Money Demand, Bank Credit and Real Exchange Rates in a Small Open Developing Economy: An Econometric Analysis for Malaysia

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ABSTRACT

This is essentially a three-part thesis on money demand, bank credit and real exchange rates in Malaysia. Long and short run real money demand functions with money variously defined as M0, M1 and M2 have been estimated using the Johansen cointegration technique and the error correction approach respectively. While liberalisation and innovation in the Malaysian financial system have not ruled out the existence of stable long run money demand relationships as attested to by the presence of cointegrating vectors, they have rendered short run relationships unstable. This called for a reestimation of short run dynamics over more recent periods and all the revised estimates could withstand a battery of diagnostic tests akin to original full sample estimates. The estimated short run functions appear to track the direction of actual changes in the demand for money reasonably well.

The second part of the thesis is basically concerned with the possible practice of equilibrium credit rationing (a la Stiglitz & Weiss, 1981 & 1983) amongst commercial banks in Malaysia and the significance of commercial bank credit vis-a-vis other monetary variables in the determination of economic activity in Malaysia. Two of the major implications of equilibrium credit rationing are the irresponsiveness of lending rates to changes in the factors determining loan demand and supply and the presence of a 'ceiling' on the lending rate. Via an application of cointegration and error correction techniques, the lending rate is found to be insensitive to determinants of loan demand while only nominally sensitive to loan supply determinants. This is corroborated by an evidence derived from an application of Sims' VAR technique that shows a lack of responsiveness of the lending rate to changes in the inter bank rate used as a proxy for the cost of financial market funds.

With regard to the ceiling on the lending rate arising from equilibrium credit rationing, its effect on the volume of deposits and hence loanable funds mobilised by banks and the interest rate payable on them may depend on the interest elasticity of their flows. Two separate cases can be considered namely the case of zero elasticity and the case of non zero elasticity. In the former case, if it is against the banks' interests to impose a high lending rate owing to possible adverse selection effects, banks may suppress the deposit rate instead. In the latter case however, the higher is the interest elasticity of deposits, the greater will be the amount of loanable funds derived and the interest rate paid on them. In our empirical analysis involving the application of cointegration and error correction techniques, commercial bank deposits in Malaysia are found to have a zero elasticity in the short run. Hence the extent of excess demand arising from an any practice of equilibrium credit rationing may be relatively limited.
By applying the Sims' VAR technique, commercial bank credit has been found to exert a greater influence than M1, M2 and the lending rate on the Malaysian GDP.

The final part of the thesis pertains to exchange rates. In an adaptation of Dornbusch's (1976) model, it appears that any policy measure aimed at alleviating the asymmetric information problem in the domestic banking system could lead to a depreciation in the long run equilibrium exchange rate and a rise in the long run equilibrium price level. The impact effects are a weaker domestic currency and a higher output level. However the magnitude of the long run and impact effects would vary directly with the interest elasticity of money demand.

The cointegration and error correction techniques have also been relied upon for estimating the long run equilibrium real effective and bilateral exchange rates of Malaysia and the short run dynamics of these rates a la Edwards (1988a, 1988b & 1989). The estimates suggest that there has been no sustained overvaluation or undervaluation of the Malaysian real exchange rates. By implication then, the question of a real exchange rate misalignment does not arise and that Malaysia's success in economic development so far has not been due to any deliberate undervaluation policy. Moreover the analysis of causal relationships amongst real exchange rate movements on one hand and exports and GDP on the other has highlighted no significant relationships existing between them. Finally, the results from modelling the short run dynamics of real effective exchange rates indicate that excess domestic credit could induce their depreciation instead of an appreciation, contrary to popular belief.

CONTENTS

Chapter 5 : EXCHANGE RATE ISSUES

Chapter 1

INTRODUCTION

1.1 Research Objectives, Methodology and Structure

This thesis is made up of three principal parts on money demand, credit and exchange rates with reference to the Malaysian economy. The first part on money demand with money variously defined as M0, M1 and M2 deals with the estimation of long and short run real money demand functions against the backdrop of liberalisation and innovation processes which the Malaysian financial system has been undergoing. These processes could render the long and short run demand functions unstable. This could erode the potency of monetary policy in achieving its desired objectives given that a stable money demand function is a prerequisite for its satisfactory conduct. In the process of estimating the demand functions, the possible influence of exchange rate movements on money demand is also explored. The effectiveness of monetary policy in regulating economic activity may be compromised if money demand is also determined by exchange rate considerations alongside other factors such as income, interest rates and inflation. Both the cointegration technique developed by Johansen and the error correction approach are employed for the estimation of the long and short run functions respectively.

The second part relates primarily to the study of bank credit in the Malaysian economy with emphasis placed upon the possible practice of equilibrium credit rationing by commercial banks and the relative significance of bank credit and other monetary variables in the determination of economic activity. The notion of equilibrium credit rationing as advanced by Stiglitz & Weiss (1981 &1983) is referred to in our analysis. Two major implications of equilibrium credit rationing are the irresponsiveness of lending rates to movements in the determinants of loan demand and supply and the presence of a 'ceiling' on the lending rate chargeable by banks. The effect of equilibrium credit rationing on the volume of deposits and hence loanable funds mobilised by banks and the interest rate payable on them could depend on the interest elasticity of their flows. This is demonstrated by using a simple profit-maximising model of a bank.

The extent of excess demand for loans as a consequence of equilibrium credit rationing may however not be very great relatively if bank deposits are not interest elastic (zero elasticity) or highly interest elastic and if there is a lack of alternative investment outlets for banks. In the case of zero elasticity, if banks find it unprofitable to increase the lending rate due to possible adverse selection effects, banks may instead depress the deposit rate. In a separate vein however, the greater is the interest elasticity of deposits, the larger will be the volume of deposits secured apart from a higher interest rate payable on them. Cateris paribus, this may limit the excess demand for loanable funds compared to a low elasticity environment.

Within the Malaysian context, alternative portfolio investment opportunities accessible to banks may be limited due to legal restrictions imposed on banks' indulgence in the stock market and the mere existence of a captive market for government securities. Moreover privatisation and government expenditure cutbacks have always been high on the Malaysian government agenda.

In the context of financial liberalisation, the prevalence of equilibrium credit rationing may defeat the objective of financial liberalisation as if banks are inhibited from raising their lending rates, so are they in respect of their deposit rates. Hence financial liberalisation may fail to produce the desired results if an economy is laden with asymmetric information problems.

In order to assess the possibility that Malaysian banks practise equilibrium credit rationing, the income and interest rate elasticities of deposits received by commercial banks and the sensitivity of the lending rate to factors determining loan demand and supply are estimated using the cointegration and error correction techniques as in the money demand study. The lending rate responsiveness is also explored using the Sims' Vector Autoregression (VAR) technique. With regard to the evaluation of the relative significance of bank credit and other monetary variables to the Malaysian economy, the Sims' VAR technique is also employed.

The third part of the thesis is centered on exchange rates in particular real bilateral and effective exchange rates and has the following objectives:

I) To consider the implications for exchange rate, price and income (output) movements given the presence of equlibrium credit rationing in the domestic banking system by adapting the Dornbusch's (1976) model;

II) To consider the fundamental determinants of equilibrium real exchange rates a la Edwards (1988a, 1988b & 1989). Both bilateral (M$ vis-a-vis US$) and effective exchange rates (trade- and export-weighted) are dwelt upon in the empirical analysis. Given the tendency amongst developing countries to preserve an overvaluation of their exchange rates, it would be interesting to verify whether there has been any misalignment of Malaysian exchange rates or a deliberate undervaluation. This is pertinent to the fact that Malaysia has at times been perceived by other developing countries as a role model for economic development. The Johansen cointegration technique and the error correction approach are also applied in this section of our study. Similar studies conducted by Edwards and others usually involve pooled regression techniques with cross sectional data; and

III)To verify whether exports and economic growths attained by Malaysia have been dictated by real exchange rate movements and to establish the direction of their causal relationships via an application of Sim's VAR technique.

The rest of this thesis is configured as follows. The subsequent section of this chapter furnishes the background of the Malaysian economy. A review of the Malaysian financial system is presented in Chapter 2 while Chapter 3 is concerned with money demand functions. Credit and exchange rate issues are dwelt upon in Chapters 4 and 5 respectively. Finally, overall conclusions are made in Chapter 6.

1.2 Background of the Malaysian Economy

Malaysia is a relatively small country situated in South-East Asia with a geographical area of 330,000 square kilometres. Rich in natural resources, it has a multi-racial population comprising Malays and other indigenous people (62.4%), Chinese (29.1%), Indians (8%), and Others (0.5%). Essentially based upon private enterprise with the Government assuming an active role in mapping out national development strategies, the Malaysian economy is one of the fastest growing in Asia. With a per capita income of US$2960 in 1992, it ranks third in terms of economic prosperity in South-East Asia after Singapore and Brunei. Prudent fiscal and monetary management amid political stability have been the prime factors contributing to Malaysia's development so far.

