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HOW MONEY MATTERS
IN AN OPEN DEVELOPING ECONOMY:
A CASE-STUDY OF JAMAICA, 1962-71

by

Keith LeVere Worrell
B.Sc., University of London, 1970
M.Sc., University of London, 1972

A THESIS SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
DOCTOR OF PHILOSOPHY
in the department
of
Economics and Commerce

SIMON FRASER UNIVERSITY
August 1979

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How Money Matters in an Open Developing Economy: A Case-Study of Jamaica, 1962-71.

Abstract

According to modern theory of the balance of payments, continuing payments deficits are the result of an excess of domestic expenditure (absorption) over national income which in turn is caused by a continuing excess of the money supply over the demand for money. Two types of remedies are proposed:

(1) Expenditure reduction through a reduction in the supply of money;

(2) Income expansion through structural changes in the economy.

A corollary of this view is that persistent balance of payments deficits are due to irresponsible monetary policy.

On the other hand, Linder's theory of trade for developing countries, which is outlined in Chapter I of this thesis, argues that developing countries must pass through a phase during which they import more than they can export. Linder calls these imports necessary imports. During this phase neither of the two remedies that are proposed by modern balance of payments theory will be effective. This means that there is no satisfactory theory of the balance of payments for developing countries. This dissertation attempts to fill this lacuna.

The thesis has the following distinguishing features:

(i) It uses Linder's theory of trade for developing countries to support an absorption model of the balance of payments. This offers a structural explanation of persistent payments deficits in developing countries. It is argued that these

persistent deficits do not always reflect irresponsible monetary policies.

(ii) It undertakes an empirical examination, via an econometric model of a 'representative' developing country, namely, Jamaica, in the period 1962 to 1971 using the model defined above. The link between the money supply, domestic absorption and the balance of trade which is discussed fully in Chapter III is estimated in Chapter IV.

A by-product of the model is that it permits the estimation of the demand for money function and the capital flows function in a simultaneous equations system. Single equation models of both these functions have been criticized for ignoring possible simultaneous equation bias.

Finally, the lag of the stock of high-powered money is in the model as a pre-determined variable. Impact multipliers with respect to this variable allows us to do some rudimentary policy analysis.

DEDICATION:

To

Catharina, Yvanne, Karen,

and humbly to

Pallas

"The incomputable does not exist."

J.W. von Goethe

Faust Part II Act I

translated by W. Arndt

ACKNOWLEDGEMENTS

I wish to acknowledge the help of some of the many people who contributed to the completion of this little work.

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I was particularly fortunate to encounter as a fellow graduate at Simon Fraser, Dr. Bharath. He became both a loyal friend and an astute mentor.

Many of the ideas developed in my thesis were first presented to me at the School of Oriental and African Studies, University of London. Among the faculty, A.P.E. Ayre, T. Byers, C. Howe and M. Hodd deserve special thanks.

The last stages of the work on the thesis were carried out during the period that I was a research fellow at the Institute of Social and Economic Research, University of the West Indies, Mona, Jamaica. Dr. Vaughn Lewis, the Director, and Dr. Compton Bourne, Head of the Monetary Studies Programme, did much to aid the completion of the thesis.

My wife, Catharina Kooman, gave me every possible support, including the typing of this final draft.

Perhaps all the forementioned should be regarded as a composite input to a Leontief Production Function. I was the limiting factor.

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Chapter 1 Introduction and Literature Survey

In this dissertation I introduce a monetary model of open developing economies which attempts to synthesize features from: (1) standard balance of payments theory; (2) economic development theory; and (3) the modern theory of international capital movements.

Since most of the countries of the third world have open developing economies, and since relatively little attention has been given to the monetary consequences of the interaction between economic development and balance of payments adjustments in these economies, this model could have fairly wide appeal.

However it has been formulated specifically to analyse the monetary sector of the Jamaican economy and a quarterly version is used to study that country during the first ten years of its existence as a sovereign state, the period 1962-1971.

This period coincides almost exactly with the last decade of the Bretton Woods fixed exchange rates system. This combined with the fact that Jamaica is a prime example of a small open economy makes it convenient to test some of the hypotheses of the monetary approach to the balance of payments. This approach, and also the absorption approach to the balance of payments are discussed at some length in this chapter.

The approach to development that I use is based on Linder's (1967) theory of trade for developing countries. This theory also is outlined in some detail in this chapter. A discussion

of the modern theory of international capital movements is deferred to Chapter III where it is introduced in the context of one of the behavioural relationships in the model.

Features from the forementioned areas of economic theory are integrated into a realistic account of the Jamaican economy. This account is encapsulated in a small simultaneous equation model which contains six behavioural equations that are estimated by the method of two stage least squares.

This chapter continues with an outline of Linder's (1967) contribution to the theory of economic development.

Linder's Theory of Trade for Developing Countries

Linder (1967) describes a group of countries which though "they have all the usual characteristics of underdeveloped countries, also have a reasonable chance of a self-sustained growth process which will eventually turn them into advanced economies." He then postulates that "the characteristic effect of trade on such countries (is that) fully to utilize their existing resources and their growth potential they require certain imports that it may prove impossible to acquire through exports of equal value. The simultaneous establishment of internal and external equilibrium is thus not possible." (p.9)

The crux of Linder's argument is that there is in value terms an import minimum and an export maximum for developing countries. This argument implies that their development

into advanced economies could be subject to a binding foreign-exchange constraint. Since this notion has been the subject of some controversy in the past, I will discuss the general concept of a foreign-exchange constraint before I continue my description of Linder's (1967) theory.

The notion of a foreign exchange constraint on economic development was first broached by Chenery and Bruno (1962). It was later formalised by McKinnon (1964) and Chenery and Strout (1966). The analysis takes off from two assumptions about a developing country's aggregate production function. These are that it is characterised by: (1) a fixed capital-output ratio; and (2) a fixed import-output ratio. Total investment therefore consists of imported inputs, MI, and domestic inputs, D, which are complements. Formally we have

$$\Delta Y = \min(\theta_1 \Delta MI, \theta_2 \Delta D) \qquad 1.1$$

where θ_1 and θ_2 are positive constants. Additionally it is assumed that growth takes place according to the Harrod-Domar formula

$$\Delta Y/Y = s(\Delta Y/I) \qquad 1.2$$

where I is investment and s is the average propensity to save. $\Delta Y/I$ is, of course, the incremental output-capital ratio.

Examination of equation 1.1 reveals that utilization of an additional unit of domestic inputs requires that imported inputs must increase by θ_2/θ_1 so that total investment must

increase by $(\theta_1 + \theta_2)/\theta_1$. This will cause output to rise by θ_2. The incremental output-capital ratio can therefore be written as $(\theta_1.\theta_2)/(\theta_1+\theta_2)$. Notice that this whole expression approaches θ_2 as θ_1 approaches infinity. In this extreme case the only binding constraint on economic growth is the availability of domestic inputs. This is the original Harrod-Domar closed economy case. Conversely as θ_1 approaches zero, imported inputs tend to be the binding constraint. Linder (1967) suggests that the latter case reflects the situation in developing countries.

A number of objections to this type of analysis have been raised. In general these aim to deny the possibility of an independent foreign-exchange constraint, or an import-export gap that is separate from the investment-saving gap. Consequently the approach is sometimes called the dual-gap hypothesis. These critics frequently question the realism of the empirical assumptions that support the production function in equation 1.1. Lal (1972) has summarised these objections. He writes:

> Three assumptions relating to the transformation possibilities (between current consumption and future consumption) open to the economy must hold simultaneously in such an economy for there to be a foreign-exchange constraint which is independent of a savings constraint to increasing future output of (domestic goods). First along any isoquant, the technology does not permit any substitutability after a point, of domestic for foreign inputs in the production of (domestic goods). Second, the domestic rate of transformation of (domestic goods) into (imports) is zero... Third, the foreign rate of transformation of (domestic goods) into (imports) is zero after a certain stage, for movements along the foreign-offer curve.

In Linder's (1967) model these assumptions are explicit. It is easy to see that if any one does not hold, a separate import-export gap cannot be shown to exist. If there is substitutability between domestic and foreign inputs, a shortage of imports can be counteracted with an expansion of domestic inputs. So that if export earnings were not enough to purchase a given set of imports, it would be sufficient to expand domestic savings by the amount necessary to acquire the domestic substitutes for imported inputs. In other words, since by definition $M - X = I - S$ where M is imports, X is exports, I is investments and S is savings, a rise in M holding X and I constant can be counteracted by an equal rise in S. According to the same reasoning, if import substitution in the domestic capital goods industry is possible a short-fall in actual imports can be compensated by the expansion of domestically produced import substitutes. Finally, if the economy can always acquire through trade sufficient imports to meet its production requirements, the whole problem becomes trivial. The validity of Linder's (1967) argument can therefore be seen to depend upon how closely equation 1.1 approximates production possibilities in a developing country.

A paper in which Joshi (1970) counselled against the misuse of the dual-gap hypothesis, domonstrated that if we made the customary neoclassical assumptions, and further assumed a planners' indifference curve, then a strict foreign exchange gap would require that planners did not value present

consumption at the margin. It should be noted that this condition is not inconsistent with the famous Mahalonobis (1953) planning model, parts of which, are attractive to many third world policy makers.

In a recent retort to the critics of the dual-gap hypothesis, Thirlwall (1967, pp.14-15) says the following:

> While the criticisms are well taken, there are two important defences of dual-gap analysis. First, factor proportions may be slow to adjust, and substitution between foreign and domestic inputs may be a long drawn-out process. If so, the traditional policy conclusions of dual-gap analysis remain valid,... if foreign exchange is the dominant constraint, attempts can be made to use "excess" saving for export promotion or import substitute activities. Countries in this situation may, however, run up against what Linder has called an export maximum,... If there is an export maximum, and domestic and foreign inputs are not easily substitutable the conclustions of dual-gap analysis cannot be lightly dismissed. (emphasis mine)

Thirlwall's (1974) remarks lead us back to the discussion of Linder's (1967) theory. This explicitly assumes that the production function in equation 1.1 is a characteristic of developing countries. We saw earlier that in that equation, the value taken by θ_1 helps to determine if the economy will experience a foreign-exchange constraint. Specifically if θ_1 is equal to infinity there is no independent foreign-exchange constraint. In this unlikely case, the capital-output ratio is the domestic capital output ratio. However, whenever θ_1 is less than infinity there is by definition an import minimum.

According to Linder (1967) this import minimum will typically exceed the export maximum of a developing economy during the stage of its structural transformation.

Since it is much easier to demonstrate an import minimum than it is to demonstrate an export maximum, I shall deal first with the former. Linder's (1967) theory draws a distinction between two kinds of imports; one for which there could be domestic substitutes, and the other for which there could be none. The set of imports for which there are no feasible substitutes consists of what he calls expansion imports and what he calls maintenance imports. The former are required to start the process of economic development. This is the stage at which the economy starts a transition from being underdeveloped to being advanced. During this transition it is necessary to service original imported equipment with further imports. These Linder (1967) calls maintenance imports. An economy that acquires expansion imports but is unable to afford maintenance imports is likely to exhibit excess capacity and domestic inputs initially employed as complements become idle again.

An import minimum poses no problems for a developing country when the value of its exports and capital flows is sufficient to cover the value of its necessary imports. However, development theorists claim that a foreign exchange constraint exists whenever the value of necessary imports exceeds the maximum possible value of the country's exports.

This constraint may be released by capital flows. But reliance upon capital flows to release a foreign exchange constraint places a country in a vulnerable position. An export maximum is therefore an important parameter for a developing country.

The possibility of an export maximum is disregarded in neoclassical trade theory; according to which, a country can continue to increase the exports of any commodity for which it retains a comparative advantage in production. Linder's (1967) demonstration that this proposition is false, is perhaps one of the major contributions to economic development theory made in the last two decades. He shows that a country may have a comparative advantage in the production of some commodity but be unable to gain a positive value-added from exporting it. This is because the Hawkins-Simon condition may not be met. In other words, the value of imports necessary to produce a unit of exports may be greater than the value of imports that can be earned from that unit of exports at the given terms of trade. That is in equation 1.1 θ_1 is less than unity.

Linder (1967) is not unaware that this proposition is somewhat counter-intuitive, so he is careful to support it with a highly plausible hypothesis about the cause of international trade in manufactures. This is the theory of "representative demand" which states that "a country is most efficient in the manufacture of goods that fit into the economic structure of (its) domestic market." What this supposes is that the entrepreneurs of a country in which a

certain commodity is generally consumed, acquire a degree of expertise in its manufacture, that is not shared by entrepreneurs in whose domestic market the commodity is not traded. He explains the role the theory of "representative demand" plays in establishing his version of a foreign-exchange constraint this way.

> There is great importance in having a theory which allows exports difficulties independent of internal policies. It is made possible by the theory of representative demand, which also, and equally significantly, shows that a developing country must somehow pass through a stage of development plagued by foreign trade difficulties, in order to become able to export manufactures. Without such a theory, discussions of a "foreign-exchange" constraint amount to nothing more than a string of arguments based on a peculiar assumption in direct conflict with the comparative-cost theory.(p.41)

The theory of representative demand, therefore, helps to explain why a developing country may earn a negative value-added from its exports. However, it is important to understand that Linder (1967) sees this as only a transitory phenomenon. In time the structure of the economy is sufficiently transformed for it to have an adequate range of exportables that fit into the structure of its domestic market. It then enjoys the normal benefits of international trade. However, during the period of transition, if a developing country attempts to invade the market for manufactures in an advanced economy it will incur severe difficulties. Therefore as far as manufactures are concerned a developing country is likely to face an export

maximum. When it comes to primary exports of developing countries, Linder (1967) relies on the tendency of these products to be characterised by a relatively price inelastic demand to establish his argument about an export maximum. Altogether his views that a developing country is likely to face an export maximum in value terms is very convincing.

For any given time, whether or not the import minimum exceeds the export maximum, is an empirical matter. But whenever this happens there will be a foreign-exchange gap which in the absence of compensating capital flows will prevent the simultaneous achievement of internal and external balance. My thesis explores the monetary consequences of one of the strategies that a developing country, which finds itself in this position, might pursue.

In a study discussed further on in this chapter, Harris (1970) suggests that the Jamaican economy became subject to a binding foreign-exchange constraint sometime between 1959 and 1961. This makes it appear worthwhile to use Linder's (1967) work to help analyse the Jamaican economy between 1962 and 1971. The way I incorporate Linder's (1967) analysis into my thesis enables me to (a) give a reason why a balance of payments deficit may arise in a developing country, and (b) why the fiscal and monetary authorities may attempt to obstruct the self-correcting tendencies of a balance of payments disequilibrium under a regime of fixed exchange rates. My next

step is to link Linder's (1967) theory to modern balance of payments theory.

If following Chenery and Strout (1966) we approximate the foreign-exchange gap by the excess of gross domestic investment over gross domestic saving, it is easy to show by use of the Keynesian income identity that the negative of this gap is equal to the balance of trade, which is identically equal to the excess of aggregate expenditure over gross domestic product. That is, by definition

$$S - I = X - M = Y - (C + I + G) \qquad 1.3$$

where S is gross domestic saving, I is gross investment, X is exports, M is imports, Y is gross domestic product, C is gross private consumption and G is government expenditure. This identity is a natural nexus between Linder's (1967) theory and balance of payments theory.

