\alpha_3 + \alpha_4) \epsilon^{NP} + \epsilon^{NS}$$

Again using (23), (24), and (25), but this time substituting into (9), produces the corresponding expression for output of traded goods:

$$\begin{aligned} y^T = y^{T0} - \Pi_6 x_{-1,0}^e - \Pi_7 \sum_{t=0}^{\infty} \left(\frac{e_2 \theta}{\phi_1}\right)^{t+1} x_{-1,t+1}^e + \Pi_8 (p^T - p_{-1,0}^{Te}) \\ - \Pi_9 (x - x_{-1,0}^e) - \Pi_{10} \sum_{t=0}^{\infty} \left(\frac{e_2 \theta}{\phi_1}\right)^{t+1} (x_{0,t+1}^e - x_{-1,t+1}^e) + \epsilon^{TR}, \end{aligned} \quad (27)$$

where:

$$\Pi_6 = \alpha_1 + \alpha_2 \theta > 0$$

$$\Pi_7 = \alpha_1 (1 + \alpha_4 \theta / \phi_0) + \alpha_2 \theta > 0$$

$$\Pi_8 = \alpha_2 + \alpha_1 / \phi_0 > 0$$

$$\Pi_9 = \alpha_1 (1 - \alpha_4 \theta / \phi_0) > 0$$

$$\Pi_{10} = \alpha_1 > 0$$

$$\epsilon^{TR} = \epsilon^{TS} - \alpha_1 \epsilon^{NS}$$

These equations permit us to make the following observations about short-run output determination in this model:

(1) Recalling that the "exogenous demand" variable X is a linear combination of g^N and r^* , where the former is a fiscal policy variable and the latter is exogenous to the domestic economy, notice that neither money nor domestic credit appears in the reduced-form output equations. Domestic monetary policy--whether anticipated or not--simply has no short-run output effects under fixed exchange rates when domestic and foreign interest-bearing assets are perfect substitutes and portfolio adjustment is costless. This familiar proposition from Mundell (1963) remains valid in the present model. 1/ The real interest rate that affects domestic spending in the "IS curve"--equation (12)--is the difference between the domestic nominal interest rate and expected domestic inflation. The former is linked to the world nominal interest rate via the interest parity condition (17). The latter can deviate from the world inflation rate and so is not exogenous to domestic policy, but as equation (25) shows, expectations of future prices depend on expected world inflation and real interest rates and on expected domestic fiscal policy, not on current or future domestic monetary policy. 2/

1/ The contrast with the Blejer-Fernandez model arises from the specification of demand for nontraded goods. In their model the demand for nontraded goods takes the form:

$$P_N = P_T + \gamma(d - d_{-1}), \quad \gamma > 0,$$

where d is the log of domestic credit. This is also their reduced-form expression for P_N , making their model recursive. Its counterpart in the present model is equation (23). This link between credit policy and the real exchange rate in the Blejer-Fernandez version (notice that $P_T - P_N = -\gamma(d - d_{-1})$ in their specification) is not present in equation (23), because under conditions of perfect substitutability and continuous portfolio equilibrium, incipient money-market disequilibria are eliminated through reserve movements, rather than through domestic price-level adjustments. The Blejer-Fernandez version is thus appropriate to a situation in which the monetary authorities do retain some degree of short-run monetary autonomy, but choose to pursue a domestic credit target.

2/ This conclusion does not depend on the absence of a real balance effect in the specification of the IS curve. Intuitively, this is because, under present assumptions, domestic monetary policy cannot be used to alter real balances. To demonstrate the result formally, note that if equation (12) contained a term $m-p$, equations (13), (14), and (17) could be used to express this variable as a function of i^* , y^T and y^N . Using (9) and (10), y^T and y^N can in turn be expressed in terms of P^T , P^N , and $p_{1,0}^e$. Since these variables already appear in the market-clearing condition (19) used to solve the current version of the model, it follows that the reduced-form output equations of the model modified to include a real balance effect cannot contain any exogenous variables which do not already appear in (19). Specifically, there would be no role for domestic credit in these equations.

