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Volume Title: Short-Term Macroeconomic Policy in Latin America

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Volume Publisher: NBER

Volume ISBN: 0-88410-489-3

Volume URL: <http://www.nber.org/books/beh79-1>

Publication Date: 1979

Chapter Title: The Use of Econometric Models in Developing Countries

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Chapter URL: <http://www.nber.org/chapters/c3882>

Chapter pages in book: (p. 1 - 38)

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The Use of Econometric Models in Developing Countries*

1. INTRODUCTION

National-income-determination models and stabilization have not been the major concern of either empirical or theoretical macroeconomic analysis in the developing economies. For example, a recent survey of the state of the art regarding the use of economywide models for less developed countries (LDCs), Blitzer, et al. (1975), does not even include a chapter on macroeconomic income-determination models.

Instead, the dominant frameworks for macroeconomic policy analysis and policy recommendations have been provided by Harrod-Domar aggregate-growth models, static and dynamic linear-programming models, and Chenery-Strout two-gap models.¹ These

*This paper draws on Behrman, "Econometric Modeling of National Income Determination in Latin America, with Special Reference to the Chilean Experience," presented at the Seminar on *Use of Econometric Models in Latin America*, sponsored by The Center of Economic and Demographic Studies of El Colegio de México and the National Bureau of Economic Research, held in Mexico City on November 27-29, 1974.

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models generally include assumptions that: (i) the degree of capacity utilization, the rate of inflation, and the level of aggregate demand are unimportant considerations; (ii) that the financial constraints on government and central bank behavior (and, thus, the entire fiscal-monetary-income-international policy-inflation nexus) can be ignored; (iii) short-run flexibility is limited by low elasticities of substitution and short-run unresponsiveness to price; (iv) (at least for the programming models on which the greatest resources have been expended) the most interesting question is "what *could* happen if socially optimal readjustment of the economy occurred in response to policy changes," rather than "what *would* happen if the independent economic units which make up the economy followed their traditional behavioral patterns in response to such changes."² The resulting models usually include only real phenomena and are characterized by supply bottlenecks resulting from foreign exchange or capital constraints.

Such an emphasis reflects two widely held views: (1) Growth is a relatively more important economic objective (and stabilization less important) in the developing countries than in the developed countries. (2) Income-determination models involving demand as well as supply are of limited value for developing economies.³

Some exceptions to the predominant view have long existed. The participants in the "structuralist-monetarist" controversy in Latin America, for example, accorded significant importance to inflation and stabilization policies in the development process.⁴

These exceptions have been increasing in number. The recognition by such authors as Schydrowsky (Chapter 9, this volume) and Behrman (1973b) of considerable underutilized capacity, particularly in cyclical downturns, has increased interest in using national-income-determination models for stabilization purposes. Numerous partial equilibrium econometric estimates have been made that imply significantly nonzero elasticities of substitution and significant responses to prices in both capacity utilization and capacity creation decisions.⁵ Even the strongest advocates of supply-oriented capital and foreign-exchange-constrained analysis seem to be having second thoughts about the importance of short-run factors and stabilization problems. For example, throughout the above-cited survey by Blitzer, et al. (1975), there are frequent references to the need to consider short-run features (e.g., prices responses, capacity utilization determination, aggregate-demand-related policies).

Recently, because of this growing interest in stabilization and other short-run problems, a large number of Keynesian-based national-income-determination models have been constructed and utilized for the developing economies.⁶

A basic problem with the construction and use of these models for policymaking purposes in developing economies is the general lack of accurate, up-to-date information (e.g., quarterly information on output and its components and sectoral or cyclical indicators that are available with a short time lag). This is a gap that at present forces policymakers to act on incorrect or dated information.⁷ It also means that income-determination models of developing countries are annual rather than quarterly. However, in the developed countries econometric models have been "most successful" in predicting output in the next quarter or six months; over a nine or twelve-month period simple trends are often as good.⁸ Thus improvement in modeling may require an investment in improving the data base, an investment that has the additional payoff of providing more accurate and up-to-date information to policymakers.⁹

There remains the more philosophical question of our present ability to forecast and affect in predictable ways the very short run with corresponding effects on the long run. However, political pressures force governments to accept some advice and take some action in the very short run, often to the detriment of the long run. Therefore, it is probably best for economists to offer advice on the short run and on short-run-long-run tradeoffs while specifying the fragile nature of such advice.

A second problem results from a simplistic transfer of aggregate demand models of developed economies with little or no adjustment for the special conditions in the developing countries. As a result, there are numerous shortcomings in such models' specifications, shortcomings that, while they may also exist in developed country applications, are perhaps less important in that context. For example: (1) National income is determined by aggregate demand in a Keynesian fashion with no testing for the existence of possible constraints due to the stocks of capital or labor, the supply of foreign exchange, or supply limitations imposed by quantitative restrictions.¹⁰ (2) Underemployed or surplus labor and dualism in the labor market are not explicitly incorporated. (3) Aggregation is so great that there is no possibility of capturing the impact of policies on relative prices, even though economists like Hansen (1973b) have maintained that policies in developing nations are primarily reflected in altered relative prices and Wachter (Chapter 8, this volume) has demonstrated, econometrically, the structuralist proposition that differing speeds of adjustment of relative prices (plus passive money) may result in inflation. The possible importance of intersectoral flows, moreover, is lost by the high level of aggregation. On the other hand, data problems are often cited as preventing disaggregation to any significant level, and there remains the question of whether dis-

aggregated models provide more accurate projections of the aggregate variables, and to what extent such models divert attention from more global problems, such as the financial-monetary-international policy-income nexus. (4) Potential policy variables are often overlooked. For example, it is often assumed that an overvalued exchange rate will be maintained through a continuance of exchange control although this is obviously a policy that is subject to change. (5) The significance of the foreign sector as a source of noncompetitive, intermediate imports, of capital goods, of government finance, and of household money and nonmonetary asset holdings is not well presented. (6) The importance—owing to fragmented and poorly functioning capital markets—of direct flows and retained earnings in the real investment process is not explored. (7) The degree of endogeneity of fiscal, monetary, and international variables and their interrelation in poorly functioning capital markets is ignored with the result that policy options are overstated. (8) There is little attempt to integrate the short-run income-determination model with long-run development models. In particular, although plant and equipment decisions are well treated, no attempt is made to study human capital formation, despite the growing evidence for its significance in development. The role of social overhead capital, long emphasized by such leading development economists as Rosenstein-Rodan (1961), also is not explored.¹¹ (9) There is a tendency to ignore economywide disequilibrium.¹²

At the same time as interest in and use of income-determination-stabilization models for the LDCs has been growing, controversies have emerged over the specification of such models in the developed economies. In the past decade, critics have claimed that deficiencies in the theoretical structure, deficiencies that may be related to points 1 to 9 above, make any analysis of stabilization policies based on such models suspect. Recently, however, some convergence seems to have occurred, at least regarding the nature of the issues. Ando (1974), Blinder and Solow (1973), and Hansen (1973a) and others have attempted to adjust the IS-LM model to explore these controversies. However, less agreement has been obtained on the significance of Lucas's (1976) point that systematic attempts to use an estimated model for policymaking purposes alters the parameters of the system and thus the responses to policy.

Given some convergence on the nature of stabilization issues in the developed countries and given the increasing preoccupation with stabilization problems in the developing countries, the time seems ripe to reexamine the applicability of modern stabilization analysis to the special situations of the developing countries.

The strategy pursued in this chapter is to examine briefly each of the components of recent econometric models used in developed economies. Then the chapter considers how these models need to be altered for analysis of stabilization in developing economies. Models of Chile and Panama are considered as examples incorporating these alterations.

