DM/86/10 INTERNATIONAL MONETARY FUND

Research Department

Output and Unanticipated Money with Imported Intermediate Goods and Foreign Exchange Rationing

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January 29, 1986

Summary

Short-run fluctuations in the growth of real output are an important concern of policy makers in developing countries. And yet, in spite of the considerable amount of attention that this subject has received in the context of industrial countries during the past 50 years, surprisingly little analytical--much less empirical--work has been done for developing countries.

In the case of industrial countries, the advent of "new classical" macroeconomics has shaken the consensus about the causes of short-run output fluctuations. Successful estimation of reduced-form output equations generated by "new classical" models contributed to their acceptance. It is natural, therefore, to extend this framework to the explanation of short-run output fluctuations in developing countries, and this has been done by several authors. However, structural features that are likely to be particularly important in the developing-country context have typically been either ignored or introduced in an arbitrary fashion.

This paper develops a simple "new classical" structural model that includes several features likely to be of importance in developing countries. The economy is modeled as an open economy along Mundell-Fleming lines, imported intermediate goods are introduced, and foreign exchange is assumed to be rationed. A reduced-form output equation is derived from this model, which is a generalization of its closed-economy analogue. After the properties of the model are analyzed, the reduced-form output equation is estimated for the Philippines. The empirical results conform quite closely to the predictions of the model.

* We would like to thank Nadeem Ul Haque, Omotunde Johnson, Mohsin Khan, Paulo Neuhaus, S. Ramachandran, and Iqbal Zaidi for their comments on an earlier draft.

I. Introduction

The advent of "new classical" macroeconomics has shaken the macroeconomic consensus about the causes of short-run fluctuations in real economic activity in industrial countries. The "policy ineffectiveness" proposition associated with Lucas (1972) and Sargent and Wallace (1976) (hereafter LSW)--which claims that only unanticipated changes in aggregate demand can cause output to deviate from its "natural" level--has been hotly contested on both theoretical and empirical grounds in an extensive literature. An important contribution to this debate was the development by Barro (1977) of a methodology for implementing empirical tests of LSW equilibrium business cycle models. Undoubtedly the ability of Barro's reduced-form equations to track aggregate U.S. time series data and the favorable results of various tests of LSW propositions within his framework contributed to the wide acceptance that "new classical" macroeconomics has received.

Although most applications of Barro's methodology have focused on the United States, several studies have extended the approach to other industrial countries. Evidence consistent with "new classical" propositions has been presented by Wogin (1980) for Canada and by Attfield, Demery, and Duck (1981a, 1981b) for the United Kingdom. Results for developing countries have been mixed. Barro (1979) applied his methodology to Mexico, Colombia, and Brazil and achieved satisfactory results only in the case of Mexico. While Hanson (1980) found significant coefficients on unanticipated money in reduced-form output equations for five Latin American countries, these results were disputed by Edwards (1983a, 1983b). Adverse results were also reported by Sheehy (1984) for the majority of cases in his 15-country sample of Latin American countries. On the other hand, the results of Blejer and Fernandez (1980), Alogoskoufis (1982), Attfield and Duck (1983), and Kormendi and Meguire (1984) generally support the "new classical" view of short-run output determination in various developing countries.

The "new classical" models developed by Lucas and by Sargent and Wallace were intended to analyze the causes of real output fluctuations in a closed industrial economy. An important flaw in the literature testing Barro's reduced-form equations in developing countries is that in almost all cases, the authors have failed to reformulate the underlying structural model to take into account the special characteristics of small, open developing economies. 1/ In some cases--Hanson (1980), Attfield and Duck (1983), and Kormendi and Meguire (1984))--reduced-form regressions similar to Barro's have been estimated directly with only minor modifications. More commonly, variables thought to be relevant to open economies

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1/ Blejer and Fernandez (1980) are an exception. However, their model is somewhat unorthodox. For a further discussion, see Montiel (1986).

or to developing countries have been added to the reduced-form output regression in ad hoc fashion. Barro (1979), for example, adds deviations from purchasing-power parity, the terms of trade, and deviations of real exports from trend in various combinations to his output equations for Mexico, Colombia, and Brazil. Edwards (1983a, 1983b) uses domestic credit rather than money as his monetary policy variable. In addition, his output equations also include the terms of trade and unanticipated growth in world money (proxied by unanticipated U.S. monetary growth). In addition to the terms of trade, Sheehy (1984) introduces the real exchange rate and the relative price of agricultural goods. Finally, Alogoskoufis (1982), uses both actual and unanticipated levels of world trade.

Neither approach to the estimation of "new classical" reduced forms in developing countries seems satisfactory. The exclusion of relevant open-economy variables from the regressions is likely to result in familiar omitted-variable problems in the context of developing countries. Nevertheless, this problem cannot be resolved by the arbitrary addition of "reasonable" open-economy variables at the reduced-form stage for at least two reasons. First, if the "reasonable" variables added to the output equation are in fact endogenous, then that equation is no longer a proper reduced form, and parameter estimates are subject to simultaneity bias. This is likely to be true, for example, in the case of the real exchange rate or the level of real exports. Second, unless the reduced-form output equation is derived from the underlying structural model, it is difficult to ascertain the form in which the "open-economy" variables should appear. The distinction between anticipated and unanticipated values of exogenous variables is critical in "new classical" models. Is it the actual or only the unanticipated component of external demand, for example, that affects domestic output in a small open economy? Unless the appropriate form of such "open-economy" variables is chosen, their inclusion in the reduced-form equation for domestic output will not correct its misspecification.

This paper derives and estimates a Barro-type reduced-form equation for domestic real output from a simple structural model of an open developing economy in which markets clear continuously and expectations are rational. Unlike in the original Barro formulation, open-economy variables appear as important explanatory variables. Unlike the existing literature, the form in which these variables appear is explicitly derived from an underlying structural model. The model is adapted to a developing-country setting by according an important role to imported intermediate goods and by allowing for the presence of foreign exchange rationing. The resulting equation is estimated for the Philippines over the period 1959-1984, and appears to fit the data quite well.

The remainder of the paper is in three sections. The first section describes a small "new classical" structural model for an open economy that imports intermediate goods and rations foreign exchange. The reduced-form equation for output is derived and its properties are discussed. This equation is estimated for the Philippines in Section III. The final section consists of a brief summary and some conclusions.

II. An Open-Economy Model with Imported Intermediate Goods and Foreign Exchange Rationing

This section specifies a simple structural model of a small open economy under fixed exchange rates. The model is characterized by continuous market clearing and rational expectations. Production is assumed to require the importation of intermediate goods. However, the presence of an effective system of foreign exchange rationing ensures that the quantity of such goods imported each period is policy-determined. A reduced-form expression for domestic real output is derived,and properties of the model are discussed.

