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The Transmission Mechanism for Monetary Policy in Developing Countries

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Abstract

In many developing countries the financial system is characterized by the absence of organized markets for securities and equities, by capital controls, and by legal ceilings on bank borrowing and lending rates, a situation which gives rise to parallel markets for foreign exchange and informal loan markets. This paper analyzes how changes in monetary policy instruments (bank credit, administered interest rates, required reserve ratios, and intervention in the parallel exchange market) are transmitted to domestic aggregate demand in a financially-repressed economy. Such an analysis is necessary to understand how the move to a more market-oriented system would affect the economy in the short run.

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Contents

I. Introduction

Both monetary and fiscal policies are commonly accorded prominent roles in the pursuit of macroeconomic stabilization in developing countries. It is presumed that the authorities in such countries have access to monetary policy instruments and can manipulate these to achieve desirable macroeconomic objectives. Curiously, however, in spite of the prominence given to monetary policy in the developing country setting, the transmission mechanism for monetary policy in a typical developing country has not been studied extensively, and consequently is not well understood.

By contrast, in industrial countries with highly developed financial markets, a broad consensus on the nature of the transmission mechanism has existed for some time. 1/ In brief, an open market purchase by the central bank leaves the private sector with too much money in its portfolio relative to other assets. In re-establishing portfolio equilibrium, agents bid up the price of durable assets, thereby lowering their respective rates of return. Since the market prices of durable goods such as physical capital thus exceeds their replacement costs, private agents attempt to increase their stocks of such assets by increasing their demands for newly-produced units of the latter. In this way, an open market purchase results in an increase in aggregate demand.

In developing countries, on the other hand, the structure of financial markets renders the operation of such a mechanism much more problematic. In the first place, the menu of assets available to private agents is very limited. Organized securities markets in which the central bank can conduct open market operations simply do not exist in many such countries. By and large, individuals can hold currency as well as demand and time deposits issued by the banking system, and they can borrow from commercial banks. Durable goods such as land and physical capital can be held directly, but organized equity markets are small or nonexistent. Capital controls and prohibitions on the holding of foreign exchange limit the extent to which foreign assets may be held by domestic residents, although parallel markets for foreign currency often emerge in response to such regulations, thereby allowing private agents to circumvent official controls, at least in part. Finally, even in the case of those assets and liabilities available to individuals such as demand or time deposits and bank credit, official restrictions typically determine the interest rates paid and charged by financial institutions. As in the case of foreign exchange, however, informal markets often emerge to evade interest rate ceilings, resulting in financial disintermediation through "curb" markets for loans.

1/ Reviews of this issue in an industrial-country setting are provided by Tobin (1978), Laidler (1978), Modigliani and Papademos (1982), and Blanchard (1980).

A "typical" developing-country financial structure, therefore, might be one in which individuals can hold domestic currency, deposits with the banking system, foreign currency, loans extended through a curb market, land, and physical capital. These assets may be financed by the individuals' personal net worth or by borrowing both from the banking system and through the curb market. Interest rates on the assets and liabilities of the banking system are fixed by applicable legal norms, while the price of foreign currency on the parallel market, as well as the interest rate on curb market loans, are determined by prevailing market conditions.

The connection between the actions of the monetary authorities and the state of aggregate demand in such an environment is not obvious. In the absence of organized securities markets, open market operations are out of the question. Nonetheless, the monetary authorities retain four instruments of policy--the level of administered bank interest rates, the required reserve ratio, the amount of credit extended by the central bank to the commercial banking system, and intervention in the parallel exchange market. The purpose of this paper is to explore, within the specific developing-country context described above, the channels through which these instruments affect domestic aggregate demand, as well as to identify the parameters which govern their effectiveness.

It should be stressed that understanding the nature of the financially-repressed economy, and the way monetary policy works in this setting, is essential to be able to predict the effects of financial liberalization policies with which many developing countries are experimenting. There is at present no clear consensus on the effects that allowing interest rates to be market determined (or raising them to such levels), or reducing reserve requirements, or eliminating the spread between the exchange rates in the official and parallel markets--policies that are central in financial reform packages--would have on the economy. 1/ When it comes to discussing the consequences of such policies, often the framework adopted is one more akin to the industrial-country model discussed earlier.

In the past, explicit analysis of the transmission mechanism for monetary policy under financial repression in developing countries has tended to fall into two camps--the McKinnon-Shaw tradition 2/ and a "neo-structuralist" approach. 3/ Adherents of the McKinnon-Shaw view maintain that raising controlled bank interest rates need not be contractionary, because in a rationed regime the induced increase in saving will result in an increased supply of credit which facilitates the

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1/ See Villanueva and Mirakhor (1990) for a recent description of financial reform policies.

2/ See McKinnon (1973) and Shaw (1973).

3/ Associated with Taylor (1981).

financing of private investment and/or working capital. 1/ By contrast, analysts of a "neo-structuralist" persuasion cite the importance of informal loan markets when bank interest rates are subject to legal ceilings and emphasize the possibility that increases in bank interest rates will draw funds away from such markets, thereby increasing the marginal cost of funds and exerting contractionary effects on the economy from both the demand and supply sides (in the latter case, due to the need to finance working capital). 2/ Notice that for the first group the primary channel of transmission is through the direct effect of the controlled bank-deposit interest rate on private saving, whereas the second group focuses on effects which are transmitted through the loan interest rate to interest-sensitive components of demand (and supply).

By contrast, the analysis presented here identifies a number of additional channels which also play important roles in the developing-country context. These include the wealth effects induced by changes in the degree of financial repression, as well as effects which operate through the premium in the free exchange market, through changes in expectations of future inflation, and through changes in the economy's net foreign assets. Since some of these mechanisms are closely affected by expectations of future events, the analysis highlights the important role of such expectations in this context.

This paper is organized as follows: the model employed to analyze these issues is presented in the next section. Section III examines the transmission mechanism under partial equilibrium conditions. The fourth section examines the macroeconomic general equilibrium effects of changes in monetary policy instruments. A final section summarizes the results and suggests some possible extensions that might usefully be undertaken.

II. A Model of Developing-Country Financial Markets

The model developed below involves an open-economy portfolio-balance type of framework expanded to include a commodity market. The economy in question is a small open one with four types of agents: households, the government, the central bank, and the rest of the banking system. The authorities maintain an official exchange rate for current international transactions, but prohibit private capital movements. To avoid complicating the analysis, the commodity structure is deliberately kept simple --i.e., a standard Mundell-Fleming structure is assumed, with a single domestic and a foreign good. Furthermore, since the focus is on exploring the shifts in the economy's aggregate demand curve induced by changes in monetary-policy instruments, the model abstracts from the supply side of the model by assuming that domestic prices are instantaneously flexible, so that full employment holds continuously. In this

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1/ See, for example, Kapur (1976) and Mathieson (1980). Fry (1982) provides a survey of such models.