The prototype model for the developed economies uses as a starting point the combination of the features of the closed economy model of Ando (1974) and the analysis of international capital movements of Branson (1974). These models are somewhat complex in order to incorporate a number of features discussed in recent controversies. Solution by differentiation does not lead to simple elegant expressions. For an understanding of such models beyond the explanation provided below, the reader is referred to the papers by Ando and Branson.

Regarding the two developing country models, Behrman's (1976b) Chilean study is an annual macroeconomic model for the period 1945-1965. It is a nine-sector model with capacity creation, capacity utilization, export, import, and price and wage determination relations for each sector involving 172 endogenous variables. Consumption-savings decisions are estimated for households and nonprofit institutions, business, and the government. Many aspects of government fiscal and monetary policies are endogenous. Its specification attempts to overcome the nine shortcomings listed above, which are frequently encountered in Keynesian-based national-income-determination models for developing economies. Less explicit reference is made to Behrman and Vargas's (Chapter 2, this volume) trimestral model of Panama. Though less complex than the Chilean study this model still includes 97 endogenous variables describing production, prices, and wages in three broad sectors—exports, other traded and nontraded goods—which in turn are subdivided into eight producing sectors. Final demand components are also estimated separately.

Finally, before considering the appropriate modifications of the developed country model, two caveats are in order. First, the developing countries are far from homogeneous. For almost any relevant feature the range across countries is enormous. In what follows below, therefore, the suggested modifications reflect characteristics not necessarily common to all developing countries but at least to a significant number of them. Second, a separate paper, if not a book, could be written on data problems. In this chapter some allusions are made to these problems, but they are not treated systematically so that the chapter can be kept to a manageable length.

2. COMPONENTS OF NATIONAL- INCOME-DETERMINATION MODELS

Table 1-1 presents the prototype model for the developed economies that is used as a starting point for the discussion of this section. Each of the major components of that model will be examined in turn with a focus on altering them for analysis of stabilization issues in developing countries.

2.1 Labor Market, Labor Supply, and Determination of Prices and Wages

2.1.A The Developed Country Model: Equations (1) through (4) describe the labor market and the determination of prices and wages in a representative econometric model of developed economies.

Equation (1) depicts the short-run relationship between output and the required man-hours to satisfy demand. It is assumed that at any point in time the economy has a collection of machines whose labor-output ratios were determined by the technology and the expected relative prices at the time of each machine's manufacture. Given the current relative prices, machines (and the labor associated with them) are used in descending order of efficiency until the demanded (= desired) output is produced. New machines may contain different technology based on expected relative prices. Thus producers' durable equipment takes the form of putty-clay.

Equation (2) gives the unemployment rate as a function of man-hours and population characteristics. It incorporates into one expression the determination of hours worked per person and the response of labor force size to employment conditions and to demographic features of the population.

Equation (3) is a Phillips curve relation for the determination of the rate of change of wages as a function of the unemployment rate and price expectations. It may be considered a reduced form equation of underlying supply and demand relations in the labor market. Lucas (1973) argues that this relation may depend upon government policy and provides some evidence to that effect.

Equation (4) determines the price level of output under the hypothesis of a (possibly lagged) markup on minimized average cost. The price level should vary proportionally with the money wage level and reciprocally with long-run productivity. The markup factor is μ . Since the markup may vary in the short run with the utilization of capacity, the unemployment rate is also included in the function.

Table 1-1. Prototype Macroeconomic Model for Developed Economies

I. Labor Market, Supply Price, and Wages

Demand for Labor

$$E = E(Z) \quad (1)$$

Supply of Labor and the Definition of Unemployment Rate

$$u = u(E, N) \quad (2)$$

Determination of Money Wage Level

$$\frac{\dot{W}}{W} = W \left(u, L \left[\begin{array}{c} \dot{P} \\ P \\ -1 \end{array} \right] \right) \quad (3)$$

Determination of Real Wage Rate and Price Level

$$P = Wf \left(L \left[\begin{array}{c} E \\ - \\ Z \end{array} \right], \mu, u \right) \quad (4)$$

II. Product Market and Aggregate Demand

Definition of Net National Product

$$Z = C + I + G + X - IM \quad (5)$$

Consumption Function

$$C = C(Y, A) \quad (6)$$

Investment Function

$$I = I(Z, r_k, \tau) \quad (7)$$

Government Expenditure

$$G = G_{\text{ex}} + G_{\text{end}}(Y, N, r_k) \quad (8)$$

Import Function

$$IM = IM(ER, P, Y) \quad (9)$$

Export Function

$$X = X(ER, P) \quad (10)$$

III. Financial Markets and Assets

Demand for Real Assets

$$V = A \cdot f^V(r_k^h, r_b^r, r_s^h, Y) \quad (11)$$

Demand for Bonds

$$B/P = A \cdot f^B(r_k^h, r_b^r, r_s^h, Y) \quad (12)$$

Table 1-1. continued

Demand for Foreign Securities

$$\frac{S \cdot ER}{P} = A \cdot f^S(r_k^h, r_b^r, r_s^h, Y) \quad (13)$$

Demand for Money

$$M/P = A \cdot f^M(r_k^h, r_b^r, r_s^h, Y) \quad (14)$$

Definition of Net Worth

$$A = V + \frac{M + B + S \cdot ER}{P} \quad (15)$$

Relation between Holding Rate and Capitalization Rate

$$r_k^h = r_k - \frac{r_k^e - r_k}{r_k} \quad (16)$$

Relation between Real and Nominal Short-Term Interest Rates

$$r_b^r = r_b - \frac{P^e - P}{P} \quad (17)$$

Relation between Holding and International Rate for Foreign Securities

$$r_s^h = r_s + \frac{ER^e - ER}{ER} \quad (18)$$

Generation of Expected Rate of Change of r_k

$$\frac{r_k^e - r_k}{r_k} = F^k \left(L \left[\begin{array}{c} \dot{r}_k \\ r_k \end{array} \right] \right) \quad (19)$$

Generation of Expected Rate of Change of Prices

$$\frac{P^e - P}{P} = F^P \left(L \left[\begin{array}{c} \dot{P} \\ P \end{array} \right] \right) \quad (20)$$

Generation of Expected Rate of Change of Exchange Rate

$$\frac{ER^e - ER}{ER} = F^{ER} \left(L \left[\begin{array}{c} \dot{ER} \\ ER \end{array} \right] \right) \quad (21)$$

Expected Income from Capital

$$\pi^e = F^\pi \left(\pi, P \cdot L \left[\begin{array}{c} \pi \\ P \\ -1 \end{array} \right] \right) \quad (22)$$

Table 1-1. continued

Market Value of Capital

$$P \cdot V = \frac{\pi^e}{r_k} \quad (23)$$

IV. Identities and Miscellaneous Relations

Definition of Disposable Income

$$P \cdot Y = P \cdot Z + r_b \cdot B - P \cdot T + r_s \cdot S \cdot ER \quad (24)$$

Definition of Savings

$$d(P \cdot A) = P \cdot Y - P \cdot C \pm d^*(P \cdot V) \quad (25)$$

Definition of Income from Capital

$$\pi = P \cdot Z - W \cdot E - \tau_c (P \cdot Z - W \cdot E) \quad (26)$$

Capital Gains on Existing Capital

$$d^*(P \cdot V) = d(P \cdot V) - P \cdot I \quad (27)$$

Balance of Payments Surplus

$$H = P \cdot X - P \cdot IM + r_s \cdot S \cdot ER - d(S \cdot ER) \quad (28)$$

Tax Function

$$P \cdot T = T(P \cdot Z + r_b \cdot B + r_s \cdot S \cdot ER, \pi, \tau) \quad (29)$$