We adopt the familiar Mundell-Fleming structure of production (see Mundell (1968) and Fleming (1962)). 1/ That is, the domestic economy is completely specialized in the production of a (composite) exportable commodity which is an imperfect substitute for the output of the rest of the world. The home country possesses some market power over the price of this commodity. To simplify matters, we assume that the imported commodity is only used as an intermediate good. The home country is small in the market for this commodity, so its price is taken as exogenously determined.

The short-run production function for domestic output is given by:

$$(1)\quad y = a_0 + a_1 n + a_2 z + a_3 t + \varepsilon_1,$$

where y is the log of domestic real output, n is the log of employment, z is the log of the real quantity of the intermediate good used in production, and t is a time trend which captures the effects of technological progress and capital accumulation. 2/ The parameters a_1 and a_2 are each positive and less than unity, $a_1 + a_2 < 1$, and $a_3 \gtrless 0$. ε_1 is a random shock which is serially uncorrelated with zero mean and finite variance.

1/ A Swan-Salter "dependent economy" version of this model is analyzed in Montiel (1986).

2/ The results of this section would be unaffected by the explicit inclusion of the capital stock in equation (1). The assumption that the capital stock grows at a constant rate is needed only for the empirical implementation of the model, in the absence of capital stock series for most countries of interest.

In the course of administering the exchange control regime, the authorities set an upper bound z on the quantity of intermediate goods that will be allowed to enter the country. Thus z must satisfy:

$$z \leq \bar{z}$$

This constraint is assumed to be binding. Domestic firms therefore maximize profits by choosing the optimum level of employment subject to the constraint $z = \bar{z}$. This yields the familiar first-order condition that the real wage be equal to the (constrained) marginal product of labor:

$$w - p = K_0 - (1 - a_1)n + a_2\bar{z} + a_3 t + \varepsilon_1,$$

where $K_0 = a_0 + \log a_1$ and w and p are the logs of the nominal wage and of the domestic price level respectively. This equation can be solved for the labor demand function:

$$(2) \quad n^D = K_1 - \frac{1}{1 - a_1}(w - p) + \frac{a_2}{1 - a_1}\bar{z} + \frac{a_3}{1 - a_1}t + \frac{1}{1 - a_1}\varepsilon_1.$$

$K_1 = (a_0 + \log a_1)/(1 - a_1)$ is a positive constant. Equation (2) is an <u>effective</u> labor demand function in the Clower (1967) sense, since it is conditional on the rationed quantity of the intermediate good. 1/

The aggregate supply of labor embodies the Friedman-Phelps natural rate hypothesis--i.e., the supply of labor depends on the expected real wage. 2/ Thus it can be written as:

$$(3) \quad n^s = b_0 + b_1 (w - p^e) + \varepsilon_2,$$

1/ It can readily be shown that the effective demand for labor given by (2) falls short of <u>notional</u> labor demand--i.e., the amount of labor that would be employed in the absence of controls--when the foreign exchange constraint is binding.

2/ See Friedman (1968) and Phelps (1968).

where p^e is the log of the price level expected to prevail in the current period, based on information available last period, i.e., $p^e = E(p|\Omega_{-1})$, where Ω_{-1} is the information set available one period earlier. 1/

Labor market equilibrium holds continuously in this model. Setting $n^s = n_D$ and solving for the market-clearing real wage after substituting from (2) and (3) yields:

$$(4) \quad w - p = K_2 - \frac{b_1(1 - a_1)}{1 + b_1(1 - a_1)}(p - p^e) + \frac{a_2}{1 + b_1(1 - a_1)}\bar{z} + \frac{a_3}{1 + b_1(1 - a_1)}t + \frac{\varepsilon_1 - (1 - a_1)\varepsilon_2}{1 + b_1(a - a_1)},$$

with $K_2 = (a_0 + \log a_1 - b_0(1 - a_1))/(1 + b_1)(1 - a_1)$. Note that a domestic price level "surprise" lowers the equilibrium real wage. Substituting (4) in (2) produces the equilibrium level of employment:

$$(5) \quad n = K_3 + \frac{b_1}{1 + b_1(1 - a_1)}(p - p^e) + \frac{a_2 b_1}{1 + b_1(1 - a_1)}\bar{z} + \frac{a_3 b_1}{1 + b_1(1 - a_1)}t + \frac{b_1\varepsilon_1 + \varepsilon_2}{b_1(1 - a_1)}$$

with $K_3 = (b_0 + b_1(a_0 + \log a_1))/(1 + b_1(1 - a_1))$. Finally, to derive the aggregate supply curve for domestic output, substitute (5) into the production function (1). The result is:

$$(6) \quad y^s = \beta_0 + \beta_1(p - p^e) + \beta_2\bar{z} + \beta_3 t + \varepsilon_3.$$

The parameters are given by:

$$\beta_0 = \frac{a_0(1 + b_1) + a_1(b_0 + b_1\log a_1)}{1 + b_1(1 - a_1)} > 0$$

1/ In the Friedman-Phelps formulation, workers essentially negotiate a labor-supply schedule one period ahead based on the price level they expect to prevail during that period on the basis of current information. In contrast to the Lucas (1972) supply function, changes in current prices have real effects to the extent that they were unanticipated last period, not to the extent that they are unperceived this period.

$$\beta_1 = \frac{a_1 b_1}{1 + b_1 (1 - a_1)} > 0$$

$$\beta_2 = \frac{a_2 (1 + b_1)}{1 + b_1 (1 - a_1)} > 0$$

$$\beta_3 = \frac{a_3 (1 + b_1)}{1 + b_1 (1 - a_1)} \gtrless 0$$

$$\varepsilon_3 = \frac{(1 + b_1)\varepsilon_1 + a_1\varepsilon_2}{1 + b_1 (1 - a_1)}$$

This aggregate supply relationship is quite similar to those that appear in closed-economy equilibrium business cycle models. Notice that open-economy considerations enter only through the presence of imported intermediate goods. If such goods are not present--i.e, if $a_2 = 0$ in equation (1)--then $\beta_2 = 0$ and (6) takes the familiar form:

$$y^s = \beta_0 + \beta_1 (p - p^e) + \beta_3 t + \varepsilon_3.$$

With imported intermediate goods and in the presence of foreign exchange rationing, the "normal" level of output, denoted y^n (the level of output produced in the absence of unanticipated shocks), is a function of the availability of intermediate goods:

$$y^n = \beta_0 + \beta_2 \bar{z} + \beta_3 t.$$

Thus, administration of the exchange control regime provides policymakers with direct leverage over the supply side of the economy. Aggregate demand policies, on the other hand, can affect the domestic level of output only to the extent that they produce price level surprises.

Additional open-economy considerations are introduced on the demand side of the economy. Since the home country's exportable and importable commodities are imperfect substitutes, the rest of the world's demand for domestic output depends, in Mundell-Fleming fashion, on relative prices $(p_F - p)$ and on foreign real income, denoted (in log form) y_F. As is conventional in equilibrium business-cycle models, real domestic demand is taken to be a function of the real domestic money supply. These considerations suggest the aggregate demand relationship.

$$(7)\quad y^D = \alpha_0 + \alpha_1 (m - p) + \alpha_2 (p_F - p) + \alpha_3 y_F + \varepsilon_4,$$

where m is the log of the domestic money supply, and all parameters are positive.