The Absorption Approach to the Balance of Payments

Meade (1951) was the first to show clearly that the excess of expenditure over income was important for explaining post-war balance of payments problems in the advanced economies. His model was further developed by Alexander (1952) and later named the absorption approached.[1]

If following Alexander (1952) we call the term in brackets on the right-hand side of equation 1.3 absorption, we can write

the equation for the balance of trade as

$$T = Y - A \qquad 1.4$$

where T is the balance of trade, A is absorption and Y is as previously defined. It now becomes clear that a deficit (surplus) on the trade balance is associated with a rise (fall) in absorption relative to domestic product. However, equation 1.4 is really an identity. By itself it says nothing about the direction of causation between the trade balance and the excess of absorption over income. Nonetheless, Meade (1951), Alexander (1952) and later Johnson (1958) all stress the fact that whichever the direction of causation, correction of an adverse trade balance requires the lowering of absorption relative to domestic income. In this connection the last named introduced to us the now famous expressions, expenditure reducing and expenditure switching. It will be recalled that an early insight from the absorption approach was that a country which was running a trade deficit and attempted to correct it with import restrictions would succeed only if the frustrated import demand was not diverted to domestic demand.

In general, absorption theorists go further. They suggest that absorption is a function of income and that a trade imbalance is the consequence of a divergence between income and absorption. One possible specification of their model is

$$A = f(Y) \qquad 1.5$$

$$f > 0$$

$$T = g(A/Y) \qquad 1.6$$

$$g < 0$$

The chain of causation suggested by the absorption approach therefore seems to be

$$Y \rightarrow A \rightarrow T$$

which may be regarded as an extension of the Keynesian model to the conditions of an open economy.

An obvious weakness of this theory is that it does not explain the cause of the divergence of A from Y. However, it will be shown below that Linder's (1967) theory suggests an adequate explanation for this divergence in the case of developing economies. Another omission in the absorption approach -- its failure to examine monetary stock adjustments associated with trade imbalances -- serves as a point of departure for discussing the monetary approach to the balance of payments.

The Monetary Approach to the Balance of Payments

The origins of the monetary approach to the balance of payments go back to Cantillon (1964) whose work first appeared

in 1755. But the recent resurgence of interest in it appears to stem from two intellectual traditions. One is Anglo-Saxon (mainly Chicago); the other is European (mainly Dutch and Swedish). Both deserve mention.

It is clear that the absorption approach analyses trade imbalances as flow disequilibria. It does not treat explicitly the apposite adjustments that take place in response to these flow disequilibria. Johnson (1958) and Hahn (1959) were the first to extend the partial equilibrium framework of the absorption approach into a more general framework which takes account explicitly of the stock adjustment process induced by a trade imbalance. In doing so they brought out the monetary nature of the balance of payments.

Until their work appeared, the monetary aspect of the balance of payments had received little attention in the Anglo-Saxon tradition, since the publication of Robinson's (1937) seminal work which focussed on relative prices. In several papers published at the end of the 1950's decade, Johnson in particular attempted to moderate the emphasis on real causes of payments imbalances that characterised what I have called the Anglo-Saxon analysis of the balance of payments.

Since according to Johnson (1968) "A balance of payments problem is monetary in nature... and fundamentally related to the fact that the banking system can create credit," (p.18) it should be instructive to analyse an identity which defines

the consolidated balance sheet of the banking industry in an open economy. This approach is similar to that taken by Currie (1976) but I have chosen a simpler identity than the one he used which was intended also to illustrate certain peculiarities of the U.K. banking sector. We have

$$F + DO + L - CA = DE \qquad 1.7$$

where F is the stock of foreign exchange reserves in the system, DO is the stock of domestic assets held by the central bank, L is the volume of bank loans, CA is cash in the hands of the non-bank public and DE is the volume of bank deposits.

From equation 1.7 we derive the following definition for M^S, the money stock:

$$M^S = F + (DO + L) \qquad 1.8$$

The bracketed term of the right member of equation 1.8 is an expression for domestic credit, a variable that plays an important role in the monetary approach to the balance of payments.

Since this approach is about an adjustment process I rewrite equation 1.8 after taking first differences.

$$\Delta M^S = \Delta F + \Delta(DO + L) \qquad 1.9$$

The monetary nature of the balance of payments becomes readily observable when it is noticed that 1.9 implies that for a given stock of money a balance of payments deficit (surplus) is by definition associated with a rise (fall) in domestic credit.

It is now possible to state the essence of the monetary approach to the balance of payments. Under a fixed exchange rate regime, a balance of payments deficit or surplus represents a phase in a stock adjustment process in the money market and is necessarily self-correcting in the long run.

Some economists (for instance Currie (1976)) dispute that a balance of payments disequilibrium is intrinsically self-correcting in the long run. They argue that under certain realistic conditions the correction of a payments imbalance is essentially discretionary and automatic. I believe this dispute is largely a matter of semantics. However, let us see why monetary theorists of the balance of payments believe in an automatic adjustment of the balance of payments under a fixed exchange rate regime.

International monetarists assume (a) a stable long-run wealth expenditure relation and (b) a stable long-run demand for money function. It is easy to show that if these two assumptions are met and, additionally, the government balances

its budget, disequilibrium in the balance of payments will induce the private sector to act in such a way as to restore equilibruum without government intervention.

To see this, assume that from an original position of full equilibrium a balance of payments deficit emerges. This implies an excess demand for foreign exchange and requires the central bank to sell some of its stock of F. The right-hand side of equation 1.8 becomes smaller and this implies in the absence of sterilization a fall in M^S. Now by the assumption of a stable demand for money function there emerges in the private sector an excess demand for money. Eventually this sector reduces its expenditure, some of which reduction falls on imports. Also, some members attempt to sell some of their financial assets causing the interest rate to rise. The combined effect of these actions brings about a return to equilibrium in the foreign exchange market.

Suppose the monetary authorities choose to sterilise the fall in F. To do so in the context we are discussing implies that they buy domestic assets DO from the private sector. Complete sterilisation means that in equation 1.9 DO changes by the same amount as, but in the opposite direction to F. The assumption of a stable demand for money means that the private sector will use the income from the sale of DO to finance its purchase of F. The net result is a fall in private sector wealth equal to the amount of DO purchased by the

monetary authorities. Given a stable wealth-expenditure relation, there follows a fall in expenditure. Again some of the reduction in expenditure falls on imports and the automatic adjustment once more is set in train. So whether or not the initial fall in F is sterilised, given the above assumptions, if the government balances its budget, there is an inherent tendency for balance of payments disequilibria to correct themselves.

Another way to see this adjustment process is to recall that in the absorption approach a balance of payments deficit implies that aggregate expenditure exceeds aggregate income. As Johnson (1958) shows this implies that payments by domestic residents to foreigners exceed receipts from foreigners. Now given a constant supply of money, the only way that domestic residents can pay foreigners more than they receive from them is by running down their idle cash balances. However if there is a stable demand for money this dishoarding will cause actual cash balances to fall short of desired cash balances; and as we have seen, the attempt to restore cash balances to their desired level will set in motion forces that restore automatically the balance of payments to equilibrium. This way of looking at the problem indicates that the absorption (flow) approach implicitly assumes a monetary (stock) adjustment process.

So far the automatic adjustment takes place in situations of balanced government budgets. Currie (1976) criticises the

monetary approach for not making this assumption explicit. If the central bank should choose to sterilise the balance of payments at the same time that the government is running an unbalanced budget, it would be possible for the actions of the fiscal and monetary authorities to cancel each other and bypass the private sector. The automatic mechanism would then not come into operation.

This case is illustrated in figure 1 which is adapted from Kennedy (1974). The Hicksian IS-LM apparatus is augmented with an upward-sloping balance of payments (BP) curve. In general, whether the BP curve is flatter or steeper than the LM curve is an empirical matter. Here it is drawn flatter to reflect the assumption that in a developing economy the interest elasticities of capital flows and imports together exceed the combined interest elasticities of the demand for and the supply of money. At position A the economy is in a balance of payments deficit. This is shown by the intersection of the LM curve with the IS curve at a point below the BP curve, where income is too high and the interest rate is too low for a balance of payments equilibrium. In the automatic adjustment mechanism of the monetary approach the fall in the balance of payments induces action that leads to an excess demand for money. This is shown by the automatic leftward shift of the LM Curve to intersect the IS curve and the BP curve at position B. Equilibrium in the balance of payments is automatically restored by a stock adjustment.

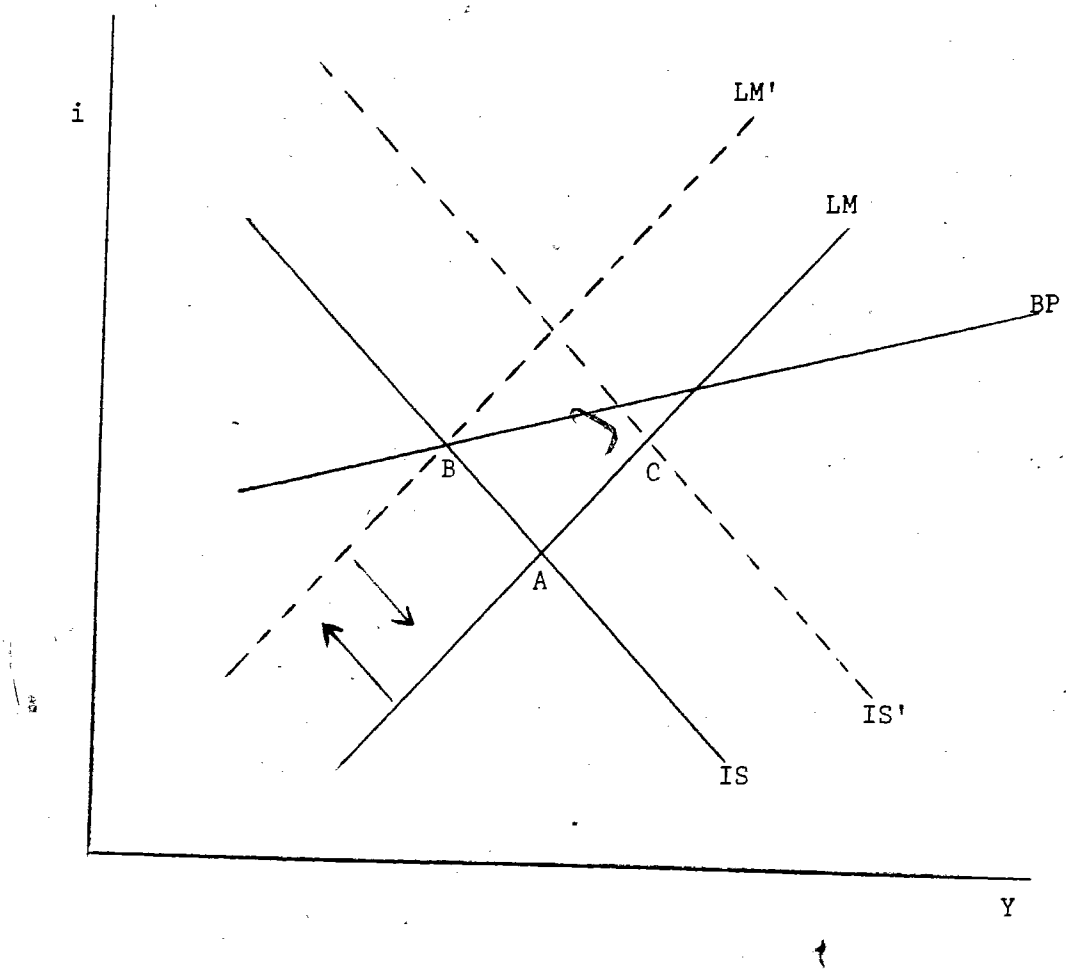

Figure 1

However, if the government now runs a permanent deficit equal to the balance of payments deficit and finances it with monetary expansion, it causes the IS curve and and LM curve to shift to the right. The LM curve shifts back from LM^1 to LM. The economy goes to a position like C where the balance of payments remains in deficit. The automatic adjustment mechanism ordinarily assumed in the monetary approach fails because the continual printing of money to finance the budget deficit in each period prevents the private sector from experiencing a fall in its stock of real balances, reaction to which experience triggers off the automatic mechanism. It is argued below that this case closely resembles what happens in the kind of developing economy outlined in Linder (1967). It should be noted that McKinnon (1969) anticipated Currie's (1976) treatment of this case.

In any case it is clear that if the balance of payments remains in deficit, the economy will eventually run out of foreign exchange. The approach of this predicament will force either a correction of the balance of payments deficit or the abandonment of the fixed exchange rate system. Whether we call the adjustment necessary to preserve the institutional framework we are discussing automatic or discretionary is largely a matter of semantics.

A much more substantive point made by Currie (1976) is that contrary to Johnson (1972) and Mussa (1974) expenditure

switching policies such as devaluation and the imposition of tariffs can have permanent effects on the balance of payments, if we make certain reasonable assumptions about the economy. An implication of this, not yet discussed in the literature, is that structural changes in a developing economy also can have permanent effects on the balance of payments.

However, the main relevance of the foregoing discussion to my thesis is that in the short-run or medium-run, a developing country that is absorbing more than it is producing in order to obtain necessary imported inputs, and which does not wish to curtail domestic expenditure, may continue to sterilise a balance of payments deficit without disturbing the wealth-expenditure equilibrium of the private sector. It may do so by running a corresponding budget deficit.

The monetary approach to the balance of payments helps us to understand clearly the long-run implications of this fiscal strategy. For example, it shows the advantage of having a large initial endowment of foreign exchange reserves before starting the "take off", or of having some institutional arrangement for financing the payments deficit before the reserves run out.

In the way it has been presented above, the monetary approach to the balance of payments appears as a paradigm change that took place after 1958. Also it is an approach that has come to be associated with a particularly conservative

ideology. However, this interpretation is true only for what I have called the Anglo-Saxon tradition. Dutch economists building on the work of Koopmans[2] developed independently a monetary approach to the balance of payments without ever rejecting the fundamental insights of the "Keynesian revolution". There is about their monetary approach an air of continuity rather than of paradigm change. This is how de Jong (1973) describes it:

> "The pursuit of Monetary Theory has never come to a complete standstill in the Netherlands, not even during the period when economists almost everywhere in the world were focussing on the income-expenditure approach of Macro-economics. There can be no doubt that the latter approach is extremely important, because it is directly related to the real sector of the national economy. There has, however, always been a group of Dutch economists who believed that, even in the post-Keynesian era, Monetary Theory would remain important and that it could shed some useful light on the income-expenditure approach and vice versa. These authors hold the view that the two theories are not exclusive but complementary." (p.1)

Later on, explaining the Dutch persistent interest in balance of payments adjustment problems he writes "Perhaps of still greater importance is the fact, that because the Netherlands' economy is extremely open to international influences... , the application of monetary theory to practical problems in the Netherlands has had from the start to take explicit account of external influences on the domestic

monetary situation." (p.3) This is in stark contrast to the position in the mainstream (Anglo-Saxon) literature described by Triffin and Grubel (1962) who were able to write: " The ghost of the 'closed economy' assumptions continues to dominate economic theory, even when discussing such 'open economy' problems as those involved in the international mechanism of balance of payments adjustments."

Koopmans' point of departure was Say's law which implies that money is neutral. However, Koopmans anticipated the Keynesian revolution in recognising that in general Say's law did not hold for a money-using economy. Nonetheless he felt it was important to demonstrate the conditions for money to be neutral in a monetary economy. Some thought had already been given to this and two schools had evolved. According to one, a necessary condition for the neutrality of money was a constant price level. The other school argued that it was the money supply and not the price level that had to be held constant. Koopmans was dissatisfied with both of these explanations and suggested instead that a criterion for neutral money was the absence of aggregate excess demand, which he called "pure" demand. He further argued that for a given money supply the only way "pure" demand could be financed was through dishoarding. So by this criterion there was neutral money when there was neither hoarding nor dishoarding.

Koopmans showed that in a closed economy zero net

hoarding occurred when spontaneous[3] saving and investment were equal. In an open economy things were a little different. The demand for money now had to be equal to the sum of both foreign and domestic monies in the economy. In this case zero net hoarding implies that the difference between "spontaneous" saving and "spontaneous" investment is equal to the difference between exports and imports broadly defined. This turns out to be no more than the open economy version of the Keynesian model.