Malaysia has been maintaining a favorable rate of economic growth annually since achieving Independence in 1957 with relative price stability except during the recessionary years in the early 1980s. Real gross domestic product (GDP) growth accelerated from an average annual rate of 4.1% in the latter half of the 1950s to 8.1% in the 1970s. However there was a considerable deceleration in the growth rate in the early 1980s owing to a protracted global economic recession that culminated in a decline of its real GDP by 1.1% in 1985. A strong recovery was subsequently staged by the Malaysian economy with an annual real GDP growth averaging 8.3% over the 1987-93 period.

Fundamentally, Malaysia is a trade-oriented economy with exports and imports of goods and services on average accounting for 81% of the GDP in 1993. Initially based upon agricultural and other primary commodities such as rubber and tin, it has over the years transformed itself into a growing industrial economy. During its formative years, Malaysia depended heavily upon rubber and tin resources as an amber of economic growth. It was already then the world's leading producer and exporter of natural rubber and tin in 1957. While 60% of its export earnings then were accounted by the exports of rubber, tin exports accounted for 11%.

Hence with 71% of its foreign trade earnings hinging on rubber and tin, it is clear that the Malaysian economy was highly susceptible to the vicissitudes of international trade. This called for a governmental embarkation upon agricultural diversification and industrial promotion programmes. Consequently, oil palm and timber gained significance on its list of exports.

Unlike some developing countries which are contented with being primary producers, Malaysia pursued a series of industrialisation programmes that initially emphasised import substitution followed by export promotion in the early 1970s and then heavy industrialisation since the early 1980s. Since the pre-Independence days until the late 1960s, Malaysia's imports largely comprised consumption goods as the domestic consumption goods industry had yet to develop to an extent capable of serving domestic demands adequately. Hence the promotion of import substitution was the main theme of the industrialisation programme then. The programme succeeded in scaling down the share of imports of consumption goods in total imports from 50.7% in 1961 to 32% in 1970 and then to a mere 16.3% in 1993.

At the dawn of the 1970s, it was felt that industrialisation based merely upon import substitution would be inadequate to serve national development needs. Overseas market ventures and hence an export-oriented industrialisation programme was then being increasinly recognised as a force for employment generation and as a catalyst for meeting socioeconomic redistribution objectives of the government as embodied in the New Economic Policy (NEP) promulgated in 1970. The programme was then first implemented with the creation of Export Processing Free Trade Zones (EPFTZs). The creation of these zones proved successful in terms of employment and export growth. While manufactured exports accounted for a mere 11.9% of Malaysia's total exports in 1970, they accounted for 22.4% and 74% by 1980 and 1993 respectively.

Subsequently, the 1980s and 1990s have been identified by Malaysian economic planners as decades of heavy industrialisation. It was perceived that Malaysia had already reached a stage of fairly rapid industrial growth and should proceed to a more advanced stage of industrialisation. The establishment of the Heavy Industries Corporation (HICOM) in 1980 signified the launching of the heavy industrialisation programme in the country. The success in heavy industrialisation so far is mirrored by a surge in the share of machinery and transport equipment exports in total manufactured exports from 11.5% in 1980 to 48.5% in 1993.

All these industrialisation programmes aided by foreign direct investments have structurally transformed the economy from one critically dependent upon primary commodities to one with an expanding industrial base. By 1993, exports of rubber and tin merely accounted for about 2.2% of total export earnings against 70% in the 1950s. Moreover by the same year, the manufacturing sector contributed about 30% of the GDP as opposed to 20% in 1980 and 14% in 1970. Apart from the manufacturing sector, the services sector has also been actively promoted by the government in recent years as a potential source of foreign exchange earnings. Specifically, the areas targetted are tourism and shipping services. The relative significance of the services sector to the Malaysian economy has been fairly stable over the past three decades, contributing about 40% of the GDP.

Chapter 2

THE MALAYSIAN FINANCIAL SYSTEM: A REVIEW

2.1 Structure Of The Malaysian Financial System

When compared to other countries at a similar stage of economic development, the Malaysian financial system is fairly well-developed. Progress in financial deepening and innovation has been rapid especially since the second half of 1970s. Not unlike other developing countries, Malaysia has been striving to develop its financial system so as to mobilise savings, allocate credits and supply financial services efficiently to the country. Generally the system has aided in the stimulation of savings and investment and in the improvement of financial resource allocation.

Broadly the Malaysian financial system can be divided into two sectors - banking and non-banking. In the banking sector, the major components are the Central Bank (at the apex of the system), commercial banks, finance companies and merchant banks. Altogether they command about 70% of the total assets of the financial system. As at the end of 1992, there were already 37 commercial banks, 1 Islamic Bank, 41 finance companies, 12 merchant banks, 7 discount houses and 8 money and foreign exchange brokers operating in the country. Of all these institutions, commercial banks collectively form the 'biggest' institution. As at the end of 1992, they commanded about 38.9% of the total assets of the financial system, 52.5% of the total deposits with the system, and 55.9% of the total loans outstanding in the financial system. Most foreign banks are small. They number only 16 with total assets worth of M$41.3 bn and a network of 146 branches, confined mostly to the older established foreign banks. The rest merely maintain 1 banking office each.

On the other hand, the non-banking financial sector is constituted by provident and insurance funds, development finance and savings institutions, and other financial intermediaries such as unit trusts, building societies, credit and charge card companies, factoring and leasing companies and several quasi-government investment and financial institutions such as the Pilgrims Management and Fund Board, the National Mortgage Corporation (Cagamas Ltd.), the Credit Guarantee Corporation and the Malaysian Export Credit Insurance Ltd (MECIB). Amongst these institutions, the Employees Provident Fund (EPF) is the largest and it yields an annual investible surplus of about M$6 bn (equivalent to over 5% of the country's GNP). Compelled by law to invest at least 70% of its assets in Government securities, it is a major financier of the Government's development expenditure. In practice, over 80% of its assets are held in the form of government securities, mostly of long-term maturities of approximately 20 years. Perhaps this is why the Malaysian government does not have to resort to inflationary financing, a practice common amongst developing countries.

As at the end of 1992, there were already 59 insurance companies in operation in Malaysia. In addition, export credit insurance is offered by the Malaysian Export Credit Insurance Ltd (MECIB), a wholly government-owned firm. It provides export insurance cover to a maximum limit of 85% to local exporters against the risk of payment defaults by their foreign buyers. Amongst the savings institutions, the National Savings Bank (NSB) is the largest in terms of scale of operation with assets worth M$4.2 bn and 452 branches (801 post offices with savings account facilities). The other savings institutions are urban cooperatives and rural cooperatives. Via their extensive branch network, the savings institutions have been successful in mobilising funds from a significant number of small savers, especially those from the lower fixed income groups.

2.2 Growth and Development of the Malaysian Financial System

Broadly, the objective of liberalising the financial sector is to enhance its efficiency by stimulating competition and strengthening the role of market forces. In Malaysia, financial reforms have only been undertaken gradually over the years (Awang Adek, et.al 1992). Though some moves toward liberalisation were already envisaged in the early 1970s, they did not constitute a continuous and steady policy to liberalise the system as the liberalisation path had been frequently interrupted by adverse economic conditions that prevailed occasionally such as the high inflation of 1973-74, the 1975 recession, the 1979 oil price shock and the protracted global economic recession in the early 1980s. For the sake of presentational elegance, we shall categorise the changes that have transpired in the Malaysian system into institutional, foreign exchange-based and legislative changes.

2.2.I Institutional Changes

Favorable macroeconomic developments witnessed at times in the 1970s and 1980s have helped in promoting significant innovations and changes to the structure of the Malaysian financial sector. Increasing financial intermediation and competition in the market for financial services have been envisaged. It was especially in the 1980s that the Central Bank began to intensify its reforms of the financial system via a program both to strengthen the financial infrastructure and to relax and simplify rules and procedures.

The 1978 interest rate deregulation constitutes the most distinctive institutional change made to the Malaysian financial system. Interest rates are commonly regarded as a significant determinant of economic activity and institutional savings.[1] Prior to October 1978, both the structure and level of interest rates were determined by the Central Bank in consultation with the Council of the Association of Banks in Malaysia. Both the maximum deposit rates and the minimum lending rates (the 'prime' and 'preferential' rates) were decided upon. The administered interest rate regime was motivated by the desire to promote the development of indigenous banks by limiting competition between domestic and foreign banks on the interest rate front as foreign banks are much more established in the trade. It is particularly noteworthy here that the Malaysian policy with respect to the lending rate was distinct from the

[1]Section 37(1) (b) of the Central Bank of Malaysia Ordinance, 1958 empowers the Central Bank to determine interest rates payable or chargeable by banks and other bank charges.

conventional wisdom about lending policies in LDCs. Instead of a ceiling as is usually cited in the literature, the Malaysian policy was one of floor-setting.