2/ See Van Wijnbergen (1983), and Buffie (1984).

setting, shifts in aggregate demand will be reflected only in the domestic price level. As indicated above, expectations play an important role in the model, and it will be assumed that agents possess perfect foresight, an assumption which enriches the transmission mechanism by allowing changes in future exchange rates and prices which are induced by current policies to affect current macroeconomic outcomes.

In principle, private households have access to five assets: domestic currency, bank deposits, curb-market loans, foreign exchange, and bank credit (which is, of course, a liability for households). There is no market for either private or government securities, and the stock of physical capital is assumed to be constant. 1/ To simplify the analysis, bank credit and curb market loans are taken to be perfect substitutes in household portfolios. This permits all rationing-induced "spillover" effects (see Barro and Grossman (1976)) of changes in the stock of bank credit to be concentrated in a single market--i.e. the curb loan market--by permitting bank credit and curb loans to be treated as a single asset.

1. Model specification

a. Households

With these assumptions, households' financial portfolios are taken to consist of currency (Z) bank deposits (D), curb market loans, bank credit (C), and foreign exchange (f_p). 2/ The value of households' financial portfolio (A) is given by $A \equiv Z + D + sf_p - C$, where s is the domestic-currency price of foreign exchange traded in the free (parallel) market. Portfolio balance requires:

$$\frac{Z}{P} = Z(i_L, \; i_M, \; \hat{s}); \; Z_1, \; Z_2, \; Z_3 \; < \; 0 \qquad (1)$$

1/ Allowing for investment would make the model much more complicated and preclude an analytical solution. This is an important limitation of the model, because the level of investment is itself an important target for policy. However, as long as the speed of adjustment of the capital stock to its desired value via investment/disinvestment is slow relative to the rate at which markets for financial assets adjust, the analysis of the short-run behavior of aggregate demand presented below will remain valid.

2/ Alternatively, f_p could be taken to be the stock of land. In essence, f_p is an asset with a flexible, market-determined domestic currency price which is traded in organized markets by well-informed agents. It is intended to represent "inflation hedges", which figure so prominently in developing-country policy discussions and might best be considered a composite of highly substitutable assets, such as land and foreign exchange.

$$\frac{D}{P} = L\,(i_L,\ i_M,\ \hat{s});\ L_1,\ L_3 < 0,\ L_2 > 0 \tag{2}$$

$$0 = H\,(i_L,\ i_M,\ \hat{s},\ A/P) + C/P;\ H_1 > 0,\ H_2,\ H_3 < 0,\ 0 < H_4 < 1 \tag{3}$$

$$\frac{sf_P}{P} = F\,(i_L,\ i_M,\ \hat{s},\ A/P);\ F_1,\ F_2 < 0,\ F_3 > 0,\ 0 < F_4 < 1. \tag{4}$$

where i_L and i_M are respectively the interest rate on curb market loans and the (controlled) interest rate on bank deposits, $\hat{s}$ is the expected (and actual) rate of depreciation of the parallel-market exchange rate, and P is the domestic price level. The signs of the first three partial derivatives of each function reflect the assumption that all assets are gross substitutes. Money (in the form of cash and bank deposits) is assumed to be held strictly for transactions purposes, so the level of real financial wealth enters as a scale variable to satisfy adding-up constraints in the demand functions for curb market loans and foreign exchange, but not for cash or deposits. 1/ The partial derivatives in (2) - (4) must satisfy the standard constraints:

$$Z_i + L_i + H_i + F_i = 0;\ i = 1,\ 2,\ 3$$

$$H_4 + F_4 = 1 \tag{5}$$

In addition to choosing the composition of their portfolios, households must also determine their level of consumption (c). The latter is taken to depend on the real loan interest rate and on the level of household resources:

$$c = c(i_L - \hat{P},\ W/P);\ c_1 < 0,\ c_2 > 0 \tag{6}$$

Household resources consist of real financial wealth (W/P) and real factor income. As indicated above, however, real output is constant under

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1/ Real output, which tends to shift asset composition among money and all other assets in response to transactions motives, is excluded from the asset demand functions because our assumptions of slow capital-stock adjustment and full employment render the level of real output constant over the time frame of the analysis.

present assumptions, so the (unchanging) level of real factor income is omitted from the function c( ). 1/

In the context of financial repression, the calculation of real household financial wealth must take into account the implicit taxes and subsidies which interest rate ceilings impose on households as creditors and debtors with the banking system. Letting i_c denote the controlled interest rate on bank credit, individuals with access to such credit receive a subsidy of $(i_L - i_c)C$--i.e., the interest-rate differential between the curb loan and bank credit markets times the amount of bank credit extended to individuals with such privileged access. The present value of this subsidy is given by $(i_L - i_c)C/i_L$, and this represents a net addition to household financial wealth. 2/ It is convenient to define an index of financial repression, denoted r, by:

$$r = (i_L - i_c)/i_L \tag{7}$$

That is, r is the present value of the subsidy, per unit of bank credit, which is implied by the prevailing interest-rate ceilings. Notice that, since binding interest-rate ceilings imply $i_c \leq i_L$, r is bounded between zero and one. When interest-rate ceilings are not binding, $i_c = i_L$ and $r = 0$. As the curb loan interest rate rises relative to the administered interest rate i_c, the constraint becomes more and more binding and r approaches unity.

While households are subsidized as debtors under financial repression, they are taxed as banking-system creditors. The present value of this tax is given by $((\bar{I}_m - i_m)/\bar{I}_m)M$, where $\bar{I}m$ is the deposit interest rate that corresponds to a loan interest rate of i_L under the banks' zero-profit condition (equation (11) below). This condition can be used to show that $(\bar{I}_m - i_m)/\bar{I}_m = r$, so the degree of financial repression can be written equivalently as a function of banks' lending or borrowing rates, and the present value of the tax on depositors can be expressed compactly as rM.

Taking these taxes and subsidies into account, households' real financial wealth can be expressed as:

1/ Since the real interest rate already appears with a negative sign in (6), including the present value of factor incomes among the arguments of the function c( ) would not qualitatively affect the analysis. Notice that this specification rules out direct McKinnon-Shaw effects of the controlled interest rate i_M on private consumption via intertemporal substitution. The effects of this omission are discussed below.