Later Dutch economists extended these ideas in order to construct models of the Netherlands' economy which enabled them to distinguish between foreign and domestic sources of disequilibrium in the money market. A variant of these models that has gained wide acceptance, and which has been applied to several developing economies, including Jamaica, is due to Polak (1957).

In this section I have shown that the monetary approach to the balance of payments has two main sources. One of these is Anglo-Saxon and revolutionary; the other, mutato nomine, is European and traditional. The model I introduce in this thesis attempts to maintain the open economy emphasis that is characteristic of the monetary approach. But it also attempts to incorporate those features of a developing economy which may impinge on its adjustments to balance of payments problems. The foregoing discussion of Linder's (1967) theory suggests what some of these features are.

Monetary Studies of Developing Countries

This chapter continues with a survey of monetary and balance of payments studies of developing countries in general and of Jamaica in particular. In this survey, the first group of studies are about the existence of an independent foreign exchange constraint in a number of developing countries.

The seminal work in this group was by Chenery and Bruno (1962). This report on the problems encountered in Israel's economic development suggested that development might be constrained not only by the lack of domestic savings, as earlier writers had assumed, but also by the lack of ample foreign exchange reserves. A similar finding for Mexico was shortly thereafter reported by Manne (1963). In due course a number of studies were undertaken in various developing countries to see if economic development in these was constrained by a shortage of foreign exchange.

These case-studies almost invariably reported that the developing countries concerned experienced a foreign exchange constraint in pursuit of their desired rates of economic growth. In addition, a major study by Prebisch (1964) for the United Nations Conference on Trade and Development (UNCTAD) indicated that if developing countries as a group attempted a growth rate of five percent per annum for the whole of the 1960's decade, they would experience a balance of payments gap of $20 bil U.S. with a corresponding balance of trade gap of $11 bil.

This led UNCTAD to claim that unless these gaps were eliminated by foreign aid and improved terms of trade for developing countries, the hope for rapid economic development in the third world would be frustrated. This, they argued, threatened the peace of the world. It was against this background that Linder (1967) wrote, delineating carefully the necessary and sufficient conditions for a given country to experience a foreign-exchange constraint.

In the light of all this, a study by Stein (1971) aroused great interest when it claimed that (a) data up to 1966 indicated that developing countries might, through their own efforts, close the trade gap; and (b) in any case, the rate of growth of imports was not a significant variable in the determination of the rate of growth in developing countries. If the latter claim were true, it might imply that Linder's (1967) analysis was invalid.

However, a subsequent study by Agosin (1973) which reworked Stein's (1971) data uncovered serious statistical and analytical flaws in the latter's report. Stein (1973) accepted the corrections.

Agosin's (1973) study is important for my thesis for two reasons. First, it establishes quite unambiguously that economic growth in developing countries is positively correlated with the growth of imports. In the second place, it shows that, controlling for the oil producing and exporting

countries (OPEC), economic growth in developing countries seems to be associated with a worsening trade balance. Both these findings lend support to Linder's (1967) analysis on which my thesis is partly based.

The discovery that developing countries were likely to experience a foreign-exchange constraint happened at the time that Anglo-Saxon economists were rediscovering the monetary aspect of balance of payments disequilibria. It is therefore not very surprising that recently there has been a plethora of monetary studies of developing countries. However, these studies have been about a very limited range of topics. In a recent paper Park (1973) outlines the scope of many of these studies, which he says "basically attempt to resolve the following three issues: (1) the most appropriate definition of money; (2) the arguments that enter the demand function for money and (3) the statistical stability of the demand function for money over time." He goes on to summarise the main findings of these studies in the following way:

> There appears to be a general consensus that the most appropriate definition of money is a narrow definition that includes currency outside the banks and demand deposits. On the second issue, most of the empirical studies show that real income is the most important determinant of the demand for real cash balances, although the available evidence is rather conflicting on the magnitude of the real income elasticity of the demand for money.

> However, there is no conclusive evidence as to whether the demand for money is influenced by either long-term or short-term interest rates.

However, Park (1973) is dissatisfied with the quality of the attention that has been given to other topics in the monetary analysis of developing countries. He argues that "monetary analyses in LDCs require a structural model complete with a financial sector in the spirit of income/expenditure theory." To illustrate the kind of model that should be used to analyse LDCs, he constructs, but does not -- in the paper under discussion -- estimate, a simultaneous equation model of the "representative" open developing economy. An important feature of his model is that it integrates the foreign and domestic financial sectors in line with recent advancements in balance of payments theory.

Unfortunately, the data requirements for estimating Park's (1973) model is still beyond the resources of most developing countries, and at present, certainly beyond those of Jamaica. This suggests the need for an even more modest structural model, which nonetheless captures the salient features of an open economy. The model in my thesis is aimed at meeting that challenge.

The final section of this chapter deals with how some of the topics discussed above have been dealt with in that sub-set of economic literature, that is about the Jamaican economy.

Monetary Studies of the Jamaican Economy

An early paper in the monetary analysis of Caribbean economies, which include Jamaica, was produced by Thomas (1963). An important feature of this paper is that it contains an embryonic treatment of some of the matters discussed by McKinnon (1969) and Currie (1976). The point of common interest is the case where the automatic mechanism of the balance of payments correction under a regime of fixed exchange rates is thwarted. In the case that Thomas (1963) discusses there is no central bank. He explains how in this situation the dependence of the balance of payments on domestic credit expansion is a function of the managment of commercial banks' portfolios and not of government policy. He concludes that in an open "dependent" economy like Jamaica, the money supply is initially a function of the balance of payments, but after a lag, and depending on the credit policies of the banks, the balance of payments may become dependent on monetary expansion.

It seems to me ironic, in view of the openness of the Jamaican economy, that the early econometric studies of that economy did not attempt to investigate some of the monetary relationships implied in Thomas (1963). In general, these studies were concerned mainly with the real sector. However, Harris (1970) attempted to estimate Jamaica's foreign-exchange gap in line with the dual-gap hypothesis.

Harris' (1970) model contains 57 endogenous variables and 6 exogenous variables. But it is not as complex as it appears since many of the equations are simply decompositions of more aggregative relationships. Mainly, his model estimates (1) merchandise imports; (2) merchandise exports; (3) external service transactions, (a) payments, (b) receipts; (4) foreign transfers; (5) government finances; (6) domestic saving and (7) investment and production. His analysis covers the period 1950-65.

Although the basic dual-gap hypothesis is formally derived from the Keynesian system, the estimating equations in his model are ad hoc; so that care must be exercised in construing the test of any economic theory from the estimates of the parameters he specifies. Nonetheless, these estimates help to convey a picture of the Jamaican economy. Not surprisingly, this picture is of a very open economy.

According to the study the disposable personal income elasticity of imports "is slightly above unity (1.067) and the highest value is that for the durables component (consisting mainly of household furnishings and automobiles). Food comes next with an elasticity of about 1.1 which is rather high in comparison to the observed elasticity of general food consumption." Later on, after demonstrating that the "import requirements of intermediate goods are approximately proportional to GDP",he goes on to show that

the coefficient on import for capital goods "indicates a fairly rapid expansion of capital imports as investment increases." These results clearly indicate the conditions that cause an import minimum.

Harris (1970) experiments with a variety of specifications of his basic export function. For the bulk of Jamaica's exports including bauxite, alumina and sugar, he obtains the best results from fitting a semi-log equation between exports and income in the developed world. Although he does not discuss this, the success with the semi-log form suggests a decreasing world income elasticity of demand for Jamaica's exports.

Finally, Harris (1970) makes projections of the Jamaican economy under four different sets of assumptions about growth rates in Jamaica and the advanced capitalist economies. He concludes that "The trend of the two resource gaps under the (four) assumptions (shows that the) trade gap turns out to be dominant in all four cases."

Much less confidence attaches to the estimates of the parameters of two other real-sector models of the Jamaican economy. These are by Carter (1970) and Manhertz (1971). The former attempts to estimate from 8 observations 22 behavioural relationships in a system containing 14 predetermined variables. Similarly, Manherz (1971) uses 8 observations to estimate 24 behavioural relationships in a system that has 27 predetermined variables.

These authors used respectively, instrumental variables and two-stage least squares to estimate their systems. However, they both found the results "inferior" to those they obtained using ordinary least squares (OLS). They have therefore published their OLS estimates. Carter (1970) writes: "In general the differences (between OLS and instrumental variables) are minor and hardly worth the considerable additional effort required." However, it is not very surprising that he obtained unsatisfactory results with the instrumental variables estimator. This technique gives biased but consistent estimates of parameters. But with a sample of 8 observations, it is unlikely that he obtained the benefit of the asymptotic properties of the instrumental variables estimator.

Manhertz (1971) seems to have ignored the degrees of freedom problem associated with the use of two-stage least squares. With more predetermined variables than data observations, the first stage in two-stage least squares is undefined and the second stage collapses into OLS. This could explain why he found his two-stage least squares estimates inferior to his OLS estimates. However, as is well-known, OLS estimates of the parameters of a non-recursive simultaneous equation system are biased. We must therefore exercise care in interpreting the results of these two studies. But in those areas where their work has any bearing

on my thesis, their results do not differ qualitatively from those of Harris (1970).

The next two studies of the Jamaican economy are, more explicitly, monetary studies. These are by Taylor (1972) and Bourne (1974). The former is a straight application of Polak's (1957) model to Jamaican data. The stated purpose of this exercise is to show that "A monetary model also (can) provide a sufficient explanation for income behaviour" in Jamaica.

The attractiveness of Polak's (1957) model lies in its simplicity. However, this virtue is gained at the expense of much realism. The model assumes: (1) a constant income velocity; (2) that imports, the only leakage out of the system, are proportional to income and (3) that injections take the form of changes in the money supply. Once we know the income velocity and the average propensity to import for any country, the model can be used to determine income and imports.

In order to justify the application of this model to Jamaica, Taylor (1972) attempts to show that that country is characterised by a constant income velocity. However, in doing so, he constructs a peculiar argument. His method is to estimate by least squares a time trend for velocity over the period 1950-70. He does this although his data show velocity fluctuating between 5.53 and 8.54. Having

obtained from his regression the result

$$v = 6.664 + 0.052t \; ; \; R^2 = 0.159$$

he comments:

> It seems apparent that despite the fairly steady climb in v over the period 1950 to 1961, the irregular decline over the rest of the period eliminated that increase resulting in virtually no change in average velocity over the period as a whole. R^2 in the fitted equation is low and probably over-estimated in view of the low value of the Durbin-Watson statistic (.80). The t value on the regression coefficient is not significant at the 5 percent level and the best single value for v over the entire period is probably 6.664. There is thus some empirical support for the assumption of constant velocity in Jamaica.

It is difficult to see how Taylor's (1972) results can be construed to prove that Jamaica is characterised by a constant income velocity. It is hoped that the demand for money function in my model may shed some light on the appropriateness of the constant velocity assumption for Jamaica.

Bourne's (1974) paper represents the most sophisticated monetary analysis of the Jamaican economy extant. It is an attempt to apply what the author regards as the most relevant economic theory to the particular circumstances of the Jamaican economy. This is how he describes the problem he perceives and the solution he attempts:

> Even in the relatively underdeveloped financial structures of the Caribbean,

> the demand for money has important consequences for monetary and real growth and change. A priori the relative and absolute magnitudes of interest-rate, price and income elasticities are critical determinants of the impact of monetary measures such as changes in the money stock, bank rate, and exchange rate on the size and composition of the public's portfolio of real and financial assets. Nonetheless, the analysis of the demand for money is grossly a neglected area among Caribbean monetary theorists and practitioners. ... (This) paper formulates at a high level of theoretical abstraction a micro model of the demand for money, and then proceeds to apply a modified form to quarterly data for Jamaica.

In this modified form the demand for money is made a function of (1) a weighted average of interest rates (RTSD); (2) expected inflation (P^e) and expected income (GNP^e). Bourne's (1974) own specification is

$$M^D = B_o + B_1 RTSD + B_2 P^e + B_3 GNP^e \qquad 1.10$$

where the dependent variable is desired money balances.

A problem emerges here. This demand for money function contains three unobservable magnitudes. These are: (1) desired money balances; (2) expected inflation and (3) expected income. Bourne (1974) transforms these unobservables "by utilising the Nerlovian partial adjustment mechanisms and Muth's national expectations hypothesis." After the transformation he has six structural parameters, three from equation 1.10 and three adjustment coefficients. However, his estimating equation contains ten independent

variables, so that his model is over-identified. Unfortunately he estimates it by the method of OLS. However, this method will not permit us to infer unique values for the structural parameters in an over-identified equation.

Nonetheless, Bourne's (1974) account of his findings are of great interest. First we note that his results suggest that the demand for money is interest-insensitive. According to him, "regardless of the definitions of money employed and irrespective of whether the interest rate is expressed in real or nominal terms, they generally fail to pass the "t" test at the 25 percent level." Should this finding be replicated in a study using a more appropriate estimating technique it would be reasonable to conclude that the Keynesian monetary transmission mechanism analysis does not offer a plausible description of the Jamaican monetary sector. This alone justifies what I am trying to do in my thesis.

After stating that the results for expected inflation are ambiguous, Bourne (1974) goes on to discuss what appears to be the main determinant of the demand for money in Jamaica. He says "the income coefficients are statistically significant at the 1 percent level or better. A great deal of confidence therefore reposes in our estimate of those coefficients."

Later on he discusses the income elasticity of the demand for money and tells us: "There is no discernible tendency for long-run elasticities to differ in any particular direction from short-run elasticities when the broad money definition

is adopted. On the other hand with the narrow money definition, income elasticity tends to decline as adjustment is completed. The range is 0.1057 to 1.8312, depicting at the lower end a relatively income-insensitive demand for money function, and depicting at the upper end an income-sensitivity reminiscent of Friedman's well-known luxury good finding." However, we are unable to judge the plausibility of this claim since, as we saw above, the estimator the author used does not permit us to infer a unique value for the income-adjustment coefficient in this case.

The main relevance of Bourne's (1974) study for my thesis is that it directs our attention to many important monetary issues in the Jamaican economy that still need resolving. For example, will a demand for money function which is part of a larger structural model still exhibit interest insensitivity? Is the income elasticity of the demand for money unity or otherwise? These and some other questions I attempt to answer later on.

The following chapter contains a discussion of some of the salient features of the Jamaican economy. Chapter III introduces my model and contains -- in defence of my capital outflow function -- a fairly complete discussion of the modern theory of international capital flows. The concluding chapter presents and interprets the estimates of the parameters. It also contains the customary account of checks on the 'validity' of the model and suggestions for further research.

Chapter II The Jamaican Economy

Jamaica is the third largest country in the Caribbean. It has an area of 4,411 square miles. Like many developing countries, a large fraction (42 percent) of its land is allotted to agriculture. The activity of this sector has been widely publicized by Jamaican folk-singers, and its sugar, bananas, coconuts, coffee and allspice are world renowned.

According to Eric Williams (1964) the early history of Jamaica is related to what Adam Smith in The Wealth of the Nations calls "the two greatest...events in the history of mankind", the discovery of the new world and the discovery of the cape route to India. According to Smith these discoveries by permitting "the triangular trade" raised "the mercantile system to a degree of splendour and glory which it could never otherwise have attained to." (p.51)

The country was "discovered" by Columbus in 1494 and settled by the Spaniards in pursuance of the papal bull of the previous year. The Spaniards held Jamaica until 1670 when they ceded it to Britain at the treaty of Madrid. Jamaica remained a British colony until 1962 when it became a sovereign state.

In the seventeenth century the British developed an extensive system of sugar cane plantations worked by slaves.

The descendents of those slaves now constitute 85 percent of the 1.95 million population. The use of slaves enabled the British settlers to amass wealth quickly and Jamaica together with its Caribbean neighbours soon became an important market for the embryonic manufacturing industry in Britain.