The system of interest rate determination was subsequently amended on October 23, 1978 and under the new regime, commercial banks can freely determine the interest rates for deposits and loans. However, some loans to the government and statutory authorities remain to be granted at preferential rates while the maximum rates chargeable for loans to the priority sectors remain the subject of regulation by the Central Bank. In fact this was only 1 of the 4 measures instituted over the 1978-79 period for the modernisation and deepening of the financial market. The others were the extension of the Central Bank's supervisory framework to include merchant banks, the amendment of liquidity requirements of financial institutions and the inauguration of two new money market instruments namely banker's acceptances (BAs) and negotiable certificates of deposits (NCDs).

A base lending rate (BLR) system was subsequently introduced on November 1, 1983. Under this system, the lending rate levied by a bank or finance company (except for loans to the priority sectors) was anchored to its declared BLR. The BLR was to be computed on the basis of cost of funds to the institution concerned after making provisions for the cost of statutory reserves, liquid asset requirements and overheads. Hence the actual cost of credit to borrowers was then determined by the BLR and an interest margin over the rate which would depend on the borrower's credit standing.

There was however a temporary suspension of market influence on interest rates during the tight liquidity period from October 1985 to January 1987. This was to curb competitive bidding up of interest rates amongst banks as it was felt that the then ongoing recovery process of the economy from its worst ever recession in the mid 1980s would be thwarted by excessive interest rates. However it did not involve any reimposition of direct controls on the rates. It was merely ruled that commercial banks and finance companies should peg their interest rates for deposits up to 12 months in maturity to the deposit rate of two leading commercial banks on October 21, 1985. For commercial banks, the maximum allowable differential vis-a-vis the lead banks was 0.5 percentage point while for finance companies a maximum of 1.5 percentage points. The ruling was finally abolished in February 1987.

In September 1987, control on the lending rate was reimposed as it was felt that banks including finance companies were maintaining excessive margins. Under this policy, commercial banks were disallowed to maintain a base lending rate that exceeds the BLR of the two lead banks by more than 0.5 percentage point. A four-percentage point limit was also set to the margin above the BLR. These guidelines were also applicable to finance companies. However this ruling was subsequently lifted on February 1, 1991 when the BLR was freed from the administrative grip of the Central Bank. Since then each commercial bank and finance company is allowed the liberty to set its own BLR according to its own cost of funds. With the exception of interest rates levied on loans granted to the priority sectors, all interest rates are now freely determined by market forces.

The financial system has been transformed into a relatively modern one offering financial services comparable to most other developed and developing countries. The computerisation of banking operations started in full force in the 1980s. Automated Teller Machines (ATMs) were first introduced in 1981, and their numbers proliferated to 1556 by the end of 1993. Currently, telebanking is at its nascent stage of development. It permits customers to conduct most of their banking transactions by phone at any time of the day and throughout a week. A link-up to the Society for Worldwide Inter-bank Financial Telecommunications (SWIFT) network was established in 1989 to facilitate overseas transactions when 23 commercial banks and the Central Bank joined the SWIFT society. Interest rate swaps, foreign exchange hedgings, sale of Government securities under repurchase agreements (repos), loan syndications and other specialised financial packages have been put in place. Same-day settlement for the clearing of cheques and automatic overnight lending at the clearing house were also amongst the measures instituted by the Central Bank. The environment for a more active secondary market has also been created via a regular and greater supply of Treasury Bills, an introduction of Government bonds of shorter maturities and an increase in the frequency of new sales and an installation of facilities for auctioning mortgage papers and Government bonds. There is also a freer competition for loans, deposits and other financial services. Forces are at work to develop Kuala Lumpur as an international financial centre. More generally there is already on average about one banking office for every 10000 people. This is somewhat consistent with the standard of major industrial countries. Moreover finance companies are posing an effective competition against banks in some areas of financial services. New financial institutions have emerged such as Cagamas (a housing mortgage corporation) that issues medium term bonds, the Industrial Bank, the Unit and Property Trusts and the Malaysian Export Credit Insurance Berhad (MECIB). The emergence of new institutions was an added catalyst to the creation of new financial products and to the liberalisation of the financial market. An international offshore financial centre (IOFC) was also established in October 1990 in Labuan, East Malaysia. It is aimed at enhancing the investment climate of Malaysia and also to complement and supplement the onshore financial system centered in Kuala Lumpur.

There is also a growing disfavor for lending to the priority sectors, thus reducing the inherently distortionary impact of government interventions. In early 1989, the guidelines on credits to agricultural food production were fully eliminated. By March 1990, the remaining guidelines are related only to lending to the Bumiputra community and to small scale enterprises. Moreover as from 1989, banks are no longer required to comply with the statutory reserve and minimum liquidity requirements on a daily basis. The new rule only requires that each bank maintain an average of the daily ratios over a fortnightly period. The statutory reserve ratio on any single day can fall by up to 0.5 percentage point below the fortnightly average. In order to broaden the investment portfolios of commercial banks and merchant banks, they have been allowed effective from September 1, 1989 to participate in the equity of Malaysian Airline System Ltd (MAS), Malaysian International Shipping Corporation Ltd (MISC), manufacturing companies and blue chip companies and in units of property trusts though only within prudent limits. A bank's total investment in these organisations is restricted to not more than 50% of its capital base (net of investments in subsidiaries and other financial institutions)

The rapid development of the Malaysian banking system has also gone parallel with the Malaysian capital market. The Malaysian capital market was practically non existent until the early 1960s. It now comprises markets for longer term financial assets (such as public and private debt instruments with maturities exceeding one year and corporate stocks and shares with unfixed maturity) and commodity futures. There is also a gradually growing tendency for companies to substitute equity capital for bank borrowings in recent years. Hence the traditional reliance on commercial banks as a source of borrowing is on the wane though still important. In terms of market capitalisation, the Kuala Lumpur Stock Exchange (KLSE) is fairly well established with an estimated market capitalisation of US$37 bn or 116% of GNP. Unlike the stock exchanges of Taipei, Seoul, Bangkok and Manila, the KLSE is more open to foreign participation with only a few restrictions e.g. a pre-determined limit to foreign ownership of commercial bank stocks.

Efforts have been made to promote the market for private debt securities. Guidelines for the issue of private debt securities have been issued on January 1, 1989 and an independently run credit-rating agency named, Rating Agency Malaysia Ltd was established in 1990. The 1990 Budget addressed the problems of developing the private corporate bond market by undertaking measures aimed at reducing the cost of issuing and trading in corporate bonds. Plans are also now underway for the establishment of financial futures and options markets.

Apart from the attempts to boost the private debt securities market, attention has also been focussed on the development of the government securities market. Measures have been taken to render Malaysian Government Securities (MGS) more attractive and to diversify their ownership so as to shed their captive market image. Especially in the late 1980s, secondary trading in MGS has been actively promoted. On January 1, 1989 in order to promote an active market for the trading of Malaysian Treasury Bills, 7 discount houses were appointed as principal dealers. The discount houses have also been allowed to hold and trade in money market instruments such as the MGS, treasury bills, CAGAMAS bonds, BAs and NCDs of up to 5 years of prematurity period, compared to an earlier limit of 3 years.

2.2.II Foreign Exchange-based Changes

The switch to a more flexible exchange rate regime in the early 1970s and then a more flexible interest rate regime in 1978 in fact represented the first steps toward deregulating the Malaysian financial market. Prior to assuming the role of the sole currency issuing authority by the Central Bank in June 1967[2], the exchange rate of the Malaysian dollar (then known as the Malayan dollar) was fixed at 2s.4d sterling. Generally daily fluctuations in the exchange rate were quite insignificant and sterling was not only the premier currency for foreign exchange settlements for Malaysia but also for reserve holdings.Subsequently on June 12, 1967 when the Central Bank commenced issuing the Malaysian currency, the Malayan dollar was exchangeable for the new Malaysian dollar at par. However with the devaluation of sterling by 14.3% in November 1967, the sterling-pegged Malayan dollar was automatically devalued by the same magnitude. Instead of the previous 2s.4d, the exchange rate for one Malaysian dollar became 2s.8.67d. Hence the Malayan dollar was then worth 85.71 cents of the new Malaysian dollar.

Following the balance of payments crisis faced by U.K. in 1972 which undermined sterling's position and which led to its floating and then the unilateral dismantlement of the Sterling Area by the U.K. Government, sterling was replaced by the U.S. dollar as the intervention currency on June 24, 1972. The parity of the Malaysian dollar was then maintained at M$2.81955 per U.S dollar and this was revised to M$2.5376 following a devaluation of the U.S. dollar on February 12, 1973.

With the worsening in the situation of international foreign exchange markets and taking the lead of other national governments, the Malaysian government allowed its currency to float on June 21, 1973. This marked the termination of the fixed exchange rate era in Malaysia, an era generally characterised by a narrow non-intervention margin set on either side of a parity. The

[2]The role was played until then by the Board of Commisioners of Currency, Malaya and British Borneo.

main reason for the floating as advanced by the Central Bank was that it had become evident that the fixed exchange rate regime was no longer conducive to the attainment of external equilibrium without any involvement of a trade-off quite detrimental to domestic balance. It was hoped that floating would broaden the scope for pursuing domestic stabilisation as a principal economic objective since floating would grant the authorities some control over money supply. Moreover it would to some extent insulate the domestic price level from foreign inflation.