The retention of the money supply as a determinant of aggregate demand in the present setting requires some comment. In a small economy with fixed exchange rates, if domestic and foreign interest-bearing assets are perfect substitutes and capital is perfectly mobile internationally, the monetary authorities cannot control the domestic money supply. As long as the authorities are committed to defending an exchange parity, the supply of money will be determined by the demand for money and will therefore be an endogenous variable even in the short run. In such a setting, the monetary authorities can only control the stock of domestic credit. This was an important insight of the monetary approach to the balance of payments (see Frenkel and Johnson (1976)). Such considerations led Blejer and Fernandez (1980) and Edwards (1983a, 1983b) to replace money with domestic credit in their reduced-form output equations. However, under such circumstances, it is not clear that the monetary authorities can have any influence over domestic demand at all. An expansion of domestic credit, for example, would simply give rise to a capital outflow as domestic residents adjust their portfolios to maintain their desired stock of money. Although the central bank's stock of foreign exchange reserves would decrease, aggregate demand would remain unaffected. The inclusion of m in equation (9) reflects the alternative assumption that capital is imperfectly mobile. In many countries, this is due in part to the existence of controls on capital movements. In the presence of controls, domestic residents are prevented from achieving their desired portfolio allocations and the authorities thereby retain control over the domestic money supply: this is likely to be the empirically relevant case in many developing countries. 1/

To derive the reduced-form expression for domestic output, set $y^S = y^D$ to impose equilibrum in the commodity market. From (6) and (7) this yields the equilibrium value of the domestic price level as a function of the expected price level:

1/ In this connection, it is noteworthy that Edwards (1983b) had more success with the use of money than with domestic credit in his output equations for several Latin American countries.

$$(8) \quad p = (\beta_1 + \alpha_1 + \alpha_2)^{-1} [(\alpha_0 - \beta_0) + \alpha_1 m + \beta_1 p^e + \alpha_2 p_F + \alpha_3 y_F - \beta_2 \overline{z} - \beta_3 t + (\varepsilon_4 - \varepsilon_3)].$$

Taking expectations conditional on information available the previous period and solving for p^e:

$$(9) \quad p^e = (\alpha_1 + \alpha_2)^{-1} [(\alpha_0 - \beta_0) + \alpha_1 m^e + \alpha_2 p_F^e + \alpha_3 y_F^e - \beta_2 \overline{z}^e - \beta_3 t].$$

Using (9) to eliminate p^e from (8):

$$(10) \quad p = (\beta_1 + \alpha_1 + \alpha_2)^{-1} [(\alpha_0 - \beta_0)(1 + \beta_1 (\alpha_1 + \alpha_2)) + \alpha_1 m + \alpha_2 p_F + \alpha_3 y_F - \beta_2 \overline{z} + \beta_3 (1 + \beta_1/(\alpha + \alpha_2))t + \beta_1 (\alpha_1 + \alpha_2)^{-1} (\alpha_1 m^e + \alpha_2 p_F^e + \alpha_3 y_F^e - \beta_2 \overline{z}^e) + (\varepsilon_4 - \varepsilon_3)].$$

The unanticipated portion of the domestic price level can be derived by subtracting (9) from (10). The result is:

$$(11) \quad p - p^e = (\beta_1 + \alpha_1 + \alpha_2)^{-1} [\alpha_1 (m - m^e) + \alpha_2 (p_F - p_F^e) + \alpha_3 (y_F - y_F^e) - \beta_2 (\overline{z} - \overline{z}^e) - (\varepsilon_4 - \varepsilon_3)].$$

Thus price level "surprises" result from innovations in monetary policy, from unforeseen external price and output shocks, and from other unforeseen disturbances to aggregate demand and supply. Finally, the reduced form expression for domestic output can be derived by substituting (11) in the aggregate supply equation (6):

$$(12) \quad y = \pi_0 + \pi_1 (m - m^e) + \pi_2 (p_F - p_F^e) + \pi_3 (y_F - y_F^e) + \pi_4 (\overline{z} - \overline{z}^e) + \pi_5 \overline{z} + \pi_6 t + \varepsilon_5$$

where:

$$\pi_0 = \beta_0$$

$$\pi_1 = \alpha_1 \beta_1 / (\beta_1 + \alpha_1 + \alpha_2) > 0$$

$$\pi_2 = \alpha_2 \beta_1 / (\beta_1 + \alpha_1 + \alpha_2) > 0$$

$$\pi_3 = \alpha_3 \beta_1 / (\beta_1 + \alpha_1 + \alpha_2) > 0$$

$$\pi_4 = \beta_2 \beta_1 / (\beta_1 + \alpha_1 + \alpha_2) < 0$$

$$\pi_5 = \beta_2 > 0$$

$$\pi_6 = \beta_3 \gtrless 0$$

$$\varepsilon_5 = \frac{\beta_1 \varepsilon_4 + (\alpha_1 + \alpha_2)\varepsilon_3}{\beta_1 + \alpha_1 + \alpha_2}$$

This analysis gives rise to the following observations:

1. The reduced-form expression for domestic output in this model is a straightforward generalization of its closed-economy analogue.

To close this economy, remove the influence of foreign demand by setting $\alpha_2 = \alpha_3 = 0$, and eliminate imports of intermediate goods by setting $a_2 = 0$. The result is $\pi_2 = \pi_3 = \pi_4 = \pi_5 = 0$, so that (12) becomes:

$$y = \pi_0 + \pi_1 (m - me) + \pi_6 t + \varepsilon_5,$$

which is the equation estimated by Barro and others under closed-economy assumptions.

2. As is true in a closed economy, systematic domestic monetary policy has no effect on domestic output, since such policies would be foreseen by the public and would be incorporated into the public's expectations for the money supply.

Only the unanticipated portion of m appears in (12). On the other hand, as indicated earlier, systematic changes in the allocation of foreign exchange for the acquisition of imported intermediate goods do affect output, even though such changes are foreseen by the public. The reasons for this effect are explored below.

3. Only the unanticipated portion of external shocks affect domestic output. Anticipated changes in aggregate demand, whether originating at home or abroad, cannot affect domestic output, essentially because they cannot give rise to unforeseen price changes and, according to equation (6), there is no other channel through which changes in aggregate demand can affect output. Thus, to the extent that variables such as world output and world trade are meant to capture the effects of changes in external demand, it is incorrect to include (like Barro (1976) and Alogoskoufis (1983)) actual values of these variables in equations such as (12). Notice also that in the context of the present model, the inclusion of an unanticipated world money term as in Edwards (1983b) is only partially correct. Such a variable is an imperfect proxy for unanticipated foreign output. The domestic effects of unanticipated foreign "real" shocks would be ignored under this procedure.