Williams goes on to demonstrate the importance of Jamaica and the other Caribbean colonies to eighteenth century commerce. He writes:

> The amazing value of these West Indian colonies can more graphically be presented by comparing individual West Indian islands with individual mainland colonies... In 1773 British imports from Jamaica were more than five times the combined imports from the bread colonies; British exports to Jamaica were nearly one third larger than those to New England and only slightly less than those to New York and Pennsylvania combined. (p.54)

It is his well-known thesis that this commerce, the heyday of which lasted from 1650 to 1850, formed the basis for the industrial revolution in Britain. In this Williams is only confirming Adam Smith's early evaluation of the importance of the "New World", of which Jamaica used to be an important member, for the success of the British industrial revolution.

Many of the features of contemporary Jamaica were formed in the eighteenth century. For example, the large plantations of the period of slavery remain an important aspect of present day Jamaican agriculture. At the start of the period under

research, 40 percent of arable land was divided among farms with an average size of over 200 acres. However, these constituted less than one percent of the total farms in the country. The majority of farms were less than five acres. These produced mainly for the domestic market whereas the large farms produced almost exclusively for the exports market.

Over the period covered in this study, the role of agriculture relative to other sectors in the economy has continued to decline. According to Palmer (1968) agriculture's share in total output had fallen to 12 percent by 1967. The official publication "Economic Survey 1972" shows that this decline continued. In 1971 agriculture's share in the G.D.P. was 8.5 percent. However, the sector continues to be the main source of employment. Even in 1971, the sugar industry alone was responsible for 8 percent of all employment.

Because Jamaica's agriculture is predominantly export oriented, a large fraction of Jamaica's food and raw materials is imported. This kind of agriculture has attracted severe criticism from several Jamaican scholars who condemn an economy that is for the most part an agricultural one but imports most of its food and raw materials. The extent of this reliance on foreign sources of food and raw materials is indicated by the ratio of food and raw materials to total imports. The official publication "Economic Survey 1961" shows that in 1960 this

ratio was 24.6 percent. This remained roughly constant throughout the decade.

The necessity to import a large proportion of food combined with the need to import strategic inputs for economic development results in Jamaica being a very open economy. The marginal propensity to import for the period covered in this study was 0.48.

Brewster and Thomas (1967) have called attention to the impact that foreign prices will have on domestic prices in an economy that imports a large proportion of its food and raw materials.

However, against the failure of the agricultural sector to provide sufficient food and raw materials for domestic use, must be placed its performance in the export market. For most of Jamaica's history, the export of agricultural commodities, especially sugar, has been the main source of foreign exchange earnings. This was so up to the late 1950's. For instance, in 1956 agricultural commodities accounted for 53.- percent of the total value of exports. But the discovery of two minerals, bauxite and gypsum, led to the decline of agriculture's share in exports.

Bauxite was discovered in Jamaica in 1942. In 1944 Aluminum Ltd. of Canada (Alcan) was granted a franchise to mine in the country. This, however, did not exclude other mining firms and shortly afterwards Alcan was joined by

Reynolds Metals Ltd. and Kaiser Aluminium and Chemical Corporation. Much later in 1964 the Aluminum Company of America joined the other three.

After a decade of explorations actual mining started in 1952 and has advanced steadily. By 1971 production of bauxite had reached 12,234,055.5 tons. Production of alumina was 1,868,000 tons in the same year.

The country is now the largest but one (Australia) producer of bauxite. It supplies roughly half of the U.S. market. The Jamaican ore, compared to others, is relatively impure. It contains only 50 percent alumina whereas other ores contain up to 70 percent alumina. On the other hand, the Jamaican ore is extremely easy to mine since it is close to the surface.

Bauxite is used to produce aluminum which is done in three stages. The first stage consists of mining and drying the ore; the second stage of processing the ore into alumina and the final stage of reducing alumina to aluminum. Originally only the first stage was undertaken in Jamaica. Now the second stage as well is done in Jamaica. Toward the end of the period under research the development of the second stage was impressive. According to the official publication "Economic Survey 1972", "in 1969 prior to the recent increase in alumina capacity only 23.5 percent of bauxite mined was processed into alumina while in 1972 alumina production used 42.9 percent (of) mined bauxite."

The reduction of alumina to aluminum requires a quantity of energy that is not yet available at an economic cost in Jamaica. If this problem could be solved, the bauxite industry would contribute greatly to the expansion of employment in the modern sector of Jamaica.

A second ore, gypsum is also mined in Jamaica. Although it is not as important for the economy as bauxite, it contributes to Jamaica's foreign exchange earnings. It is also important for the domestic cement industry.

Commenting on how the development of the mining sector has transformed the Jamaican economy, Palmer (1968) observes "In 1950, when the G.D.P. was $70.1m, agriculture contributed 38.8 percent and manufacturing 11.3 percent. Bauxite mining operations had not yet begun; consequently the mining sector was negligible. In 1967 the G.D.P. rose to $336.5m with agriculture's contribution falling to 11.7 percent and that of manufacturing and mining rising to 15 percent and 9.6 percent respectively." (p.15)

This structural transformation has been reflected in the change in the source of foreign exchange earnings. This change already was well advanced when the period under research in this thesis began. In 1956 the mining sector accounted for less than 30 percent of exports while agriculture accounted for more than 50 percent. By 1963 bauxite and alumina accounted for 42 percent and agriculture for 48.4 percent.

By 1971 the quantities of bauxite and alumina exported were 7,590,000 tons and 1,783,000 tons respectively. And these two minerals accounted for 64.1 percent of exports compared to agriculture's share of roughly 20 percent.

The change in the composition of exports has not been matched by a similar change in the composition of the labour force. This is because the mining industry uses a capital-intensive technology. At the end of 1971 there were 11,629 persons employed in the mining sector. This includes workers employed by the bauxite companies in agriculture and construction. These workers constitute only 1.4 percent of the labour force.

The Jamaican economy has two major problems. The cause of one of these, the continuing deficit on the balance of trade, was discussed in Chapter I. This chapter continues with a discussion of the other, the high level of unemployment.

In a recent analysis which resembles that of Harris and Todaro (1970), Tidric (1975) argues that the persistence of unemployment in Jamaica is related to the rapid growth of the mining sector. He wishes to explain why although "between 1953 and 1960 total output in real terms increased by 76.8 percent..., the labour force increased by only ... 15,800 workers (and) non-agricultural jobs by 50,000 ... unemployment fell only slightly from 98,000 to 88,000."

He argues that this paradox can be explained by considering the "distorted wage structure...in which workers of the

same skill level receive different wages in different industries." He continues, "Disparities among major sectors are dramatic. Unskilled bauxite mining workers earn about twice as much per week as unskilled workers in transportation or construction... .Unskilled construction workers in turn earn almost two and one-half times as much as agricultural workers." He then demonstrates his hypothesis that the higher wages in the "modern" sector spill over into the traditional sector causing: (a) "supply-withdrawal" unemployment in this sector; and (b) an excess supply of labour in the "modern" sector which though is prevented from bidding down the wage rate. In his words, people"are voluntarily unemployed with respect to sugar but involuntarily unemployed with respect to mining."

Among the interesting conclusions Tidric (1975) deduces from his model is one which states that "wage policy guidelines should be tied explicitly to the wage or income gap.... Permissible wage increases should be inversely proportional to the gap between the wage level in the industry with excess supply and the wage or income level in the low-wage or low-income self-employed sector." He then goes on to caution the reader not to infer that rural development is necessarily a more optimal strategy than further industrialization.

Tidric (1975) offers no suggestions about how a wage-control policy should be implemented. However, his model appears to support a policy which taxes away some of the

quasi-rent of mining labourers and uses the revenue to make rural labour more attractive to Jamaicans. The problem deserves much further attention.

The failure of the mining industry to generate sufficient jobs to solve Jamaica's unemployment problem has led the authorities to attempt further diversification of the economy. The two policies which have been pursued are: (1) the development of the tourist industry; and (2) the infusion of foreign-owned light manufacturing enterprises in the spirit of Vernon's (1966) product cycle theory.

The period under research was extremely favourable for the advancement of tourism in Jamaica. The strained relations between the U.S. and Cuba provided a large market that Jamaica with its excellent rum and congenial climate was in a position to exploit. This coincided with a decrease in the cost of airline transportation largely due to the introduction of large jets. This lower cost was reflected in lower prices to tourists. The evidence shows that Jamaica reacted as expected to this new market.

Palmer (1968) says: "Two important indexes of (the development of tourism) are the growth of hotel accommodations and the number of tourists visiting the island annually. In 1961, hotel accommodations amounted to 6,140 beds in 71 hotels, 42 guest houses and 72 resort cottages. At the end of 1967 this (sic) had increased to 8,900 beds.

The total number of tourists visiting Jamaica annually increased from 75,000 in 1950 to 330,000 in 1967." (p.29)

The official publication "Economic Survey 1972" shows that by the end of 1971, hotels, guest houses, cottages and apartments providing accommodation for visitors employed 9,400 persons. The same source claims "that for every one person employed directly in the tourist industry, there is another employed outside the tourist industry as a result of tourism." This industry therefore employs about 2 - 4 percent of the total labour force and about 3 - 2 percent of those actually employed. In the same year it contributed an estimated $91 m in total earnings which is about 7.8 percent of G.D.P. and was responsible for 18 percent of total export earnings. This sector's contribution to export earnings is second only to that of the mining sector.

None-the-less we may wonder about the prospects for further growth in the tourist industry. Recent years have seen an escalation in fuel prices which may raise the cost of air travel, and a recession in the advanced economies from which the majority of tourists come. However, these were not problems for the greater part of the period covered in this thesis and will not be further discussed.

The policy of encouraging foreign-owned light manufacturing firms to operate in Jamaica was stimulated by the election of the "People's National Party" (PNP), under the

leadership of Norman Manley, to office in 1955. This then moderately socialist party was committed to the industrialization and diversification of the Jamaican economy from the time of its inception.

Widdecombe (1972) quotes the following passage from the document which introduced the party's first ten-year plan, which was the country's second:

> Like other underdeveloped countries, Jamaica suffers from a shortage of capital for manufacturing industry. The government has therefore taken steps to create a climate to attract investors. This has mainly been effected by incentives and concessions under the Pioneer Industries (Encouragement) Law, revisions of the Customs Tariff to encourage imports of machinery and raw materials, special incentive legislation for the cement and textile industries, tariff protection and quota restrictions. The creation of an industrial development corporation charged with the duties of stimulating, facilitating, and undertaking the development of industry and the establishment of an industrial estate supplied with water and electric power for the location of factories. (pp.153-154)

The same document shows that one of the main reasons for encouraging the participation of foreign-owned firms in the country's development was to provide a large number of non-agricultural jobs. It states: "It is intended to lay special emphasis on attracting foreign capital to Jamaica, and the provision of incentives by the way of tax concessions, tariff protection and industrial space will be continued ... as a means of providing employment outside of agriculture and therefore not susceptible to the factors that affect agricultural employment directly such as export prices or climatic conditions."

The policy was less successful than was anticipated and most of the shift from agricultural employment into manufacturing employment took place before 1962. Widdicombe (1972) indicates that between 1950 and 1960 employment in large manufacturing firms grew from 21,728 persons to 46,050. He claims that "by 1960 large manufacturing plants provided almost 8 percent of all the regular jobs." Later on he cites a statement made in 1971 by the then Minister of Trade and Industry, which suggests strongly that the rate of transformation of the labour force from agricultural to manufacturing decreased after 1960. According to that minister, "At 31st December (1970), 1,494 manufacturing establishments operating in the island and employing 49,000 were registered with the Factories Inspectorate of the Ministry of Labour and National Insurance."

Nonetheless as the economy continued to change from an agricultural one to an industrial one the role of manufactures continued to increase. By 1971 the manufacturing sector was contributing to G.D.P. $148.6 m which is about 13 percent.

The Financial Sector

The present financial system in Jamaica evolved out of the system that operated in the once vast British colonial empire. This colonial system had two main features. The

extension of the U.K. (and in the case of the Caribbean, Canadian also) banks to the colonies, and the operation of currency boards.

Newlyn (1954) describes commercial banking in British colonies in the following way:

> The vast majority of banking business in the colonies is carried on by what may be called "supra-territorial" banks, that is to say banks which operate in a number of different political areas ... In principle the branch managers in the various colonial branch offices are in exactly the same position as branch managers of the deposit banks in the United Kingdom; they employ such funds as can be used locally in a manner consistent with the bank's lending policy, and any surplus becomes available for use elsewhere. Thus a bank serving more than one colony could offset a borrowing area against a lending area in exactly the same way that different districts are offset in England and Wales.(p.438)

The six commercial banks that operated in Jamaica during the period of the study were Barclay's Bank, the Bank of Nova Scotia, the Royal Bank of Canada, the Canadian Imperial Bank of Commerce, the Bank of London and Montreal, and the First National City Bank of New York.

Of the six, only Barclay's Bank was British owned. However, it, and the Royal Bank of Canada, owned more than 70 percent of the bank assets in Jamaica. These two dominant firms acted in the manner described by Newlyn (1954). The other international banks followed their lead.

During the colonial era and in the early years of independence, Jamaica was a "lending area" for the international banks. This situation changed during the period of my study and Jamaica became a "borrowing area". The reason for this is that consumer credit expanded rapidly during the period. The commercial banks were responsible for more than two thirds of this credit, much of which they financed with the aid of loans from their headquarters.

Although the international commercial banks have maintained the dominance they acquired when Jamaica was a colony, there has been some change in the Jamaican monetary system. Much of this change has been a concomitant of the abolition of the currency board system.

The Jamaican Currency Board was abolished and in 1961 its functions were taken over by the Bank of Jamaica. The Jamaican Currency Board was one of several scattered throughout the colonial part of the Commonwealth. Newlyn (1954) succinctly describes their workings:

> The operations of the currency authority are automatic and passive, and consist in being ready to buy and sell the local currency at a fixed rate (plus a small commission) against sterling in London. Sterling accumulated as a result of the issue of local currency is invested in London and thus constitutes a security fund...out of which payments are made in sterling against local currency surrendered in the colony. (p.423)

It is clear that under this system the local currency was no more than a surrogate for British money. Indeed, there was not a fiduciary issue in Jamaica until 1958. The major disadvantage of this system is well-known. The British held a monopoly over the issue of non-interest-bearing debt in Jamaica. The use of money therefore constituted a leakage out of Jamaica of real resources.

Another disadvantage of the currency board system is that it encouraged the banks to keep a large fraction of their assets overseas. Assets denominated in Jamaican currency could be converted into sterling and vice versa for only a small cost to the banks. This encouraged the banks to invest in Britain funds acquired from the issue of deposits in Jamaica.

A possible advantage of the system may be that money users acquired a degree of confidence in Jamaican currency that has survived the "ancien regime". But on the balance the currency board system was a liability for Jamaica.

The currency board era in Jamaica came to an end in 1960 when the Bank of Jamaica was established by an act of the parliament of Jamaica. This was the first central bank in the Caribbean and according to Thomas (1972) it had to survive "a considerable prejudice against Central Banks in 'under-developed' economies." (p.35) Nonetheless, the authorities hoped to bring the operations of the commercial banks under the control of the central bank.

In his classic description of the working of a capitalist banking system Keynes (1930) claimed that "the typical modern Banking system consists of a Sun namely the Central Bank and the Planets ... the Member Banks." (p.9) In order to enable the Bank to assert its heliocentric role parliament empowered it to: (1) vary the reserves of the commercial banks held in the form of Central Bank deposits between the limits of 5 percent and 15 percent; (2) prescribe a maximum limit on bank advances; and (3) establish a minimum domestic asset to liability ratio.