Government Budget Constraint

$$dM + dB = P \cdot G - P \cdot T + r_b \cdot B \quad (30)$$

V. Variable Definitions

A: Net Worth of Consumers

B: Government Debt Held by Private Sector

C: Consumption in Constant Currency

$d^*(PV)$: Real Capital Gain on Existing Real Assets in Current Currency

E: Employment in Man-Hours

ER: Exchange Rate in Domestic Currency per Unit of Foreign Currency

ER^e : Expected Exchange Rate in Domestic Currency per Unit of Foreign Currency

G: Total Government Expenditures in Constant Currency

Table 1-1. continued

G_{ex} :	Exogenous Government Expenditures in Constant Currency
G_{end} :	Endogenous Government Expenditures in Constant Currency
H :	Surplus on Balance of Payments in Current Currency
I :	Net Investment in Constant Currency
IM :	Imports in Constant Currency
L :	Lag Operator
M :	Money Supply in Current Currency (Currency Plus Reserves)
N :	Vector Expressing Total Population and its Structure
μ :	Standard Mark-up Factor (i.e., the Ratio of Price of Output to its Minimized Cost of Production Expected to Prevail under Normal Employment Conditions)
P :	Price Level for Output
P^e :	Price Level Expected to Prevail
π :	Income from Real Assets in Current Currency
π^* :	Expected Income from Existing Real Assets in Current (not future) Currency
r_b :	Nominal Rate of Interest on Government Debt
r_b^r :	Real Rate of Interest on Government Debt
r_k :	Capitalization Rate (in real terms) Applicable to Real Assets
r_k^e :	Level of r_k Expected to Prevail
r_k^h :	Holding Rate (in real terms) Applicable to Real Assets
r_s :	Real Rate of Interest on Foreign Securities
r_s^h :	Holding Rate (in real terms) Applicable to Foreign Securities
S :	Net Foreign Securities Held by Private Sector
T :	Taxes in Constant Currency
τ :	Tax Rates (Subscript "C" refers to Corporations)
u :	Unemployment Rate
U :	Market Value of Existing Real Assets in Constant Currency
W :	Nominal Wage Rate per Man-Hour

Table 1-1. continued

X:	Exports in Constant Currency
Y:	Disposable Income in Constant Currency
Z:	Net National Product in Constant Currency

2.1.B.1 Wage and Price Determination in Dualistic Labor Markets: Most developing economies are characterized by dualism in labor and product markets. To capture the effects of long-run changes in the sectoral distribution of the labor force, as well as the short-run problems of income determination, it is necessary to include explicitly this dualism.

In a dualistic labor market there is thought to be a modern sector that is market oriented and pays wages approximately proportional to the value of the marginal product of labor. Its technology is of recent vintage and permits only limited substitution between primary factors.¹³ In some countries unions are quite powerful in this sector.

The traditional sector is much less market oriented. In most countries a major component of this sector is noncommercial agriculture. For this subsector the marketed surplus often is a small part of total production and *may* be an inverse function of price. However, analysis in Behrman (1968) suggests that this response is *positive and quite large*. While factor substitution usually is possible, the relatively high labor-to-capital ratio often results in disguised unemployment with marginal products substantially below those in the modern sector. Because of family and communal arrangements, the income of individual laborers may be determined by tradition and related to the average rather than the marginal product.

The dominant view of the impact of this dualism on the labor market is based on the well-known model of Lewis (1954). The average share of labor in the traditional sector, plus a differential for moving costs, provides a floor for modern sector wages.¹⁴ The average share of labor in the traditional sector is assumed to remain approximately constant over a wide range of sizes of the traditional labor force.¹⁵ It is therefore argued that over a substantial range the supply of labor for the modern sector is quite elastic.

One way of incorporating this approach into equations (1) and (2), would be to apply them only to the modern sector (with all the included variables referring only to that sector). The traditional sector would act as one residual claimant on labor, and urban unemploy-

ment, open or disguised, as the other.¹⁶ In practice it might be necessary to aggregate these two residuals, given the problems of defining urban unemployment and due to continual shifts in demand for "modern" goods, which affect both open unemployment and rural-urban migration in a complicated fashion.

Prima facie this approach might *seem* to lead to an approximation of a Keynesian case in the modern sector, with an "unlimited supply of labor" at a fixed wage and employment in the modern sector determined by the demand for modern sector goods. But this wage is fixed in real terms, and thus the situation is also classical in an important sense, which suggests an alternative approach.

If modern and traditional goods were good substitutes, so that we could treat them as one good, equations (1) and (2) could be said to apply to the economy and equation (3) could be replaced by an equality between (expected) real wages in the modern sector and the exogenously given, traditional labor income. Equilibrium employment and output would be unresponsive to changes in aggregate demand. Rather than wages determining the price level, as shown in equation (4), prices (as determined by equation [14], the demand for money) would tend to determine nominal wages in classical fashion.¹⁷ These results hold in their essentials if the goods are not perfect substitutes, although in this case a shift in demand patterns could alter the distribution of employment and, if directed toward modern goods, yield some aggregate efficiencies.

The problem with this approach is that it does not cover the case of urban Keynesian unemployment, resulting from a lack of aggregate demand. For a given, fully employed labor force there is a unique allocation of labor that equates (expected) urban wages with a given, traditional labor income.¹⁸ To consider both dualistic labor markets and Keynesian unemployment the strict equality between labor incomes in the traditional and modern sectors must be replaced by a gradual adjustment process toward equality. In that case a drop in aggregate demand, assuming also a slow adjustment of prices, would lower modern sector output, cause urban unemployment, and slow rural-urban migration out of the growing population. The average rural income might differ from the (expected) wage for a time.

Over a longer period migration and human capital would alter urban labor supply substantially, and capital-labor ratios would vary. Moreover, changes in minimum (as opposed to average) wages may depend (inversely) upon (lagged?) urban unemployment. These factors would tend to narrow the relation between measured (expec-

ted?) urban wages and the average share of labor in the traditional sector over the longer run.

The basic problem highlighted in this discussion is that equation (3) remains a reduced form of the operation of the labor market in which the underlying supply and demand relations are not well stated or perhaps even understood. The explicit statement of these relations becomes very important in explaining wages in one sector of a jointly determined two- (or more) sector model. In an explicitly two-sector model wages in the urban sector are determined by the demand for labor, which depends on nominal wages and prices of urban sector goods and the supply of labor, which in turn is dependent upon nominal wages and on prices in the *two* sectors. Far from being constant, rural supply, relative prices of rural goods, and rural incomes may all vary with employment in the urban sector.¹⁹

The same problem of incomplete specification exists in the equation of price determination via markup, expressed in equation (4), aside from the obvious point that short-run variations in markups (and therefore, their explanation) are much more important in countries where the industrial nonwage share reaches 40 to 50 percent of value added (see Michalopolous [1969]) and some important items in the price index are produced by government factories or closely controlled by governments. At best equation (4) could explain relative prices in a two-good model but not their absolute level.

One solution might be to treat the traditional sector rather than its labor force as a residual. The urban wage level could be related to the unemployment rate and some trend in rural incomes. The price *index* could be determined through a markup equation with a nonunitary elasticity of the price index with respect to urban wages. The difficulty with this approach is that it neglects the determinants of the intersectoral movements it is trying to model.

Perhaps the best solution would be to retain the demand-determined modern sector employment figure of equation (1) and jointly determine the unemployment rate, the wage in the modern sector, and the (residual) labor force, output, and average product in the traditional sector through a set of equations that require *relative* prices to adjust to equate demands and supplies for both traditional and modern products and long-run equality between real labor earnings in the two sectors. This approach obviously requires a division of aggregate demands between the two sectors and an additional equation to determine the *general* price level.

