A QUARTERLY MONETARY MODEL OF THE TRINIDAD AND TOBAGO ECONOMY: 1970:I - 1978: IV

BY

W. JOEFIELD-NAPIER

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INSTITUTE OF SOCIAL AND ECONOMIC RESEARCH
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INTRODUCTION AND OVERVIEW

The purpose of this paper is to analyse the sources of change in Trinidad and Tobago's prices, real output and balance of payments in the eight years preceding 1978. To do this, we construct a model which highlights the interrelationships between the real and monetary sectors of the economy. Using quarterly data and some estimates, we measure the sensitivity of the real macroeconomic variables to monetary changes.

This study is of interest for three reasons: first money is recognized as important in affecting the course of economic activity. Hence, the channels through which money supply and demand changes are important for control purposes. Several studies have examined various aspects of the channel through which Trinidad and Tobago money supply and demand changes impinge on the real sector. Bourne [1979] examined the behaviour of interest rates in Trinidad and Tobago from 1969 to 1976; and Ramsaran [1979] investigated the relationship between the balance of payments and money stock between 1966 and 1975. The present study examines money supply and money demand relationships from 1970 to 1977. The results of this study can be compared with the previous studies.

Second, this study is the first to analyse the relationships between real and monetary aggregates for this eight year period. In this context, it may be noted that Persaud [1975] has constrcted a macroeconometric model of the Trinidad and Tobago economy, but a major defect of this model is that it ignored the interaction between the real and monetary sectors. To the extent that the model in this study traces the sources of change in the private and government sectors back to changes in both the monetary and foreign sectors, it contributes to our understanding of the workings of the Trinidad and Tobago economy.

The third reason for undertaking this study is that it introduces new empirical information into the existing controversy in Caribbean monetary economics between advocates of short term monetary policies and advocates of short term fiscal policy. The Keynesian and 'Classical' economists opinions concerning the relative importance of monetary and fiscal instrument for stabilizing economic activity are crucial to their arguments: the former argue that additions to and substractions from the flow of expenditures are the most important factors influencing economic activity, while the latter argue that "money does matter" and as such it affects economic activity more significantly than other exogenous variables. In deriving impact multipliers from the model, this study provides a basis for judging the validity of the arguments used in the controversy.

Section two (2) of this paper presents the theoretical structure of our quarterly model with a detailed examination of the individual equation and their role in the model. Section three (3) gives the statistical estimates and the application of the model. As well, the response of the real sector to sets of assumptions about changes in the monetary and foreign sectors are quantitatively traced. The exercise enables us to derive the general inter-action between balance of payments changes and growth in the domestic economy which in turn provides a consistency check to any quantitative recommendations that may be made by the Central Bank.

THE MODEL

The theoretical structure of the model can best be illustrated by Flow Chart I. The system of equations which are the counterpart of this flow chart is as follows:-