Nevertheless, it has never been the intention of the authorities to observe a 'clean' float. The Central Bank would continue to defend the Malaysian \$ at its upper intervention limit of M\$2.5947/U.S.\$. This was intended to moderate excessive fluctuations in exchange rate, allegedly due to speculative activities. Finally another change was made to the exchange rate regime on September 27, 1975 when basket-pegging was instituted. Under this new arrangement, the exchange rate is determined in terms of a basket of currencies of Malaysia's most significant trading partners as 'it was no longer desirable for the Central Bank to determine the exchange rate of the Malaysian dollar in terms of the U.S. dollar alone and to buy and sell the U.S. dollar in order to maintain an exchange rate so determined.' (Bank Negara Malaysia, 1984). However, it remains the policy of the Central Bank to intervene in the foreign exchange market **only** at appropriate times to moderate day-to-day fluctuations in the value of the Malaysian dollar vis-a-vis the 'basket' of currencies. Lin (1989) has pointed out that in practice the ringgit has never been pegged strictly to the basket. Instead fluctuations in the ringgit relative to the basket as dictated by foreign exchange market conditions have been envisaged. The Central Bank's policy has been to intervene only if there are excessive fluctuations in the exchange rate that destabilise the exchange market.

This switch to a more flexible exchange rate system has been accompanied by the dismantling of exchange controls. The discriminatory system of exchange control rules based on the Sterling Area was first moderated in May 1973 and further relaxations were witnessed in 1978 and 1984 and more recently in 1987. The exchange control is exercised by the Central Bank in accordance with the provisions of the Exchange Control Act 1953 and its subsequent revisions. The Act provides for the recording and monitoring of movements of funds and for the safeguarding of the nation's foreign exchange position should the need arise. In practice, all commercial banks and the Islamic Bank have been delegated the authority to approve applications for both current and capital payments. The latest measures to liberalise further the exchange control rules were instituted on January 1, 1987 and they include:

1) the freedom to make payments to foreign countries in any foreign currency except South African and Israeli currencies though payments in Malaysia must necessarily be effected in Malaysian ringgit (M$);

2) the freedom to make payments to non residents for any purpose including repatration of profits by foreign investors;

3) the granting of more authority to 'authorised banks' by allowing them to approve all payments irrespective of the amount involved. These banks only need to refer to the Controller of Foreign Exchange for approval if payments are to be made for the purpose of investing in securities and immovable properties abroad or for the purpose of extending credit to or placement of deposits with non residents;

4) the freedom for non residents to undertake direct or portfolio invesments in Malaysia without any prior permission;

5) the freedom to delay the repatration of export proceeds to Malaysia up to a period not exceeding 6 months;

6) the freedom to maintain inter-company accounts. Permission is not needed from the Controller for a company in Malaysia to maintain inter-company accounts with their associated companies, branches or other companies offshore. Such companies only need to furnish the Controller with monthly returns. However this does not apply to proceeds from exports of Malaysian goods and proceeds from loans to Malaysian companies;

7) the liberty of non resident controlled companies (NRCCs) to borrow locally. No permission is needed from the Controller for a sum to be borrowed that does not exceed M$10 million from all sources in Malaysia so long as at least 60% of the sum is from locally-incorporated financial institutions. Prior permission is only required for a sum exceeding M$10 million. However under normal circumstances, approval is readily granted;

8) the freedom for residents to borrow in foreign currency from banks in Malaysia so long as the borrowing is for productive purposes;

9) the freedom to borrow without any prior approval from non residents provided the amount of foreign borrowing does not exceed a sum equivalent to M$1 million. Approval is however readily granted if the amount exceeds the stipulated level; and

10)the freedom for the public to deal in gold in any terms or weight without any prior sanction from the Controller.

All this constitutes a removal of major barriers to international capital movements in the country, hence exposing the local financial market to the rest of the world. Similar programs have in fact been pursued by neighbouring countries such as Thailand and Indonesia.

2.2.III Legislative Changes

This chapter has so far outlined the institutional and foreign exchange-based changes that were envisaged in the Malaysian financial system. However it is stressworthy that the system did not actually experience a smooth transition to its present state. Its development trend was upset during the early 1980s by the global economic recession. The adverse economic environment sent a number of financial institutions into financial distress in the mid 1980s, especially those heavily exposed to the property market. Following a decline in profitability, the capital base of some banks was eroded and this necessitated an increase in their paid-up capital so as to maintain the prescribed capital-adequacy ratio.

All this prompted legislative changes aimed at enhancing the supervisory and regulatory powers of the Central Bank over the financial system. The passage of the Banking and Financial Institutions Act (BAFIA), 1989 is the main response. The Act which came into force on October 1, 1989 is a substitute for the Banking Act, 1972 and the Finance Companies Act, 1969. By virtue of the Act, the Central Bank's traditional jurisdictions have been extended beyond the banking system to encompass most of other institutions in the financial system. The Act provides for an integrated supervision of the system and constitutes a modernisation and streamlining of laws pertaining to banking and other financial institutions. Specifically, the Act provides for:

1) stricter licensing requirements;

2) a tighter control on deposit-taking activities and on the establishment of subsidiaries and offices by licensed institutions;

3) restrictions on businesses that can be carried out to those for the purpose of which the licenses have been issued;

4) an enhancement of capital adequacy requirements including the need to maintain a reserve fund[3];

5) minimum standards of financial accountability to be observed;

6) a control of ownership and management and

7) a control on the direction of credit in particular loans granted to individuals or firms which a bank or its officials may have vested interests.

Also by virtue of the Act, the 16 branches of foreign banks operating in Malaysia have been compelled to incorporate locally within a time frame of 5 years from the effective date of the Act or such longer period at the discretion of the Minister of Finance. A 100% foreign ownership of these branches is permitted. However in this case they would remain be treated as foreign banks and would be subject to the existing policies toward foreign banks. Otherwise they would be accorded the same status and privileges as domestic banks.

2.3 Monetary Policy as a Demand Management Policy: The Malaysian Experience

Monetary policy issues fall under the purview of the Central Bank of Malaysia. The principal functions of the Bank which was officially inaugurated on January 24, 1959 are:

1) to issue currency and to maintain reserves in safeguarding the value of that currency;

2) to act as a banker and financial advisor to the Government;

[3]The minimum capital funds or net working funds that commercial banks, finance companies and merchant banks ought to maintain are increased to M$20 mn, M$5mn and M$10 mn respectively. With respect to banks, they were given a transitional period of one year to comply with the requirements. Whilst for finance companies, a gradual increase in their capital funds to M$3 mn by September 30 ,1992 and to M$5 mn by September 1995 is allowed.

3) to promote monetary stability and a sound financial structure; and

4) to influence the credit situation in the economy to the national advantage.

To enable the Bank to discharge these duties, it is vested with comprehensive legal powers to regulate and supervise the financial system under the Central Bank of Malaysia Ordinance, 1958, the Banking Act, 1973 and the Finance Companies Act, 1969 with subsequent amendments as embodied in the Banking and Financial Institutions Act, 1989 to suit the changing times. Over the years, stable economic growth, a high level of employment, stability of the purchasing power of the Malaysian currency, poverty eradication and socioeconomic restructuring, a high living standard and a reasonable balance in the country's international payments position have been recognised as national economic objectives which the Bank is expected to tend to.

Though the Bank was established in 1959, it was not until the 1970s that monetary policy became a tool for macroeconomic stabilisation. In the 1960s, monetary policies were merely designed for the purpose of strengthening and developing the domestic financial system as it was the Bank's first priority then. The task of macroeconomic stabilisation was then largely assigned to the fiscal arm of the government only to be complemented to some extent by monetary policy. This was rendered feasible by the prevalence of the then low tax incidence and thus there was still some scope for taxation to be used as a built-in stabiliser. Moreover there was then a lack of indigenous banks and the predominance of foreign banks stifled the effects of monetary policy as they had all the ways and means of circumventing the regulatory mechanism of the Bank. However with the growing incidence of taxation over the years, further tax policy manoeuvres became less expedient and hence arose the need for a greater reliance on monetary measures to achieve macroeconomic stability. Furthermore fiscal policy operations have become constrained by the socioeconomic redistribution objectives of the government. The full assumption of the sole currency-issuing power by the Bank in 1969 and the floating of the Malaysian currency in 1973 helped set the stage for monetary policy to play a greater role in macroeconomic stabilisation.A number of monetary policy instruments, both of the general impact variety and of the selective impact variety are at the Central Bank's disposal. They include statutory reserve requirements, minimum liquidity requirements, discount operations, open market operations, interest rate regulation, credit control and guidelines on lending and moral suasion. They all operate with varying degrees of efficiency.

Regulating the nations's supply of money and credit to ensure that their long run rates of growth are consistent with the increasing and changing needs of a rapidly expanding economy is the primary objective of the Bank. Over the short and medium run, its task is to ensure that the growth in money and credit is adequately elastic to dampen any inflationary or deflationary pressure in the economy and to induce a sustained growth in output and employment amid relative price stability and external equilibrium.