2/ This is actually an approximation to the true present value of the subsidy, which depends on the entire stream of future interest rates and credit. The approximation is adopted for tractibility.

$$W/P = \frac{Z + D + sf_p - C + rC - rD}{P}$$

$$= \frac{Z + (1 - r)(D - C) + sf_p}{P} \qquad (8)$$

Thus, the wealth effects of financial repression depend on whether households are net creditors ($D - C > 0$) or debtors ($D - C < 0$) of the banking system. When $D - C > 0$, for example, an increase in the degree of financial repression (r) reduces household wealth, since the implicit tax imposed on households by interest rate ceilings on deposits exceeds the subsidy received by favored borrowers.

b. The banking system

Bank assets consist of reserves held at the central bank (R) and credit extended to households (C). Their liabilities are the deposits held by the public (D), and credit received from the central bank (B). The balance sheet of the banking system is therefore given by:

$$R + C = D + B \qquad (9)$$

Banks hold no excess reserves. Given a required reserve ratio of σ, reserve holdings are thus given by:

$$R = \sigma D \qquad (10)$$

Reserves at the central bank pay no interest, but credit extended to the banking system by the central bank carries an interest charge which, for convenience, is set equal to the interest rate which banks charge their customers, i_c. Under these conditions, the zero-profit condition for the banking system is given by:

$$i_c = i_M/(1 - \sigma) \qquad (11)$$

c. The central bank

The central bank pegs the official exchange rate at a value $\bar{s}$. All international commercial transactions are settled at this rate. Denoting

the central bank's stock of foreign exchange reserves (measured in foreign currency) as f_c, and the trade balance (measured in units of the domestic good and taken to be an increasing function of the real exchange rate $(\bar{s}/P)$) as $x(\bar{s}/P)$, the stock of foreign exchange reserves evolves according to: 1/

$$\bar{s}\dot{f}_c = Px(\bar{s}/P) \tag{12}$$

The central bank's assets include both foreign exchange reserves and credit to the banking system, while its liabilities consist of cash and reserves held by the banking system. Thus the central bank's balance sheet is:

$$\bar{s}f_c + B = Z + R \tag{13}$$

d. The government

Since the central bank's loans to the banking system earn interest, this income must be allocated in some way. It is assumed to be transferred to the government, which then uses it to purchase domestic goods. Since the analysis is concerned with monetary rather than fiscal policy, there is no other role for the government in the model than to dispose of these funds. Letting g denote real government spending on domestic goods, the government budget constraint implies:

$$Pg = i_C B \tag{14}$$

e. Commodity-market equilibrium

The model is closed by the condition that the market for domestic goods must clear. Letting y denote domestic real output and Ω the excess demand for domestic goods, this condition is:

$$\Omega = c(i_L - \dot{P}, W/P) + g + x(\bar{s}/P) - \bar{y} \tag{15}$$

$$= 0$$

1/ This assumes, of course, that foreign exchange reserves do not pay interest.

2. The model in compact form

Before solving the model presented above, it is useful to introduce some additional notation which can be used to rewrite the simultaneous portion of the model in a more convenient form. Specifically, let e ($= \bar{s}/P$) denote the official real exchange rate, $f = f_c + f_p$ the economy's total net foreign assets, and $d = s/\bar{s}$ the ratio of the free market exchange rate to the official rate, which we shall refer to as the premium. The rate of change in d is denoted $\hat{d}$. Using this notation, the equilibrium condition in the curb loan market (equation (3)) can be rewritten as:

$$0 = H[i_L, i_M, \hat{d}, e(f + (d - 1)f_p)] + eb + (1 - \sigma)L(i_L, i_M, \hat{d}) \qquad (16)$$

In addition to using e and d, several substitutions have been performed in deriving (16). Using (9) in the definition of A and then substituting from (13) enables the term A/P in (3) to be replaced by $e(f_c + df_p)$ in (16). Equations (9) and (10) together imply that $C = B + (1 - \sigma)D$--i.e., the amount of lending that the banking system can undertake consists of deposits net of reserves plus loans from the central bank. Substituting from (2) and using the resulting expression to replace C in (3) yields (16), where $b = B/\bar{s}$. A similar procedure permits (4) to be written as:

$$def_p = F[i_L, i_M, \hat{d}, e(f + (d - 1)f_p)] \qquad (17)$$

Next, by using equations (9) and (13) in (8), real household financial wealth can be written as:

$$W/P = \frac{sfp + \bar{s}fc + r(B - R)}{P}$$

Thus, the wealth effects of financial repression depend on the excess of central bank lending to the banking system (B) over reserves held by the banking system. Intuitively, this is because credit to households (C) can exceed deposits (D) only if the resources made available to banks by the central bank (B) exceed the resources extracted by the central bank (R). Using equations (10) and (2) and letting $w = W/\bar{s}$ and $b = B/\bar{s}$, we can rewrite the preceding equation as:

$$W/P = ew$$

$$= e(f + (d - 1)f_p) + r(eb - \sigma L[i_L, i_M, \hat{d}]) \qquad (18)$$

Substituting this in the commodity market equilibrium equation (15) and using the notation introduced above, yields:

$$\Omega = c[i_L + \hat{e}, ew] + i_c eb + x(e) - \bar{y} \qquad (19)$$
$$= 0,$$

where use is also made of the government budget constraint (14).

Equations (16) - (19), together with the balance of payments equation (12) and the definition of the financial repression index r given in (7), constitute the simultaneous portion of the model. The monetary policy variables are the administered interest rate on deposits i_M, the required reserve ratio σ, central bank lending to the banking system b, and central bank intervention in the free market. The latter is captured by the stock of foreign exchange available to the private sector f_p, which can be altered by the central bank subject to the condition $df_c = -df_p$, since the economy's net international indebtedness f is a state variable in the system, with equation of motion given by (12) (since $\dot{f}_p = 0$). When the central bank sells foreign exchange in the parallel market, it may do so either at the parallel rate or the official rate. In the latter case, households will reap a windfall. 1/ The endogenous variables in the system are the curb loan interest rate i_L, the degree of financial repression r, the balance of payments $\dot{f}_c$, as well as both the levels of the real exchange rate e and premium d and their expected and actual rates of change $\hat{e}$ and $\hat{d}$. It is important to note that the effects of the monetary policy instruments on aggregate demand are captured by their effects on the official real exchange rate e, since $e = \bar{s}/P$ and changes in P reflect shifts in aggregate demand, given the economy's vertical aggregate supply curve.