A : The Real Sector Equations

A1: The Consumption Function

$$\left(\frac{C}{P}_t\right) = a_o + a_1 Y + a_2 (C/P)_{t-1}$$

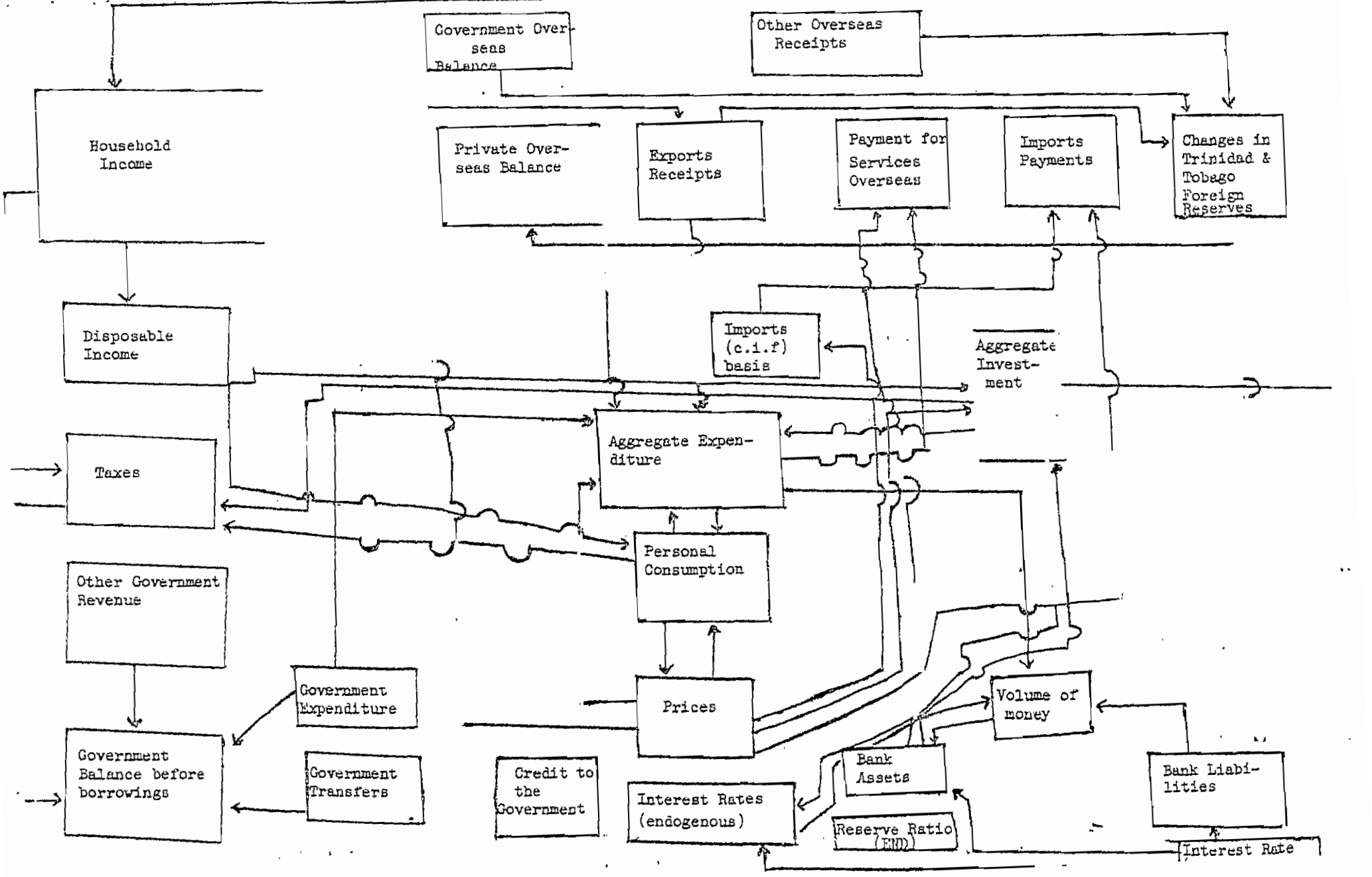
with $a_1 > o$ and $a_2 > o$, and

where C/P = real consumption expenditure

Y = real income, and

$(C/P)_{t-1}$ = real consumption expenditure in the previous period.

FLOW CHART I: MONETARY & INCOME FLOWS IN THE TRINIDAD AND TOBAGO ECONOMY



A2: The Investment Function

$$I_t = b_o + b_1 Y + b_2 LRI_{t-1} + b_3 I_{-1}$$

with $b_1 > o$, $b_2 < o$, and $b3 > o$

I = Investment

Y = Real income and

LRI = The long term rate of interest

A3: The Government Revenue Function

$$(GRE)_t = C_o + C_1 Y + C_2 P^e$$

with $c_1 > o$, and $c_2 < o$

where GRE = government revenue,

Y = real income, and

P^e = the rate of inflation

A4: The Import Demand Function

$$(IM/P)_t = d_o + d_1 Y + d_2 (Pm/Pn)$$

with $d_1 > o$, and $d_2 < o$

where IM/P = the volume of imports

Y = real income, and

Pm/Ph = the ratio of import prices to domestic prices.

A5: The Export Demand Function

$$(EX/P)_t = e_o + e_1 Y_f + e_2 (P_x/P_w)$$

with $e_i > o$ and $e_2 < o$

Where EX/P = the volume of exports

P_x = the price index of total exports

P_w = a weighted index of UK, USA and Canadian import prices.

A6: The Price Function

$$(P-P_{t-1})/P_{t-1} = f_o + f_1 Y + f_2 MS$$

with $f_1 > o$ and $f_2 < o$

where $(P_t-P_{t-1})/P_{t-1}$ = the relative change in prices

Y = real income, and

MS = money supply.

B The Monetary Sector Equations

(B1) The money demand function

$$(M/P)_t = g_o \lambda_o + g_1 \lambda Y + g_2 \lambda P^e + g_3 \lambda TBR + (1-\lambda)(M/P)_{t-1}$$

with $g_1 > o$, $g_2 < o$, and $g_3 \lessgtr o$, and

where (M/P) = real money balance

Y = real income

P^e = the rate of inflation, and

TBR = the short term interest rate.

(B2) — The Money Supply Function

$$MS = h_o + h_1 UBR + h_2 DRI + h_3 LIQ$$

with $h_1 > o$, $h_2 < o$, $h_3 > o$

where MS = money supply

UBM = unborrowed base money

DRI = the difference between the discount rate and short term interest rate (TBR)

LIQ = the liquidity ratio

(B3) The Term Structure of Interest Rate Function

$$LRI_t = k_o + k_1 TBR + k_2 LRI_{t-1}$$

with $k_1 > o$, $k_2 > o$

where LRI= the long term rate of interest, and

TBR= the short term rate of interest.