Of the three measures, only the last affected significantly the operations of the banks. It also permitted the emergency of an appreciable market for government debt. For example, the commercial banks' holdings of Jamaican treasury bills increased tenfold between 1961 and 1971. The banks now take up more than half of the issue, whereas they held an insignificant fraction before 1961. In the same period the foreign assets to domestic reserves ratio fell from an average of greater than unity to less than half.

When it comes to the two other measures, one was redundant and the other was employed only once in the period of my study. Evidence shows that the liquid reserve ratio of the banks was always in excess of the legal maximum. Indeed one of the unusual features of the Jamaican economy is that the commercial banks keep a large quantity of excess

reserves. In this situation, the authorities are unable to regulate the supply of money simply by marginally varying the reserve ratio. Thomas (1963) speculates that these conditions cause the money multiplier to be highly volatile and unpredictable.

In general, the authorities were reluctant to impose a ceiling on bank advances. However, they overcame their reluctance in the last quarter of 1969. Following what was at the time a record deficit on the balance of payments, the authorities imposed a credit ceiling on all advances for the purpose of importing consumer durables, and on advances to foreign-owned firms. These restrictions lasted until the end of 1970.

During the period under research Jamaica was committed to the evolution of a fully developed capital market. To that end the authorities encouraged the growth of financial intermediaries. In 1971 the non-bank financial intermediaries either already operating or about to begin operating were: merchant banks; the Jamaica Development Bank; the Jamaica Mortgage Bank; trust companies; building societies; insurance corporations and divers financial dealers.

Although the range of financial assets was fairly wide, the majority of trading was in Jamaican treasury bills. For instance, at the end of 1971, trading in treasury bills amounted to $14.7 m. The corresponding value of trade in

domestic registered stock was $7.1 m. Since, as we saw above, the commercial banks take up more than half of the issue of treasury bills, they remain the dominant financial institution.

This concludes my description of the Jamaican economy during the period of my research. It reveals a relatively poor country that is steadily developing in spite of many serious problems. The economy has an interesting and proud history. Its contribution to the development of the modern capitalist system is disproportionate to its size. As a result of its peculiar history it has evolved into a very open economy needing to import much of its food and raw materials. In the early days agriculture was its main industry in every respect. That industry is still its chief source of employment. But the mining industry is now the largest source of foreign earnings. Unemployment remains one of the two major problems. The other is the tendency to run trade deficits in order to accelerate economic development. The financial sector has undergone much transformation, but the banking system is still predominantly foreign-owned. In general, the monetary authorities operate under severe constraints.

Chapter III The Model

The model developed in this chapter attempts to trace through the consequences of persistent increases in the money supply of a developing economy that is characterised by the features outlined in Linder (1967). It will be recalled that such an economy tends to be in 'external disequilibrium' on account of having to import more than it can export. It is assumed: (1) that the monetary expansion is to supplement economic development policies; (2) that the monetary authorities maintain a desired level of high-powered money so that they are prepared to sterilise the balance of payments whenever they deem this necessary; (3) that there are (a) a stable money multiplier and (b) a stable demand for money; (4) that the money market clears in a single period; and (5) that we are concerned with a regime of fixed exchange rates.

With these assumptions, the picture that emerges is of a country sometimes spending in excess of its domestic income. The resultant deficit on the balance of trade is not always offset by capital flows. In order to maintain a money supply commensurate with the level of economic growth the monetary authorities must sometimes sterilise deficits on the balance of payments. How much they sterilise is an empirical matter, but complete sterilisation involves the risk that the system may run out of foreign exchange reserves prematurely. It therefore seems likely that they sterilise only partially. The model subjects this picture to an empirical test.

The basic structure of the model consists of twelve endogenous variables and twelve predetermined variables. However, five of the

endogenous variables are stated as definitions and one, the nominal interest rate, is determined by the assumption of equilibrium in the domestic money market. This means that there are six behavioural relationships, each of which will now be formally specified and discussed, starting with the change in the money supply function.

The Change in the Money Supply Function

This function attempts to capture the insight of Thomas (1963), which was cited above. Discussing the Caribbean economies including Jamaica, he claims "that both money supply and balance of payments are inter-dependent." The first set of equations below attempts to show this interdependence.

The monetary base, here called high-powered money consists on the sources side, of the central bank's stock of foreign exchange reserves in terms of domestic currency, and its stock of domestic assets. Recalling the assumption that the authorities have a desired stock of high-powered money, it is assumed that adjustment to this desired stock always takes place within one period. We have

$$H_t = H_t^* \qquad 3.1$$

A simple linear adjustment function which contains as arguments: (1) the balance of payments; and (2) the change in the level of income is postulated. That is

$$H_t^* = H_{t-1} + a_0 + a_1 B_t + a_2 \Delta Y_t \qquad 3.2$$

where H_t^* is desired high-powered money in the current period, H_t is the actual stock of high-powered money, H_{t-1} is high-powered money in the previous period, B_t is the balance of payments, ΔY_t is the current change in the level of domestic income and the a_i's are constant coefficients.

To complete the derivation of a change in the money supply function, recall that money consists of bank deposits and cash in the hands of the non-bank public. That is

$$M_t^s = \frac{1}{d} R_t + CA_t \qquad 3.3$$

where M^s_t is current money stock, R_t is the commercial banks' current holding of reserves, CA_t is the current stock of cash in the hands of the non-bank public and d is the reserves-deposits ratio. Equation 3.3 may be written as

$$M_t^s = \frac{1}{d} R_t + (H_t - R_t)$$

or

$$M_t^s = (\frac{1}{d} - 1) R_t + H_t \qquad 3.4$$

When this is transformed into first differences we have

$$\Delta M_t^s = (\frac{1}{d} - 1) \Delta R_t + \Delta H_t \qquad 3.5$$

Substitution of 3.1 and 3.2 into equation 3.5 yields the following behavioural equation

$$\Delta M_t^s = \left(\frac{1}{d} - 1 \right) \Delta R_t + a_0 + a_1 B_t + a_2 \Delta Y_t \qquad 3.6$$

which may be simplified to

$$\Delta M_t^s = \alpha_0 + \alpha_1 \Delta R_t + \alpha_2 B_t + \alpha_3 \Delta Y_t \qquad 3.7$$

$$\alpha_1 \gtrless 0; \quad \alpha_2 \gtrless 0; \quad \alpha_3 > 0 .$$

The gist of 3.7 is that the balance of payments and the change in the level of income help to determine the supply of money by determining the rate of adjustment of actual to desired level of high-powered money.

The Money Demand Function

It was pointed out above that most recent work on the balance of payments assumes a stable demand for money function. According to Friedman (1956) the criteria for stability are a small error variance and a limited number of arguments. The arguments he suggests should be in the demand function establish it as a topic in capital theory. This is how a large number of monetary economists have regarded the demand for money, some more explicitly than others. The major landmarks in this tradition are Keynes (1930, 1936), Hicks (1935), Robinson (1951) and Friedman (1956, 1970). The basic view is that money is just one —

albeit the most liquid -- of many assets in an efficient portfolio, all of which are held for their expected yields. In my opinion the clearest, though somewhat neglected, statement of this thesis is given in Robinson's (1951) classic paper where she declares:

> Each type of asset is a potential alternative to every other; each has, so to speak, a common frontier with every other and with money. Equilibrium in the market is attained when the interest rates are such that no wealth is moving across any frontier.

What this seems to mean is that given his wealth or permanent income, the investor, either individual or firm, will seek a composition of assets such that all yields are equalised at the margin.

The question arises as to whether this kind of theory is applicable to developing countries. Some economists, Bolnick (1976) for example, seem to hold that it is not. According to these, the cash balance hypothesis offers the best account of the demand for money in developing countries. However the problem with this view is that, as Hicks (1935) demonstrated long ago, the cash balance theory can be expected to hold only in cases where there are no assets, real or monetary, that can substitute for money. This is hardly the case in Jamaica.

These considerations have led me to specify an asset demand for money function, that bears some resemblance to the one suggested by Friedman (1970). The major modification I have made is to combine the expected yield on bonds -- the nominal interest rate -- and the expected yield on durables which is the expected rate of inflation,[4] into a single variable. This specification is valid in cases where the main substitute

for money is physical capital, and appears to be particularly appropriate for Jamaica which I find to be truly a nation of small shop-keepers. The demand for money function in the model is

$$m^d_t = b_0 + b_1 y^p_t + b_2 r^e + u_t \qquad 3.8$$

where m^d_t is current real balances, y^p_t is the current value of permanent income, r^e is the expected real rate of interest and u_t is a stochastic term. As is customary, I assume a constant elasticity.

The variable y^p appears in the demand for money function. However, permanent income is an unobservable magnitude. To deal with this problem, I assume that permanent income can be represented by a geometrically weighted distributed lag on actual income. That is

$$y^p_t = y_t + \lambda y_{t-1} + \lambda^2 y_{t-2} + \lambda^3 y_{t-3} + \ldots. \qquad 3.9$$

Substitution of this equation intc equation 3.8 yields

$$m^d_t = b_0 + b_1(y_t + \lambda y_{t-1} + \lambda^2 y_{t-2} + \lambda^3 y_{t-3} \ldots) + b_2 r^e + u^t \qquad 3.10$$

Equation 3.10 may be transformed by using the method given by Koyck (1954). This involves lagging a period and multiplying through by λ to get

$$\lambda m^d_{t-1} = \lambda b_0 + b_1(\lambda y_{t-1} + \lambda^2 y_{t-2} + \lambda^3 y_{t-3} + \ldots) + \lambda b_2 r^e_{t-1} + \lambda u_{t-1} \qquad 3.11$$

Next, equation 3.11 is subtracted from 3.10 leaving

$$m_t^d = b_0 - \lambda b_0 + b_1 y_t + b_2 r_t^e - \lambda b_2 r_{t-1}^e + \lambda m_{t-1}^d + u_t - \lambda u_{t-1} \qquad 3.12$$

which may be simplified to get

$$m_t^d = \beta_0 + \beta_1 y_t + \beta_2 r_t^e + \beta_3 r_{t-1}^e + \beta_4 m_{t-1}^d + v_t \qquad 3.13$$

$$\beta_1 > 0;\ \beta_2 < 0; \beta_3 > 0;\ \beta_4 > 0; v_t = u_t - \lambda u_{t-1}$$

I believe that equation 3.13 will be of especial interest to Caribbean economists. A successful money demand function for any of the countries in the region has so far eluded them, although casual empiricism suggests that a function containing a wealth variable and an interest rate variable should perform well. My judgment is that what is needed is to embed this kind of demand for money function in a structural model, such as I am attempting here.

The Absorption Function

As we saw in Chapter I, original absorption theorists believed that domestic income was the main argument in the absorption function. That view is maintained in this model, but the following gloss is added. The government of a developing country usually is committed to a high level of expenditure on infrastructural projects. Commenting on the practice of the Jamaican government during the period covered by this study, Palmer (1968) has the following to say:

> It is obvious that the Jamaican economy is a predominantly private enterprise economy. In this setting, the government's economic role is that of providing the economic and financial infrastructure appropriate for rapid economic development. The share of government capital formation in total capital formation reflects substantial effort on the part of the government to lay down and improve social overhead capital to facilitate growth and development. (pp.62-64)

It appears reasonable to me to assume that the level of income would be a major determinant of the level of government expenditure. In the first place as an index of demand for infrastructural projects, and in the second place as a source of revenue. In the latter case, we know from the balanced budget multiplier theorem, that government spending financed by taxation raises the ratio of absorption to income. During the period of the study the share of government expenditure in gross domestic product rose from 7% to 12.5%. The latter proportion is within the range suggested for a developing country by Lewis and Martin (1956). I expect that altogether there will be a very strong positive relationship between the level of income and absorption.

Another major influence on absorption in Jamaica should be the stock of real balances. It was suggested in Chapter I that in the absence of sufficient capital inflow to offset a deficit on the balance of trade, the government has to run a deficit on its budget if it wants to counteract the monetary consequence of a deficit on the balance of payments. This consequence is an automatic correction of the balance of payments disequilibrium accompanied by a general fall in absorption. The Jamaican authorities have always wished to avoid a general fall in

absorption. As well as retarding economic development, this probably increases unemployment which we saw in Chapter II is ordinarily as high as 20 percent. The commitment of the authorities to a high level of absorption has been stated by politicians as well as by officers of the Bank of Jamaica, one of whom wrote to me: " Bear in mind though, that these policies (ie. certain central bank policies) are operating in a framework of an economy which is in an almost permanent state of depression. This partly explains the Governments's heavy reliance in deficit financing." [5]

Since in developing economies deficit financing is done mainly by monetary expansion, we may expect to find a link between the level of the money stock and the level of absorption.

The way this link works is through the real balance effect. This is of course the oldest monetary transmission mechanism in economics. It was clearly understood by Cantillon and was implicit in Hume. However, the current interest in it stems mainly from Pigou (1943) and Patinkin (1948). The theory is well known. Given that there is a stable demand for money, an increase in the supply of money [6] over the trend growth rate causes the actual stock of real balances to exceed the desired stock and induces a rise in expenditure.

In addition to this, McKinnon (1973) has argued that in a developing country there is likely to be a significant real balance effect on investment. According to him an increase in real balances, especially if it is brought about through a decline in the price level, complements the other forms of saving available to small entrepreneurs.

The foregoing suggests that the two main arguments in the absorption function should be the level of domestic income and the stock of real balances. To these I have added a third explanatory variable, the domestic rate of interest. This is expected to influence absorption mainly through its influence on investment. It is a purely empirical matter whether such an influence — called the cost of capital effect — exists independently of the real balance effect. The estimation of this model might shed some light on this empirical problem, which is so far still unresolved. The absorption function therefore takes the form

$$A = \gamma_0 + \gamma_1 Y + \gamma_2 (M^S/P_D) + \gamma_3 i \qquad 3.14$$

$$\gamma_1 > 0;\ \gamma_2 > 0;\ \gamma_3 < 0$$

The Balance of Trade Function

The balance of trade function in my model is based primarily on the absorption approach. Pierce and Shaw (1974) present a succinct account of the views of early absorption theorists. According to them:

> The absorption approach emphasises the fact that payments imbalances are 'characterised' by (but not necessarily 'caused' by) ex ante divergences between aggregate income receipts and aggregate domestic expenditure (absorption). In some situations a strong causal connection between (income) and (absorption) on the one hand, and (exports) and (imports) on the other can exist. For example an (increase) in (absorption) holding (income) constant, creates an excess of aggregate receipts causing the increase in (absorption) to spill over on to imports and deteriorate the balance of trade. (p.339)

These authors go on to caution that "the whole structural form of the absorption equation does not lend itself easily to a conclusive specification of the directions of causation between trade variables, absorption variables and the level of domestic income."

The model developed in my thesis offers a possible explanation of why absorption can increase, relative to income, and deteriorate the balance of trade. The crucial link is the relationship between money and absorption that was outlined above. A rise in the size of the money stock, ceteris paribus, causes the level of real balances to exceed the desired level. This causes a rise in absorption, and in an open economy such as we are discussing, a rise in imports. With exports unchanged the balance of trade deteriorates. In the model, the rise in absorption causes income to rise first after which the rise in income induces a rise in imports. Some of these imports are necessary imports à la Linder (1967) in the sense that they are required to maintain the new level of desired income in the succeeding period. A special case is where all additional absorption spills over on to imports. Assuming these are necessary inputs to the development process, income will not rise until later on. In all this it is assumed that the initial change in the money supply is intended either to counteract the contractionary consequences of balance of payments deficits correction under fixed exchange rates or to increase the rate of economic growth. It is the necessity for this kind of policy that led Linder (1967) to claim that in a developing economy " The simultaneous establishment of internal and external equilibrium is ... not possible." (p. 9)

The foregoing suggests that income should be an argument in the balance of trade function of an absorption model. In the case of Jamaica, I expect to find a highly significant negative relationship between income and balance of trade.