4. Although anticipated monetary policy has no effect on real output, it nonetheless does have other real effects. Specifically, an anticipated increase in the domestic money supply increases domestic absorption and thus causes a deterioration in the trade balance.

To see this, note from equation (10) that an anticipated increase in the domestic money supply (so that $d(m - m^e) = 0$) causes the domestic price level to rise by:

$$dp = \frac{\alpha_1}{\beta_1 + \alpha_1 + \alpha_2} + \frac{\beta_1 \alpha_1}{(\alpha_1 + \alpha_2)(\beta_1 + \alpha_1 + \alpha_2)} dm$$

$$= \frac{\alpha_1}{\alpha_1 + \alpha_2} dm$$

$$< dm$$

Thus the real supply of money increases and domestic absorption rises. Since output is unchanged, however, this implies a deterioration in the trade balance. Such a deterioration is brought about as foreigners are induced to shift demand away from domestic goods due to the increase in their relative price. It can be shown, using equation (11), that this effect of anticipated monetary policy changes is absent if such changes are accompanied by proportional exchange rate devaluations, so that $dm = dm^e = dp_F = dp_F^e$.

5. As a corollary to the third observation above, an unanticipated devaluation ($d(p - p_F^e) > 0$) stimulates domestic output.

The channel through which this effect operates is by giving rise to an unanticipated increase in external demand as the relative price of domestic output falls. Through reasoning similar to the analysis of an anticipated increase in the money supply, it can be seen that an anticipated devaluation will have no output effects, but will diminish domestic absorption and improve the trade balance.

6. A change in the availability of foreign exchange for the importation of intermediate goods affects real output, even if such increases are perfectly anticipated.

This is demonstrated by setting $\bar{z} = \bar{z}^e$ in (12). Then $dy/d\bar{z}^e = \pi_5 > 0$. The intuitive reason for this result is that workers and firms will not find it mutually advantageous to offset the real effects of anticipated changes in $\bar{z}$. Consider, for example, the case of an anticipated reduction in $\bar{z}$. From (11), since the change in $\bar{z}$ is anticipated, we have $d(p - p^e) = 0$--i.e., its price effects are anticipated. From the production function (1), a reduction in z would require an increase in n to maintain y unchanged ($dn/d\bar{z}|_y = -a_2/a_1 < 0$). However, workers and firms cannot mutually agree to this increase in employment, since according to (2), an increase in n^D requires a reduction in the actual real wage, whereas by (3) an increase in n^s requires an <u>increase</u> in the anticipated real wage. Since an announced reduction in $\bar{z}$ cannot drive a wedge between actual and anticipated real wages, workers cannot be "tricked" into supplying additional labor at a lower real wage.

7. The stimulative effects on output of an anticipated increase in the availability of intermediate imports are larger than those of an unanticipated increase in such imports.

To derive the effect of an anticipated increase in $\bar{z}$, set $\bar{z} = \bar{z}^e$ in (12) and differentiate. The result is $dy/d\bar{z}^e = \pi_5$. The effect of an unanticipated increase in $\bar{z}$ is $dy/d\bar{z}$ (i.e., $\bar{z}^e$ is held constant), which, from (12), is $\pi_5 + \pi_4$. Since π_4 is negative and smaller in absolute value than π_5, the result follows. Intuitively, the reason for this is that an increase in $\bar{z}$ represents a positive "supply shock." From (10), workers will thus expect a lower price level and from (3), will moderate their nominal wage demands (by $dw = -(\beta_2/(\alpha_1 + \alpha_2))d\bar{z}^e$). This shift is absent when the increase in $\bar{z}$ is unanticipated, and the higher real wage and lower employment level as a result imply lower real output in this case.

8. An anticipated loosening of restrictions on the importation of intermediate goods increases output, even if such anticipations are not subsequently validated.

The case in which such expectations are validated <u>ex post</u> falls under point number six above. The effect of an increase in $\bar{z}^e$ with unchanged $\bar{z}$ is given by $dy/d\bar{z}^e = -\pi_4 > 0$. Thus π_4 is properly interpreted as the effect of an anticipated <u>tightening</u> of exchange restrictions (decrease in $\bar{z}^e$) that is not subsequently borne out by experience (so $\bar{z}$ is unaffected). Intuitively, an increase in $\bar{z}^e$ lowers the expected price level (see (10)), which causes a rightward shift in the labor supply curve (equation (3)), thus imparting a positive supply shock to the economy, which results in increased y.

One additional step is necessary before moving to an empirical application of the model analyzed above. According to equation (12), deviations of real output from its "normal" level are serially uncorrelated. However, measures of cyclical economic activity in industrial countries are well known to exhibit substantial persistence over time, so empirical applications of the closed-economy version of (12) typically include distributed lags of the independent variables or at least one lag of the dependent variable. One way to motivate the inclusion of a lagged dependent variable in the model of this section is to interpret the aggregate supply equation (6) as a long-run relationship to which gradual adjustment is optimal due to the presence of increasing costs associated with changes in production levels. However, the resulting supply equation would no longer be consistent with profit-maximizing behavior on the part of firms, since the labor demand function (2) would be unchanged.

To remedy this problem, we instead move back one step and assume that convex adjustment costs are specifically associated with variations in the level of employment. Thus, n^D is the long-run desired level of employment, and the short-run demand for labor adjusts gradually to this level according to:

$$(13) \quad n - n_{-1} = \lambda\,(n^D - n_{-1}); \; 0 < \lambda < 1.$$

The short-run demand for labor therefore becomes:

$$(2') \quad n^{D'} = \lambda K_1 - \frac{\lambda}{1 - a_1}(w - p) + \frac{\lambda a_2}{1 - a_1} z + \frac{\lambda a_3}{1 - a_1} t + (1 - \lambda)\, n_{-1} + \frac{\lambda}{1 - a_1} \varepsilon_1$$