III. The Transmission Mechanism in Partial Equilibrium

To solve the model, one can begin by solving the portfolio equilibrium conditions (16) and (17) for the curb interest rate i_L and the rate of change of the premium $\hat{d}$ as functions of the remaining endogenous and exogenous variables. The results are:

$$i_L = i(d, e, f; b, i_M, \sigma, f_p) \qquad (20)$$

1/ Sales at the official rate may be inadvertent. For example, the case of "leakages" from the official to the parallel market arising from export underinvoicing or import overinvoicing can be treated as a sale of foreign exchange to the parallel market at the official rate. A dual-market model incorporating such leakages is presented in Bhandari and Vegh (1990).

with:

$$i_1 = -\Delta^{-1}\,\sigma L_3 H_4 e f_p < 0$$

$$i_2 = \Delta^{-1}\,\{F_3 b + (F_3 + F_4\,\sigma L_3)(f - f_p) - \sigma L_3 H_4 d f_p\} < 0$$

$$i_3 = \Delta^{-1}\,e(F_3 + \sigma L_3 F_4) < 0$$

$$i_4 = \Delta^{-1}\,eF_3 < 0$$

$$i_5 = \Delta^{-1}\,\sigma(F_2 L_3 - F_3 L_2) \gtrless 0$$

$$i_6 = -\Delta^{-1}\,F_3 L > 0$$

$$i_7 = -\Delta^{-1} e\,(F_3 + \sigma L_3 + \sigma L_3 H_4\,(d - 1)) \gtrless 0$$

or:

$$i_7 = -\Delta^{-1} e\,(F_3 + \sigma L_3) > 0$$

and:

$$\hat{d} = d(d,\ e,\ f;\ b,\ i_M,\ \sigma,\ f_p) \qquad (21)$$

with:

$$d_1 = \Delta^{-1}\,\sigma L_1\,H_4 e f_p > 0$$

$$d_2 = -\Delta^{-1}\,\{F_1(f - f_p + b) - \sigma L_1 d f_p\,[1 - F_4\,\frac{e(f + (d - 1)f_p)}{def_p}]\} \gtrless 0$$

$$d_3 = -\Delta^{-1}\,e(F_1 + \sigma L_1\,F_4) < 0$$

$$d_4 = -\Delta^{-1}\,eF_1 < 0$$

$$d_5 = \Delta^{-1}\,(F_1\,\sigma L_2 - F_2 \sigma L_1) > 0$$

$$d_6 = \Delta^{-1}\,LF_1 > 0$$

$$d_7 = \Delta^{-1}\,e(F_1 + \sigma L_1 + \sigma L_1 H_4 (d - 1)) > 0$$

or:

$$d_7 = \Delta^{-1}\,e(F_1 + \sigma L_1) > 0$$

where:

$$\Delta = (Z_1 F_3 - F_1 Z_3) + \sigma(F_3 L_1 - F_1 L_3) < 0$$

and the alternative versions of i_7 and d_7 depend on whether central bank sales of foreign exchange in the free market are at the free rate or the official rate.

These partial derivatives can readily be given intuitive interpretations. Consider, first, the effects of the three dynamic variables d, e, and f. An increase in the premium reduces the curb interest rate, but increases the rate of depreciation of the free exchange rate. At the initial values of i_L and $\hat{d}$, the increase in the premium creates an excess supply of foreign exchange and an excess asset demand for curb market loans. To induce households to hold more foreign exchange in their portfolios relative to curb loans, the expected rate of depreciation in the free exchange market has to rise and the loan interest rate to fall. A real official depreciation (increase in e) corresponds to a reduction in the domestic price level. On impact, this creates an excess asset demand for curb loans, both because the real value of the portfolio of lending households increases and because the real value of the resources provided to the banking system by the central bank is higher. The interest rate on loans therefore falls. The impact effect on the free exchange market is ambiguous, however, as both the real supply of foreign currency and the real demand for this asset increase. Finally, since an increase in the economy's net international creditor position must be associated with an increased real value of household financial portfolios, households seek to hold both more foreign exchange and more curb loans as assets. Thus, both the curb interest rate i_L and the rate of depreciation of the free exchange rate $\hat{d}$ fall when f increases.

Turning to the monetary policy variables, an increase in bank credit increases the asset demand for loans. The loan interest rate i_L falls, and to prevent the emergence of an excess demand for foreign exchange as households switch out of the loan market, $\hat{d}$ must fall as well. This situation is reversed in the case of an increase in the required reserve ratio σ. As banks' supply of loans is reduced the loan interest rate rises. This in turn requires an increase in $\hat{d}$ to induce households to hold their existing stock of foreign exchange. The effect of an increase in this stock (through central bank intervention in the parallel market), on the other hand, is to create an incipient excess supply of foreign exchange as households seek to restore their desired portfolio composition. Consequently, an increase in $\hat{d}$ is required to restore equilibrium. The increase in $\hat{d}$ tends to reduce the asset demand for loans. If the foreign exchange is sold at the official rate, however, this will be partly offset by a positive wealth effect on the asset demand for loans due to the windfall reaped by households, rendering the effect on i_L ambiguous. If the currency is sold at the parallel rate, the latter effect is absent (the last term inside the parentheses in both i_7 and d_7 disappears), and the loan interest rate rises.

Matters are also somewhat complicated with regard to changes in the administered interest rate i_M. On impact, an increase in i_M will result in an excess supply of foreign exchange, as funds are attracted into the domestic financial system and away from the holding of foreign assets.

However, the net asset demand for loans may rise or fall. Though bank lending will rise as deposits increase, household lending will fall as households shift funds away from the loan market and into deposits. Since banks hold reserves while private lending agents do not, each unit moved by households from the loan market into the domestic financial system reduces the net supply of loans. 1/ However, to the extent that funds attracted to banks come out of cash or foreign currency holdings, the supply of loans rises. Thus the key to the impact effect of changes in i_M is whether households primarily move funds out of the loan market or out of cash and foreign currency--i.e., whether loans, on the one hand or cash and foreign currency, on the other, are better substitutes for deposits. This determines the sign of $(L_2/l_3 - F_2/F_3)$ in i_5. In the "currency substitution" case (in which foreign currency and domestic money are close substitutes), the expansion of deposits would primarily be at the expense of cash and foreign currency, rather than loans, and in this case an increase in i_M is likely to result in an incipient excess asset demand for loans, causing i_L to $\underset{\wedge}{\text{fall}}$ $(i_5 < 0)$. Whether i_L increases or decreases, however, the effect on $\dot{d}$ will be positive.