Generally the choice of an appropriate monetary aggregate as an 'intermediate target' is crucial to the success of monetary policy in macroeconomic stabilisation. The use of different monetary aggregates namely, M1, M2 and M3 to represent money supply may sometimes lead to divergent policy implications. Officially M1 is money narrowly-defined to comprise currency in circulation and demand deposits of the nonbank private sector while M2 is M1 plus fixed and savings deposits of the nonbank private sector placed with the Central Bank and the commercial banks, negotiable certificates of deposits (NCDs) and central bank certificates. M3 is then M2 plus all private sector deposits with the finance companies, merchant banks and discount houses and the Islamic Bank, excluding placements amongst these institutions.

The criteria for selecting an appropriate measure of money adopted by the Bank over the period 1960-75 are the following:

1) the strength of the relationship between movements in a monetary aggregate and movements in aggregate output or income;

2) the stability of the relationship over time; and

3) the predictive power of this relationship.

However in practice all the three monetary aggregates have been monitored by the Bank. Based upon the balance sheet approach, money supply in Malaysia is mainly influenced by the following:

1) the financial management of the entire public sector;

2) the lending operations of the banking system (Central Bank and the commercial banks) to the nonbank private sector. The bulk of the credit extended by commercial banks has been for the financing of working capital and capital formation;

3) the external payments position of the country.

In macroeconomic management, monetary policy commonly involves the Bank's control over liquidity. Some of the important monetary policy instruments might have suffered a loss of efficacy and or relevance arising from financial innovation and liberalisation and policy shifts. On the external front, freer capital movements arising from a greater integration with other international financial centres might have also posed an added challenge to the Bank's ability to exercise monetary control.

In common with most other monetary authorities, the Central Bank has two sets of monetary policy instruments that affect the availability and cost of money and credit. However the more traditional set of instruments that encompasses statutory reserve and liquidity requirements, open market operations and discount window which operate through bank reserves has a more global impact on the economy compared to the other set which has a more selective and direct impact. The latter comprises interest rate regulation, credit control and lending guidelines and moral suasion. The exigencies and efficacies of these instruments depend on the state of development of the financial system and the Central Bank's philosophy in financial management and legal powers. We shall outline these instruments in turn as follows:

a) Statutory reserve requirements. It is regarded as the most effective instrument of monetary control of the Central Bank . The requirements apply not only to commercial banks but finance companies and merchant banks as well and are defined in terms of eligible liabilities of these institutions. Interest is not paid on these reserves. The reserve ratio has been revised from time to time in tandem with the desired liqudity situation in the economy. The ratio applicable to commercial banks since January 3, 1994 is 9.5%. Since January 1, 1989, financial institutions concerned need no longer observe the ratio applicable to them on a daily basis. They only need to average out their required reserve holdings over a fortnightly period to meet the appropriate ratio. This instrument was first experimented with by the Central Bank in July 1969 to curb the then burgeoning bank liquidity by raising the reserve ratio to 5%.

b) Minimum liquidity requirements. It is imposed on commercial banks, finance companies and merchant banks and is aimed not only at protecting depositors by ensuring the liquidity of banks but also at influencing the credit situation. Perhaps even more so to secure bank financing for the Government in its developments efforts by designating long term Government securities as one of the liquid assets that banks could hold for fulfiling the requirements. Since the inception of the Central Bank in 1959, the minimum liquidity ratio has only been infrequently revised. Only the portfolio composition of assets deemed liquid has been changed by type and magnitude to cater to the changing needs of circumstances. Prior to June 1, 1990 banks were required to maintain a primary liquid asset ratio of 5% of eligible liabilities within the minimum overall liquidity requirements of 17%. Primary liquid assets were defined as cash, balances with the Central Bank, net money at call with the discount houses, Treasury Bills and Malaysian Government Securities (MGS) and Cagamas bonds with less than one-year maturity period. As in the case of statutory reserve requirements since 1989, the institutions concerned are permitted to observe their respective minimum liquidity ratios based on the average holdings of eligible liquid assets over the entire stretch of each liquidity period (i.e. from 1st to 15th and from 16th to the end of each month) instead of a daily compliance.

c) Discount operations. The Central Bank may vary the terms and condition under which the commercial banks and other eligible institutions such as the finance companies, merchant banks and discount houses may have access to its credit facilities via rediscounting of eligble short-term assets or via secured advances. The rate of interest charged is referred to as the discount rate. The Central Bank's discount policy will have a direct impact on the growth of money and credit as an increase in discounting would add to the reserves of banks and vice-versa. Such facilities are traditionally associated with the Central Bank's role as a last resort lender. They are only available to these financial institutions only as a 'privilege' aimed at providing them with a temporary source of funds to meet large unexpected withdrawals or portfolio adjustments and as a 'safety-valve' during a liquidity stress. Such discount window funds are normally of short maturities up to 2 weeks and rarely exceed one month. It is noteworthy that no formal announcement of the discount rate is made by the Central Bank as such practice is deemed unnecessary. Nevertheless, direct borrowing from the Central Bank collateralised by Government securities has been gaining popularity amongst financial institutions.

d) Open market operations (OMOs). It is perhaps an even more powerful monetary policy instrument. Irrespective of whether it is an institution or a private individual that trades Government securities with the Central Bank, such operations inevitably yield a direct impact on the volume of bank reserves. However due to the absence of a well-developed capital market especially a secondary market for Government securities, OMOs have limited practicality in Malaysia. There is only a captive market for longer-term Government securities and usually are they held until maturity. As an alternative to the traditional OMOs, the Central Bank has been engaging in swap transactions with commercial banks as a means of easing any tight inter-bank money market condition. Such transactions usually involve the trading of Malaysian currency, i.e. the ringgit against another currency with a precommitment to reverse the transactions at a predetermined future date and exchange rate. These are usually short term transactions varying from 1 month to 3 months. Nonetheless, OMOs are set to become an important instrument in the not too distant future with the ongoing efforts by the Central Bank to promote a secondary market for Government securities.

e) Interest rate regulation. Regulation of interest rates (deposits and loans) is another conduit of the Central Bank influence on bank liquidity and the availability and cost of bank credit. Prior to interest rate deregulation on October 23, 1978, the minimum lending rates for 'prime' and 'preferential' customers of banks and the ceiling on deposit rates were fixed by the Central Bank. The underlying rationale for such an interest rate regime were:

1) to influence the level and maturity structure of savings;

2) to boost the growth of indigenous banks by shielding them from competition from foreign banks on the interest rate front; and

3) to influence economic activity on the belief that private borrowings and savings are sensitive to interest rate variations.

However since the early 1970s the Central Bank has been paving the way for a more market-oriented system of interest rate determination. A new interest rate regime was installed for the commercial banks in October 1978 whereby they could determine the deposit and lending rates at their own free will. However, the practice of pegging lending rates to the prime lending rate has in more recent years been replaced by pegging to a base lending rate (BLR). The BLR is a rate quoted by a bank based upon its cost of funds computed on the basis of cost of holding cash, statutory reserves and liquid assets and overhead costs. The actual lending rate charged by a bank is some positive margin from the BLR depending upon the customer's credit standing, nature of the project to be financed, repayment schedule and the collateral placed. However problems of asymmetric information could contain the margin.

The other instruments which have a selective impact are:

f) Credit control and guidelines on lending. Quantitative control on credit extended by commercial banks and finance companies was first exercised in early 1974 by the Central Bank as an anti-inflationary move. A maximum overall growth ceiling of 20% and 25% was imposed on credit extended by commercial banks and finance companies respectively. This followed a hefty rise in bank credit by 53%, money supply by 37.6% and consumer prices by 10.5% in 1973. The move was complemented by a set of guidelines laid down by the Central Bank on the direction of credit designed to restrict lending for consumption and speculative purposes in favor of productive ventures. As inflationary pressures moderated, this restriction was subsequently lifted in February 1975.

The other lending guidelines are also selective in their impact. In order to promote their development, a number of sectors have been designated as 'priority' sectors. Banks are compelled to extend them loans on preferential terms. The sectors involved so far are the Bumiputra community, agricultural sector, manufacturing industry, building and construction, and real estate development. Specific lending guidelines were first introduced in 1976 and they have been subject to a regular annual review. It must be borne in mind however that these guidelines are specified primarily in terms of shares in a bank's loan portfolio. Rarely has it involved attempts to channel credits in quantitative terms. Furthermore the interest rates charged on these priority loans have been positive in real terms.However the practice of priority lendings has been downplayed by government policy of late. For instance in a March 28, 1989 announcement, guidelines on credits to agricultural food production were abolished altogether and a greater degree of flexibility was introduced to interest rate charges so as to be more consistent with market forces. Such selective credit policies may not affect our subsequent analysis on credit materially as guidelines are not based upon absolute amounts of credit to be devoted to these sectors and furthermore lending to the priority sectors constitute only a small proportion of the total credit granted by banks. It has been estimated that loans made under these policy guidelines constituted a mere 31% of total loans outstanding as at the end of 1989. In general it must be noted that the selective guidelines rarely involve attempts to channel credits in quantitative terms.

g) Moral suasion. It has also occasionally been deployed by the Central Bank to achieve a desired situation in a more `voluntary' spirit. For instance in the 1960s, banks were urged to reorientate their operations by holding more domestic against foreign assets. In the 1970s and early 1980s, they were discouraged from lending for speculative purposes and urged to be more development-oriented . It was perceived that banks could assist in national development by providing longer term financing on the basis of project viability rather than purely on the ability to furnish the right collateral . The numerous calls on commercial banks to step up lending to the priority sectors are another example of the use of moral suasion.