(2) Only unanticipated changes in traded goods prices affect domestic output in this model. Anticipated traded goods prices ($p_{-1,0}^{te}$) do not appear in either (26) or (27). This is the counterpart of the familiar closed economy "monetary neutrality" result for the present model. The reason for the absence of $p_{-1,0}^{te}$ from (26) and (27) is evident from (23) and (25). An anticipated increase in traded goods prices will increase prices of nontraded goods and the expected price level in the same proportion. With all actual and anticipated prices changes proportionately, there are no real output effects. This means, of course, that an anticipated devaluation will have no real output effects. Likewise, since expectations of future changes in traded goods prices do not enter the reduced-form output equations, a preannounced schedule of exchange-rate changes (a "tablita") would have no real output effects. Unanticipated increases in traded goods prices, on the other hand, are expansionary, increasing output in both sectors.

(3) Increases in the exogenous components of demand--whether anticipated or not, whether in the current period or anticipated in some future period--expand output in the non-traded goods sector and contract it in the traded goods sector. In this model such increases can take the form of reductions in the external real interest rate or increases in government spending on nontraded goods. A similar result was obtained with a different aggregate demand specification in Montiel (1986). These results arise from the exogeneity of traded goods prices, which permit even anticipated changes in demand to affect the real exchange rate (equation (24)). An increase in government spending on nontraded goods and/or a reduction in the external real interest rate result in an appreciation of the real exchange rate, according to equation (24), and thus shift output from traded to nontraded goods. This will occur even when such changes were previously anticipated.

(4) The output effects of unanticipated changes in exogenous demand exceed those of anticipated changes in demand in the nontraded goods sector. The opposite holds true, however, in the traded goods sector. Notice that, since $(\alpha_3 + \alpha_4)/\phi_0 < 1$, in equation (26) $\Pi_4 > \Pi_1$, and $\Pi_5 > \Pi_2$. On the other hand, in equation (27) we have $\Pi_6 > \Pi_9$ and $\Pi_7 > \Pi_{10}$. The intuition behind the results is that when expansionary demand shocks are foreseen, workers will demand higher nominal wages next period. This leftward shift in the labor supply curve acts as a negative supply shock which partly offsets the expansion in demand in the nontraded goods sector, thus reducing the output responses in that sector. In the traded goods sector an expansion of demand for nontraded goods has an adverse effect through an induced increase in the equilibrium nominal wage. This negative effect is magnified when the labor supply curve shifts to the left.

IV. Credit Policy and the Stock of Reserves

The previous section demonstrated that changes in the stock of credit have no effects on aggregate demand in the present model. It is natural to ask, therefore, where the effects of changes in the stock of credit show up in this model. The answer is the conventional one given by the monetary approach to the balance of payments--changes in domestic credit are reflected in changes in foreign exchange reserves. In this section, the reduced-form equation for the stock of foreign exchange reserves is derived and the effects of changes in the stock of credit as well as of other exogenous variables are analyzed.

To derive the reduced-form expression for foreign-exchange reserves, we first derive the corresponding expressions for domestic aggregate real output and the domestic price level. We then use these together with equations (13) and (15) to solve for the stock of foreign-exchange reserves n .

The reduced-form equation for aggregate real output is obtained by substituting (26) and (27) in (14). The result is:

$$y = y_0 + \sigma_1 X_{-1,0}^e + \alpha_2 \sum_{t=0}^{\infty} \left(\frac{e_2}{\phi_1}\right)^{t+1} X_{-1,t+1}^e + \sigma_3 (p^T - p_{-1,0}^{Te}) \quad (28)$$

$$+ \sigma_4 (X - X_{-1,0}^e) + \sigma_5 \sum_{t=0}^{\infty} \left(\frac{e_2}{\phi_1}\right)^{t+1} (X_{0,t+1}^e - X_{-1,t+1}^e) + \epsilon^Y,$$

where:

$$\sigma_1 = [\theta (\alpha_3 + \alpha_4) - (1-\theta) \alpha_1] - \theta [\alpha_4 \theta + \alpha_2 (1-\theta)]$$

$$\sigma_2 = [\theta (\alpha_3 + \alpha_4) - (1-\theta) \alpha_1] (1 + \alpha_4 \theta / \phi_0) - \theta [\alpha_4 \theta + \alpha_2 (1-\theta)]$$