To explore the determination of real private financial wealth in the model, substitute for r in (18) from (7) and use equation (20). This yields:

$$ew = w(d, e, f; b, i_M, \sigma, f_p) \tag{22}$$

$$w_1 = ef_p + (1 - r)(eb - \sigma L)(i_1/i_L) > 0$$

$$w_2 = [f + (d - 1)f_p] + (1 - r)(eb - \sigma L)(i_2/i_L) + r[b - (b + f - f_p)] > 0$$

$$w_3 = e + (1 - r)(eb - \sigma L)(i_3/i_L) - re > 0$$

$$w_4 = (1 - r)(eb - \sigma L)(i_4/i_L) > 0$$

$$w_5 = (1 - r)(eb - \sigma L)(i_5/i_L - 1/i_M) > 0$$

$$w_6 = (1 - r)(eb - \sigma L)(i_6/i_L - 1/(1 - \sigma)) < 0$$

$$w_7 = e(d - 1) + (1 - r)(eb - \sigma L)(i_7/i_L) + er \gtrless 0$$

or:

$$= (1 - r)(eb - \sigma L)(i_7/i_2) + er < 0$$

The wealth effects of the variables considered above can be decomposed into three parts: (i) a direct wealth effect; (ii) an effect which operates through changes in the degree of financial repression; and

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1/ This analysis is familiar from the "neo-structuralist" literature. See Van Wijnbergen (1983), and Buffie (1984).

(iii) an effect which operates through changes in the base on which the implicit financial repression tax is levied.

Equation (22) indicates that wealth effects are one mechanism through which monetary policy instruments may affect aggregate demand. All of the monetary policy instruments under examination here exert such effects. Both an increase in credit to the banking system (b) and a sale of foreign exchange in the free market (f_D) lower the portfolio-equilibrium loan interest rate. By reducing the degree of financial repression, this increases real private financial wealth. An increase in controlled interest rates also reduces the degree of financial repression. In the "currency substitution" case ($i_5 < 0$), this is because market interest rates fall while controlled interest rates rise. Even when market interest rates rise ($i_5 > 0$), however, their rise is proportionately smaller than that of controlled interest rates, so that $i_5/i_L - 1/i_M > 0$ and the degree of financial repression is reduced--generating positive wealth effects in this case as well. When the required reserve ratio rises, on the other hand, the proportionate increase in the loan interest rate (i_6/i_L) exceeds that of the interest rate on bank credit (given by $1/(1 - \sigma)$), so the degree of financial repression increases and the wealth effect is negative. Notice, finally, that in the case of foreign exchange sales at the official rate the direct wealth effect is positive. In addition, there is a positive wealth effect that arises from lower household deposit holdings, which reduce the base of the financial repression tax. Since the sign of i_7 is ambiguous in this case, the rate of financial repression may increase or decrease, so wealth effects arising from this source are ambiguous. Finally, if foreign exchange is sold at the free rate, there are no direct wealth effects (the first term in w_7 disappear). Since i_L rises, the degree of financial repression increases and the wealth effect from this source is negative. In this case, the net wealth effect depends on the initial degree of financial repression (r), and is more likely to be negative the lower the initial degree of financial repression.

Turning to the remaining variables in equation (22), changes in the premium, the real exchange rate, and the economy's net foreign assets all exert direct wealth effects in a straightforward manner, as well as indirect effects similar to those of the monetary policy instruments through their influence on the degree of financial repression. Both the real exchange rate and the stock of net foreign assets also affect the base on which the financial repression tax is levied. In particular, increases in e and f are associated with increases in L, which increases the private sector's net creditor position vis-a´-vis the public sector. While this effect tends to offset the otherwise positive wealth effects of increases in e and f, inspection of w_2 and w_3 reveals that this offset is only partial, since it is dominated by the direct wealth effect in both cases. Thus w_2 and w_3 are both positive.

The next step is to examine the properties of the commodity market-clearing equation (19). Using equations (20), (22), and (11) in (19), this equation can be written as:

$$\hat{e} = e(d, e, f; b, i_M, \sigma, f_P) \tag{23}$$

with:

$$e_1 = -\bar{c}^{-1}(c_1 i_1 + c_2 w_1) > 0$$

$$e_2 = -\bar{c}^{-1}(c_1 i_2 + c_2 w_2 + x' + i_c b) > 0$$

$$e_3 = -\bar{c}^{-1}(c_1 i_3 + c_2 w_3) > 0$$

$$e_4 = -\bar{c}^{-1}(c_1 i_4 + c_2 w_4 + i_c e) > 0$$

$$e_5 = -\bar{c}^{-1}(c_1 i_5 + c_2 w_5 + (1 - \sigma)^{-1} eb) \gtrless 0$$

$$e_6 = -\bar{c}^{-1}(c_1 i_6 + c_2 w_6 + i_c eb/(1 - \sigma)) < 0$$

$$e_7 = -\bar{c}^{-1}(c_1 i_7 + c_2 w_7) \gtrless 0$$

Equation (23) is of central importance for understanding the transmission mechanism for monetary policy in this model. Notice that equation (23) must hold at every instant of time, and that the effect of changes in the monetary policy instruments on aggregate demand is the inverse of their effect on the real exchange rate e (since $e = \bar{s}/P$ and changes in aggregate demand are reflected one-for-one in changes in P). Consider, for example, an increase in central bank credit to the banking system (b). Thus, from (23) we can write:

$$\frac{dP}{db} = -\frac{de}{db}$$

$$= -[-(e_4/e_2) + e_2^{-1}\, d\hat{e}/db - (e_1/e_2)\, dd/db - (e_3/e_2)\, df/db]$$

$$= e_2^{-1}(e_4 + e_1\, dd/db - d\hat{e}/db + e_3\, df/db) \tag{24}$$

The term in parentheses describes the effect of changes in b on the demand for the domestically-produced goods, while the coefficient e_2^{-1} captures the change in P (and thus in e) required to restore equilibrium in the commodity market. Equation (24) tells us that the effect of changes in b on aggregate demand can be decomposed into four parts. The term e_4 captures the "autonomous" contribution of b to aggregate demand--i.e., the effect of, say, an increase in b on aggregate demand after allowing for portfolio reallocations but before allowing for any induced adjustments in the premium d, in the expected future time path of the real exchange rate (that is, $\hat{e}$), or in the economy's net foreign assets f. Changes in b will, however, also induce adjustments in these other endogenous variables which themselves affect demand and thus represent part of the transmission mechanism through which monetary policy operates.

In particular, the term e_1 dd/db captures the effects of b on demand which operate through induced changes in d, the term $-d\hat{e}/db$ captures effects which appear through induced changes in $\hat{e}$ (the inverse of the domestic inflation rate), and e_3 df/db measures effects transmitted through changes in the stock of foreign assets.