C: IDENTITIES

Income

(C1) $Y = C+I +E_n$

where Y = aggregate income

C = consumption

I = investment

E = autonomous expenditure

((C2) BALANCE OF PAYMENTS

$$NFA = XP - IM + NFK$$

where NFA = net foreign assets

XP = the value of exports

IM = the value of imports

NFK = net foreign capital inflows

(C3) RESERVE MONEY

$$BM = XP - IM - GR + GE + \Delta PSC$$

where BM = the stock of base money

XP = the value of exports

IM = the value of imports

GR = government domestic revenue

GE = government expenditure

PSC = private sector credit

Before we go into an equation by equation exposition of the complete system it is of some importance to note a few interesting features of the model. First, it can be observed that in the foreign sector both the savings and trade gaps (that is, the well known "two gaps" of Chenery and Strout) have been aggregated into a single gap which may be termed the "resource " gap. Essentially, the latter gap indicates the difference between potential expenditure flows such as consumption plus investment plus exports and the availability of total resources as measured by the gross domestic product plus imports. In the theoretical model this gap is measured by the national income identity.

Second, the feedback of the resource gap and the phenomenon of inflation are recognised - implicitly/explicitly in the model. Thus, in the model, as the pattern of expenditure flows are formed on one side of the real sector, aggregate real supply is generated on the other side through capital stock. This gap, which may be defined as:-

$$\text{Excess Demand} = C + I + E - IM - GDP$$

contains slack variables such as inventory investment and exogenously elements of demand flows such as government expenditure on goods and services and net income from abroad. The net value of the 'gap' measures the magnitude of excess demand in a given period left unsatisfied due to supply shortages.

In the monetary sector institutional factors, such as banking habits and government's monetary policy, determine the supply of money, and this in turn influences the level of demand. Together with the inflationary gap the monetary situation determine the process of growth through the terms of trade, the cost of borrowing funds (interest rate) and associated variables.

Third, quarterly data have been utilised in the estimation of all the parameters, the use of this type of data has the distinct advantage of adding to the degrees of freedom and so enables the sample to cover a much wider variety of experiences of the various sectors of the economy. Furthermore, the parameters that are estimated can be much more meaningful in the formulation of policies, than parameters derived from annual data.

The specification of the model equations may also be examined briefly. In the set of equations (1) - (6) in the monetary model, Equation (A1) measures the behaviour pattern of aggregate consumption. In line with the standerd practice followed in macro monetary models, the movements of real income determine movements in real expenditure. The relationship is however modified by the introduction of another structural variable which measures the extent of past levels of consumption expenditure.

This variable plays a dual role. Firstly, it implies that if hthe level of consumption expenditure in the past was high, there is likely to be greater stimulation of consumption in the future. Secondly, it is intended to capture the fact that an increasing orientation of the economy towards the utilization of consumer goods will invariably lead to an expansion of consumer goods industries and this in turn would siphon off potential capital goods investment funds. As such the past consumption expenditure variable will have an indirect impact on capital goods investment.

In equation (A2) investment flow is measured through the absorptive capacity variable GDP. The growth of gross domestic product and previous levels of investments are the variables which are expected to be conducive to investments.

Equation (3) determines the expenditure flow on imported goods. While Gross Domestic Product captures the income effect, the ratio of domestic prices to import prices are introduced to capture the substitution effect, if any, between the domestic versus foreign sources of supply. It may be argued that the relative prices are irrelevant to cases of imports required by Trinidad and Tobago since a substantial part of its imports are in the form of petroleum which are refined and then re-exported. Although this may be true for petroleum, merchandise imports for consumption goods as well as capital goods and machinery have been observed to have a significant relative price effects. The size of relative price elasticity, however, is expected to be low in the case of capital goods and machinery, but high in the case of consumption goods. Furthermore, even in the case of consumption goods, we expect that the general profitability in the domestic market as indicated through the relative price variable may accelerate import substitution processess and so influence the size of the relative price elasticity. Finally, it should be noted that in equation (3) a net foreign reserves variable could be introduced to capture the fact that in a developing economy - such as Trinidad and Tobago - the overall capacity to import might be constrained by the overall balance of payment position. Unfortunately, such a variable has been omitted in this study.

The behaviour of merchandise exports is determined by equation (4). In this equation, the level of income or activity of the importing area or country,and price of exports commodities are considered as the main determinants of foreign demand for Trinidad

and Tobago's exports. At this point it may be noted that although we recognised that the terms of trade position could be affected by the economy's past position in the area of international trade, we did not include any variable in the export equation to reflect this. Equation (5) is a proxy for the movements in the general price level. As has been indicated previously the value of excess money supply together with the real value of aggregate excess demand determine the movements in prices, therefore, ideally, in defining an equation for representing price changes, a variable representing normal or safe money should be included. The 'safe' level of money supply is that when corrected for any exogenously determined variations in velocity grows at the same rate as real output. In other words, it is that level of money which only changes to accomodate and is in con-currence with any changes in real production and money income velocity. As such, any change beyond the safe money supply promotes an acceleration in price movements. The fact that our price equation does not include the 'safe' level of money is an apparent deficiency in the model. As such, we do not know from the model whether or not the monetary authorities are highly efficient and capable of making quick and complete adjustments of actual money supply to the 'safe' level.