Using (2') instead of (2), the model can then be solved as before. The aggregate supply equation becomes:

$$(6') \quad y^s = \tilde{\beta}_0 + \tilde{\beta}_1 (p - p^e) + \tilde{\beta}_2 \bar{z} + \tilde{\beta}_3 t + \tilde{\beta}_4 n_{-1} + \tilde{\varepsilon}_3,$$

with:

$$\tilde{\beta}_0 = [a_0 (\lambda a_1 b_1 + \phi_1) + a_1 \lambda (b_0 + b_1 \log a_1)]/\phi_1.$$

$$\tilde{\beta}_1 = \lambda a_1 b_1/\phi_1 > 0$$

$$\tilde{\beta}_2 = a_2(\lambda a_1 b_1/\phi_1)/\phi_1 > 0$$

$$\tilde{\beta}_3 = a_3(\lambda a_1 b_1/\phi_1)/\phi_1 \gtrless 0$$

$$\tilde{\beta}_4 = a_1 b_1 (1 - \lambda)(1 - a_1)/\phi_1 > 0$$

$$\tilde{\varepsilon}_4 = [(\lambda a_1 b_1 + \phi_1)\varepsilon_1 + \lambda a_1 \varepsilon_2]/\phi_1$$

$$\phi_1 = \lambda + b_1 (1 - a_1) > 0.$$

(6') is a generalization of (6), and reduces to (6) when $\lambda = 1$. The coefficient on lagged employment, β_4, becomes zero in this case. Otherwise, it is bounded between zero and one. Using (6') together with the aggregate demand equation (7) produces a new reduced-form expression for real output which is similar to (12) except for the addition of a term in lagged employment. This term can be eliminated by lagging the production function one period, solving it for n_{-1}, and substituting. This yields the final reduced form expression:

$$(12') \quad y = \tilde{\pi}_0 + \tilde{\pi}_1 (m - m^e) + \tilde{\pi}_2 (p_F - p_F^e) + \tilde{\pi}_3 (y_F - y_F^e) + \tilde{\pi}_4 (\bar{z} - \bar{z}^e) + \tilde{\pi}_5 \bar{z} + \tilde{\pi}_6 t + \tilde{\pi}_7 y_{-1} + \tilde{\pi}_8 \bar{z}_{-1} + \tilde{\varepsilon}_5,$$

where:

$$\tilde{\pi}_0 = \tilde{\beta}_0 + \frac{(a_3 - a_0)(1 - \lambda)\, b_1\, (1 - a_1)}{\lambda + b_1\, (1 - a_1)}$$

$$\tilde{\pi}_1 = \alpha_1 \frac{\lambda a_1 b_1}{\lambda a_1 b_1 + \phi_1 \phi_2} > 0$$

$$\tilde{\pi}_2 = \alpha_2 \frac{\lambda a_1 b_1}{\lambda a_1 b_1 + \phi_1 \phi_2} > 0$$

$$\tilde{\pi}_3 = \alpha_3 \frac{\lambda a_1 b_1}{\lambda a_1 b_1 + \phi_1 \phi_2} > 0$$

$$\tilde{\pi}_4 = - a_2 \frac{(\lambda a_1 b_1 + \phi_1)\, \lambda a_1 b_1}{\phi_1 (\lambda a_1 b_1 + \phi_1 \phi_2)} < 0$$

$$\tilde{\pi}_5 = a_2 \frac{(\lambda a_1 b_1 + \phi_1)}{\phi_1} > 0$$

$$\tilde{\pi}_6 = a_3 \frac{\lambda a_1 b_1}{\phi_1} \gtrless 0$$

$$\tilde{\pi}_7 = (1 - \lambda) \frac{b_1 (1 - a_1)}{\phi_1} > 0$$

$$\tilde{\pi}_8 = -a_2\, (1 - \lambda) \frac{b_1 (1 - a_1)}{\phi_1} < 0$$

$$\varepsilon_5 = \frac{\lambda a_1 b_1 \varepsilon_4 + (\lambda a_1 b_1 + \phi_1)\, \phi_2 \varepsilon_1 + \lambda a_1 \phi_2 \varepsilon_2}{\lambda a_1 b_1 + \phi_1 \phi_2} - \frac{(1 - \lambda) b_1\, (1 - a_1)}{\phi_1} \varepsilon_{1_{-1}}$$

$$\phi_2 = \alpha_1 + \alpha_2 > 0$$

In contrast to (12), equation (12'), contains additional lagged terms in both output and imports (with the latter bearing a negative coefficient) and serially correlated residuals.

In addition to the signs of the coefficients, the model also predicts that their magnitudes will obey certain restrictions:

a. $0 < \tilde{\pi}_7 < 1$

b. $0 < -\tilde{\pi}_8/\tilde{\pi}_7 = a_2 < 1$

c. $\dfrac{\lambda a_1 b_1 + \phi_1}{\phi_1} = \dfrac{\tilde{\pi}_5 \tilde{\pi}_7}{\tilde{\pi}_8} > 1$

d. $-1 < \tilde{\pi}_4/\tilde{\pi}_5 = \dfrac{-\lambda a_1 b_1}{\lambda a_1 b_1 + \phi_1 \phi_2} < 0.$

We now turn to an empirical application of the model.

III. Empirical Application of the Model to the Philippine Economy

The model developed in the previous sections is now applied to the Philippine economy over the 1959-1984 period. The Philippines was considered to be particularly suitable for illustrating the model since it is an open economy that possesses several of the characteristics that were stressed in the theoretical model, at least to a first approximation. First, foreign exchange and import rationing have been prevalent in the Philippines since the early 1950s. These exchange and trade restrictions have been alternatively strengthened and relaxed over the years, but they have been in place in one form or another over most of the period. A detailed description of the evolution of the exchange and trade system in the Philippines is contained in Zaidi (1984). 1/

Second, the structure of Philippine merchandise imports indicates that the bulk of imports consists of intermediate goods rather than final goods. In 1981, 58 percent of the Philippines imports consisted of machinery, transport equipment and other manufactured goods, and 30 percent of

1/ See also Baldwin (1975), and the various issues of the Annual Report on Exchange Arrangements and Exchange Restrictions published by the International Monetary Fund.

imports came under the category of fuels. Third, the Philippines has begun to rely increasingly upon exports of manufactured goods to enhance its growth prospects. In 1981, 45 percent of Philippine merchandise exports consisted of manufactured goods. Such goods are more likely to be imperfect substitutes for the output of the rest of the world than would be true for primary commodities. 1/

The first characteristic of the Philippine economy, rationing of foreign exchange and hence imports, is consistent with the specification of aggregate supply in the theoretical model. The third characteristic, exports of mainly manufactured goods, is consistent with the aggregate demand side of the model. The second characteristic, imports of mainly intermediate goods, plays a role in the specification of both aggregate supply and aggregate demand. The closed economy version of the model, which does not take these special characteristics into account, has been estimated for the Philippines by other researchers. For example, Attfield and Duck (1983) and Kormendi and Meguire (1984) examine the influence of unanticipated money growth on real output in the Philippines, among other countries. Their results indicate that unanticipated money growth has only limited success in explaining real output in the Philippines. It would therefore be useful and interesting to evaluate the empirical success of the open economy version of the model, allowing for the special characteristics of economies such as the Philippines.

The empirical application of the reduced form output equation derived in the previous section necessitates the choice of the data counterparts for variables such as y_F, p_F, m, and z. While the time series used are described in greater detail in an appendix, the following observations may be helpful at this stage. The foreign real income variable used for y_F is industrial country real GDP. The foreign price variable p_F needs to be expressed in domestic currency units, and therefore its choice is limited by the exchange rate series that are available for the Philippines. Since an exchange rate for the Philippine peso against the aggregate of industrial countries or the world is not available, the U.S. wholesale price index and the peso/U.S. dollar exchange rate are used to construct the series for p_F. The wholesale price index is chosen over the other indices since it contains the highest proportion of traded goods.