In the Chilean model (Behrman [1976b]) of income determination in an inflationary economy, the major determinant of the *gen-*

eral price level was the rate of change of the money supply, with its impact distributed over a number of years. As described below, this money supply was determined by other factors in the system, such as the government budget deficit. Because of the distributed lags in the price-determination process, moreover, stemming inflation is quite difficult unless expectations about future price movements can be lowered drastically.

Nonmonetary factors also affect the general price level. Cost-push factors operating through intermediate input and unit labor costs are more important in transmitting overall inflationary pressures (including those that arise from the role of expectations in the wage-bargaining process) than previous studies, such as Harberger (1963), have maintained. Real changes in per capita gross domestic product (and other indices of current activity), in labor productivities, in demands (final and intermediate) relative to sectoral capacity, and in the distribution of factoral income and of sectoral product have significant effects, as do foreign sector policies. Government minimum wages, although widely discussed in Chilean circles, do not appear to have a very significant impact on wage changes once other prices are incorporated into the wage change relations.

On the other hand, in the Panamanian case, which is probably a prototype of open economies, prices seemed to be largely determined by the world economy, plus taxes and tariffs. However, Borts and Hanson (Chapter 9, this volume) suggest the relation is not proportional, perhaps because of home goods and variations in the *effective* exchange rate or government price setting. Thus there is more scope for monetary policy than Johnson's (1973) simple, monetary model of the balance of payments allows, as discussed below. Regarding wages, the (expected) price levels are one of the most important determinants, unemployment rates and sectoral productivity seem less important, and minimum wages have almost no effect. Brodersohn (1977), Behrman (1971a), and other studies cited in Fernandez and Hanson (1977) confirm the fact that price expectations are important in Latin American wage determination, generally entering proportionately. However, Brodersohn (Chapter 7, this volume) in the Phillips curve context, and Barro (Chapter 6, this volume), Fernandez (Chapter 5, this volume), and Lucas (1973) in an alternative form provide little support for a stable relation either between wage growth and unemployment or between cyclical variations in real output and monetary fluctuations.

2.1.B.2 The Importance of the Foreign Sector: The foreign sector plays a much more important direct role in labor, production,

and price relations in most developing economies (and probably in most small open developed countries) than is indicated in the model of Table 1-1. Four modifications of the counterparts of equations (1) to (4) for the modern sector need to be made to reflect the impact of the foreign sector.

(i) Some imported intermediate inputs and raw materials are critical in the production process. The elasticity of substitutions between such imports and domestic factors may be low or zero. Especially in the disequilibrium exchange rate system common for many developing economies, the constraint on production and employment may not be the putty-clay stock of machinery and equipment, but the availability of these imported inputs. Equation (1) may require modification to reflect this possibility.

(ii) Equation (1) also needs to be modified to reflect the fact that technologies used in the modern sector are largely imported from developed countries with much different factor endowments. Very little choice may be available (or may be thought to be available) even *ex ante* for the capital-labor ratio of the developing countries. Therefore, the putty-clay response to expected relative prices is constrained to a choice among relatively capital-intensive technologies. What Eckaus (1955) calls the "factor proportions problem" limits the absorption of labor by the modern sector.

(iii) The discussion in section 2.1.B.1 suggests that for many developing economies equation (3) should be modified or the structural form more explicitly specified. One further modification needs to be made. In many developing economies an important and easily available index of inflationary expectations is the rate of change of the exchange rate. In addition to the history of past inflation, therefore, this variable (or some function of past values of it) should be included for such countries.

If wages respond to such factors, they may "overshoot" the devaluation-induced price rises in some industries. In that case it is possible that equation (1) does not hold because wage costs on the "last" machine needed to produce demanded output exceed the firm's income. Output is then determined by desired supply, not demand as indicated in (1), and unemployment is related to high real wages, not a lack of demand. Such an interpretation may explain the negative output effects associated with devaluation in Chile in the late 1950s (Harberger [1963]), Argentina in 1959, and Colombia in 1962.

(iv) In light of the widespread importance of consumption and intermediate and raw material imports if a variant of equation (4) is included, then it should be modified to reflect markups on imports

as well as on labor costs. Changes in the international prices or in import policies, therefore, have direct effects on the domestic price level and on output, particularly in open economies such as those of the Caribbean and Central America.

2.2 Product Market and Aggregate Demand

2.2.A Developed Countries: Equation (5) is the definition of net national product. Equations (6) through (10) describe the demand for real output.

Equation (6) is the *consumption function*. Real consumption depends upon expected real disposable income (approximated by a distributed lag of actual real disposable income) and net worth in a variant of the life cycle hypothesis.

Equation (7) is the *investment function*. For the developed countries in which capital markets are well functioning so that the cost of capital is well identified, investment decisions are based on a comparison of the present value of the expected stream of income generated by the investment and the cost of investment. Simultaneous variables that enter into the investment decision, therefore, include the capitalization rate applicable to real assets and net national product in real terms. The appropriate tax rates also have a role.

Equation (8) defines total *government expenditure* as the sum of exogenous central government expenditures and endogenous local government expenditures. The latter respond fairly strongly to cyclical conditions of the economy.

Equation (9) is the *import function* and equation (10) is the *export function* for developed economies. Imports respond positively to the level of income and the domestic price level and inversely to the exchange rate (defined as the number of units of domestic currency per unit of foreign currency). Exports are assumed to respond directly to the exchange rate and inversely to the domestic price level.

2.2.B.1 Consumption in Developing Countries: For the developing economies, several hypotheses about private consumption behavior have been suggested. (i) Because of the existence of a large number of individuals at or near a subsistence income level, consumption may not be proportional to income even in the long run. If true, the high marginal propensity to consume at low income levels, *ceteris paribus*, may imply a relatively high multiplier. (ii) Retained business earnings (although not necessarily from corporations) are a relatively important source of savings. Therefore, a division between

unretained and retained income of businesses might be desirable. Modigliani and Tarantelli (1975) provide some evidence that a further division between property and labor income may be less fruitful. (iii) The marginal propensity to consume out of the income generated in some sectors—especially sectors related to exports—may be higher than elsewhere in the economy. The inclusion of a separate argument in the function for income from exports might be desirable. This modification would further increase the impact of the foreign sector on stabilization. (iv) If interest rates are controlled, then a policy-oriented model would consider the direct effect of their decontrol on the rate of consumption. Controlled interest rates may also increase the substitution between foreign and domestic saving.

Finally, data problems may make it difficult to include nonmonetary assets in the measure of net worth.²⁰ This distortion is not as great as it would be for the developed countries because the stock of money balances represents a large percentage of privately held assets, perhaps as great as 40 percent in nominal terms.²¹

2.2.B.2 Investment in Developing Countries: For some of the more advanced developing countries, evidence exists that supports the use of the same basic formulation (e.g., Behrman [1972b] considers investment by sectors). More generally, however, substantial modifications are needed to reflect special aspects of capital markets, social overhead capital, and international considerations.

(i) Domestic capital markets in developing economies often are not well functioning. Markets are very fragmented, especially between the traditional and modern sectors. In the modern sector legal limits on nominal interest rates frequently are effective so that credit rationing occurs in bank markets. Government planning organizations also often attempt to control the allocation of physical capital by nonmarket means.

The net result is that much of the domestically financed investment does not pass through a capital market (or, at least not through "the" capital market). Instead it originates in retained earnings or in direct flows from the government. Government policy is often directed toward increasing the former source by changes in the terms of trade, by price ceilings, and foreign trade policies in favor of sectors in which investment is desired. Quite commonly industry is so favored over primary production, and import substitution or nontraditional exports are favored relative to traditional exports.