Equations (B1)-(B3) represent the monetary flows in the model. Equation (B1) describes the demand for money. The inclusion

of the income variable in the equation can be justified on the ground that short term fluctuations in the levels of real balances are in the main determined by changes in the level of domestic demand factors.

As for the variable 'Pe' its inclusion as an explicit variable in the demand equation for money can be justified on two grounds. Firstly, due to the relatively underdeveloped nature of the capital market in Trinidad and Tobago, the real alternatives to monetary assets are the real assets such as real estate and consumer durables. Hence, any change in their prices would reflect on the demand for money. Second, in an inflationary climate, such as that which existed in the economy since 1970, we expect that the holders of money would minimize the cost of holding money by shifting to financial assets which in essence would reflect the change in commodity prices rather than in interest rates.

A major conceptual problem exists however, in the inclusion of 'pe' in the money demand equation, since in essence the rate of interest that has been specified as one of the explanatory variables in the equation itself embodies the rate of change of prices. In other words, there is likely to be a high incidence of multicollinearity between 'p^e' and 'r.' Notwithstanding this apparent shortcoming the two variables 'p^e' and 'TBR' were included in the equation, since other researchers have found that the relationship between these variables is insignificant.

Turning to the short term interest rate (TBR) our preference for its use rather than the long run interest rate (LRI) in the money demand equation is based on two grounds; first, in the post 1970 period there has been an upsurge in the demand for short term bonds by Trinidad and Tobago households; and second, the money supply equation that we will be discussing subsequently contains the short run interest rate, (TBR) in DBR. The point that is being made here is that in order to examine the interactions between the supply of and demand for money functions, it seems better to utilise TBR rather than LRI in the money demand equation.

The specification of the money supply equation basically rests on two hypotheses about commercial banks behaviour in Trinidad and Tobago; the first is that local banks adjust their portfolios to optimize profits, and these adjustments in turn affect money supply independently of any action by the Central Bank, and the second, is that commercial banks are uncertain as to the direction and magnitude of shifts in their current interest rate structure and hence with regard to the market value of the non-natural securities in their portfolios. The preceding hypotheses imply that a typical commercial bank needing funds at short notice and faced with uncertainities has only two options: the first, is the transformation of one type of assets (say, Treasury Bills) into an eligible asset, or the second, is a simultaneous creation of an asset (reserves) and a liability (by borrowing). The choice options that are open to the Commercial bank can best be summarized by using the simplefied balance sheet given in Table I below.

TABLE I

COMMERCIAL BANK BALANCE SHEET

ASSETS		LIABILITIES	
Foreign Assets	: FA	Foreign Liabilities :	FL
(a) Foreign Liquid Assets		in $ Trinidad & Tobago to non-residents	
(b) Foreign Earning Assets		in foreign currency to	
		- non residents	
		- residents	
Required Reserves	: RR	Demand Deposit Liabilities:	DD
Excess Reserves	: ER	Time Deposit Liabilities	:TD
Government Securities	: GS^B	Other Liabilities	:OB
Loan Portfolio	: LP^B	Capital	
(a) Bank Accepts			
(b) Trade Bills			
(c) Export Accepts etc.			

While the simplified balance sheet in Table I does not give the whole picture for a commercial bank, it can be clearly seen that in principle if such a bank is in need of reserve it can in principle vary any of the following: FA, RR, ER, GS^B or LP^B. However, the extent to which it can vary these parameters will of course be determined by the constraints it faces, for instance, liquidity ratio, borrowing terms and costs, and so on.

While we have dealt with the options available to a single bank in need of eligible assets, it goes without saying that the analysis could be extended to the entire commercial banking

system. We have done this here, and for the sake of simplicity we further assume that in equilibrium all domestic inter-bank lendings and borrowings cancel out. Hence, under the prevailing assumption, the commercial banking system as a whole adjusts its portfolio only with respect to the public and the Central Bank.

One of the advantages of the approach outlined above is that it allows us to highlight the way in which the money supply mechanism run- that is, the monetary authorities supply base money which is distributed between the public and the commercial banks according to their portfolio preferences, and the resulting allocation determines money supply.