Although the absorption approach is a rival explanation of the balance of trade to the relative price theory, absorption theorists do not claim that relative prices are unimportant. Therefore the second explanatory variable in the balance of trade function is the ratio of the domestic price level to an index of foreign prices. The current state of economic knowledge does not permit us to infer the a priori sign of the relationship between relative prices and the balance of trade. The approach that stems from Robinson (1937) postulates a negative relationship. However, following Harrod's (1952) rejection of post-war U.K. devaluation policies, a school has emerged which stresses the negative impact on the balance of trade, of a worsening of the barter terms of trade. This issue is the subject of much current debate in Jamaica due to the IMF - imposed devaluation of this country's currency. Although the data used to estimate the balance of trade function in my model come from an earlier period, the results from the estimation may shed some light on the current debate.

The final argument I have put in my balance of trade function is the change in the level of income. It is hoped that this will pick up any effects of economic development not included in the level of income. If it does this efficiently it should have a negative effect on the balance of trade in light of Linder's (1967) theory. The foregoing

leads to the following estimating equation.

$$T = \varepsilon_0 + \varepsilon_1 Y + \varepsilon_2 (P_d/P_f) + \varepsilon_3 \Delta Y \qquad 3.15$$

$$\varepsilon_1 < 0;\ \varepsilon_2 \gtrless 0;\ \varepsilon_3 < 0$$

The Capital Outflow Function

In recent years there has been much refinement of the capital flow-interest rate relation. Earlier, capital flows were seen as affecting changes in flow equilibria and responding to differences in the levels of domestic and foreign interest rates. This view was put strongly by Mundell (1968) a decade ago. Talking about the foreign exchange market he said:

> This market can be divided into two components, the balance of trade ... and the net flow of capital, influenced chiefly by the rate of interest. To every level of the terms of trade there will correspond a given balance of trade and for every rate of interest there will be a specific rate of lending ... at high rates of interest the net inflow of capital will be larger, or the net outflow will be smaller than at the low rates of interest. (pp. 154-155)

The stimulus for rethinking this view seems to have come from a number of sources. Notably the recent contributions to the monetary approach to the balance of payments opened the way for seeing capital flows as stock adjustments in international assets rather than as continuous flows. Later an important remark by Tinbergen (1967) highlighted the fact that changes in the levels of interest rates caused once for all changes in international portfolios, and not continuous

flows in capital at the new level as Mundell (1968) claimed.[7] Later Branson (1968) and Floyd (1969) developed Tinbergen's (1967) insight; and it is now generally agreed that to the extent that capital flows are interest sensitive, they are a function of differences in changes in interest rates rather than differences in levels of interest rates.

It is possible to identify two versions of the stock adjustment model of international capital flows. The earlier portfolios balance version represented in the work of Branson (1968) and Branson and Hill (1971), and a later version which is part of recent empirical work on the monetary approach to the balance of payments. The latter version is exemplified in the work of Kouri and Porter (1974). The portfolio version assumes that in the domestic economy the demand for and the supply of money determine the domestic interest rate, changes in which, relative to changes in other countries' interest rates, induce international portfolio adjustments. According to this view the critical choice is between foreign bonds and domestic bonds. The monetary approach is slightly different.

According to this, the domestic interest rate is determined in the world money market, and foreign and domestic bonds are perfect substitutes. In this view an increase in the domestic money supply, ceteris paribus, because it increases the world money stock, leads to an excess demand for world bonds. When the domestic share of world bonds is exhausted, investors turn to the world market causing an outflow of capital.

Mostly, the same arguments enter the capital flow functions of both models, but they are given different rationalisations. For instance, the

change in foreign interest rates enters both specifications. However, in portfolio studies it enters in conjunction with the change in the domestic interest rate, whereas in monetarists' studies it is the only relevant interest rate change. Put another way, the monetarists' assumption that foreign and domestic bonds are perfect substitutes implies, as Kouri and Porter (1974) correctly show, that foreign and domestic interest rates are equal. On the other hand, Branson's (1968) assumption that there is substitution between the two kinds of bonds implies only that, in regression studies, the absolute values of the coefficients on the two kinds of interest rate changes should be equal.

Another variable that enters the capital flow functions of both versions of the stock adjustment model is the balance of trade. Branson and Hill (1971) rationalise the inclusion of the balance of trade on the grounds that it is a proxy for trade credit. Kouri and Porter (1974), on the other hand, put it in because "the current account--in the same way as a change in the Central Bank's net domestic assets--affects capital flows because it is an autonomous source of a change in the monetary base." To test the validity of this monetarist postulate, it is necessary only to compare the coefficients on the trade balance and the change in domestic assets of the central bank, when they appear together in the same regression. In the monetarists' view, these should not be significantly different.

However, in Kouri's and Porter's (1974) own work, such an equation appears for the following countries: Germany, Australia, Italy and The Netherlands. The monetarist hypothesis is confirmed in the first two

cases but falsified in the others. Kouri and Porter (1974) admit that they ''have no good explanation available for these differences.'' We may consider their failure as a justification for attempting a modification of the strict monetarist hypothesis. This modification is already implied in my model.

Kouri and Porter (1974) regard the change in the domestic assets of the central bank as an exogenous variable. In their reduced - form model, capital flows always respond passively to changes in the bank's domestic assets. However, they concede that ''it is possible that the authorities try to adjust (the change in the domestic assets of the central bank) at times so as to offset the liquidity effect of payments deficits or surpluses.'' What appears as an obiter dictum in their model is closer to a ratio decidendi in mine. Equation 3.2 in this chapter along with the specification of the balance of payments as an endogenous variable imply that the domestic assets of the central bank must sometimes change passively to maintain the authorities' desired stock of high-powered money. This is one reason why I think it is not appropriate to estimate the capital outflow function, which contains the change in the domestic assets of the central bank, by the method of ordinary least squares. A similar argument is made against the use of this estimator when an interest rate variable appears in the capital flows function. Both these variables appear in the capital outflow function in this model.

The foregoing suggests that the balance of trade and the change in the domestic assets of the central bank should have similar signs. However, there is no necessity for their magnitudes to be equal. In other

words, the hypothesis that is being tested here, is neither the strict monetarist nor the one associated with the earlier Branson and Hill (1971) model, but one that attempts to synthesize both approaches. The above-mentioned signs are expected to be positive.

The last two variables that the modern theory of international capital movements indicates should enter the capital outflow function are the change in domestic income and the change in world income. These two change in income variables may be regarded either as proxies for changes in investment or proxies for changes in wealth in the domestic and world economies respectively. Floyd (1969) argues that a rise in domestic investment relative to investment in the rest of the world should induce an inflow of capital. If a change in domestic income mirrors a change in investment, there should be a negative relationship between capital outflows and the change in domestic income. Kouri's and Porter's (1974) monetarist model also postulates a negative relationship between the change in domestic income and capital outflows. However, this is based on the monetarist view that a rise in income causes a rise in the demand for money which corresponds to a fall in the demand for both domestic and foreign bonds. This implies a reduction in capital outflows. Hence whether the change in income enters as a proxy for a change in investment or as a proxy for a change in wealth, we ought to observe a negative sign on the change in domestic income coefficient and the opposite sign on that for the change in world income.

Before leaving this section, it is necessary to mention the omission of two important sets of variables. The modern theory of capital

movements contends that the growth and size of the stock of wealth and also the degree of risk attached to holding domestic and foreign assets should be arguments in the capital outflow function. However, all of the published studies encounter difficulty in modelling these effects. These omissions are more critical in some cases than in others, depending on whether or not the included variables capture the effect of the omitted variables. It has proven impossible to find accurate data on the stock of wealth and the degree of risk in Jamaica for the sample period. It is left to the estimation of the model to indicate how serious this specification error is in the present case.

In the model capital outflow is defined to mean the net outflow of both short-term and long-term capital. This aggregation of 'compensatory' and 'autonomous' items -- to use Meade's (1951) terms -- into one variable may be criticised on the grounds that movements in the two kinds of assets are motivated by different factors. To illustrate, asset changes of the bauxite firms in Jamaica are probably much more insensitive to short run interest rates movements than changes in short run capital. This is a valid criticism and should be noted when reading the results of the estimation of this model. However, I have been unable to find a comparable data series on disaggregated capital flows. Perhaps Caribbean economists should try hard to collect such a series. But this problem seems to have plagued analysts before. For instance, Pierce and Shaw (1974) cite the following claim made in a U.K. Treasury report to illustrate how difficult in principle it is to distinguish between the two kinds of capital flows. It says:

> For instance if (a U.K. resident) buys shares on Wall Street and sells them a short time later, these count as long-term capital transactions, because the shares bought and sold cannot be distinguished from other deals in shares held for a long time. (p.332)

Bearing the above caveats in mind, the estimating equation that comes out of the foregoing analysis is

$$K = \kappa_0 + \kappa_1(\Delta i_D - \Delta i_F) + \kappa_2 T + \kappa_3 \Delta DO + \kappa_4 \Delta Y + \kappa_5 \Delta W \qquad 3.16$$

$$\kappa_1<0;\ \kappa_2>0;\ \kappa_3>0;\ \kappa_4<0;\ \kappa_5>0$$

The Domestic Price Level Function

The price equation in this model is different from those generally encountered in monetary models. In the original version of the quantity theory the domestic price level is determined in the domestic money market. However, this is for a closed economy. Consequently, in the monetary approach to the balance of payments, a distinction is made between traded goods and non-traded goods. Only the price level of the aggregate of the latter is determined by the interaction of supply and demand for domestic money. The price level of traded goods is assumed to be determined in the world market. However the two price levels are shown to be functionally related.

Although I agree with the international monetarists that in an open economy the domestic price level is related to the world price level, I believe that in the case of an open economy like Jamaica this relation-

ship is brought about through the cost of production rather than through substitution in trade. Some monetarists, on the other hand, contend that a rise in import prices cannot cause a permanent rise in the domestic price level. Whether or not this is true for advenced economies, it makes little sense in the case of Jamaica where the production of nearly all goods involves the use of 'necessary imported inputs'. This includes the production of wage goods, and links the cost of domestic labour to import prices. Therefore, a rise in the price of 'necessary imported inputs', ceteris paribus, implies a rise in the domestic price level.

Furthermore, some economists are coming around to the view that the prices of imported inputs are a critical factor for determining the price level in industrial economies. This is clearly the view of the Cambridge Economic Policy Group as exemplified in the work of Cripps and Godley (1976). As far as the Caribbean is concerned, Brewster (1968) has shown convincingly that the predominant factor determining the price level in these economies is the price of imported inputs. I have therefore chosen to treat the domestic price level as a simple linear function of an index of the export prices of Jamaica's major trading partners. The particular index I have chosen is a principal component of those prices, which explains 97 percent of their variance. Although this is an extremely simple specification, I do not think it will be regarded as a naive one by those familiar with the Caribbean economy and Caribbean economics. We therefore have

$$P_D = \mu_0 + \mu_1 P_F \qquad 3.17$$

$$\mu_1 > 0$$

Closing the Model

The model has an income accounting framework and is closed with the following set of definitions.

$$Y = A + T \qquad 3.18$$

$$B = T + K \qquad 3.19$$

$$\Delta DC = \Delta H_t - B \qquad 3.20$$

$$r_t = i_t - \dot{p}^e \qquad 3.21$$

$$M^s = M^d \qquad 3.22$$

Finally, given any endogenous variable Z_t, $\Delta Z_t = Z_t - Z_{t-1}$.

The Workings of the Model

To see how the model works, assume that from a position of full equilibrium, but at a level of activity below that desired by the authorities, there is a rise in the money supply. The money market is thrown out of equilibrium as there is an excess of cash balances over the level desired by the private sector. Because there is a stable demand for money an attempt to unload some of the excess cash balances is made. This is reflected in the absorption function where we see that absorption is positively related to the stock of real balances.

Assuming that the economy is not at full employment, and there are no other reasons why all of the rise in absorption should spill over on to imports, income will rise. This will cause a rise in imports and with exports unchanged, a fall in the balance of trade.

However, we see from the capital outflow function that a fall in the balance of trade is associated with an inflow of capital. Since in the model the balance of payments is defined to be the sum of the balance of trade and capital outflows, it follows that in general, the change in the balance of trade will have a direct and/or an indirect impact on the balance of payments. It will fail to do so only in the case where the net effect of capital flows on the balance of payments just offsets the net effect of the balance of trade. There is no reason why this particular ex ante case should be typical. Any net change in the balance of payments is transmitted to the money supply since, as we have seen, the balance of payments is an argument in the reaction function of the monetary authorities. Should this change lead to a rise in the money supply, the process outlined above will begin again.

Actually, the analysis carried out in Chapter I of this thesis suggests that a kind of money supply —— balance of payments spiral similar to the one outlined in the preceding paragraph — might be characteristic of developing countries. Recall that according to Linder (1967) these countries continually run deficits on the balance of trade. Whenever these are not offset by capital flows the balance of payments also goes into deficit. This reduction in the stock of high-powered money would lead normally to a drop in liquidity which

we may expect the authorities in a developing country to be anxious to avoid. So it is reasonable to expect that these authorities sterilise deficits on the balance of payments enough to permit the money supply to continue to rise. This would result in the kind of spiral outlined above.

In the meantime the domestic money market continues to clear. The rise in income and change in interest rate that accompanies a rise in the money supply together cause the demand for money to rise. Furthermore, the rise in income causes a fall in the balance of trade which also helps to absorb the excess supply of money. In other words, equilibrium in the domestic money market is maintained at the cost of disequilibrium in the foreign sector. This appears to be the problem with which Linder (1967) was concerned. The present model may be viewed as an attempt to develop some of the monetary implications of his work.

The complete working of the model is illustrated by the flow chart in Figure 2. The variables above the double line are predetermined and the arrows indicate the direction of causation hypothesised in this thesis.

The model was designed primarily to offer a structural explanation of balance of payments problems in developing countries and to forecast some of the important parameters in that explanation. However, it is possible to infer some rudimentary policy conclusions from its structure. In the model, lagged high-powered money is a predetermined variable which has associated with it impact multipliers. These can be used to predict the impact in the next time period of a unit change in the current period's monetary base over which the authorities are assumed to have

some control. Furthermore, the way that the policy reaction function of the authorities has been specified allows for an exogenous component in the rate of change of high-powered money. It may be presumed that, mutatis mutandus, the higher is the rate of change of the exogenous part of the monetary base, the higher will be the rate of change of the money supply.

Finally, although the model is cast in terms of comparative statics, two dynamic considerations are implicit. The first relates to the degree of sterilization and the second to the rate of economic growth. It is clear that the greater is the degree of sterilization, the sooner will the economy run out of foreign exchange reserves. On the other hand, the faster is the rate of economic growth, the earlier will the economy reach the phase envisaged in Linder (1967) where the value of necessary imports no longer exceeds the value of maximum exports.

In the next chapter, the theory developed in this thesis is submitted to empirical falsification and validation.