To capture these features, direct financial flows from the government and the results of quantitative allocations mechanisms need to

be included in the investment function. Some success was obtained with these real credit variables in the Panamanian model. To represent the impact of policies that work through altering terms of trade, a multisector model is required.

(ii) The development literature emphasizes repeatedly the role of social overhead capital in the development process. Because of externalities and increasing returns to scale over the relevant range, Rosenstein-Rodan (1961) and others maintain that the government must increase such social overhead capital in order to induce private investment. Birnberg and Resnick (1973) show that social overhead capital was an historically important element in export growth. The role of social overhead capital in determining the stream of expected net income from investment, therefore, should be made explicit.

(iii) International considerations may enter into investment decisions in two important ways.

First, a considerable portion of the capital stock originates from direct foreign investment in the modern sectors of many developing economies. One implication of this foreign ownership is that for such investment the relevant cost of capital reflects the opportunity cost in the international capital market (modified by local tax, repatriation and earnings regulations, and expected exchange rate movements) and not in the domestic market. Another implication is that net factor payments abroad may have a stabilizing influence if they are determined as a residual. (See Reynolds [1968].)

Second, for many of the developing economies much of the machinery and equipment for investment in the modern sector is imported.²² This point is related to the factor proportions problem referred to above because of the concentration on developing relatively capital-intensive technology in the mature economies and to the disaggregation of imports referred to below. It also means that exchange rate policy and other import policies have important roles in determining the cost of capital. Finally, it is possible that the quantity of imported capital goods may constrain real investment if the elasticity of substitution between domestic and foreign investment goods is, in fact, very low and quantitative restrictions are an important component of trade policy as in many developing countries. Behrman (1975a) provides evidence that the availability of imported machinery and equipment constrained investment in Chile.²³

2.2.B.3 Government Expenditure in Developing Countries: For developing economies current government expenditures often (but

not always) are more centralized than in developed economies such as the United States. Nevertheless, there remains a large, effectively endogenous component. The government is a relatively large employer in comparison to total modern sector employment, its wage bill makes up a substantial portion of its expenditures, and cuts in these expenditures as part of stabilization policy would be extremely risky politically in most cases.

Government expenditures also generally are affected directly by foreign sector conditions through the budget constraint. Taxes related to the foreign sector are a major source of variance in government revenues (see below). A further effect is through official capital inflows. The evidence presented by Papanek (1972, 1973) suggests (although not conclusively, see Mikesell and Zinzer [1973]) that such flows are diverted partly to current government expenditures. These inflows may also lead to local inflationary problems if they result in monetary creation instead of increased imports.

2.2.B.4 The Import Equation in Developing Countries: For most developing economies, as is noted above, imports play a critical role in the provision of noncompetitive raw materials, intermediate inputs, and machinery and equipment capital goods for the modern sector. Moreover, because many of these imports are noncompetitive and because import substitution policies often have reduced competitive imports to a low level, the price and exchange rate elasticities usually are thought to be low while measured income elasticities are high. However, for Chile estimated elasticities suggest that the 63 percent drop in the price level deflated exchange rate (between 1946 and 1973) implied *ceteris paribus* increases in imports of 57 percent for secondary consumption goods, 88 percent for transportation-related investment goods, 18 percent for intermediate goods, and 50 percent for services (Behrman [1975a] and [1976a]).

To capture the differential impact of the various types of imports on growth and stabilization as well as the differential responses to different components of income and price indices, some disaggregation is necessary.

Policies to regulate imports are widely thought to be among the most potent available to the governments of developing countries in their quest toward growth, distribution, and stabilization objectives. Among the policies often utilized are multiple exchange rate systems, tariffs, direct government imports, prior import deposits, and quantitative restrictions.²⁴ Clearly in a policy-oriented model these policies should be included explicitly in the import function. It should also

be noted that import demand may depend on "excessive" monetary expansion in a fixed-rate regime as discussed in the Panamanian model and Borts and Hanson (Chapter 9, this volume).

Quantitative restrictions frequently are used to maintain a disequilibrium system with overvalued exchange rate(s) and excess demand for foreign exchange. Disequilibrium is allowed to persist because of the perceived negative distribution, inflationary and political effects of devaluation, and widespread convictions about inadequacies of allocation by prices. The existence of strong vested interests in the disequilibrium system (e.g., owners of factors in import substitution subsectors, the recipients of import licenses, or the government bureaucracy) also helps to perpetuate the continuance of these systems. To satisfy what appears to be substantial excess demand, perpetuated in part by the restrictions themselves,²⁵ controls generally are relaxed when foreign exchange becomes available from export booms or increased capital inflows. The import functions need to be modified, therefore, not only to include the above-mentioned policy tools and foreign prices, but also the availability of foreign exchange in a system of disequilibrium exchange control.

2.2.B.5 The Export Equation in Developing Countries: The correct specification of the export function, or functions, is a critical component of a stabilization model for most developing economies. Fluctuations in the value of exports from developing economies, according to the structuralists and a large number of others (e.g., Heller [1954] and Higgins [1968]), are a major source of instability for these countries. Not only do such variations directly affect total aggregate demand, but, through the government deficit they also change aggregate demand because of the dependence of government revenues on international trade revenues. Furthermore, they may alter production in the modern sector because of the low elasticity of substitution for critical, imported inputs and a short-run foreign exchange constraint. The holders of this view conclude that general fiscal and monetary policy will not be very effective in stabilization attempts. Instead emphasis must be placed on exchange rate and tax policies directly related to exports. Some observers further conclude that movement toward less dependence on the foreign sector is desirable in order to lessen its destabilizing influence.

MacBean (1966) summarizes a variety of previous work on export-based instability and suggests that the above-hypothesized strong relationship between export instability and overall instability is exaggerated. Diaz Alejandro (1977) reports substantially more varia-

tion in Colombian imports than in exports and in exports than in GDP. Mathieson and McKinnon (1974) even conclude that there is a slight indication that "outward-looking" trade policies may decrease instability. MacBean (1966) posits that two factors lie behind the lack of a strong relationship between domestic variables and export fluctuations: (i) the low value of the foreign trade multiplier in part because of repatriation of factor returns to foreign owners and because of leakages into taxes on exports and (ii) the distributed lag nature of reactions to change in exports.

Such studies challenge the once-conventional wisdom about the destabilizing influence of international markets. The issue is far from resolved, however, because of the failure of such studies to specify adequately the structure (including the lags in responses mentioned above) of the developing economies. Even the strongest doubters of the importance of international market fluctuations, moreover, grant that export variations probably are destabilizing in those cases in which exports are very concentrated in a few products.

To effectively capture the important, short-run role of exports, it seems best to divide them into two (or more) categories that differ substantially in exchange rate and tax subsidy treatment: traditional (largely primary products) and nontraditional (often industrial products).

The traditional exports are often major sources of government revenues. In addition to their "world" price, as modified by taxes, some element of market power (perhaps within the framework of international commodity agreements) may need to be represented.

Far from being taxed, many nontraditional exports may receive substantial subsidies in hopes of diversifying sources of foreign exchange and gaining entry into faster growing markets without causing a decline in "world" price. Many studies have shown a substantial positive response to changes in these subsidies and a corresponding negative response to an increasingly overvalued exchange rate. Referring once again to Chile, Behrman (1975a) and (1976a) show that the 63 percent drop in the price level deflated nominal exchange rate between 1946 and 1972 caused, *ceteris paribus*, drops in exports of 100 percent from industry, 50 percent from small- and medium-scale mining, 32 percent from agriculture, 19 percent from large-scale mining, and 13 percent for exports from services. These results also suggest that these foreign sector regimes increase *dependence* on traditional exports (i.e., those from large-scale mining) despite stated intentions to encourage diversification. The response to uncertainty in relative prices was widespread although not generally large in mag-

nitude, implying that there was a significant, but not substantial, payoff to the sliding-peg exchange rate policy of 1965-1970 in terms of reducing balance of payments difficulties.