Money supply is a multiple of base money creation, and the variables included in the function are derived in the following way:

Let $B = C^P + R$ (the total monetary base under the control of the Central Bank).

where the components and the sources of B are:

COMPONENTS	SOURCES
RR: Required Reserves	GS^{CB}: The Central Bank holdings of government securities
ER: Excess Reserves	BB_{Co} : Borrowings by commercial banks
C^P: Currency	NFA : net foreign exchange reserves - FL-FA

Now let $UBM = GS_{CB} + NFA$ (the unborrowed monetary base) (B2.1)

so that

$$RR + ER + C^P = BB_{co} + UBM \qquad (B2.2)$$

Equation (B2.1) can be rearrenged, so that we obtain

$$UBM = RR + (ER - BB_c) + C^p \qquad (B2.4)$$

If the reserve allocation ratio is δ then:

$$RR = \delta\ DD = \delta M_1 - \delta C^p \text{ (in the case of narrow money since } M_1 = CP+DD) \qquad (B2.5)$$

and

$$RR = \delta DD = \int M_2 - \delta(C^p + TD + SD) \text{ (in case of broad money).} \qquad (B2.6)$$

The public choice to hold its money balances in the form of C^p or DD will depend on factors such as banking habits and the interest rates charged on deposits. Since we cannot quantify the banking habit variable and since the time series data on the interest rates changed on demand deposits vary from commercial bank to commercial bank, we assume that a simple linear relationship between C^p and MS, that is,

$$C^p = nM. \qquad (B2.7)$$

The analysis is extended by taking into account commercial banks allocations between free reserves and interest earning assets in the banks portfolio. As excess reserves are held to safeguard against the risk involved in the creation of deposits, if the cost of borrowing from the Central Bank, r^d, increases, commercial banks would tend to hold non excess reserves. Conversely, if the yield on the highest alternative interest earning asset in the banks portfolio increases, that is, if $\gamma > \gamma d$, then banks would minimize ER. In the case of BB_{co} exactly opposite relations should be evident.

In other words, if the cost of creating deposits through borrowing reserves, measured by the rediscount rate 'γ^d', exceeds the yield on alternative liquid assets, say 'γ', then banks would borrow less from the Central Bank. From the above analysis we derive a statement for free reserves:

$$FRR = ER - CBB \qquad (B2.8)$$

and $$DRI = \gamma D - RI \qquad (B2.9)$$

where 'FRR' indicates free reserves;

and DRI the difference in the cost and yield of assets.

An additional variable explains the quantity of free reserves held by commercial banks; their liquidity position as measured by the ratio of liquid assets to deposits (LIQ). In otherwords as Commercial banks liquidity rise they are in a better position to face uncertainity and so substitute interest earning assets for excess reserves. Also, higher liquid asset ratios mean greater surplus of liquid assets over the limit prescribed by the Central Bank, and the latter could be converted into interest earning assets. As a consequence for each bank the liquid asset ratio is also a function of free reserves. By assuming that the FRR equation takes a linear form we derive the following expression:

$$FRR = (ER-CBB) = \alpha + \beta DRI + \delta LIQ \qquad (B2.10)$$

with $\beta > o$ and $\delta < o$

Finally, by substituting equation (2.7), (2.9) and (2.10) into (2.4) and solving for MS we obtain the final form of the money supply as:

$$MS = \frac{1}{\delta + n - \delta n} (- \alpha + \psi UBR - \beta DRI + \delta LIQ \qquad (B2.11)$$

with $\psi > o$, $\beta < o$, and $\delta > o$.

The next equation to be discussed is the term structure of interest rate equation which essentially in the model forms a link between the long and short run rates within the money market as well as a link between the real and monetary sectors. As the reader will appreciate, the selection of elements in this function is rather difficult, since long term interest rates are generally some function of expected short term rates over the life of the particular long term rate, and expectations are complex. Because, we are unable, at this time, to formulate an adequate hypothesis about interest rates expectations, we simply followed an approach suggested by Evans [1969] and assume that the long term rate is directly related to the short term rate by a stock adjustment process that is:

$$LRI = \alpha_1 + \alpha\ TBR + \delta_1\ LRI_{t-1}$$

where δ is the coefficient of adjustment.

It is of some interest to note that if the stock adjustment coefficient 'δ' approximates unity, then there will be a long delay in adjustments between the long and short term rate, and consequently, there will be a long delay in the reaction of monetary factors on investment and income.

Finally equation (C1) - (C3) are identities which close the system. Equation (C1) measures aggregate excess demand and equation (C2) in the model stands for balance of payments accounts of Trinidad and Tobago with the rest of the world. The stock of gold and foreign exchange reserves adjust according to the balance of payments surplus or deficit.

THE EMPIRICAL RESULTS

In this section of the paper we shall analyse O.L.S. estimates of the structural equations based on total income expenditure and financial data. It will be seen that, for some of the equations, changes in the formulation are introduced and these changes are commented upon while discussing the results.

The coefficient of determination (R^2), the standard error of estimate (Se), and the Durbin-Watson statistic are provided below each estimated equation. Under each regression coefficient is written its standard error and the former is adjudged as being statistically significant if it exceeds the latter. In the case of the Durbin-Watson statistic, the test of serial correlation is performed at the 5 per cent level.