$$\sigma_3 = \theta \Pi_3 + (1-\theta) \Pi_8 > 0$$

$$\sigma_4 = [\theta (\alpha_3 + \alpha_4) - (1-\theta) \alpha_1] (1 - \alpha_4 \theta / \phi_0)$$

$$\sigma_5 = \theta (\alpha_3 + \alpha_4) - (1-\theta) \alpha_1$$

$$\epsilon^Y = \theta \epsilon^{NR} + (1-\theta) \epsilon^{TR}$$

Note that only one of the parameters can be signed unambiguously--surprise increased in traded goods prices are expansionary, as discussed previously. The ambiguity in the remaining signs reflects the fact that increases in demand for nontraded goods simultaneously expand output of those goods and contract output of traded goods. Since $0 < \alpha_4 \theta \phi_0 < 1$, however, it can be verified by inspection that if σ_1 is positive, the remaining ambiguous parameters will also be positive--i.e., if anticipated current increases in demand for nontraded goods increase aggregate output, then so will current unanticipated increases in demand as well as increases in either component of expected future demand. It can be shown that the condition $(1-b_1) < (1-a_1)$ --i.e., the demand for labor in the nontraded goods sector is less elastic than in the traded goods sector--is sufficient to render σ_1 positive. For concreteness, this is assumed to be the case. It follows that increases in domestic demand increase aggregate real output--i.e., $\sigma_1, \sigma_2, \sigma_3, \sigma_4$, and σ_5 are all positive.

Turning to the domestic price level, note first from equation (8) that p can be written as:

$$p = p^T - \theta(p^T - p^N).$$

Substituting for the reduced-form expression for the real exchange rate (equation (24)) we therefore have:

$$\begin{aligned} p = & p_{-1,0}^{Te} + \theta X_{-1,0}^e + \theta \left(1 + \frac{\alpha_4 \theta}{\phi_0}\right) \sum_{t=0}^{\infty} \left(\frac{e_2 \theta}{\phi_0}\right)^{t+1} X_{-1,t+1}^e \\ & + \left(1 - \frac{\alpha_4 \theta}{\phi_0}\right) (p^T - p_{-1,0}^{Te}) + \theta \left(1 - \frac{\alpha_4 \theta}{\phi_0}\right) (X - X_{-1,0}^e) \\ & + \theta \sum_{t=0}^{\infty} \left(\frac{e_2 \theta}{\phi_1}\right)^{t+1} (X_{0,t+1}^e - X_{-1,t+1}^e) + \theta \varepsilon^{NP} \end{aligned} \quad (29)$$

where p^T has been divided into its anticipated and unanticipated components.

To obtain the reduced-form expression for the stock of foreign exchange reserves, substitute (15) into (13) and solve for n . This yields:

$$n = \psi^{-1} m_0 + \psi^{-1} p - \psi^{-1} f_1 i + \psi^{-1} f_2 y - \psi^{-1} (1-\psi) d + \psi^{-1} \varepsilon^M.$$

Using (17), (28), and (29) in this expression we have:

$$\begin{aligned}
 n = n_o + \pi_{11} p_{-1,0}^{Te} + \pi_{12} x_{-1,0}^e + \pi_{13} \sum_{t=0}^{\infty} \left(\frac{e_2 \theta}{\phi_1}\right)^{t+1} x_{-1,t+1}^e \\
 + \pi_{14} (p_{-1,0}^T - p_{-1,0}^T) + \pi_{15} (x_{-1,0}^e - x_{-1,0}^e) + \pi_{16} \sum_{t=0}^{\infty} \left(\frac{e_2 \theta}{\phi_1}\right)^{t+1} (x_{0,t+1}^e - x_{-1,t+1}^e) \\
 + \pi_{17} r^* + \pi_{17} (p_{0,1}^{Te} - p^T) - \pi_{18} d + \epsilon^{nR}
 \end{aligned} \tag{30}$$

where:

$$n_o = \psi^{-1}(m_o + f_2 y_o) > 0$$

$$\pi_{11} = \psi^{-1} > 0$$

$$\pi_{12} = \psi^{-1}(\theta + f_2 \sigma_1) > 0$$

$$\pi_{13} = \psi^{-1}[\theta(1 + \alpha_4 \theta / \phi_o) + f_2 \sigma_2] > 0$$