The choice for the monetary variable m is more complex. As is well known, there is scant theoretical guidance for the selection of a monetary variable between narrow money (M1) and broad money (M2). Therefore, as Laidler (1977, p. 103) observes, "the correct definition of money becomes an empirical matter." The reduced form output equation was hence estimated separately using M1, M2 and DC. Broad money was eventually chosen as the monetary aggregate since it yielded the "best" results in terms of the significance and signs of the estimated reduced-form coefficients.

1/ World Bank, World Development Report, 1984, Tables 10-11, pp. 236-238.

For the imports variable z, clearly it would be ideal to use only imports of intermediate goods rather than total imports. However, a time series of imports of intermediate goods in the Philippines is not readily available, and hence a series for total import volume is used.

The main practical estimation problem in the model outlined above is the estimation of anticipated and unanticipated components of y_F, p_F, m and $\bar{z}$. Tests of the model hinge on forming accurate proxies for y_F^e, p_F^e, m^e and $\bar{z}^e$. Clearly, misspecification is always a danger in this line of research. If the proxies for y_F^e, p_F^e, m^e and $\bar{z}^e$ include a measurement error, such misspecification will lead to an errors-in-variables bias in the coefficients of the reduced form output equation.

It is assumed that all expectations are formed rationally. That is, expectations are assumed to be equivalent to optimal, one-period-ahead forecasts, conditional on available information. Strictly speaking, of course, the use of rational expectations requires that expectations be related to the underlying macroeconomic structure. Since this is empirically quite intractable, in this paper we follow most researchers in this area, and attempt to satisfy the key property of rationalty: orthogonality of expectional errors to the variables in the information set [see Sargent (1973)].

The assumption of rational expectations implies the condition

(14) $X_t^e = E\ (X_t | \Omega_{-1}) = X_t - \delta$

Where $E\ (X_t | \Omega_{-1})$ denotes the expectation of X_t conditional on the past values of a set of variables included in the information set Ω, and δ is a random term orthogonal to Ω_{-1}, $E\ (\delta | \Omega_{-1}) = 0$. 1/ Under the assumption that the conditional expectation in equation (14) is linear, it follows that

(15) $E\ (X_t | \Omega_{-1}) = \theta\Omega_{-1}$

and hence

(16) $X_t = \theta\Omega_{-1} + \delta$

1/ The variable X^e in equation (14) may be taken to represent alternatively y_F^e or p_F^e or m^e or $\bar{z}^e$. The specific composition of the information sets for these four variables is discussed below.

Where θ is a vector of regression coefficients conformable to Ω. Thus, X_t^e is in effect formed as the prediction from a linear regression of X_t on Ω_{-1}.

The prediction equations and the output equation may be estimated separately in a two-step procedure using ordinary least squares. In the first step, the prediction equations for y_F, p_F, m and $\bar{z}$ are estimated. The fitted values from these equations are used as proxies for y_F^e, p_F^e, m^e and $\bar{z}^e$ in the second stage equation explaining real output. Assuming serially independent errors and no omitted variables in the four prediction equations, this two-step procedure yields consistent, but inefficient, estimates of the parameters in the model. The parameter estimates are inefficient, since the two-step procedure does not take into account the cross-equation restrictions between the prediction equations and the output equation. By estimating the prediction equations and the model for output at the same time, using a procedure such as full information maximum likelihood (FIML), more efficient parameter estimates could be generated, and also the validity of the cross-equation restictions could be tested. With only 26 data points, however, jointly estimating a 5 equation system with a host of cross-equation restrictions using FIML is hardly justified. Hence, the two-step estimation procedure is used in this paper.

We now turn to the selection of variables that should enter the information set in the prediction equations. For all four variables (y_F, p_F, m and $\bar{z}$), the information set includes at least two lagged values of the variable itself. The additional variables that enter the information set were selected on the basis of considerable experimentation with bivariate autoregressions involving numerous potential explanatory variables. For the M2 prediction equation two lagged values of world M2 are also included in the information set. The information set for the import prediction equation includes two lagged values of international reserves and two lagged values of real GDP. The inclusion of international reserves in this prediction equation is consistent with the foreign exchange rationing element of the model, since allocations of foreign exchange by the authorities are likely to depend on reserve adequacy and on recent levels of economic activity. For the prediction of industrial country real GDP, y_F, the information set consists of four lagged values of industrial country M2, besides the two lagged values of y_F. Finally, for the U.S. wholesale price index, p_F, the information set consists only of four lagged valued of p_F.

In short, the prediction equation for M2 is a bivariate autoregression with world M2. The prediction equation for import volume is a trivariate autoregression with international reserves and real income. The prediction equation for y_F is a bivariate autoregresssion with industrial country M2.

And, the prediction equation for p_F is a fourth-order autoregression. The prediction equations were all estimated in growth rate form to ensure stationarity. The estimation results are presented in Table 1. The fitted values from the prediction equations were used to calculate the levels of y_F^e, p_F^e, m^e and $\bar{z}^e$.

The test for white noise residuals from the prediction equations involved an examination of the residual's autocorrelation function. The pertinent F-statistics for testing the hypothesis of white noise residuals, using third-order autoregressions of the residuals themselves, are also reported in Table 1. These F-statistics are below their critical values, indicating that the residuals from all four prediction equations are white noise.

Having obtained the proxies for y_F^e, p_F^e, m^e and $\bar{z}^e$ from the prediction equations, we can proceed to the second step of the estimation process where these proxies are used in the reduced form output equation derived in Section II. Three versions of the output equation are estimated. The first version is the closed economy version with only unanticipated money. The second version is an open economy version that includes unanticipated foreign income and unanticipated foreign prices. Finally, the third and most complete version includes the import variables besides the other closed and open economy variables. The estimation results are presented in Table 2. For all versions a Cochrane-Orcutt estimation procedure was used.

The estimation results show that the closed economy version of the model, regression (i), performs fairly well. The coefficient on unanticipated money growth is significant at the 10 percent level. In regression (ii), the estimated coefficient on unanticipated foreign income has the correct sign, and while the coefficient on unanticipated foreign prices has the correct sign, it is not significant. The complete model, regression (iii), performs exceptionally well. All the coefficients have the signs predicted by theory. In particular, the coefficients on unanticipated imports and lagged imports have the expected negative sign, while the coefficient on current imports is positive. Furthermore, the three coefficients on the import variables are significant at the 1 percent level.