The Consumption Function

$$(C/P)_t = -34.496 + 0.255\ Y + 0.753\ C_{t-1}$$
$$\qquad\qquad (21.087)\ (0.130)$$

$$R^2 = 0.981 \quad Se = 10.590 \quad DW = 0.623$$

The Investment Function

$$I_t = -288.298 - 31.538\ LRI_{10} + 0.163\ Y$$
$$\qquad\quad (138.773)(19.022) \qquad (0.071)$$

$$R^2 = 0.418 \quad Se = 20.334 \quad DW = 0.148$$

The Government Revenue Function

$$GRE_t = -276.291 + 0.848\ Y + 2.293\ P^E_{t-1}$$
$$(28.526)\quad (0.001)\quad (1.383)$$

$$R^2 = 0.938 \quad Se = 18.030 \quad DW = 0.349$$

The Import Demand Function

$$(IM/P)_t = 343.953 + 0.030\ Y_{dom} - 54.669\ (PM/Pd)$$
$$(95.543)\quad (0.261)$$

$$R^2 = 0.678 \quad Se = 41.750 \quad DW = 1.294$$

The Export Demand Function

$$(Ex/P)_t = 227.610 - 0.283\ Y_{for} - 0.304\ (P_x/P_w)$$
$$(70.422)\quad (0.570)\quad (0.442)$$

$$R^2 = 0.992 \quad Se = 31.013 \quad DW = 1.534$$

The Price Function

$$P^e = 2.073 + 0.401\ P^e_{t-1} - 0.001\ Pm_{t-1}$$
$$(0.783)\quad (0.164)\quad (0.002)$$

$$R^2 = 0.420 \quad Se = 2.119 \quad DW = 2.314$$

The Demand for Money Function

$$(M/P)_t = -1286.669 + 3.253\ Y + 14.528\ TBR$$
$$(296.894)\quad (0.732)\quad (7.560)$$
$$-5.572\ P^E + 0.210\ (M/P)_{t-1}$$
$$(2.199)\quad (0.191)$$

$$R^2 = 0.995 \quad SE = 2.888 \quad DW = 2.303$$

The Supply of Money Function

$$MS1 = 464.188 + 2.095\ UBM - 14.065\ LIQ + 71.389\ DRI$$
$$(126.649)\ (0.356)\qquad (5.384)\qquad (34.758)$$

$$R^2 = 0.884\quad Se = 10.555\quad DW = 0.324$$

The Term Structure of Interest Rate Function

$$LRI_t = 7.199 + 0.111\ TBR$$
$$(0.197)\ (0.432)$$

$$R^2 = 0.934\quad Se = 18.292\quad DW = 0.215$$

DISCUSSION OF THE ESTIMATED EQUATIONS

The Consumption Function

The estimates of the consumption function show that total income (GDP) and the period lagged consumption are the two explanatory variables which account for almost all the variation on dependent variable as seen from the size of the coefficient of determination (R^2=0.981). The contribution of each variable is revealed by the size of each regression coefficient. The contribution of lagged consumption exceeds that of total income and this implies that there is considerable delay in consumers reaction to changes in income. But since the equation shows a high incidence of serial correlation our findings should be treated cautiously.

Having mentioned an apparent shortcoming in the estimated consumption function, our next concern is to interpret the estimates. In this context, we note that the short run marginal propensity to consume out of income in Trinidad and Tobago is 0.255.

On the other hand, the long run marginal propensity to consume estimated from the same equation is:-

$$\frac{.255}{1 - .753} = 0.955$$

Since the long run marginal propensity differs significantly from the short run propensity, this implies that the elasticity of expectation in the Trinidad and Tobago economy in the 1970's has been dynamic. The short run income elasticity calculated at the mean value is 0.360, and the long run income elasticity is 1.348. The above results mean that an increase in income by one percentage point will be translated into an increase consumption of .360 and 1.348 per cent in the short and long run, respectively. The latter results means that in the long run there is likely to be negative savings.

The Investment Function

As our result shows the two explanatory variables, the long run rate of interest (10 year Government bond rate) and aggregate income account for explaining only 42 per cent of quarterly variations in investment expenditure over the review period. Also, the equation seems to be unacceptable from the point of view of the Durbin-Watson 'd' statistic (0.148).

The equation shows that within Trinidad and Tobago demand induced investment contributed by the income variable is almost insignificant when compared with investment induced by the easiness of tightness of funds. Further reflection on the result pertaining to the income variable indicate that all things being equal a one percentage point increase in income would increase investment by approximately 0.16 per cent.

The coefficient of the long term interest rate is 31.538. The inferences that can be drawn from the above result are the following: -

(a) First the significantly negative value of the coefficient implies that if government increases the long term bond rate there will be a significant fall in private investment.

(b) Secondly, the result seem to imply that under some assumptions, the actual change in investment exceeds desired quarterly investment changes.

THE GOVERNMENT REVENUE FUNCTION

Although R^2 in the estimated Government revenue function is quite high (0.938), the low positive Durbin-Watson 'd' statistic indicates the presence of serial correlation in the error term. This implies that our estimates and the succeeding interpretation must be treated cautiously.

According to our estimates the marginal propensity of government revenue is approximately 0.85 per cent. This means that a dollar increase in aggregate income leads to a .85 per cent increase in government revenue. The income elasticity of government revenue is 13.03 .