$$\pi_{14} = \psi^{-1}(1 + \alpha_4 \theta / \phi_o + f_2 \sigma_3) > 0$$

$$\pi_{15} = \psi^{-1}[\theta(1 - \alpha_4 \theta / \phi_o) + f_2 \sigma_4] > 0$$

$$\pi_{16} = \psi^{-1}(\theta + f_2 \sigma_5) > 0$$

$$\pi_{17} = -\psi^{-1} f_1 < 0$$

$$\pi_{18} = -\psi^{-1}(1 - \psi) < 0$$

$$\epsilon^{nR} = \psi^{-1} \epsilon^M.$$

Although the resulting expression is complicated in appearance, it has a straightforward interpretation. It is in essence a stock version of the familiar "reserve flow" equation of the monetary approach to the balance of payments generalized for the endogenous determination of domestic prices and output. Most important for our purposes, the effect of changes in the stock of domestic credit is to create offsetting changes in foreign exchange reserves. The coefficient of domestic credit (d) in (30) is negative and equal in absolute value to the ratio of the proportion of the monetary base backed by domestic credit to the proportion backed by foreign exchange reserves. ^{1/} Thus changes in d will be exactly offset by changes in n , leaving the money supply unchanged (this can be verified from equation (15)). Notice that, since only the actual stock of domestic credit enters (30), this statement holds whether the change in the stock of credit is anticipated or otherwise. The distinction between anticipated and unanticipated changes in domestic credit therefore plays no role anywhere in the model. With the money supply unchanged, the domestic interest rate is unchanged, and the monetary authorities are left without leverage over domestic demand. This accounts for the absence of d from the reduced-form output equations (26) and (27).

The effects of the remaining exogenous variables in (30) can be interpreted readily. An anticipated increase in traded goods prices increases the price level pari passu. Since this increases the domestic demand for money, it gives rise to a capital inflow and an increase in n as long as d is unchanged. Current increases in government spending on nontraded goods increase both real output and the domestic price level and thus increase the demand for money and the stock of reserves. The magnitude of this effect depends on whether the increase was anticipated or not ($\pi_{12} \neq \pi_{15}$), since this will determine both the total effect of g^N on nominal GDP ($p+y$) and its composition. Similarly, a current reduction in external real interest rates increases the demand for money and therefore reserves, not only by increasing domestic output and prices, but also by reducing the domestic nominal interest rate. The first two effects appear in π_{12} and π_{15} , the last in π_{17} . Recall that r^* enters X with a negative sign, and π_{17} is negative. Unanticipated increases in traded goods prices also increase the stock of reserves, again because they cause the domestic price level and the level of real output to rise, thereby increasing the demand for money. Finally, an anticipated increase in traded goods prices increases the external nominal interest rate, given the real rate r^* . As a consequence, the domestic nominal interest rate rises, the demand for money falls, and the foreign exchange reserves decrease. Thus, an expected future exchange-rate depreciation leads to a capital outflow.

^{1/} Recall that ψ is a constant which measures the initial share of foreign exchange reserves in the domestic money stock.

V. Some Empirical Exercises

In view of the analytical results in previous sections, a question naturally arises about the interpretation of empirical studies which find statistically significant short-run output effects associated with changes in the stock of domestic credit for various developing countries (see the survey by Khan and Knight (1985)). Based on the analysis presented here, the results of these studies cannot be interpreted to be consistent with the loss of short-run monetary autonomy in the countries concerned, since in that case neither money nor credit should appear in reduced-form output equations. A more reasonable interpretation is that the presence of any monetary aggregate in reduced-form output equations provides evidence against the loss of monetary autonomy--i.e., against the empirical relevance for many developing countries of costless portfolio adjustment and perfect substitutability. In that case, the appropriate monetary aggregate to be included in such equations cannot be determined a priori, but will in general depend on the monetary policy regime in effect during the sample period.