However the administration of monetary policy by the Central Bank has its pitfalls too. In general, its monetary policy stance at any point in time is a manifestation of its reaction to the prevailing macroeconomic condition. For instance in 1975 and 1985-86, an expansionary monetary policy was maintained to help stimulate economic recovery or to avert an economic downturn. Instead, a contractionary monetary policy was observed e.g. in 1981 to supress inflation by denying fuel to the ember of inflation. There are also times when monetary policy can be regarded as neither expansionary nor restrictive. Past experiences reveal that monetary measures have a more immediate impact on the production of goods and services than on wages and prices. This supports the notion of wage and price stickiness in macroeconomics, pointing to monetary policy effectiveness against policy ineffectiveness propositions. Notwithstanding this, there are periods in the Malaysian economic history when monetary policy revealed its inexpediency due to severity of an economic condition or the classic dilemma of meeting conflicting objectives. An instance when monetary policy instead succumbed to the pressure of the economy was in 1973 when the threat of imported inflation was too intense. Even a revaluation of the Malaysian currency failed to cushion the economy from the impact of surging prices of imports especially foodstuffs. The Government had then to respond by undertaking measures to stabilise food prices by more direct means. The measures included a provision of subsidies for essential food items, a discriminate removal of import restrictions and other indirect taxes on relevant products, an imposition of export control on deficient items and a campaign against hoarders and speculators. Moreover monetary policy was not reinforced by fiscal policy as efforts to mop up excess liquidity were not accompanied by any fiscal action to enhance taxes but instead were more or less offset by the Government's obsession with spending on socioeconomic restructuring.

The case of classic dilemma has perhaps been best illustrated by events in the early part of the 1980s. In the early 1980s, monetary management was challenged with both the need to negate the dampening effects of world recession and the need to maintain monetary stability so as not to provide added fuel to inflation and worsen the balance-of-payments. This called for a selectively accommodative monetary policy that would boost private investment outlays and output in areas experiencing demand pressures while at the same time that would check undesirable consumption, speculation and hoarding. A policy that would induce inflows of long term capital was also favored. The Central Bank was again confronted with a challenge of similar sort in 1986 when the need to maintain exchange rate stability and the need to reduce interest rates arose simultaneously. Monetary situation was then left 'tighter' then desired most of the time in that year. The predicament emerged from uncertainty about the Malaysian economic prospect following a drastic fall in commodity prices and upheavals in the corporate and financial sectors. Hence despite some effort of the Central Bank to inject liquidity into the economy, it was defeated by two bouts of speculative attack against the Malaysian currency during April-May and August-September of the same year. Bolder attempts were only warranted during the 4th quarter when pressures on the Malaysian currency began to show signs of relief. The Central Bank then capitalised on the event on October 15, 1986 to boost liquidity in the economy by reducing the statutory reserve requirements for commercial banks by 0.5 percentage point to 4% of eligible liabilities while the minimum liquidity requirements was slashed by 1.5 percentage points to 17%.

2.4 Development of the Financial System: Some Quantitative Assessment

To recapitulate, financial liberalisation encompasses measures aimed at freeing interest rates from any regulatory and institutional constraints, promoting the development of financial institutions and secondary markets for financial instruments, enhancing credit and deposit facilities, formalising the unorganised financial sector and boosting competition amongst financial institutions (Awang Adek, et.al 1992). One of the major thrusts of a financial liberalisation program may be to permit market determination of interest rates. Increased savings particularly financial savings could be spurred by the movement from a below equilibrium interest rate in a financially-repressed setting to the equilibrium rate under a competitive regime. With a larger pool of funds available, more lumpy investments could be undertaken. Moreover low yielding and inefficient investment projects could be rationed out of the financial market via the interest rate mechanism. This could result in an overall enhancement of investment efficiency and national income. However there is some evidence in the case of Malaysia that the development of its financial system so far has actually not been due to the maintenance of positive real yields on bank deposits. Figure 2A furnishes real interest rate series of savings and 3-month fixed deposits with commercial banks. It seems that negative real rates of return could even prevail in recent years despite the October 1978 interest rate liberalisation measures. This could also be due to the prevalence of equilibrium credit rationing in the bank credit market.

Nevertheless parallel with rapid growth, relative price stability and structural changes experienced by the Malaysian economy, the Malaysian financial system has undergone radical transformations and financial deepening. Table 2.I provides a comparison between monetisation in Malaysia and in a selected group of developed countries namely Germany, U.S., Korea and Japan over the period 1975-92 based upon the ratio of broad money supply (M2) to GNP in nominal terms. While Malaysia maintained the second lowest ratio after Korea in 1975, it maintained the second highest after Japan in 1992. As a digression, in fact then there is an absence of any distinct inverse or direct relationship between this yardstick of monetisation and national economic development. Similar comparisons can be effected vis-a-vis other Association of South East Asian (ASEAN) countries (Table 2.II).

Figure 2A

Real Interest Rates on Savings & 3-Mth Fixed Deposits (Quarterly)

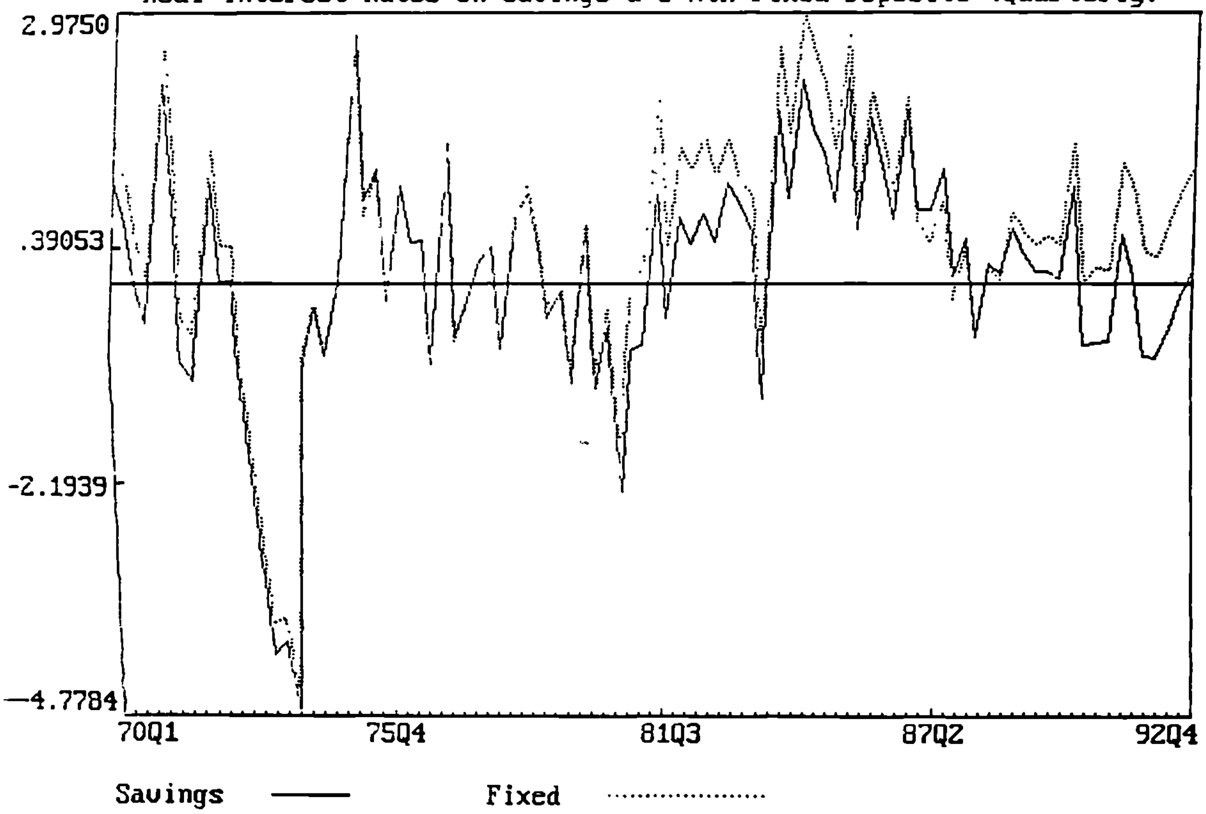


Table 2.I

Ratio of Broad Money Supply (M2) to Gross National Product at Current Prices (GNP): Selected Countries

	Malaysia	Germany	U.S.	Korea	Japan
1975	0.46	0.54	0.64	0.31	0.85
1985	0.69	0.59	0.61	0.37	0.95
1989	0.77	0.60	0.59	0.41	1.15
1992	0.82	0.66	0.57	0.42	1.08

Source: Bank Negara Malaysia (1994)

Malaysia has appeared to fare better than the other ASEAN countries except Singapore. The higher degree of monetisation in the Malaysian economy is also manifest in two other alternative measures namely the demand for nominal M2 and for bank deposits in per capita nominal terms. There was a considerable expansion in the per capita demand for M2 and for bank deposits from US$324 to US$2356 and from US$263 to US$2317 respectively from 1975 through 1992. Though these figures pale in comparison with Singapore's, they are still significantly higher than those of Philippines, Thailand and Indonesia.