As compared to Persaud [1975] study our government revenue function could perhaps be regarded as an improvement, since we have an additional variable, price changes (P^e), to reflect the impact of inflation on governments revenue. The estimated equation shows that government revenue can be expected to increase by 2.293 per cent each quarter even if income remains constant, but prices continue to spiral upwards.

THE IMPORT DEMAND FUNCTION

According to our previous discussion the volume of total imports is assumed to depend on the level of aggregate income and the price of imports relative to domestic prices. The fitting of this function is quite good as shown by the coefficient of multiple determination and the Durbin-Watson statistic. The two explanatory variables explain as much as 68 per cent of the quarterly variation of imports over the sample period.

An estimated income elasticity of .052 indicates that the relatively high rates of growth in aggregate income during the 1970's are associated with a higher demand for imports. Particularly, the demand for imports rise strongly with the rapid increases in the export earnings of the petroleum sector.

The relative price elasticity of -0.331 indicates that Trinidad and Tobago importers are quite insensitive to change in relative prices.

THE EXPORT DEMAND FUNCTION

Overall the export demand function does not provide a good fit. Although R^2 is quite high (0.99), both explanatory variables - the foreign market activity variable and relative prices - are statistically insignificant. Additionally, the activity variable has the wrong sign. As for the Durbin-Watson statistics this falls in the inconclusive range, hence not much could be said about the impact of auto-correlation on the estimated coefficients.

Notwithstanding the poor fit of the equation if we take the estimated price coefficient at its face value and calculate the price elasticity, the value of -0.111 seems to indicate that Trinidad and Tobago's merchandise exports are inelastic with respect to relative prices.

The Money Demand Equation

In the estimated money demand function, aggregate income, 'Y' emerges as the most significant variable. In addition, the rate of interest on short term government securities 'TBR' variable as well as the price expectation variable 'P^e' and lagged real balances (M/P), variable are atatistically significant. The explanatory power of this equation is quite good as the four variables that were selected accounts for over 99 per cent of the variation in real balance (money).

The money demand equation has another interesting feature. In the more recent monetary discussion the demand for money is usually conceived as a stable function of its arguments. Moreover, Keynes speculative motive is regarded in current economic discussions as an 'adhoc' explanation of the interest elasticity of the money demand function and as an element which should be eliminated from macroeconomic models utilising a Keynesian framework. In fact according to Johnson [1962] Keynes monetary theory has been refined and elaborated by subsequent writers in the Keynesian tradition. Keynes most extreme departure from previous analysis - his emphasis on the speculative demand for money at the expense of the precautionary -

has been gradually abandoned.." Our evidence in the Trinidad and Tobago context is in direct contradiction with the voluminous empirical work on the topic and may be regarded as typical Keynesian in one respect. The fact that the price expectational variable 'P^e' has a negative sign seems to support Keynes argument about the speculative behaviour of households and business firms.

Connected with the problem of the speculative behaviour of households and firms is the question of the income elasticity of money. More specifically, the point is generally made in the literature that in developing economies the income elasticity of money exceeds one- that is, money is considered to be a luxury good. While this view is strongly supported by Adekunle (1968), Iyoha (1976) and others dispute it. However, it is interesting to note that in Trinidad and Tobago money can be considered a luxury good, since the income elasticity is estimated at 5.537.

Two final points may be noted in-so-far as this equation is concerned and these are: firstly, that the speed of adjustment of money seems to be quite rapid in Trinidad and Tobago, and secondly that in all our estimates the variable 'TBR' has a positive coefficient. If the estimation procedure is not responsible for the positive 'TBR' coefficient then it suggests that an increase in Government short term interest rate leads to an increase in the demand for real balance.

The Money Supply Function

The estimates obtained for the money supply function show that R^2 is very high but there is some evidence of serial correlation (DW=0.324). All of the estimated coefficients are statistically significant by our usual statistical test, and all the coefficients have the correct apriori signs.

The coefficient of unborrowed monetary base has a positive sign and its value of 2.095 suggests then a dollar increase in currency and/or reserves would lead to a $2.1 increase in money stock (directly and indirectly). Correspondingly, the negative coefficient of the variable LIQ suggests that a one percent increase in liquidity ratio would reduce money stock by approximately 14.1 per cent. As the coefficient of the interest rate differential variable, the fact that is positive indicates that money supply is interest inelastic. In other words, the result seems to suggest that a limit increase in the excess of the discount rate over the short term interest rate would bring about a corresponding increase on money supply. Evidently, the above result needs to be checked and in future work it is intend to do this by separating out the discount rate (DR) and the short run rate (TBR) in the money supply function.

Finally, our analysis of the money supply function yielded the following elasticities:

(a) $UBM_{ME} = 0.477$

(b) $LIQ_{Me} = -1.090$

(c) $DRI_{Me} = 0.278$

These elasticities suggest (a) that a one per cent increase in unborrowed base money and the interest rate differential would increase total money supply by 0.47 and 0.27 per cent respectively; (b) that a one per cent increase in the liquidity ratio will reduce money supply by 1.09 %.