In this section some preliminary empirical tests are conducted to detect first, if money or credit affect domestic macroeconomic variables in developing countries, and second, which monetary policy variable proves to be relevant in particular countries. If money is found to exert some independent influence--after controlling for the role of domestic credit--over domestic macroeconomic variables, the presumption is that the country in question enjoys some degree of short-run monetary autonomy and that its monetary authorities have chosen the money supply as an intermediate policy variable. If no such independent role is found, i.e., money is passive and simply adjusts to changes in prices and income, then either we are in the world described by the monetary approach to the balance of payments with no short-run monetary autonomy, or the authorities have chosen domestic credit as the intermediate monetary policy variable. In the former case, neither credit nor money would exert an independent influence on the relevant domestic macroeconomic variables, whereas in the latter case credit would exert such an influence and money would not.

For this empirical analysis the most useful domestic macroeconomic variable of interest is nominal GDP, which by combining the behavior of domestic prices and of real output should be a fairly sensitive barometer of the effects of financial aggregates on domestic aggregate demand. ^{1/} The issue is whether the past behavior of money or credit helps predict the current value of nominal GDP, after controlling for the past behavior of nominal GDP and the other financial aggregate. This procedure is essentially a test of "Granger causality" among money, credit, and nominal GDP. Since such tests are known to be sensitive to the exclusion

^{1/} Where real output does not vary greatly compared to the price level from year to year, the use of nominal GDP indirectly provides a test of the relationship between financial aggregates and domestic aggregate demand.

of relevant variables, the tests in this section also control for the past behavior of gross international reserves. The procedure used is the estimation of vector autoregressions (VARs), which generalizes the standard causality tests to more than two variables.

The variables used for the tests are nominal GDP, broad money (money plus quasi-money), domestic credit, and gross international reserves. The sample consists of 12 developing countries, chosen on the basis of geographical distribution and data availability. 1/ For each country the rate of growth of nominal GDP was regressed on one- and two-year lags of the growth of money, domestic credit, international reserves, and nominal GDP. 2/ Two additional regressions are also run in which the rate of growth of money and the rate of growth of credit, respectively, were each explained by one- and two-year lags on the remaining variables (as well as their own past values). The purpose of these additional regressions was to determine the direction of causality between the two financial aggregates and nominal income. If the observed stock of money is largely determined by exogenous shifts in money demand rather than supply, i.e., it is passive, then one should expect to find a significant predictive power for nominal GDP in the money equation and no significant predictive power for money in the nominal GDP equation. On the other hand, if money is controllable but credit is nevertheless chosen as the intermediate policy variable, we should expect to find unidirectional causality from credit to GDP much more commonly than from money to GDP.

The tests for predictive power are tests of exclusion restrictions. To test whether money helps predict nominal GDP, an F-test is conducted to determine if the coefficients on lagged money growth in the equation for nominal GDP growth are statistically different from zero. The reverse direction of causality is then tested by conducting the same tests for the coefficients of lagged GDP growth in the equation for the growth of money. Sufficiently large values of the F statistic suggest that the independent variable in question helps predict the dependent variable, even after controlling for the remaining variables in the equation, and thus the independent variable "causes" the dependent variable in the Granger sense. After examining the money-income links in this fashion, the same tests are conducted for money and credit.

The results of these tests are reported in Tables 1 and 2. Table 1 gives the test of Granger causality between money and nominal GDP. The second column of this table reports the F statistic for the predictive power of money growth for future nominal GDP growth. In six of the twelve possible cases the value of the F statistic allow us to reject the null

1/ The countries chosen were Bolivia, Chile, Ghana, India, Indonesia, Mexico, Morocco, Pakistan, Peru, Sierra Leone, Sudan, and Turkey. The data were annual, for the period 1962-86.

2/ The transformation of variables into growth rates reduces the possibility of spurious correlation arising from variables following common trends.

Table 1. Causality Tests: Money and Nominal GDP 1/

	Money to Income	Income to Money	Direction of Causality
Bolivia	32.072*	0.806	Money to income
Chile	0.150	3.317	Neither way
Ghana	5.997*	1.872	Money to income
India	2.158	6.877*	Income to money
Indonesia	2.915	3.154	Neither way
Mexico	12.031*	13.499*	Both ways
Morocco	4.170*	3.770	Money to income
Pakistan	0.288	4.294*	Income to money
Peru	12.803*	2.163	Money to income
Sierra Leone	8.111*	1.023	Money to income
Sudan	2.377	6.934*	Income to money
Turkey	0.197	20.287*	Income to money

1/ *Denotes statistical significance at the 5 percent level.