For Colombia various studies show that "minor" exports, that is, noncoffee, nonpetroleum exports, were extremely responsive to changes in the effective exchange rate (elasticities of two to four are reported in Diaz Alejandro [1977], Musalem [1970], and Sheahan and Clark [1972]). The system of effective devaluations initiated in 1967 is generally considered responsible for the enormous jump in the proportion of minor exports in a much higher total export figure.²⁶

2.3 Financial Markets and Assets

2.3.A A Simple Model of Financial Markets in Developed Countries: The financial market for the developed economies in Table 1-1 is patterned on the extensions of Tobin's (1969) portfolio equilibrium model by Ando (1974) and Branson (1974). Equations (11) to (14) are demand functions of private sector asset holders for four imperfectly substitutable assets: equities, government bonds, foreign securities, and money. Equation (15) is the definition of the rates of return (with a fixed zero rate of interest for money) and income (with a transactions demand for money). The nominal supplies of money and bonds and the interest rate on foreign securities of a given risk are assumed to be exogenous.

All assets are gross substitutes. Domestic asset holders must hold given quantities of equities and government bonds, since these assets are not traded internationally. Domestic asset holders face an elastic supply of foreign securities at an interest rate fixed internationally. They are free to trade in money and foreign securities. Any purchase of the latter implicitly reduces domestic foreign exchange by an identical amount, and its effects on domestic money supply are completely sterilized.

Equations (16) to (18) are relations between holding and capitalization, real and nominal, and holding and international rates for the three respective nonzero return assets. Equations (19) to (22) are simple hypotheses about the formation of expectations. Equation (23) determines the market value of real assets by capitalizing the expected stream of income from *existing* assets.

Branson (1974) analyzes a similar model for developed countries. His main results are as follows. (1) The inclusion of noninternationally traded assets restores the effectiveness of monetary policy as measured by the possibility of altering rates of return on such domes-

tic assets relative to foreign securities. (2) The relative impact of open market operations on domestic asset rates depends on which asset is the instrument of open market operations.

For the developing economies a number of changes need to be made. As discussed above, asset markets are generally fragmented, function poorly, and are relatively unimportant in channeling investible funds. Dualism is a common feature, with changes in the organized market having only limited impact on the unorganized sector. Government bond markets and private security markets both generally are quite small.

Monetary policy usually is limited in scope, especially internally. Central banks are hesitant to undertake substantial open market operations in the very narrow bond market. In some cases the Central Bank acts as a development bank, making lines of credit available to favored sectors. The nominal money supply is not only dependent upon such credit or rediscount operations but also on de facto or de jure obligations to finance the government deficit and on foreign exchange movements. Among the monetary instruments that might be included in a complete model of the financial sector are marginal and average reserve requirements, rediscount rates, prior deposits on imports, and exchange rate(s). Also important are interest rate ceilings and quantitative restrictions on internal credit and on international capital flows. The use of this latter group of policies may require that relations in the model be modified to reflect rationing due to quantitative variables. Uncertainty about future quantitative policies also may complicate the formation of expectations in equations (19) to (22).

The foreign sector impinges on the financial markets in a number of important ways. As is indicated in the previous paragraph, foreign exchange movements have substantial impact on the domestic money supply, and the major discretionary monetary operations are in the foreign sector. This discretion is probably limited to the short run, especially if the government attempts to maintain overvalued exchange rates. In particular, with fixed, effective exchange rates it may be difficult to pursue an independent monetary policy because domestic credit expansion will largely "leak out" via excessive imports and capital outflows that lead to drops in international reserves and money.²⁷ Rather than affecting inventories and ultimately output, imports and local holdings of foreign assets may simply increase. To be effective monetary policy may have to be linked with effective devaluation.

Foreign direct ownership or domestic capital in the modern sector often is important, and therefore equation (22) or (23) must be mod-

ified so that only the value of the domestically owned portion of the capital stock enters into domestic portfolio decisions.

In a few developing countries, such as Mexico, the interest rate in the international market may effectively create a liquidity trap for the organized monetary market. In general, however, the international interest rate does not peg the domestic rate for at least one of three reasons: (i) Quantitative restrictions on capital movements break the link between domestic and international capital markets. (ii) The existence of Bransonian internationally nontraded assets that are not perfect substitutes for internationally traded assets permits some independence in interest rate movements. (iii) Risk premiums may be dependent upon the debt-income ratio (Hanson [1974]).

While some of these features have been incorporated in various models of less developed countries, particularly the interrelation between money supply, the foreign sector, and the government deficit, this area remains one of the weak points of such models. Too little is known about the functioning of domestic capital markets to permit an adequate specification though the information accumulated through results of the OAS Capital Markets program may improve future models.

2.4. Identities and Miscellaneous Relations

Equations (24) to (28) define *disposable income*, *private savings*, *income from capital*, and *the balance of payments surplus*. For the developed countries these definitions are basically self-explanatory. Note that capital gains on existing assets arise because of changes in the capitalization rate or changes in the expected stream of income from these existing assets due to varying economic conditions. They do not, of course, include additions to real assets from current net investment. For the developing countries the major special problem is the evaluation of capital gains because of the narrow markets for internal equities.

Equation (29) is the tax function (net of transfers). For developed economies the major complication behind this simple representation often is the treatment of the corporation income tax. Therefore, income from capital is included as an argument in this function in addition to total personal income.

In developing economies the tax equation is more complex. (i) The traditional sector is not monetized. (ii) Within the modern sector wages represent a smaller function of output than in developed countries, making withholding difficult. (iii) Literacy is relatively low. (iv) Systematic accounting systems are not widely used. (v) The legitimacy of government revenue collection is less widely accepted and

the tradition of voluntary compliance is less strong. (vi) Lack of resources, low civil service pay, and traditional social relations often make efficient and honest tax collection very difficult.

As a result, the relative importance of alternative sources of tax revenues differs from patterns in developed countries. General personal and corporation income taxes are much less important. Instead dependence is greater on import and export taxes, indirect taxes, and taxes on income generated by foreign-owned corporations. Taxes related to the foreign sector are much more significant because generally they are relatively simple to administer and more difficult to evade. This greater dependence on the foreign sector adds to the difficulties of stabilizing these economies because balance of payment considerations may conflict with the use of taxes for stabilization purposes. The more regressive nature of the tax structures with its greater dependence on indirect taxes, moreover, implies less "automatic stabilization" from the tax system than in more developed countries. Thus it might be appropriate to disaggregate the tax system (see Behrman [1976b] for example).

Equation (30) is the government budget constraint that Christ (1968) and others emphasize repeatedly. In a closed economy or in an economy with balance of payments equilibrium, this relation need not appear explicitly. The model already contains the private sector accounts and a full recording of transactions between the private and government sectors. If the private sector accounting identities are satisfied, so also must be those for the government sector, and the model is a closed system. However, as alluded to above, and as discussed in the Panamanian model, the question of the appropriate way of closing the model is important when output and demand functions are estimated separately. Models based on developed country experience seem to use inventories as the slack variable while those dealing with more open economies and fixed exchange rates tend to use the balance of payments deficit.

The model of Table 1-1 for the developed economies is presented on a very aggregative level. Actual empirical utilizations of such models often are on a more disaggregate level. The frequently encountered hypothesis that a major source of inflation in the United States and in some of the other more developed economies is the combination of sectoral shortages with short-run rigidities points to the need for at least some disaggregation.