The Term Structure of Interest Rate Function

The final equation on the term structure of interest rate function which provides one of the links between the real and monetary sectors in the model. The estimated relationship as shown above is unsatisfactory; the equation shows a high degree of serial correlation but high R^2. Also the estimated coefficient TBR seem to suggest little, if any, relationship between the long term and short term end of the government bond market. Further research in this area seems necessary.

SUMMARY

In this paper an attempt was made to identify the relationship between the real and monetary sector in Trinidad and Tobago using quarterly data. Much of the results we obtained are contradictory to generally held opinion but this may be due to the unreliability of data and inadequacy of the estimation procedure used. We intend to continue this exercise by utilising alternative estimation procedures in deriving the parameter estimates. We also intend to test the predictive power of the model.

APPENDIX A

Data Source

The time series data utilised in this study were obtained from the following sources:

1. Central Bank of Trinidad and Tobago, Statistical Digest (Various issues)
2. Central Statistical Office, Quarterly Economic Report, (Various issues).
3. I.M.F. Financial Statistics (Various issues).

APPENDIX B

FURTHER ESTIMATES OF STRUCTURAL EQUATIONS

The estimates of the preferred structural equations are presented in the main body of the paper. Further estimates of the structural equations based on the OLS procedure are given in this appendix.

The Consumption Demand Function

$$C/P = 36.208 - 16.473\ TBR + 9.790\ Y$$
$$(27.871) \quad (2.839) \quad (0.040)$$
$$R^2 = 0.938 \quad SE = 10.447 \quad DW = 0.678$$

$$C/P = -103.856 + 0.930\ Y$$
$$(23.504) \quad (0.050)$$
$$R^2 = 0.961 \quad SE = 14.874 \quad DW = 0.368$$

The Investment Demand Function

$$I = 122.238 + 0.109\ Y - 6.279\ LRI_{20}$$
$$(149.197) \quad (0.071) \quad (17.845)$$
$$R^2 = 0.284 \quad SE = 21.309 \quad DW = 0.133$$

$$I = 64.125 + 0.123\ Y$$
$$(32.138) \quad (0.068)$$
$$R^2 = 0.311 \quad SE = 20.918 \quad DW = 0.122$$

The Government Revenue Function

$$GRE = -271.522 + 0.853\ Y$$
$$(28.164)\quad (0.060)$$
$$R^2 = 0.934\quad SE = 18.292\quad DW = 0.215$$

$$GRE = -16.162 + 0.042\ Y + 1.475\ Pm_{t-1}$$
$$(22.089)\quad (0.064)\quad (0.513)$$
$$+ 0.969\ GRE_{t-1}$$
$$(0.072)$$
$$R^2 = 0.902\quad SE = 6.643\quad DW = 0.491$$

The Price Function

$$P^e = 1.993 + 0.395\ Pm - 0.0002\ Pm_{t-1}$$
$$(0.802)\ (0.163)\quad (0.0021)$$
$$R^2 = 0.408\quad SE = 2.121\quad DW = 2.304$$

$$P^e = 2.571 + 0.001\ Y$$
$$(3.624)\quad (0.008)$$
$$R^2 = 0.290\quad SE = 2.293\quad DW = 1.230$$

$$P^e = 2.160 - 0.0005\ Y + 0.395\ Pm_{t-1}$$
$$(0.336)\ (0.007)\quad (0.163)$$
$$R^2 = 0.410\quad SE = 2.121\quad DW = 2.301$$

The Money Demand Function

$$M/P = -1564.781 + 12.975\ TBR + 3.975\ Y$$
$$(73.084)\quad (7.445)\qquad (0.106)$$
$$R^2 = 0.902\quad SE = 27.395\quad DW = 1.006$$

$$M/P = -1650.901 + 22.470\ TBR + 4.103\ Y$$
$$(70.331)\quad (7.263)\qquad (0.103)$$
$$-6.542\ P^e$$
$$(2.143)$$
$$R^2 = 0.914\quad SE = 2.415\quad DW = 1.773$$

The Money Supply Function

$$MS1 = 424.443 + 1.996\ UBM - 14.305\ LIQ$$
$$(126.765)\quad (0.355)\qquad (5.271)$$
$$+ 87.844\ DRI + 12.836\ P^e$$
$$(35.753)\qquad (8.586)$$
$$R^2 = 0.870\quad SE = 10.630\quad DW = 0.294$$

$$MS_2 = 1140.146 + 5.157\ UBM - 35.309\ LIQ$$
$$(356.415)\quad (0.997)\qquad (24.820)$$
$$+ 278.052\ DRI + 53.784\ P^e$$
$$(100.523)\qquad (24.141)$$
$$R^2 = 0.844\quad SE = 29.044\quad DW = 0.641$$

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