Table 2. Causality Tests: Domestic Credit and Nominal GDP 1/

	Credit to Income	Income to Credit	Direction of Causality
Bolivia	0.116	0.536	Neither way
Chile	18.963*	4.778*	Both ways
Ghana	3.821*	0.817	Credit to income
India	0.674	2.421	Neither way
Indonesia	7.017*	0.220	Credit to income
Mexico	1.221	4.805*	Income to credit
Morocco	0.114	1.284	Neither way
Pakistan	0.158	7.813*	Income to credit
Peru	11.674*	5.671*	Both ways
Sierra Leone	1.511	1.478	Neither way
Sudan	0.437	0.573	Neither way
Turkey	0.412	2.271	Neither way

1/ *Denotes statistical significance at the 5 percent level.

hypothesis that money growth does not help predict future nominal GDP growth at the 95 percent confidence level. In turn, nominal GDP growth helps predict future money growth in four other cases (column 3). Bidirectional causality is found in only one case (Mexico), and for the case of Chile no link was found in either direction at the 95 percent level.

These results are informative both in an absolute sense and in comparison with the results for domestic credit. In the absolute sense, it is obvious that for many developing countries the behavior of money helps predict the future behavior of a key domestic macroeconomic variable (nominal GDP) even after controlling for the effects of domestic credit. This result suggests a potential role for money in reduced-form output equations for developing countries, even though domestic credit may prove to be more closely related to the future behavior of nominal GDP for some countries. In fact, it does not often appear to be more closely related empirically, at least for this group of countries. As column 2 of Table 2 shows, domestic credit proves to have predictive ability for nominal GDP in only four of the twelve countries, with unidirectional causality running from domestic credit to nominal GDP in only two cases (Ghana and Indonesia), compared to five in the case of money. The results are thus consistent with imperfect capital mobility and indicate the widespread use of the money supply as an intermediate target variable in developing countries.

VI. Summary and Conclusions

It is sometimes claimed that in a small open economy with fixed exchange rates the domestic monetary authorities have no control over the money supply, even in the short run. What the authorities in such countries do control is the stock of domestic credit. Several authors have therefore advocated replacing money by domestic credit in Barro-type reduced-form tests of policy ineffectiveness propositions for small open economies with fixed exchange rates, and for developing countries in particular.

Loss of short-run monetary autonomy is not a necessary attribute of such economies, however. The degree of substitutability between foreign and domestic interest-bearing assets and the costs of adjusting portfolios will have an important bearing on the degree of monetary autonomy observed in the short-run. The issue is therefore a country-specific empirical one. Cumby and Obstfeld (1983), for example, found that Mexico enjoyed a substantial degree of monetary autonomy during the 1970s, while Takagi (1986) found no scope for monetary control in several Central American countries during the 1950s.

The issue taken up here is the proper specification of the reduced-form output equation for those cases in which costless portfolio adjustment and perfect substitutability make for a complete absence of short-run monetary control. By solving a simple "new classical" structural model,

this paper showed that it is not appropriate to simply replace money with credit in the reduced-form tests. This is because the conditions that make money uncontrollable in the short run simultaneously make credit policy powerless to affect aggregate demand. Fiscal policy in the form of spending on nontraded goods plays an important role in the determination of domestic output in this model, as do external real interest rates and unexpected changes in domestic currency prices of traded goods. When costless portfolio adjustment and perfect substitutability render short-run monetary control inoperative, reduced-form output equations for small open economies should omit both money and credit from the set of explanatory variables.

When these conditions underlying the assumption of perfect capital mobility are absent and developing countries retain some degree of short-run monetary autonomy, the appropriate monetary aggregate to be included in such equations will depend on the monetary policy regime in effect during the sample period. Some preliminary evidence presented here for a sample of 12 developing countries is consistent both with a non-negligible degree of short-run monetary autonomy and with the use of the money supply as an intermediate policy target over the sample period. Under these circumstances, the reduced-form output equation would indeed contain a financial aggregate, but that aggregate would be money, rather than credit.

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