For the developing countries, we have already discussed the need to separate the labor market. In addition, Hansen (1973b) argues that disaggregation is much more important than in developed countries since much of the direct policy impact is on relative prices. The

estimation of Chilean sectoral relations (Behrman [1976b]) provides support for this claim. There is a great deal of heterogeneity across sectors in technological substitutabilities and in both the degree and the time path of behavioral responses to economic variables. Relative prices play major roles in both short-run and long-run resource allocation decisions. Both capacity utilization and capacity creation decisions respond significantly to these prices. Possibilities for substantial increases in capacity utilization and for factor substitution do exist.²⁸

To ignore the role of the price system and these other characteristics when conducting analysis and giving policy presumptions, therefore, may be costly in terms of foregoing the use of some policy tools, overemphasizing the role of "key factors," and creating incentives for misallocations. And yet the dominant macroeconomic frameworks utilized for analysis of development problems for the most part assume that these factors can be ignored. For example, in the Chilean case, ODEPLAN (*Oficina de Planificación Nacional*, National Economics Planning Office) has utilized relative rigid fixed-capital-coefficient and/or foreign-exchange-saving gap models as the basis for planning and prediction.²⁹ On the other hand, policy tools have included price ceilings, quantitative restrictions on international trade and on credit, and multiple exchange rates at overvalued levels.

2.6 The Effects of Macroeconomic Policy in Models of Income Determination

To explain how the developed and developing country models work, as well as to obtain a qualitative simulation of the impact of policy variables, it is useful to consider two hypothetical experiments, an unexpected increase in the money supply and an increase in government spending, and trace out their effects on the major variables in the system.

In the developed country model, an increase in the stock of money, realized through the open market purchase of government bonds (equation [30]), tends to change interest rates (equation [14] and equation [16]). To the extent the cost of capital falls, it stimulates demand for investment goods (equation [7]). (We neglect the foreign sector, changes in taxes, and any possible wealth effects from a change in the ratio of money to bonds.) Demand for labor and output rise, stimulating second round demands of households, government, and investors (taxes also rise, which may have second-order effects on government bonds and private wealth). Unemployment falls (equation [1] and equation [2]) and prices rise because of the direct effect of unemployment (positive in equation [4]) and the

indirect effect on wages (equation [3]) and prices (equation [4]). The extent of the price rise, relative to the rise in output, depends on the ratio (lagged?) of aggregate demand to the labor force.

An expansion of government demand, financed through bond sales, raises demand directly (equation [8]) and indirectly (equations [30] and [6]) through the second-round output-income effects. (We again neglect the foreign sector, changes in taxes, and changes in wealth.) The rise in bond sales raises interest rates and reduces investment, partially offsetting the increase in government spending. The fall in unemployment (equations [1] and [2]) has positive, direct, and indirect effects on prices (equations [3] and [4]).

In the developing country model it is difficult to separate monetary policy from government spending because there are no organized financial markets in which to buy or sell bonds.³⁰ Aside from the use of government spending, about the only practical way to increase the money supply is through changes in bank reserves or central bank credits. In all three cases the effects of changes in money tend to be concentrated in certain sectors and affect their second-round spending directly, owing to previous credit rationing, as compared to the more general effects of interest rate changes in developing countries. The more general effects of monetary policy in developing countries occur through such second-round spending of income recipients on local as opposed to imported goods and on local intermediate purchases by the favored industries. To the extent that the favored industries and their suppliers are close to "capacity" and fixed exchange rates are maintained, relative prices tend to change and/or imports and capital flows tend to vary, weakening the general impact of monetary policy on domestic output. In particular, in the Panamanian case, the effect of increases in nonagricultural credit or money was quite small although positive.³¹ While coordinated variation in effective, exchange rates would permit greater independence in monetary policy, the necessity of their coordination with monetary policy reduces the number of completely independent instruments.

Fiscal policy in developing countries is closely related to monetary policy, again because of the narrow financial markets. Variations in government spending, financed locally through variations in bank holdings of government debt, tend to cause inverse variations in credit that "crowd out" other local credit demand and produce offsetting effects in investment. On the other hand, variations in government spending, financed through foreign borrowing that does not bid up local interest rates, have a two-pronged effect through their indirect effect on reserves and money as well as their direct effect on

spending. The Panamanian model seems to indicate the "crowding out" effect or capacity constraints are quite important.

In developing economies both monetary and fiscal policy have their greatest effect on the modern sector. Their effect on the traditional sector occurs through variations in relative prices and in rural-urban migration rates. The greater the gap between (expected) wages in the city and the average labor income in the country, the smaller is the variation in relative prices and the greater is the variation in migration rates. Thus, in a special sense, the rural sector also acts as a capacity constraint that affects the division of changes in aggregate demand between price and output effects.

2.7 Conclusions: Some General Points in Income-Determination Models and Short-Term Policymaking in Developing Countries

While conditions vary substantially across countries and modeling of certain aspects of the developing countries remains rudimentary, several important general points or questions about income determination processes and countercyclical policy have appeared in our discussions.

(1) Supply variations in the traditional sector may cause cyclical variations while countercyclical policies mainly affect the modern sector. More general policy tools must be developed to affect both sectors.

(2) If the traditional sector determines the real wage for the modern sector and there is no money illusion, then the modern sector labor market is very classical. Increased aggregate demand will not raise equilibrium employment and production although they will affect these variables when urban unemployment is abnormally high. Decreases in aggregate demand will lower urban employment and slow migration. However, much research remains to be done on the determination of labor's income in the traditional sector and its relation to urban wages through migration.

(3) Changing international conditions and/or variations in government policy seem to be responsible for most of the cyclical fluctuations in developing countries, as opposed to the traditional view expressed in developed country models that investment is the key.³² In addition to the oft-described direct and multiplier effects of changes in world prices of exports or imports, variations in world prices tend to have indirect effects through variations in international reserves and, correspondingly, the money supply. Government policy may respond to reserve losses and variations in conditions in the ex-

port and import competing industries; in addition, variations in external financing may force variations in monetary emission. Variations in prices of noncompetitive raw materials and intermediate import may cause short-run fluctuations through either supply limitations or reduction of demand in other sectors. Finally, attempts to maintain disequilibrium exchange rates may lengthen the period of adjustment to external disturbances.

Given the importance of the foreign sector in generating cyclical fluctuations, some effort should be devoted to ensuring its correct specification in the income-determination model. The various policies to reduce its impact should be closely studied and some effort made to direct stabilization policies toward it. Some attempts have been made in this direction, both on the level of individual countries and in cooperation with other countries. However, stabilization problems often are viewed as less important than objectives such as growth and distribution. If a temporary foreign exchange surplus is available because of an export boom or increased capital inflows, for example, pressures are enormous to utilize it to alleviate other problems. Only rarely do governments find it feasible to conserve such an excess for use when the next foreign exchange deficit occurs. Only when such governments are convinced that the costs to these fluctuations are large or that there are gains in other policy dimensions of increased stabilization are more resources likely to be utilized for stabilization purposes.

(4) The international capital market does not limit stabilization options in developing countries by fixing domestic interest rates.³³ This is so because of the existence of Bransonian noninternationally traded assets, because of quantitative restrictions and exchange rate variations that break the link between international and domestic markets, and because of variations in risk premiums as international debts vary relative to national product.

(5) Stabilization policies are limited by international creditors, by the lack of integrated and well-functioning financial markets, and by the offsetting response of international reserves to domestic credit expansion. The last limitation is, of course, true only under fixed exchange rates, and monetary policy would be "more independent" under flexible rates. However, exchange rate and aggregate demand policies are too often treated as independent policy investments.