The notion that Malaysia is ahead in financial intermediation relative to Philippines, Thailand and Indonesia is perhaps reflected by the ratio of total assets of the financial system to GNP in nominal terms. The ratio rose steadily from 1.23 in 1975 to 2.81 in 1989 and further to 3.17 in 1992. Broadly similar inferences may be drawn based upon the income elasticity of assets of financial institutions though it would suggest that Malaysia is even ahead of Singapore. The elasticity is computed based upon the ratio of the average annual growth rate of total assets of

Table 2.11

ASEAN: Selected Measures of Monetisation and Financial Deepening, 1975 - 1992

	Indonesia				Malaysia				Philippines				Singapore				Thailand			
	1975	1985	1989	1992	1975	1985	1989	1992	1975	1985	1989	1992	1975	1985	1989	1992	1975	1985	1989	1992
M2/GNP	0.17	0.25	0.37	0.48	0.46	0.69	0.77	0.82	0.24	0.29	0.33	0.36	0.61	0.70	0.90	0.99	0.34	0.60	0.69	0.90
M2 per capita (nominal US$ terms)	35	125	182	308	324	1325	1586	2356	85	154	222	303	1451	5223	10153	16326	121	432	851	1437
Per capita bank deposits (US$)	21	82	132	218	263	1394	1596	2317	52	130	180	252	1160	4344	8851	14541	94	385	766	1312
Total financial system assets/GNP	0.41	0.68	0.74	1.10	1.23	2.34	2.81	3.17	0.82	1.36	1.12	1.05	4.50	7.64	10.34	8.63	0.64	1.20	1.30	1.74
Income elasticity of financial system	1975 - 1992				1975 - 1992				1975 - 1992				1975 - 1992				1975 - 1992			
	1.34				1.64				1.11				1.48				1.54			

Source: Bank Negara Malaysia (1994)

the financial system to the average annual growth rate of GNP in nominal terms. An elasticity exceeding unity would imply a process of financial deepening. The elasticity calculated over the 1975-92 period for Malaysia is 1.64 and is the highest of all the ASEAN countries under review.

Nonetheless, the development of the financial system has not distinctly produced any upward trend in the income velocities of circulation of M0 (currency-in-circulation) and M1 be they nominal or real (Figures 2B & 2C). In the case of M2 however, a downward trend is apparent instead and this probably reflects the continued progress in financial intermediation made by the Malaysian economy.

Figure 2B
Nominal Income Velocities of Money (Nominal M0, M1 and M2)

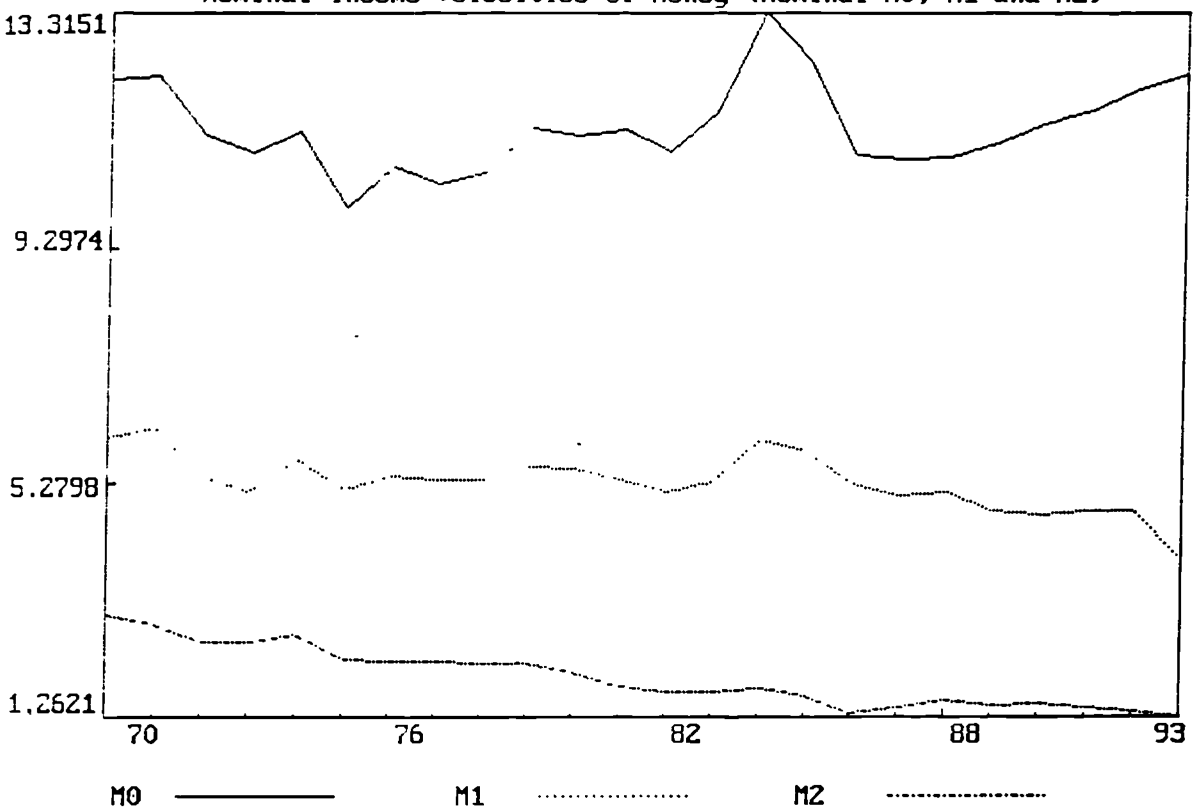
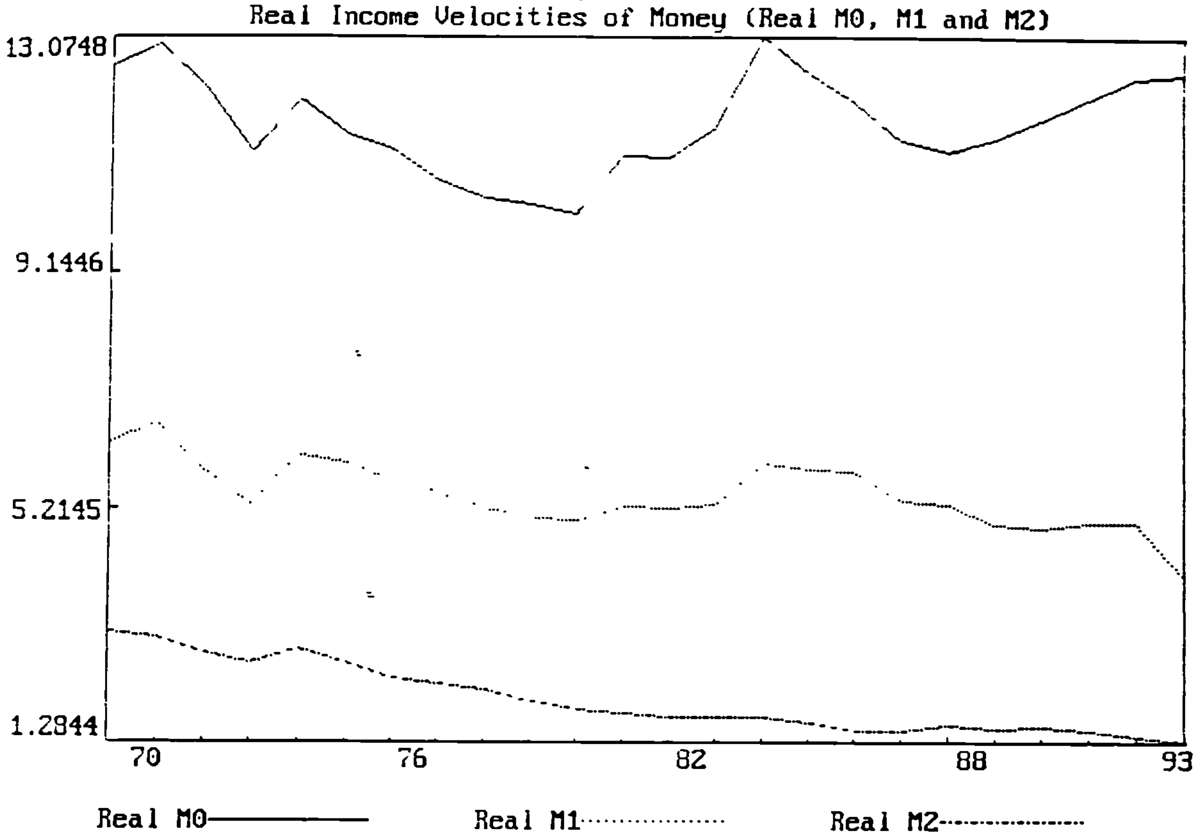


Figure 2C
Real Income Velocities of Money (Real M0, M1 and M2)



Chapter 3

MONEY DEMAND

3.0 OVERVIEW

This chapter of the thesis deals with the estimation of Malaysian money demand functions against the backdrop of financial liberalisation/innovation process that the Malaysian financial system has undergone. Financial sector reforms have important ramifications on the design and conduct of monetary policy as they affect the stability of money demand functions. This is because a stable money demand function is a prerequisite for a monetary policy to achieve its desired objectives. Reforms of the financial sector have been a global phenomenon with their acceleration in the late 1970s in many industrial countries and in the early 1980s in several developing countries in the Pacific Basin and Latin America. In many African countries and Eastern Europe, major financial reforms have been underway.