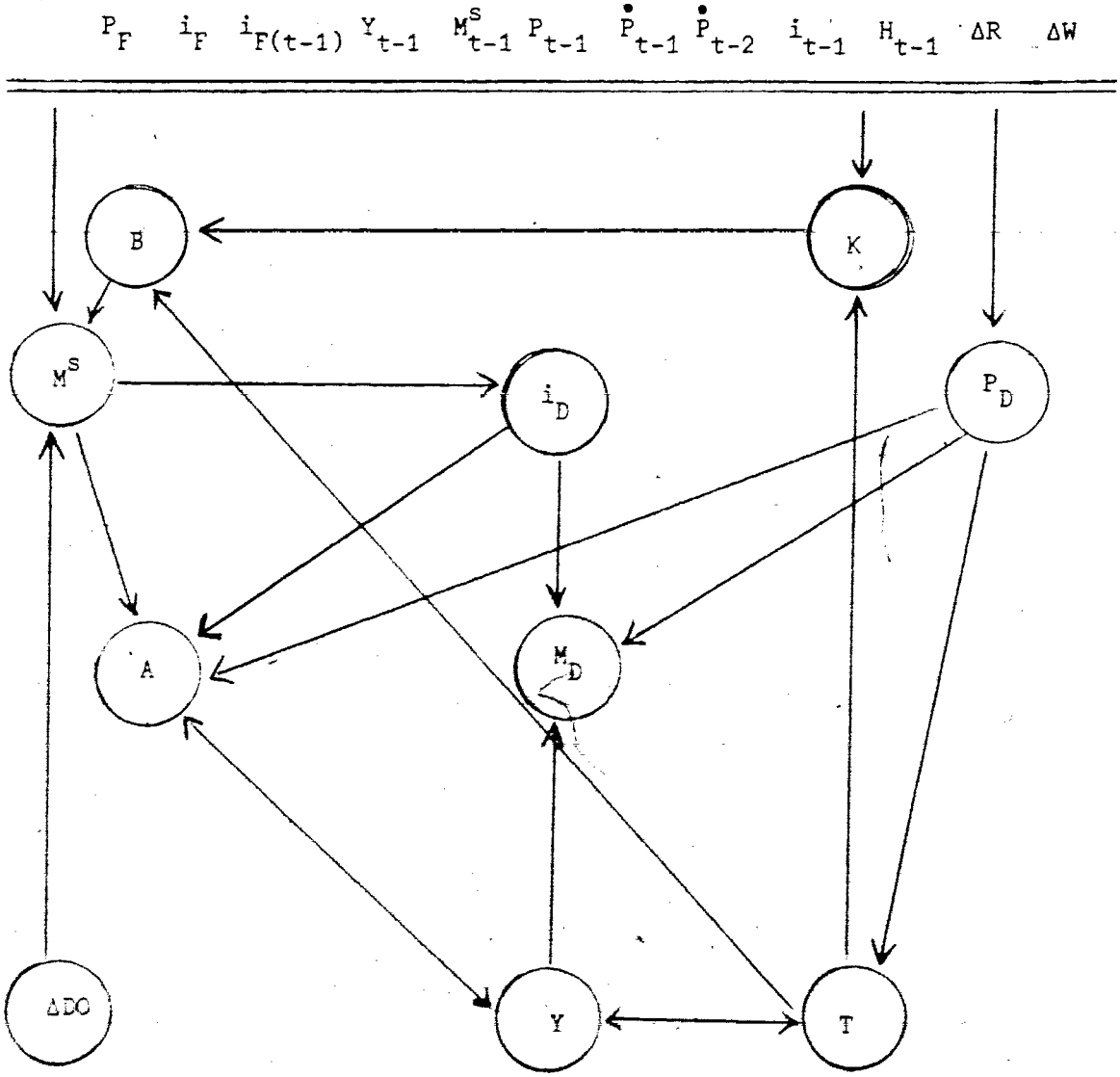
P_F i_F $i_{F(t-1)}$ Y_{t-1} M^S_{t-1} P_{t-1} $\dot{P}_{t-1}$ $\dot{P}_{t-2}$ i_{t-1} H_{t-1} ΔR ΔW
B
K
M^S
i_D
P_D
A
M_D
ΔDC
Y
T

Figure 2

Chapter IV Estimation of the Model

The model was estimated by the method of two-stage least squares (2SLS). As pointed out in the previous chapter, some of the variables in the model are non-linear though all the coefficients are linear. In an important paper, Edgerton (1972) has shown that the unmodified 2SLS method will yield consistent estimates of the parameters in a system like mine; if the total number of predetermined variables in the system is greater than or equal to the sum of the linear endogenous variables, the non-linear variables and the included predetermined variables in each estimated equation.[8] An examination of my model will show that this condition is easily met. This is important since in Chapter I, I claim that the best previous study of the monetary sector of the Jamaican economy, that by Bourne (1974), did not employ a consistent estimator.

Most of the model was estimated on the Simon Fraser University computer, using the Econometric Software Package (ESP) programme. However, some additional estimations were carried out on the University of the West Indies computer. A discussion of the regression results now follows.

The Change in the Money Supply Function

In terms of the features generally regarded as desirable in regression analysis, the money supply regression is the most disappointing one. There is little doubt that this defect reflects the fact that the re-

gressors in equation 3.7 turn out to be collinear in the present sample. However, much of the rest of the model pivots around equation 3.7 and any alteration of this equation might have induced a specification error. Shourie (1972) discusses this dilemma which he claims is frequently encountered in econometric models of developing countries. Arguing the case for keeping all of the regressors even if they are collinear, he says they "should be included even if the t-ratios of one or (all) are not significant so that mechanical regression procedures do not attribute to one of them the variance of the dependent variable that (all) together help explain. From this negative point of view a variable may be very important even if it is 'statistically insignificant'."

The results from estimating equation 3.7 are:

$$\Delta M^S = 3.30 + 0.26\Delta R - 1.15B + 0.11\Delta Y \qquad 4.1$$

$$(t=3.48) \quad (1.19) \quad (-3.55) \quad (2.31)$$

$$\bar{R}^2=0.34; \quad S.E.E.=5.2; \quad d=2.4$$

All the coefficients have signs that were expected. The t value of the intercept coefficient implies that during the period under investigation there was a significantly positive rate at which the monetary authorities permitted the stock of high-powered money to change that was independent of any of the variables specified in my model. This is not surprising since the model does not pretend to incorporate information about all the institutional factors that influenced

the decisions of the governor of the Bank of Jamaica. This fact is acknowledged by the inclusion of an intercept in equation 3.2 from which the intercept in the money supply function is derived. It might be of some interest to note that if the estimate of the intercept coefficient in equation 4.1 can be trusted, it forms the basis for some rudimentary policy analysis, since it permits us to infer the rate at which high-powered money and consequently the money stock, would change for different magnitudes of what we may call the institutionally determined rate of change of high-powered money. I suggest below that this is an area that deserves further study. However, this policy implication is noted in principle only here. Since it appears possible that equation 4.1 may be affected by multicollinearity, it would be wrong to use individual coefficients from that regression for policy prescriptions.

The coefficient linking the change in the level of the reserves of the commercial banks to the change in the money supply is positive, as expected, but the level of significance is disappointing. Also, the size of the reserve-deposit ratio implied by this coefficient is biased upward.

Perhaps the most striking coefficient in the change in the money supply function is that for the balance of payments variable. This is significantly negative and appears to imply that during the period covered in the sample, the monetary authorities pursued a policy of sterilising the balance of payments. This result is of some interest in light of what has happened subsequently to the Jamaican economy.

The final argument in the change in the money supply function is the change in the level of domestic income. This variable yields a significant coefficient with the sign that was postulated in Chapter III. Since, in that chapter, the relationship between the change in income and the change in the money supply was fully discussed, no further analysis will be made here. However, in view of the multicollinearity between regressors in equation 4.1, the results of this regression are offered cautiously.

The Demand for Money Function

Because it is generally assumed that the demand for real balances function is a constant elasticity function, equation 3.8 must be interpreted as a log linear transformation of that function. It follows that the coefficients in the estimating equation are the elasticities of their respective variables. The results are:

$$m_t^d = -0.05 + 0.37y_t - 0.47r_t + 0.31r_{t-1} + 0.7m_{t-1}^d \qquad 4.2$$

$$(t=-.27) \quad (1.9) \quad (-4.4) \quad (3.1) \quad (4.4)$$

$$\bar{R}^2=0.89; \quad S.E.E.=0.08; \quad d=1.7$$

All the coefficients have their expected signs and pass the customary level of significance test. According to the results, the short run income elasticity of the demand for real balances in Jamaica during the 1960's was 0.37. This is within the very wide range

reported by Bourne (1974) who for the same period writes:

> The findings on income-elasticity are much less unambiguous. (ie. than other findings in his study) There is no discernible tendency for long-run elasticities where the broad money definition is adopted. On the other hand with the narrow money definition, income elasticity tends to decline as adjustment is completed. In both cases, the short-run elasticities are positive, though substantially varying in magnitudes. In the case of narrow money the range is 0.1057 to 1.8312: depicting at the lower end a relatively income-insensitive demand for money function and depicting at the upper end an income-sensitivity reminiscent of Friedman's well-know 'luxury good' finding.

As indicated above, the coefficient on the income variable may be interpreted as the short-run income elasticity of the demand for real balances. This is as expected positive and significant. It is well-known that an estimating equation like 4.2 can be generated either from the adaptive expectations process for the permanent income hypothesis or from the partial adjustment of actual to desired stocks of real balances. Following Feige (1967), the former hypothesis was preferred in this thesis. But it is interesting to notice that had I employed the partial adjustment mechanism, the long-run income elasticity of the demand for real balances which can be computed by dividing the coefficient on income by the adjustment coefficient in the equation, would have been estimated to be 1.23. This estimate which is different from Bourne's (1974) is similar to those found in other demand for money studies, where the partial adjustment hypothesis has been maintained.

The fact that the income elasticity of the demand for real balances

appears to be significantly different from unity should warn us against the naive application of Polak's (1957) model to the economy of Jamaica in the manner of Taylor (1972).[9]

According to the results, the real interest rate elasticity of the demand for real balances is 0.47. This is within the range usually found in demand for money studies, and suggests that the Jamaican economy was in the 1960's behaving like a typical monetary economy.[10] It is interesting to notice that equation 3.12 constrains the coefficient on the lagged interest rate variable to be equal to λ times the coefficient on the current real rate of interest, and opposite in sign to the latter coefficients. According to the estimated results this value should be 0.33. As can be seen, the actual estimated value is 0.31 with the correct sign.

It is important to note that this study is the first to discover a significant interest rate elasticity of the demand for money in Jamaica, although others appear to have anticipated such a result.

As expected, the coefficient on the lagged dependent variable is positive and highly significant. The way that the demand for money is specified in the model implies that the weights attached to previous income streams in the calculation of permanent income is relatively high. This may reflect a feature of a fast growing economy such as Jamaica was during the period of this study.

The Absorption Function

The theory developed in Chapter III suggests that the absorption function is of the form

$$A = \gamma_0 + \gamma_1 Y + \gamma_2 (M^S/P_D) + \gamma_3 i \qquad 3.14$$

A single modification was made to the above specification. In 1969, Jamaica encountered its first major balance of payments crisis. The authorities responded by imposing reluctantly a number of controls on the commercial banks and other lending agencies in the country. The aim was to decrease drastically the value of luxury imports that were financed mainly by loans from commercial banks. The controls remained in operation for five quarters. I incorporated a 'crisis' dummy variable CR to the model to pick up the influence of government policy on absorption and the balance of trade.

The results from estimating the absorption function are:

$$A = -14.5 + 0.99Y + 49(M^S/P_D) - 1.6i - 1.8CR \qquad 4.3$$

$$(t=-2.2) \quad (23.9) \quad (2.9) \quad (-1.7) \quad (-1.3)$$

$$\bar{R}^2 = 0.99; \quad S.E.E.=2.5; \quad d=1.7$$

In general, this equation appears to explain domestic absorption very well. A good indication of this is given by the standard error of the estimate. The mean value of absorption over the sample period was \$321.4m. The typical size of the difference between the estimated and observed value of absorption is only \$2.5. The equation therefore fits very well.

As expected, the estimated partial derivative of absorption with respect to income is close to unity. This partial relationship is the strongest in the function. The next most important link appears to be that between the stock of real balances and absorption. According to the coefficient, when real balances change by a unit with the other variables held constant, absorption changes by nearly $50m. This is plausible in view of the fact that one of the variables that is being held constant is income, which we have seen has a very strong impact on absorption.

It is interesting to note that the interest rate coefficient has the right sign and is significant at the 95 percent level for a one-tailed test. On reflection this is not surprising since so much of domestic expenditure by the private sector for both consumption and investment during the 1960's was financed by credit. This result appears to suggest that there was much more scope for interest rate policy than is accepted by conventional wisdom.

The coefficient on the 'crisis' dummy variable has the expected sign, but it is significant only at the 90 percent level. This means that we should be cautious in claiming that this study shows that the crisis measures had their desired impact. Nonetheless the dummy variable marginally improved the fit of the regression.

The Balance of Trade Function

The results from estimating the balance of trade function are

$$T = 12.2 - 0.1Y - 0.008(P_D/P_F) - 0.002\Delta Y + 3.8CR \qquad 4.4$$

$$(t=3.6) \quad (-6.2) \quad (-2.4) \qquad (-0.07) \quad (1.5)$$

$$\bar{R}^2 = 0.62; \ S.E.E.=4.6; \ d=2.3$$

Once more, all the coefficients in the regression have the signs that were predicted in Chapter III. However, that for the change in the level of domestic income is not significantly different from zero. That on the 'crisis' dummy is significant at the 90 percent level and the others at the 95 percent level or more.

Just as outlined in the model, a rise in income causes a deterioration in the balance of trade. The coefficient shows that when income rises by $1m it causes the deficit in the trade balance to increase by $100,000. Jamaica therefore corresponds very closely to the type of economy Linder (1967) was discussing. An understanding of that work, along with the finding in this thesis, makes it difficult to accept Johnson's (1977) attack on structural models of the balance of payments for underdeveloped economies.

The coefficient on relative prices makes it clear that a rise in the local price level relative to world prices causes a fall in the balance of trade. This is in agreement with received theory. It may also suggest that Harrod's (1952) doctrine, according to which devaluation worsens rather than improves the balance of trade, is not relevant for Jamaica. However, this is only a tentative conclusion. The thrust of that argument is that devaluation can actually cause the domestic price level to rise if the demand for imported inputs is

inelastic and this is clearly the case in Jamaica. More research is needed to discover if the adverse effect on imported inputs of a change in the terms of trade brought about by devaluation outweighs the beneficial effects on trade in final goods, of an adjustment in relative prices. Nonetheless, the finding on this coefficient should be of some value to policy makers in Jamaica.

The coefficient on the 'crisis' dummy suggests that the measures introduced in the last quarter of 1969 had the desired impact on the decline in the trade balance.

The Capital Outflow Function

The capital outflow function developed in Chapter III is meant to represent a synthesis of both the Branson and monetarist versions of the stock adjustment model. The results from estimating that function are

$$K = -0.67 - 0.05(\Delta i_D - \Delta i_F) + 1.18T + 1.16\Delta DO + 0.0004\Delta W + 0.06\Delta Y \qquad 4.5$$

$$(t=-0.58) \quad (-0.03) \quad (8.81) \quad (1.80) \quad (0.84) \quad (1.49)$$

$$\bar{R}^2=0.69; \quad S.E.E.=4.6; \quad d=1.75$$

In this regression, the coefficients on relative changes in interest rates, the balance of trade, change in the domestic assets of the central bank and the change in world income all have the right signs. That on the change in the level of domestic income differs from what was predicted in Chapter III.

However although the sign of the coefficient on the interest rate variable is what was expected, this coefficient does not differ significantly from zero. This appears to confirm the view expressed to me by Jamaican economists that most of the capital movements between the rest of the world and Jamaica during the 1960's was undertaken by the multi-national bauxite corporations and was not very sensitive to short-term interest rates movements. The problem here was anticipated in Chapter III when I admitted that the capital outflow variable in the model might be too aggregative to enable us to test the modern theory of international capital movements adequately. Nonetheless the coefficients on the other two major variables are significant at the 95 percent level and over.

It will be recalled that the monetarist version of the stock adjustment model of capital flows predicts that the coefficients on the balance of trade and the change in domestic assets of the central bank should be similar. This turns out to be the case in Jamaica. The coefficients are close to unity. In the monetarist model this is evidence of perfect capital mobility. But it was made clear in Chapter III that the capital outflow function in this thesis is meant to reflect a synthesis of the Branson model and the monetarist model; so the value of those coefficients should not be interpreted necessarily as proof of any exclusive monetarist hypothesis. Branson's and Hill's (1971) purpose for including a balance of trade variable is to capture the effect of trade credit on capital flows. This effect also might be expected to produce a coefficient close to unity in an economy like Jamaica.