Leaving aside these induced effects for the present, let us consider more closely the autonomous component. This component is given by the partial derivatives e_4 through e_7 under equation (22) for each of the four monetary policy instruments respectively. As these partial derivatives indicate, the autonomous effect operates through three distinct mechanisms--a real interest rate effect, a real wealth effect, and a fiscal effect.

Consider first an expansion of credit to the banking system (an increase in b). From equation (20), given d, e, and f an increase in b requires a reduction in i_L to restore portfolio equilibrium ($i_4 < 0$). This stimulates private demand through the real interest rate effect ($c_1 i_4 > 0$). Since i_L falls, the degree of financial repression decreases, and this increases real private wealth (equation (22)). Thus the wealth contribution $c_2 w_2$ reinforces the interest rate effect. Finally, an increase in b increases revenues for the public sector due to the interest charges on the larger stock of credit extended by the central bank, and since this additional revenue, amounting to $i_c e$, is spent by the government on home goods, demand increases for this reason as well.

An increase in the administered interest rate on deposits in principle has an ambiguous effect on demand. Consider, however, the "currency substitution" case mentioned earlier. In this case, $i_5 < 0$ (equation 20). The interest rate effect ($c_1 i_5$), which is the source of the ambiguity in the more general case, is therefore positive under these circumstances. Since the degree of financial repression falls ($i_5/i_L - 1/i_L < 0$) whether i_5 is positive or negative, wealth rises, and the contribution of the wealth effect is therefore always positive. The fiscal effect is also positive, since central bank (and thus government) income is increased when administered interest rates are raised ($eb/(1 - \sigma) > 0$). Thus, either the "currency substitution" case or a sufficiently weak positive effect of increases in i_M on the loan interest rate i_L is sufficient to make the partial-equilibrium effect of an increase in i_M on aggregate demand positive. 1/

Increases in the required reserve ratio increase the portfolio-equilibrium loan interest rate, exerting a negative effect on demand

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1/ Notice that, if the direct McKinnon-Shaw effect of i_M on consumption were present, this would contribute to a negative interest-rate effect on demand, making the ambiguous case more likely. However, as the next section will show, the presence of i_M in the consumption function will not alter the qualitative nature of the general-equilibrium effects of changes in i_M.

through this channel ($c_1 i_6 < 0$). Moreover, the degree of financial repression is increased as well, resulting in a negative wealth effect on demand. Due to the increase in the administered credit interest rate i_c, however, fiscal revenue increases, thus providing a positive effect which functions as at least a partial offset to the negative demand effects described above. Though e_6 could thus have either sign, only the case $e_6 < 0$ will be considered in the remainder of the paper. 1/

The monetary authorities can bring about an increase in f_p by selling some of their foreign exchange reserves in the free exchange market. The autonomous effect on demand is ambiguous in sign. If the foreign exchange is sold at the free rate and the initial degree of financial repression is sufficiently low (so $w_7 < 0$), an increase in f_p raises the portfolio-equilibrium loan interest rate, making the interest rate effect $c_1 i_7$ negative. The consequent increase in the degree of financial repression exerts an additional negative wealth effect, which is not offset in this case by the reduction in the base of the financial repression tax.

In addition to these autonomous effects, monetary policy instruments induce changes in aggregate demand through their effects on the parallel market premium, on expectations of inflation, and on the economy's net foreign assets. Increases in the premium and in the economy's stock of foreign assets both decrease the portfolio-equilibrium loan interest rate, which exerts positive interest rate as well as wealth effects (by reducing the degree of financial repression) on demand. They also directly increase real household financial wealth, which supplements the indirect wealth effect through the reduction in financial repression. An increase in the expected rate of inflation, given the loan interest rate, lowers the expected real interest rate and thereby stimulates demand for home goods.

Because of these induced effects operating through d, $\hat{e}$, and f, the total effect of monetary policy instruments on domestic aggregate demand differs from the autonomous effect described above. In order to determine the net effect of policy instruments on aggregate demand, it is necessary to take these indirect transmission mechanisms into account--i.e., to calculate the total effect of policy instruments including effects transmitted through changes in d, $\hat{e}$, and f. These general-equilibrium effects can be derived from a solution to the model.

IV. The General Equilibrium Transmission Mechanism

The model can be represented as a system of three differential equations in d, e, and f. The system consists of equations (21), (23),

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1/ The case $e_6 < 0$ is of greater interest both because it is likely to be empirically dominant and because the magnitude of the fiscal effects are tied to essentially arbitrary assumptions about the initial size of b and the composition of induced government spending.

and (12) respectively. There is a single predetermined variable in this system (the stock of net foreign assets f), and two "jump" variables (d and e).

To solve the model, the system is first linearized around the steady state defined by $\dot{d} = \dot{e} = \dot{f} = 0$, which is denoted (d^*, e^*, f^*). This linearized system is:

$$\begin{bmatrix} \dot{d} \\ \dot{e} \\ \dot{f} \end{bmatrix} = G \begin{bmatrix} dd \\ de \\ df \end{bmatrix} + \begin{bmatrix} d_4 & d_5 & d_6 & d_7 \\ e_4 & e_5 & e_6 & e_7 \\ 0 & 0 & 0 & 0 \end{bmatrix} \begin{bmatrix} db \\ di_M \\ d\sigma \\ df_p \end{bmatrix} \tag{25}$$

where:

$$G = \begin{bmatrix} d_1 & d_2 & d_3 \\ e_1 & e_2 & e_3 \\ 0 & f_2 & 0 \end{bmatrix}$$

and, for symmetry, the function f has been defined as $f(e) = x(e)/e$ (so $f_2 = x'/e > 0$). The properties of this equilibrium can be determined from:

$$\text{Trace}(G) = d_1 + e_2 > 0$$

$$\text{Det}(G) = \Delta = f_2(d_3e_1 - d_1e_3) < 0$$

Since the trace condition implies that the sum of the roots must be positive, the system has at least one positive root. Since the negative determinant means that the product of the roots is negative, on the other hand, the number of negative roots is odd. This establishes that the system contains one negative and two positive roots--i.e., the equilibrium (d^*, e^*, f^*) exhibits saddlepoint stability. Let λ denote the negative root. The solution of the model can be written as:

$$f = f^* + (f_o - f^*) \exp(\lambda t) \tag{26a}$$

$$e = e^* + (\lambda/f_2)(f_o - f^*) \exp(\lambda t) \tag{26b}$$

$$d = d^* + \left[\frac{d_3 + d_2\lambda/f_2}{\lambda - d_1}\right] (f_o - f^*) \exp(\lambda t) \tag{26c}$$