On the basis of the three regressions, two tests of exclusion restrictions were performed. First, we tested for the exclusion of the three import variables $(\bar{z}-\bar{z}^e)$, $\bar{z}$ and $\bar{z}_{-1}$, and obtained the following test statistic: $F(3, 16) = 4.39$ (5 percent critical value = 3.24). We can thus reject the null hypothesis that these three variables should be excluded from the regression. Second, we tested for the exclusion of all the open economy variables in the model $[(\bar{z}-\bar{z}^e)$, $\bar{z}$, $\bar{z}_{-1}$, $(y_F-y_F^e)$, and

Table 1. The Prediction Equations: 1959-1984 1/

A. Money prediction

$$\hat{m}_t = \underset{(0.033)}{0.093} + [\underset{(0.194)}{0.335} + \underset{(0.188)}{0.048}\,L]\hat{m}_{t-1} + [\underset{(0.00036)}{0.00055} + \underset{(0.00037)}{0.00069}\,L]\,\hat{WM2}_{t-1}$$

R^2 = 0.385, SEE = 0.053, F (3, 19) = 0.277 2/

B. Import prediction

$$\hat{z}_t = \underset{(0.084)}{-0.165} - [\underset{(0.236)}{0.116} + \underset{(0.195)}{0.369}\,L]\hat{z}_{t-1} + [\underset{(1.106)}{3.232} + \underset{(1.319)}{0.632L}]\hat{y}_{t-1}$$

$$+ [0.024 + 0.034L]\hat{R}_{t-1}$$

R^2 = 0.516, SEE = 0.088, F (3, 19) = 0.157 2/

C. Foreign income prediction

$$\hat{y}_{F,t} = \underset{(0.027)}{0.048} + [\underset{(0.228)}{0.236} + \underset{(0.232)}{0.126L}]\hat{y}_{F,t-1} + [\underset{(0.205)}{0.376} - \underset{(0.233)}{0.472L} - \underset{(0.241)}{0.248L^2} + \underset{(0.213)}{0.112L^3}]\hat{ICM2}_{t-1}$$

R^2 = 0.451, SEE = 0.016, F (3, 19) = 0.067 2/

D. Foreign price prediction

$$\hat{p}_{F,t} = \underset{(0.009)}{0.011} + [\underset{(0.221)}{1.232} - \underset{(0.341)}{0.866L} + \underset{(0.354)}{0.396L^2} + \underset{(0.234)}{0.007L^3}]\hat{p}_{F,t-1}$$

R^2 = 0.693, SEE = 0.031, F (3, 19) = 0.334 2/

1/ L is the lag operator defined by the operation $L^iX = X_{-i}$. The hats denote growth rates. The variiables m, z, y, y_F and p_F are defined in the text. The remaining variables are WM2 = world broad money, R = international reserves, and ICM2 = industrial country broad money. The figures in parentheses are standard errors of the coefficients.

2/ The F-statistics are for testing the hypothesis of white noice residuals using third-order residuals' autoregressions, and not for testing the significance of the regression.

Table 2. The Reduced Form Output Equations: 1959-1984 1/

Regression Number	Constant	$(y_F-y_F^e)$	$(p_F-y_F^e)$	$(m-m^e)$	$(\bar{z}-\bar{z}^e)$	$\bar{z}$	$\bar{z}_{-1}$	y_{-1}	Time	R^2	SEE	Durbin H
(i)	0.013 (0.541)	--	--	0.150* (0.079)	--	--	--	1.014*** (0.288)	-0.002 (0.007)	0.950	0.009	imaginary
(ii)	-0.147 (0.527)	-0.163 (0.338)	0.243 (0.167)	0.179* (0.088)	--	--	--	1.095*** (0.281)	-0.003 (0.007)	0.985	0.009	imaginary
(iii)	-0.047 (0.239)	0.438 (0.340)	0.175 (0.165)	0.313** (0.111)	-0.263*** (0.082)	0.282*** (0.059)	-0.160*** (0.051)	0.935*** (0.132)	-0.001 (0.003)	0.999	0.008	0.925

1/ The figure in parentheses are standard errors of the coefficients. A single asterisk denotes significance at the 10 percent level, a double asterisk denotes significance at the 5 percent level, and a triple asterisk denotes significance at the 1 percent level.

$(p_f - p_F^e)]$, and obtained the following test statistic: $F(5, 16) = 3.24$ (5 percent critical value = 2.85). Hence, the null hypothesis that all the open economy variables should be excluded from the regression can also be rejected.

Finally, the restrictions on the magnitudes of the coefficients are all satisfied. π_7, the coefficient on lagged output, is positive and less than unity. The estimate of a_2 (derived from $-\pi_8/\pi_7$) is 0.171, which also falls between the bounds of zero and one. The quantity $-\pi_5\pi_7/\pi_8 = 1.648$ is greater than unity, as expected, and $\pi_4/\pi_5 = -0.933$ is negative and greater than minus one. In sum, the regression results using data from the Philippines provides strong support for the open economy model of short-run output determination developed in this paper. 1/

IV. Summary and Conclusions

This paper has reformulated a simple "new classical" structural model to take account of features that are likely to be important in small open developing economies. Previous attempts to estimate Barro-type reduced-form equations for output for developing countries have either estimated regressions appropriate to closed-economy models or added open-economy variables in an arbitrary fashion. There are many ways to "open up" closed-economy "new classical" models, and ours is a simple example consisting of an adaptation of the Mundell-Fleming framework with imported intermediate goods, limited capital mobility, and foreign exchange rationing. The resulting model has some familiar properties, such as the irrelevance of anticipated monetary policy for short-run deviations of domestic output from its "normal" level. Consistent with this, only the unanticipated components of external price changes and of changes in the level of external economic activity cause domestic output to deviate from normal. In contrast, both anticipated and unanticipated changes in the availability of imported intermediate goods affect real output, since these variables operate through the supply side of the economy. Though the model is rather specialized and therefore unlikely to be applicable to a majority of developing countries, it produced good empirical results for the Philippines, a case for which the importance of foreign exchange rationing during our sample period has been well documented by Zaidi (1984).

1/ It is interesting to note (see Table 2), that the coefficient of unanticipated money increases as additional open economy variables are included. The closed-economy version is reasonably close to Hanson's 10-percent rule for Latin American countries, but the final version is more than twice this large. Thus the weak output effects of monetary policy in developing countries uncovered in Khan's (1985) survey may be related to misspecification of reduced-form output regressions in small open economies.

The policy implications of the model may be illustrated by the following example. Consider the effects of a stabilization program adopted to take effect during period t and consisting of an announced tightening of monetary policy during period t, a devaluation that takes effect at the beginning of period t, and a loan to the authorities during this period that is expressly intended to loosen foreign exchange restrictions and make available an increased supply of imported intermediate goods. According to the analysis of Section II the monetary tightening, since it is anticipated, would have no effect on real domestic output in the short run. The reduction in the money supply would result in a less than proportionate reduction in the price level, so the real money supply would decrease, domestic absorption would fall, and due to the improvement in competitiveness, external demand for domestic output would rise. The devaluation implies a lower foreign currency price of domestic output and thus a further increase in external demand. Since this effect is anticipated at the beginning of period t, it would not affect real output, but would increase the domestic price level less than in proportion to the devaluation, reinforcing the negative effect of the monetary contraction on the real supply of money and thus on domestic absorption. Whether the domestic price level would rise or fall as a result of these measures depends on the magnitudes of the devaluation and of the monetary contraction and on the parameters of the model. In any case, domestic output would be unaffected, real absorption would fall, and the economy's external competitiveness would improve.