(6) The partial equilibrium evidence of substantial technological and behavioral flexibilities suggests that models that assume too great rigidities (see the introduction) may distort the perceived choice set and overemphasize the importance of "key" factors. The partial equilibrium evidence of significant substitution possibilities and price

responses suggest that macropolicies might have significant impact on aggregate variables. However, general equilibrium simulations of the Chilean model and particularly the Panamanian model indicate that these policies may have much less aggregate impact than partial equilibrium analysis might suggest, owing to overall resource constraints and indirect effects (such as those transmitted through the money supply-foreign exchange-price nexus).

A great deal of the effect of macropolicies also depends on the size of and behavior within the traditional sector as well as relations between conditional and modern sectors and the ratio between aggregate demand and existing capacity, factors that are not well described in existing models.

(7) Both the partial equilibrium and the general equilibrium analyses lend support to Hansen's (1973b) emphasis on the need for disaggregation to capture relative price effects. The estimated partial equilibrium relations are quite heterogeneous across sectors in regard to technological possibilities, behavioral responses, and patterns of adjustment. The general equilibrium simulations suggest that policies may have much greater impact on the composition of aggregates than on their size, especially when the economy is near its capacity as defined by existing institutions and behavior. To what extent institutions and behavior of individuals and policymakers should be taken as given remains a special dilemma for those who would venture into the tangle of income-determination models of developing countries.

NOTES

1. Examples include Adelman and Thorbecke (1966), Blitzer, Clark, and Taylor (1975), Cabezon (1969), Chenery and Strout (1966), Clark and Foxley (1970, 1973), Eckaus and Parikh (1968), Manne (1974), UNECAFE (1960), and UNCTAD (1968).

2. "Socially optimal" is used here not to imply the incorporation of externalities, but to mean the maximization of an objective function, given constraints imposed by the model, starting and terminal conditions, and exogenous variables. Some aspects of behavioral responses are incorporated in these studies, such as the sectoral pattern of income elasticities for private consumption.

3. Rao (1952) presents an early statement of this view. Ranis (1974) gives a recent summary.

4. For good summaries of the "structuralist-monetarist" debate, see Campos (1964) and Wachter (1974).

5. Behrman (1968) summarizes many of the estimates that relate to agricultural supplies. Morawetz (1974) gives references for a number of studies of elasticities of substitution. Behrman (1971a, 1972a, 1972b, 1972c, 1973a, 1973b, 1973c, and 1976b) and Behrman and Garcia (1973) present sectoral estimates for the Chilean experience.

6. Beltrán (1974) summarizes the features of many of the Latin American models. Larry Lau (1975) has compiled a bibliography of 200 such models of which 50 relate to Latin America.

7. For example, R. French-Davis (1973) shows that the Chilean Klein-Saks stabilization program was originally thought to have failed when inflation doubled in 1958 but reestimates show the rate was approximately constant over the 1957-1958 period. While the social costs of this stability also may have been judged too high, the facts of the case were substantially different from those that went into the original evaluation.

8. See Zarnowitz (1967), for example.

9. See Behrman and Vargas (Chapter 2, this volume) for an attempt to develop and use such data bases in constructing quarterly models of developing countries.

10. See Barro and Grossman (1976) for a theoretical framework of supply as well as demand restraints that determine income for an economy that is not in general equilibrium. Howard (1976) finds support for the Barro-Grossman hypothesis regarding supply constraints in a controlled economy.

11. Many of the studies previously mentioned attempt to correct one or two of these shortcomings. Nevertheless, the list of shortcomings in any specific study generally is quite large. For example, Corbo's (1971) well-known study of Chile considers the problem of an endogenous money supply and includes supply constraints, but it does not avoid most of the other shortcomings listed in the text. Moreover in the simulations of that study, because of convergence problems, excess demand is exogenized so that there is no link between monetary and real variables or the money supply and prices.

12. See Barro and Grossman (1976) and Behrman (1976b).

13. The movement toward putty-clay considerations in the macroeconomic literature for developed economies lags substantially the emphasis on ex post fixed proportions for the modern sector of the less developed economies. Eckaus (1955) provides an early statement regarding less developed countries.

14. The discrepancy between the marginal products in the two sectors obviously leads to static inefficiencies.

15. The average share per laborer sometimes is assumed to be fixed by tradition until withdrawal of surplus labor raises the marginal product in this sector to that prevailing in the modern sector, when market behavior begins to dominate the economy (Fei and Ranis [1964]).

16. Harris and Todaro (1970) attribute a certain minimum level of urban unemployment to the existence of government or unions, which establish fixed wages. They claim that rural-urban migration occurs as long as the expected income (taking into account both the higher modern sector wage and the probability of obtaining employment) exceeds the average labor share in the traditional sector. The result is an equilibrium level of open employment or disguised unemployment in the cities, which persists as long as government or unions maintain a differential between the traditional sector's average labor share and the modern sector wage.

17. Interest rates might also enter so the model need not be completely dichotomized.

18. Suppose that production functions in both sectors are subject to constant return to scale and for simplicity that individual returns in the traditional sector are equal to the average product of labor. For given capital stocks in the two sectors there is only one labor allocation that equates the marginal product in the modern sector and the average in the traditional and "employs" all of the labor force. If unemployment in the urban sector is permitted, then a single "equilibrium" level of unemployment will be determined unless the elasticities of labor "demand" schedules in the two sectors have a very particular configuration.

19. Fei and Ranis (1964) claim that it may be difficult to use the rural surplus for development if rural labor incomes do not remain at the traditional level and prices of rural goods tend to rise. See also Hymer and Resnick (1971).

20. The theoretical question also remains as to whether privately held government bonds should be counted as private wealth. See Barro (1974).

21. See Gomez and Schlesinger (1971) for an attempt to estimate family net worth in Colombia.

22. Díaz Alejandro (1977) reports 75 percent of investment of Colombian machinery and equipment was imported in 1975.

23. If the availability of foreign capital inflows (both official and private) directly or indirectly affects investment (e.g., see Areskong [1974]) they should be included in the model as part of a reduced form of the investment equation and through spillovers of frustrated demands in the consumption-saving function. The theoretical framework for modeling such spillovers might follow Barro and Grossman (1976).

24. In some developing economies considerable smuggling exists in attempts to avoid these policies.

25. See Bruton (1969) and Musalem (1971).

26. Noncoffee exports grew from \$177 million or approximately 25 percent of exports in 1966 to \$671 million or 55 percent of exports in 1974 or over 28 percent per year. While Calvo and Escandón (1973) and Cabarrouy and Spillane (1974) attribute much of the growth up to 1969 or 1971 as simple maintenance of market share, one must point out that market share would not be maintained without appropriate incentives to export, that is, conversion of the world price into an appropriate local currency value.

27. Borts and Hanson (Chapter 9, this volume) discuss the extent to which this view is correct with some empirical results for the Panamanian case.

28. Estimated sectoral elasticities of substitution between capital and labor range from 0.0 to 0.9. The adjustment periods for substitution between primary factors are fairly long in several cases in which the long-run elasticities are high. For most sectors in the short and medium runs, therefore, the results provide some support for the assumption of limited flexibility that underlies Eckaus's (1955) technological explanation of the existence of under- or unemployed labor, the structuralist analysis of inflation, and the use of fixed coefficients in input-output-based models. Limited flexibility, however, is not the same as no flexibility. Some primary factor substitution apparently is always possible in response to real relative price changes.

29. For example, see Harberger and Selowsky (1966) or ODEPLAN (1970).

30. The lack of markets may reflect government attempts to sell bonds at low, fixed rates of return to banks as well as the stage of development.

31. See Behrman and Vargas (Chapter 2, this volume) and Borts and Hanson (Chapter 9, this volume).

32. But see Friedman (1965) and Okun (1970).

33. Macroeconomic theory suggests that fiscal policy would retain its potency under fixed rates; it is only the effectiveness of monetary policy that is questioned. See Mundell (1968).

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