Taking time derivatives of these expressions yields:

$$\dot{f} = \lambda(f_o - f^*) \exp(\lambda t) \tag{27a}$$

$$\dot{e} = \lambda(\lambda/f_2)(f_o - f^*) \exp(\lambda t) \tag{27b}$$

$$\dot{d} = \lambda \left[\frac{d_3 + d_2\lambda/f_2}{\lambda - d_1}\right] (f_o - f^*) \exp(\lambda t) \tag{27c}$$

Equation (27a) indicates that when the economy's net foreign assets are below their steady-state level ($f_o - f^* < 0$), f will be rising (recall that $\lambda < 0$). That is, a trade surplus will emerge. Similarly, from (27b), this situation will be characterized by a real appreciation (i.e., expected and actual inflation in excess of the world rate, which has been taken to be zero). With regard to the premium, according to equation (27c), its behavior under these circumstances depends on the sign of $(d_3 + d_2\lambda/f_2)/(\lambda - d_1)$. The denominator of this expression is negative, but since the sign of d_2 is ambiguous, so is the sign of the numerator. Some benchmark cases shall be considered below.

To investigate the general-equilibrium effects of monetary policy, begin by deriving the steady-state effects of changes in monetary policy instruments. Setting $\dot{d} = \dot{e} = \dot{f} = 0$ in (25) and solving for dd, de, and df yields:

$$\begin{bmatrix} dd \\ de \\ df \end{bmatrix} = - \frac{f_2}{Det\ (G)} \begin{bmatrix} d_3e_4-d_4e_3 & d_3e_5-d_5e_3 & d_3e_6-d_6e_3 & d_3e_7-d_7e_3 \\ 0 & 0 & 0 & 0 \\ d_4e_1-d_1e_4 & d_5e_1-d_1e_5 & d_6e_1-d_1e_6 & d_7e_1-d_1e_7 \end{bmatrix} \begin{bmatrix} db \\ di_M \\ d\sigma \\ df_p \end{bmatrix} \quad (28)$$

Notice that, since under the assumptions of the model there is a unique real exchange rate compatible with trade-balance equilibrium, monetary policy instruments cannot affect the steady-state real exchange rate (i.e., the second row of the coefficient matrix in (28) consists of zeroes). The premium and the economy's stock of foreign assets, however, will be affected in the steady state, and all three variables will deviate from their steady-state values during the transition. The dynamic effects of each of the monetary policy instruments are now investigated in turn.

1. Central bank credit to the banking system

The steady-state effects of an increase in b are given by:

$$\frac{df^*}{db} = - \frac{f_2}{Det\ (G)} (d_4\ e_1 - d_1\ e_4) < 0 \quad (29a)$$

$$\frac{dd}{db} = - \frac{f_2}{Det\ (G)} (d_3\ e_4 - d_4\ e_3) \gtrless 0 \quad (29b)$$

Thus, an increase in central bank credit to the banking system reduces the steady-state stock of foreign assets (a result familiar from the monetary approach to the balance of payments), but has ambiguous steady-state effects on the premium.

Equation (29a) permits the time path of domestic demand in response to the increase in credit to be described. Since the initial stock of foreign assets is predetermined, the initial level of f exceeds its steady-state value f^* (i.e., $f_o - f^* > 0$). From equation (26b), this means that $e_o < e^*$. Since e^* is unchanged, e must appreciate on impact--i.e., the domestic price level must rise when b is increased. The general equilibrium effect of an increase in b on domestic demand is thus expansionary on impact--i.e., the economy's aggregate demand curve shifts to the right.

How is this effect transmitted? From equation (24), we know that part of the effect arises from the "autonomous" component described earlier. Since f does not change on impact, none of the initial effect on demand arises from a change in the economy's net foreign assets (the fourth term in (24)). From equation (29b), we know that initially $\hat{de}/db > 0$. This depreciation of the real exchange rate over time implies that the domestic rate of inflation falls below its initial value (zero in this case). In itself, this effect is contractionary (since it contributes to raising the real interest rate), so it does not represent a vehicle for the transmission of positive effects on demand. Unfortunately, it is not possible to establish without further restrictions whether the free exchange rate d depreciates or appreciates on impact. Thus, some portion of the expansionary impulse may be transmitted through an increase in d.

2. Changes in controlled interest rates

Using equation (28), the steady-state effects of an increase in the controlled interest rate i_M are:

$$\frac{df}{di_M} = - \frac{f_2}{Det(G)} (d_5 e_1 - d_1 e_5) > 0 \qquad (30a)$$

$$\frac{dd}{di_M} = - \frac{f_2}{Det(G)} (d_3 e_5 - d_5 e_3) < 0 \qquad (30b)$$

Thus, an increase in the controlled interest rate increases the steady-state stock of foreign assets and reduces the steady-state premium in the free exchange market. These results have an important implication, however. From equation (26b), the increase in f^* implied by (30a) means that, on impact, $e_o > e^*$. That is, the real exchange rate depreciates. Since this can only be brought about by a reduction in the domestic price level, this means that, even in the currency-substitution case in which an increase in the controlled interest rate i_M reduces the loan interest rate i_L, the effect of this measure on aggregate demand is contractionary on impact when general equilibrium interactions are taken into account.

To see how this can happen, notice that in the case of changes in i_M, equation (24) becomes:

$$\frac{dP}{di_M} = e_2^{-1} (e_5 + e_1 dd/di_M - \hat{de}/di_M + e_3 df/di_M) \qquad (31)$$

In the "currency substitution" case, e_5 is positive (see equation (23)). From equation (27b), the effect of a change in i_M on $\hat{e}$ on impact will be negative--i.e., domestic inflation will exceed the world rate. As equation (31) indicates, this adds a further expansionary mechanism to supplement the autonomous component e_5. Finally, since f do not change on impact, the last term in (31) is zero. Thus, the negative impact on domestic demand must arise from the term $e_1 dd/di_M$. An increase in administered interest rates exerts a contractionary effect on demand on impact because it reduces the premium in the free exchange market. It does so by increasing the relative attractiveness of holding assets in the form of deposits with the domestic banking system, thereby reducing demand for foreign currency.

This example highlights the importance of a comprehensive treatment of the transition mechanism in developing countries. In this case, taking into account effects that operate through the unconventional mechanism of the free exchange market reverses the sign of the effect of a key monetary policy instrument on aggregate demand.