To these effects must be added the impact of an actual and anticipated increase in the availability of intermediate good imports, which, as shown in Section II, is an increase in output. Since such an increase in intermediate imports represents a positive "supply shock," the domestic price level will fall. The result is to further improve domestic competitiveness and to increase the real money supply.

The unambiguous effects of the package are therefore an increase in domestic output and an improvement in the economy's competitiveness. Whether the domestic price level, the real money supply, and real domestic absorption will increase or decrease depends on the magnitudes of the various measures adopted and the parameters that characterize a specific economy. It is certainly possible that these measures could simultaneously increase domestic output, reduce the rate of inflation, and improve the balance of trade. The empirical relevance of a model with such properties would seem to merit further investigation.

Data Description

All time series were obtained from International Financial Statistics (IFS). The individual time series used are described below. Lower case letters denote natural logarithms.

1. Real output (y): y = real GDP (IFS line 99b.p).

2. Money (m): m = money plus quasi money (IFS lines 34 + 35).

Quarterly end-of-period data was used to obtain annual averages.

3. Imports (z): z = import volume (IFS line 73).

4. Foreign prices (p_F): p_F = U.S. wholesale price index (IFS line 63), converted to peso terms using the peso/U.S. dollar exchange rate (IFS line rf).

5. Foreign Real Income (y_F): y_F = industrial country real income (IFS line 110.99bpx).

6. World money (WM2): WM2 = world money plus quasi money (IFS line 001.351x).

7. International Reserves (R): R = total reserves minus gold (IFS line 1 1.d).

8. Industrial country money (ICM2): ICM2 = industrial country money plus quasi money (IFS line 110.351x).

References

Attfield, C.L.F., P. Demery, and N.W. Duck, "Unanticipated Monetary Growth, Output, and the Price Level: U.K. 1946-77," European Economic Review, Vol. 16 (June/July 1981), pp. 367-85.

_____, "A Quarterly Model of Unanticipated Monetary Growth, Output and the Price Level in the U.K. 1963-1978," Journal of Monetary Economics, Vol. 8 (November 1981), pp. 331-50.

Attfield, C.L.F. and N.W. Duck, "The Influence of Unanticipated Money Growth on Real Output: Some Cross-Country Estimates, Journal of Money, Credit, and Banking (November 1983), pp. 442-54.

Baldwin, R.E., Foreign Trade Regimes and Economic Development: The Philippines (New York: Columbia University Press for National Bureau of Economic Research, 1975).

Barro, R.J., "Unanticipated Money Growth and Unemployment in the United States," American Economic Review, Vol. 67 (March, 1977), pp. 101-15.

_____, "Unanticipated Money, Output, and the Price Level in the United States," Journal of Political Economy, Vol. 86 (August, 1978), pp. 549-80.

_____, "Money and Output in Mexico, Colombia, and Brazil," in J. Behrman and J.A. Hanson, eds., Short-Term Macroeconomic Policy in Latin America (Ballinger, Cambridge, MA, 1979).

Blejer, M.I. and R.B. Fernandez, "The Effects of Unanticipated Money Growth on Prices and on Output and its Composition in a Fixed-Exchange-Rate Open Economy," Canadian Journal of Economics, Vol. 13 (February, 1980), pp. 82-95.

Clower, R.W., "The Keynesian Counter-Revolution: A Theoretical Appraisal," in Monetary Theory (Penguin Books, Baltimore, MD 1973), pp. 270-297.

Edwards, S., "The Short-Run Relation Between Inflation and Growth in Latin America: Comment," American Economic Review, Vol. 73 (June 1983), pp. 477-82.

_____, "The Relation Between Money and Growth Under Alternative Exchange Arrangements: Some Evidence from Latin American Countries," (unpublished, 1983).

Fleming, J.M., "Domestic Financial Policies Under Fixed and Floating Exchange Rates," Staff Papers, International Monetary Fund (Washington), Vol. 9 (November 1962), pp. 369-79.

Frenkel, J.A. and Harry G. Johnson, The Monetary Approach to the Balance of Payments (London: Allen & Unwin, 1976; Toronto: University of Toronto Press, 1976).

Friedman, M., "The Role of Monetary Policy," American Economic Review, Vol. 58 (March 1968), pp. 1-17.

Hanson, J.A., "The Short-Run Relation Between Growth and Inflation in Latin America," American Economic Review, Vol. 70, pp. 972-89.

IBRD, World Development Report (Washington), 1984.

Khan, M.S., and M.D. Knight, "Fund-Supported Adjustment Programs and Economic Growth," Occasional Paper, Number 41. International Monetary Fund (Washington), 1985.

Kormendi, R.C., and Meguire, P.G., "Cross-Regime Evidence of Economic Rationality," Journal of Political Economy, Vol. 92 (October 1984), pp. 875-908.

Laidler, D.E.W., The Demand for Money: Theories and Empirical Evidence, 2nd ed. (New York: Dun-Donnelley Pub. Corp., 1977).

Lucas, R.E., "Some International Evidence on Output-Inflation Tradeoffs," American Economic Review (June 1973), pp. 326-34.

Montiel, P.J., "Output and Unanticipated Money in the 'Dependent Economy' Model," (unpublished, IMF, 1986).

Mundell, R.A., "The Monetary Dynamics of International Adjustment Under Fixed and Flexible Exchange Rates," Quarterly Journal of Economics, Vol. 24 (May 1960), pp. 227-57.

Phelps, E.S., "Phillips Curves, Expectations of Inflation, and Optimal Unemployment Over Time," Economics, Vol. 34 (August 1967), pp. 254-81.

Sargent, T.J., "Rational Expectations, the Real Rate of Interest and the Natural Rate of Unemployment," Brookings Papers on Economic Activity, 2: 1973, pp. 429-480.

Sargent, T.J. and N. Wallace, "'Rational' Expectations, the Optimal Monetary Instrument, and the Optimal Money Supply Rule," Journal of Political Economy, Vol. 83 (April 1975), pp. 241-54.

Sheehy, E.J., "Money and Output in Latin America," Journal of Development Economics, Vol. 14 (January/February 1984), pp. 203-18.

Wogin, G., "Unemployment and Monetary Policy Under Rational Expectations," Journal of Monetary Economics, Vol. 6 (January, 1980), pp. 59-68.

Zaidi, I.M., "A Rationing Model of Imports and the Balance of Payments in Developing Countries: Theoretical Framework and an Application to the Philippine Economy," (unpublished, IMF, 1984).