The coefficient on the change in the proxy for world income has the sign predicted by monetarists for a given rate of change in the world money supply. However the value of this coefficient does not differ significantly from zero.

Finally in the capital outflow function, the coefficient on the change in domestic income has a positive sign and is significant at the 90 percent level for the one-tailed test. This means that as Jamaicans became richer they demanded relatively more foreign assets. This finding is contrary to what is predicted by monetarists and what was expected in this thesis. However, it is consistent with the accusation made by certain Jamaicans against some of their wealthy compatriots. These are sometimes accused of exporting wealth that is needed for the development of the country.

Slightly more than 30 percent of the variance in capital movements between Jamaica and the rest of the world is left unexplained by the present model. This probably reflects the fact that the explanatory equation does not include a variable to capture the stock or scale effect of capital movements. The modern theory of capital flows shows unambiguously that such an effect is important. However, as it was pointed out in Chapter III, it is usually difficult to find data that are useful for incorporating that effect. Such was the case in this study.

The Domestic Price Level Function

When equation 3.17 was estimated by the straightforward 2SLS method,

the sole independent variable and the intercept explained 97 percent of the variance of the domestic price level. However the Durbin Watson statistic was 0.43 signifying a very high degree of negative auto-correlation. It seemed desirable to tackle this problem.

Fair (1970) has developed a consistent estimator that combines the properties of 2SLS and the Cochrane and Orcutt (1948) iterative least squares method. A problem with this method, is that it requires in addition to the use of all the predetermined variables in the model as regressors at the first stage, those also of the lag of the predetermined variables, the lag of the included endogenous variables and the lag of the regressand. The use of all these variables as first stage regressors greatly increases the danger of multicollinearity and reduces the degrees of freedom available for estimating the first stage.

To over come this problem, I replaced the predetermined variables and the lag of the predetermined variables which are excluded from equation 3.17 with a vector of their principal components. A simple treatment of this approach, which incidentally takes special note of the problems incurred in estimating simultaneous equations models for less developed economies, is given by Klein (1973). The results from estimating the transformed equation are

$$P_D = 133.3 + 16.3P_F \qquad 4.6$$

$$(t=96.4) \quad (13.7)$$

$\bar{R}^2=0.97$; S.E.E.=1.8; d=1.8

As expected, nearly all the variance in the domestic price level can be explained by an index of the price of imports. This is ample confirmation of the hypothesis, first stated by Brewster (1968) and accepted in this thesis, that the determinant of the price level in Jamaica and other Caribbean economies is the cost of imported inputs, including food, for domestic production.

The Impact Multipliers of the Model

In view of the fact that the model is a short-run one, I have derived in absolute terms the impact multipliers with respect to the predetermined variables for those six endogenous variables that are functions in the model. These multipliers are given in Table I. Each element in the coefficient matrix shows the direct impact on the now endogenous variable of a unit change in the column predetermined variable when the other predetermined variables are held constant. A blank element indicates that the t statistic of the coefficient is less than unity. Although impact multipliers are of limited value for the construction of economic policy, they may help decision makers to understand the short-term impact of a change in monetary policy on some crucial endogenous variable, for instance the impact of a unit rise in the balance of trade performance. To this extent, the entries in the last column may be of considerable interest.

TABLE I

Endogenous Variables	Predetermined Variables												
	ΔR	ΔW	P_F	i_F	$i_{F(t-1)}$	Y_{t-1}	M^s_{t-1}	P_{t-1}	$\dot{P}_{t-1}$	$\dot{P}_{t-2}$	i_{t-1}	H_{t-1}
ΔM^s			22.3			-0.09	0.6	0.25			1.6	
m^d			0.07			-0.0006	0.001	0.002	0.04			0.003
A	-1.0		66.6			-0.2		0.62	-20.7	-14.7		
T	-0.3		3.2			0.08	-0.2				1.3	-0.4
K	-0.8		-5.0			0.2		0.42			2.5	
P_D	-0.1		17.2	-1.7		0.03	0.1	0.07			-0.2	-0.3

Testing the Model

The first test applied to the model is to determine whether the identifying restrictions were correctly employed. The problem addressed here stems from the use of 2SLS to estimate a system which contains several over-identified equations. In order to produce unique estimates of the structural parameters in these equations 2SLS makes use of predetermined variables in the system excluded from individual equations. This first test given by Basmann (1960) is to discover if predetermined variables that have been excluded from individual equations were correctly excluded.

This test compares the unexplained variation (e'e) in the dependent variables in the structural model, with the unexplained variation that would result from making the endogenous variables in each equation a function of all the predetermined variables in the system (w'w). If predetermined variables are correctly excluded, there should be no significant difference between e'e and w'w. That is, the ratio e'e/w'w should be close to unity.

The Basmann test has an F distribution with (n-g+1) and (T-K) degrees of freedom where n is the number of excluded predetermined variables, g is the number of endogenous variables, T is the number of observations and K is the total number of predetermined variables. It is written

$$F = \left\{(e'e/w'w) - 1\right\} \left\{(T-K)/(n-g+1)\right\}$$

A computed F less than the critical value of F (F_c), indicates that the related equation is well-specified in terms of the predetermined variables in the model. The results of the Basmann test are given in Table II.

TABLE II

Equation	e'e	w'w	F	F_c
4.1	1138.16	573.0	3.80	3.39
4.2	0.059	0.041	2.96	4.11
4.3	539.0	518.01	0.14	3.39
4.4	676.1	561.8	0.92	3.56
4.5	1704.3	1003.3	3.49	3.86
4.6	98.7	78.6	0.66	3.06

Only the change in the money supply equation fails (marginally) to pass the specification test. Therefore we can look forward with some interest to the predictive power of the model.

The model was tested for its forecasting accuracy using as a measure of performance Theil's (1966) Inequality Coefficient. This coefficient is yielded by the formula

$$U = \left[\Sigma(P_t - A_t)^2 / \Sigma A_t^2\right]^{\frac{1}{2}}$$

where P_t is the predicted value and A_t the actual value of the variable being predicted. It is bounded by zero and infinity. A value close to zero indicates a good forecast whereas a value greater than unity indicates a fairly inefficient forecast. The coefficient is implicitly compared to the naive forecast of no change in the variable. However I have compared the forecasts from the model with the forecasts yielded by a more rigorous naive predictor according to which, for any variable z,

$$z_{t+1} = a_1 z_t + a_2(z_t - z_{t-1})$$

The Theil Inequality Coefficient for the naive forecast is given in the last column of Table III under the heading U'. In fact, this turns out to be a very powerful forecast test, for as Nelson (1973) has remarked: "Because of the strong tendency economic time series have to maintain their level of rate of change, these naive predictors are often hard to beat." It will be seen that the model beats this naive predictor in all but one case, the change in the money supply function. The OLS estimates of the reduced form of the model were used to generate the forecasts.

TABLE III

Quarter	Forecast	Observed	Error	U	U'
	A. Change in the Money Supply				
3/1971	4.87	12.60			
4/1971	1.83	19.80			
1/1972	-4.86	-8.10			
2/1972	0.62	12.00			
	Average absolute error		10.08		
	Theil Inequality Coefficient			0.83	0.36
	B. Real Balance Demand				
3/1971	0.82	0.85			
4/1971	0.86	0.97			
1/1972	0.92	0.92			
2/1972	0.90	0.98			
	Average absolute error		0.056		
	Theil Inequality Coefficient			0.076	0.03
	C. Absorption				
3/1971	305.3	317.4			
4/1971	326.1	316.0			
1/1972	341.2	307.7			
2/1972	332.8	344.3			
	Average absolute error		16.80		
	Theil Inequality Coefficient			0.060	0.91

Quarter	Forecast	Observed	Error	U	U'
	D. Balance of Trade				
3/1971	-15.39	-19.60			
4/1971	-16.23	-19.50			
1/1972	-21.44	-20.70			
2/1972	-21.88	-23.20			
	Average absolute error		2.38		
	Theil Inequality Coefficient			0.133	0.99
	E. Capital Outflow				
3/1971	-15.53	-15.18			
4/1971	-18.13	-29.08			
1/1972	-22.99	-46.70			
2/1972	-32.66	-2.62			
	Average absolute error		16.26		
	Theil Inequality Coefficient			0.695	0.82
	F. Domestic Price Level				
3/1971	162.6	165.0			
4/1971	167.5	165.0			
1/1972	171.8	165.0			
2/1972	170.9	167.0			
	Average absolute error		3.88		
	Theil Inequality Coefficient			0.025	0.47

Table III must be interpreted as showing that in every case the model forecasts better than the naive forecast implicit in the Theil Coefficient. However, it is well-known that accurate forecasts by themselves do not establish the validity of a model. It is doubtful whether any econometric criterion that establishes the validity of an econometric model will ever exist. But in an economy where many of the strategic variables are beyond the control of the authorities, some method of forecasting the values of these variables is desirable. Although the model in this thesis is small, it has embedded some of the key monetary variables of a developing economy in a structure based on sound economic theory. And as Klein (1968) asserted, "best predictions will be made from best structural models." The forecasting ability of the model is recommended with the above caveat and testimonial equally in mind.

Policy Implications of the Model

The results in Table II indicate that we can be fairly confident about the asymptotic estimates of the money demand function, the absorption function, the balance of trade function, the capital outflow function and the domestic price level function. We must be more cautious in interpreting the change in the money supply function.

From the point of view of economic policy the results from the estimation of the demand for real balances function are of much interest. Here we notice that once the interest rate variable is

carefully selected and specified economies at the stage of development that characterised Jamaica in the 1960's appear to have similar scope for monetary policy to that found in more advanced economies. This is contrary to the claim Bolnick (1976) appears to be making. It might be of interest also that the short-run income elasticity of the demand for money does not suggest that it was a luxury good in Jamaica during the 1960's. That inference is supported by the finding of a very strong link between real balances and absorption in the absorption function. The implication of this is that the monetary authorities have a limited scope for expanding the money supply without inflation and balance of payments problems. The estimate of the impact multiplier with respect to lagged high-powered money on the balance of trade also bears this out.

The results suggest that the two balance of payments variables behave approximately in the way Linder's (1967) theory and this thesis predict. The policy implication of this has been discussed fully in Chapter I.

The findings on the domestic price level are not new, and Brewster (1968) has already suggested a number of policy implications to which little needs to be added.

This brings me to the subject of further research into the issues discussed in this thesis. First it should be noted that this is the first study of the Jamaican economy to discover a significant interest rate effect on the demand for real balances. It appears that estimating this function in a simultaneous equation model leads to a more

precise account of the effect of the interest rate. It will be recalled that Teigen (1964) shows that single equation estimates of the demand for money underestimates the interest sensitivity of this function. When my study is compared with that of Bourne (1974) it appears to show that what Teigen found for the U.S. is true also for the Jamaican monetary sector.

Nonetheless, it is clear that the model developed in this thesis can be improved. The Basmann test shows that the change in the money supply function is not entirely well-specified. It should be possible to correct this without severely altering the model. The dynamic properties of the model have been largely ignored. It should be possible to develop the model to take explicit account of these.

We now have several models of the real sector of the Jamaican economy and the monetary model developed in this thesis. It may be profitable to combine features from the models of the real sector with features from this monetary model to obtain a more comprehensive understanding of the Jamaican economy.

Finally, further estimation of the model using later and perhaps more accurate data may be required to increase our confidence in policy prescriptions based on the estimates of its parameters.

List of References

1. Moggridge (1976, pp.54-55) shows clearly that Keynes knew of the approach before The Economic Consequences of the Peace (1919).

2. An account of Koopmans' major work Zum Problem des Neutralen Geldes (On the Problem of Neutral Money) (1933) is given in de Jong (1973).

3. Here Koopmans is anticipating Myrdal's well-known distinction between ex ante and ex post categories. Koopmans uses the terms 'spontaneous' and 'induced'.

4. Inflation expectations are formally derived by using the Nerlovian adjustment mechanism $\dot{p}^e = \dot{p}_{t-1} + \Pi(\dot{p}_t - \dot{p}_{t-1})$ and arbitrarily assigning Π the value of zero. This follows the tradition set for monetary studies of developing countries.

5. In a letter dated 12 May 1977 from L. Muschette, Director of Research, Bank of Jamaica.

6. As Patinkin (1948) shows, the money variable that is relevant for the real balance effect is the stock of government interest-bearing and non-interest-bearing debt. However, I follow the tradition started by Klein (1947) and followed by many economists of using M^S/P as a proxy for real balances in econometric work.

7. See Tinbergen (1967) pp.111-112. A similar point was later made by Grubel (1968); see particularly pp.1312-13.

8. The appropriateness of the 2SLS estimator for non-linear models has been demonstrated also by Amemiya (1973) and Kelejian (1971).

9. Teigen (1974) shows easily that a constant income velocity, the Polak assumption, implies a unitary income elasticity of the demand for money. His reasoning is as follows. If velocity is constant, $M^d=\beta y \rightarrow \Delta M^d = \beta \Delta y$. We may write the income elasticity of the demand for money as $\frac{\Delta M^d}{\Delta y} \cdot \frac{y}{M^d} = \beta \frac{y}{M^d}$. But $M^d=\beta y$ so that we end up with $\frac{\beta y}{\beta y} = 1$.

10. However the interest rate elasticity appears to be relatively high. It was pointed out to me after the model was estimated, that an expected rate of inflation variable should enter the demand for money function in conjunction with the real interest rate. The omission of this variable may be responsible for the apparent upward bias in the real interest rate elasticity.

Appendix 1 List and Description of Variables used in the Thesis

MI = imported inputs

D = domestic inputs

S = gross domestic saving

I = gross domestic investment

X = exports

M = Imports

Y = nominal income (money gross domestic product)

y = real income

y^P = permanent real income

C = gross private consumption

G = government expenditure

T = balance of trade (X-M)

A = domestic absorption

F = stock of foreign exchange reserves

DO = domestic assets of the central bank

R = commercial banks' reserves

L = commercial bank loans

DE = commercial banks' deposits

CA = cash in the hands of the non-bank public

H = high-powered money

H_{t-1} = lagged high-powered money

H* = desired high-powered money

B = balance of payments (ΔF)

P_D = domestic price level

P_F = foreign price index

$\dot{p} = (P_{D_t} - P_{D_{t-1}})/P_{D_{t-1}}$

$\dot{p}^e = \dot{p}_{t-1}$

i_D = domestic interest rate

i_F = foreign interest rate

r = real interest rate

M^s = money supply

M^d = money demand

m^d = real balanced demand (M^d/P_D)

d = banks' reserves ratio

ΔW = change in world imports

K = capital outflows

Appendix 2 Variables in the Structural Model

Endogenous Variables	Pre-determined Variables
H	ΔR_t
M^s	ΔW
m^d	P_F
A	i_F
T	$i_{F(t-1)}$
K	Y_{t-1}
P_D	M^s_{t-1}
Y	P_{t-1}
B	$\dot{P}_{t-1}$
i_D	$\dot{P}_{t-2}$
r	i_{t-1}
ΔDO	H_{t-1}

Appendix 3 Data

All the data used in the study are taken from the International Financial Statistics of the International Monetary Fund.

This source does not publish quarterly data on income and absorption and these are not available for Jamaica in any other source. Following Bourne (1974) the quarterly series for these variables were derived from the annual series by a linear interpolation subjected to the constraint that the interpolated quarterly values of merchandise imports were used as weights in the interpolation.

Throughout the study the domestic interest rate refers to the yield on Jamaican treasury bills and the foreign interest rate to the U.K. treasury bill rate.

The domestic price level is the Kingston consumer price index. The derivation of the foreign price index is described in the text.

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