3. Changes in reserve requirements

From equation (28), the steady-state effects of an increase in the reserve requirement ratio σ are given by:

$$\frac{df}{d\sigma} = - \frac{f_2}{Det(G)} (d_6 e_1 - d_1 e_6) > 0 \qquad (32a)$$

$$\frac{dd}{d\sigma} = - \frac{f_2}{Det(G)} (d_3 e_6 - d_6 e_3) \gtrless 0 \qquad (32b)$$

Equation (32a) indicates that an increase in the required reserve ratio will increase the steady-state stock of foreign assets. As in the case of administered interest rates, however, the effect on the steady-state premium is ambiguous in sign. Since $(f_o - f^*) < 0$, equation (26b) indicates that the real exchange rate depreciates on impact--i.e., the increase in σ has contractionary short-run effects on domestic demand. Since the domestic price level begins to rise immediately (equation (27b)) and since the country's net foreign assets (f) do not change on impact, this demand contraction represents the net effect of the autonomous component of the transmission mechanism and the component operating through changes in the premium. The autonomous component, which in this case is given by the partial derivative e_6 under equation (23), has already been shown to be negative in sign. Though signing the separate contribution of the change in the premium would require additional

restrictions, it is clear that general-equilibrium repercussions through this channel can at most dampen the effects of the autonomous component.

4. Intervention in the free exchange market

The steady-state effects of central bank sales of foreign exchange in the free market are given by:

$$\frac{df}{df_p} = - \frac{f_2}{Det(G)} (d_7 e_1 - d_1 e_7) > 0 \qquad (33a)$$

$$\frac{dd}{df_p} = - \frac{f_2}{Det(G)} (d_3 e_7 - d_7 e_3) < 0 \qquad (33b)$$

Although the magnitudes of these expressions depend on whether the foreign exchange is sold at the official or the market price, their signs do not. A sale of foreign exchange in the free market (increase in f_p) increases the steady-state stock of foreign assets ($df/df_p > 0$) and reduces the steady-state premium ($dd/df_p < 0$). This measure will thus be contractionary on impact once general equilibrium interactions are taken into account, even though the sign of the partial-equilibrium autonomous component could not be determined unambiguously (see the partial derivative e_7 under equation (23)). As in previous cases, the short-run contractionary impulse must operate through some combination of autonomous effects tending to raise the real loan interest rate and of the induced change in the premium.

V. Summary and Conclusions

A typical developing-country financial environment is characterized by: (a) the absence of markets for domestic securities; (b) by the presence of capital controls; and (c) by legally-determined interest rates on bank assets and liabilities. Legal restrictions on foreign exchange and loan transactions give rise to parallel markets for foreign exchange as well as to informal markets for loans. The tools of monetary policy in this environment consist of central bank credit to the banking system, the setting of administered interest rates and required reserve ratios, and intervention in the free exchange market. Both the management of monetary policy in such a setting and the assessment of the macroeconomic effects of financial reform measures such as lowering reserve requirements or raising controlled interest rates require an understanding of the transmission mechanism through which such instruments affect aggregate demand.

The analysis above suggests that they do so in a number of ways other than the conventional effects on interest-sensitive components of demand operating through changes in market-determined interest rates that have been emphasized in the neo-structuralist literature. In this paper, these have been divided into autonomous (partial-equilibrium) effects and effects which emerge through general equilibrium interactions. The former include, in addition to interest-rate effects, those which operate through changes in household wealth and through the government budget. Wealth effects arise from the recognition that financial repression entails an implicit system of taxes and subsidies on households as creditors and debtors of the banking system. Changes in monetary policy instruments affect the effective degree of financial repression, and thus the present value of these taxes and subsidies, both by changing the rate at which financial repression taxes household portfolios of given composition and by altering the composition of portfolios in ways that affect the base to which the financial repression tax applies. Moreover, since monetary policy changes affect the profits of the central bank, the fiscal consequences of these changes represent a separate channel through which the effects of policy on demand are transmitted.

General equilibrium effects emerge through the consequences of policy changes for the parallel market premium, the expected rate of inflation, and the economy's stock of foreign assets. Since all these variables affect the state of domestic demand, induced changes in their values represent important additional channels through which monetary policy may exert aggregate demand effects.

In the model specified here, the direction of change in domestic aggregate demand on impact in response to changes in monetary policy instruments is determined by a combination of autonomous effects and effects which operate through the premium in the free exchange market. Regarding the other two mechanisms of transmission, the effects of induced changes in the stock of foreign assets are felt only over time (since this stock evolves as a function of cumulative current account surpluses), while expectations of future inflation tend in each case to dampen the demand effects of the policy change. The reason is that expectations of future inflation are expansionary. Since in this model the price level tends to return to its steady-state level, an expansionary shock (one which increases today's price level) will reduce expected future inflation, which in itself has a contractionary influence. Conversely, a contractionary shock will reduce today's price level, but only temporarily, and the expected recovery of prices is itself expansionary.

For two of the monetary policy instruments examined here--central bank credit to the banking system and the required reserve ratio--the short-run general-equilibrium impact on demand is qualitatively the same as the partial equilibrium impact operating through loan interest rate, wealth, and fiscal effects. Whether the general equilibrium repercussions through the free market premium and expected inflation on balance augment or weaken these effects depends on the particular values given to the parameters of the model. Thus, in empirical assessments of the likely

macroeconomic impacts of prospective monetary policy measures, these general-equilibrium mechanisms must be taken into account.

In the case of changes in administered interest rates and intervention in the free exchange market, the full general-equilibrium effects of the measures differ from what would be predicted on partial-equilibrium considerations. Increases in administered interest rates prove to be contractionary (i.e., aggregate demand for home goods decreases), even in the currency-substitution case in which partial equilibrium demand effects are positive. The reason is that the adverse wealth effects of a lower premium in the free exchange market overwhelm the positive contribution to demand emanating from lower loan interest rates. Similarly, though the partial-equilibrium consequences of a sale of foreign exchange in the free market by the central bank are ambiguous, this measure can also be shown to be contractionary when induced general-equilibrium mechanisms of transmission are incorporated into the analysis.

For the purpose of identifying the nature of the macroeconomic interactions that govern the impacts of monetary policy instruments on aggregate demand in developing countries, the model presented here can most usefully be extended in two directions. First, some stickiness in price adjustment is likely to be empirically important in many cases, and this would affect not only the price-output consequences of changes in demand, but also the role of expectations of inflation in transmitting the effects of monetary policy. Second, as indicated at the outset, it is desirable to integrate capital accumulation explicitly into the model. It is important to note, however, that while this would increase the complexity of the general-equilibrium analysis, the mechanisms of transmission that have been identified here would remain relevant in the extended model.

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