It is envisaged that very useful policy implications can be drawn from this exercise as money demand represents one of the channels of monetary transmission mechanism. Moreover it is contended by a number of researchers that changes to broad monetary aggregates emanate primarily from money demand shocks rather than money supply or monetary policy shocks (Christiano & Eichenbaum, 1992).

In addition, this chapter addresses the issue of effectiveness from the viewpoint of exchange rate sensitivity of money demand. This relates to Mundell's (1963) notion that the elasticity of money demand with respect to the exchange rate has a bearing on the relative effectiveness of monetary and fiscal policies. In a flexible exchange rate regime, if the demand for money indeed depends upon the exchange rate apart from the levels of interest rates and income, the monetary policy effects on income and employment may be compromised while the effectiveness of fiscal policy may be enhanced both to some extent. Monetary policy would lose its effectiveness if the impact of a depreciation is negative on money demand (Bahmani-

Oskooee & Pourheydarian, 1990). For instance when the domestic currency is weak vis-a-vis foreign currencies, any expansionary monetary policy pursued by the monetary authority may be defeated in its objective as agents may favor foreign against the domestic currency. This is however an irrelevant issue in the case of a fixed exchange rate regime since there would be no movements in the exchange rate that would create an incentive for agents to transform their financial assets from one currency denomination to another.

The rest of this chapter is configured as follows. Section 3.1 provides a review of the general literature on money demand including a brief reference to past studies on Malaysian money demand as they have not been properly conducted. Section 3.2 discusses the demand functions to be estimated and Section 3.3 describes the data mobilised in our modelling exercise. The time series characteristics of the data are explored in Section 3.4. Estimates of the long run money demand functions via the use of Johansen's cointegration technique are presented in Section 3.5 while Section 3.6 deals with the modelling of short run dynamics. Finally the chapter concludes with remarks in Section 3.7.

3.1 Literature Review on Money Demand

3.1.I General Literature

The demand for money is an issue that has been studied extensively at both the micro and the macro level (Adam, 1992). The microeconomic foundations of money demand are principally laid down by Baumol (1952) and Tobin (1956) who lay stress on the transactionary motive and Tobin (1958) who lays stress on liquidity and portfolio selection. Noteworthy extensions of the transactions model to include uncertainty and precautionary motives are made by Miller & Orr (1966), Akerlof & Milbourne (1980) and Sprenkle & Miller (1980). Money's role as a medium of exchange in markets for goods and services is underscored by Mc Callum (1989, ch.3) and Dowd (1990) in analysing the demand for money. They introduced the concept of 'shopping time' based upon the notion that trade with money as opposed to barter trade generates larger savings in shopping time which has value and so is welfare enhancing. This is because the time saved can be expended on utility-maximising leisure or on paid employment. In an empirical implementation, Dowd (1990) explores the notion that the wage rate which can be used as a proxy for the value of transactions time has a bearing on money demand. This is in view of the fact that money helps in the economisation of transaction costs and such costs include an element of time.

Money as a store of value is underscored in the overlapping generations (OLG) framework by Sargent & Wallace (1982) and Wallace (1988). What matters in the OLG model is the durability of money that enables it to act as a store of value and not money's role in the economisation of shopping time.

At the macroeconomic level, the demand for money analysis was popularised by Friedman (1956) based upon Fisher's quantity theory of money. However following the 1973 oil shock, many estimated money demand functions persistently overpredicted real money holdings (see Goldfeld, 1976). This implies a dramatic surge in the velocity of circulation of money in the mid 1970s, a period commonly dubbed as the 'missing money' episode. This triggered two major responses in research (Adam, 1992):

1. A search for a more comprehensive specification of the money demand function by entertaining the possibility of omitted variable biases arising from structural changes and financial innovations. Attention was then devoted specifically to domestic interest rates and currency substitution effects. Nevertheless such respecification efforts were found only to be a necessary but not a sufficient condition for the restoration of the stability of the aggregate demand for money function;

2. As a corollary of the above, the cointegration and error correction technique in modelling the demand for money (see Granger (1986), Engle & Granger (1987), Hendry (1986) and Johansen & Juselius (1990)) was developed. The use of the technique helps in averting spurious regression problems as prior to the application of the technique, the time series properties of the variables will have to be examined to ensure their consistency with one another. Hence it provides a more robust means of estimating long run relationships amongst a set of macroeconomic variables of interest and their short run dynamics.

The issue of dynamic specification as discussed in (1) above is also featured strongly in the development of buffer stock or disequilibrium theories of money demand (Adam, 1992). Artis & Lewis (1976), Laidler (1985) and Carr & Darby (1981) are amongst those closely associated with these models. The buffer stock theory of money demand generally assumes that unanticipated changes in the money supply are initially absorbed in holdings of money balances which would gradually be disbursed for the purchase of a broad spectrum of assets and goods via the operation of the real balance effect. A popular empirical implementation of the buffer stock approach is the shock absorber model developed by Carr & Darby (1981) which includes the unanticipated component of the money supply as an additional argument in the partial adjustment money demand model. The rationale for the introduction of this money shock variable is to overcome the limitations of the partial adjustment model such as its frequent inaccurate predictions of real money balances and a mal-implication yielded by the model that the interest rate would overshoot in the short run following variations in money supply (Boughton & Tavlas, 1990). This mal-implication arises from the fact that the partial adjustment model includes a lagged dependent variable as one of the regressors which necessarily implies that the interest elasticity of money demand is smaller in magnitude in the short run than in the long run. Hence for changes in the money supply to be willingly held, the interest rate has to overshoot its long run equilibrium level in the short run. However interest rate overshooting is not a phenomenon in financial markets as contended by monetarists (Goodhart, 1984). Instead of incorporating money supply shocks, other studies have also incorporated variables such as bank advances and the budget deficit as a proxy for 'shocks' (Cuthbertson & Taylor, 1990). The buffer stock element is modelled by Cuthbertson (1988) and Cuthbertson & Taylor (1989) by assuming the influence of short run demand for money by 'surprises' in income, prices and interest rates.

It is generally believed and also entirely plausible that economic and financial sector development experienced by a country has a bearing on the stability of its money demand function. Institutional developments have been broadly perceived as being responsible for the observed long run cycles in the money demand function (see e.g. Bordo & Jonung, 1987 & 1990). At an early stage of economic and financial system development, it is typical for an economy to encounter a downward trend in its money velocity in tandem with the growing degree of monetisation in the economy (Tseng & Corker, 1991). However as the economy grows in sophistication, a reversal could generally be anticipated as financial market innovations would warrant an economisation of money holdings amongst economic agents. The variation of the velocity with the stage of economic and financial development would then affect the stability of the money demand function. The notion that financial innovations would generate an instability of the function is actually not novel and it is traceable back to Gurley & Shaw (1955 & 1960). They contended that the interest elasticity of money demand would be significantly boosted by a proliferation of money substitutes in the financial market and the structural changes that it undergoes. The interest elasticity would be significantly enhanced by the increasing presence of interest bearing money substitutes. Lieberman (1977) argues that an increasing resort to credit and money substitutes, a better synchronisation between receipt and expenditure flows, and a greater efficiency of the payments mechanism may precipitate a permanent decline over time in the transactions demand for money. In focussing on currency demands, Ochs & Rush (1983) maintain that once currency economising innovations have been initiated, the demand for money can be expected to be permanently affected as these innovations may involve massive initial capital outlays though their operating costs may be low. Hence some element of irreversibility is involved.

The period of 'great velocity decline' in the 1980s as opposed to the period of 'missing money' in the 1970s in the industrial countries most notably U.K. and U.S. does not constitute a refutal of the negative influence of financial innovations on money demand as the former was characterised by an acceptance of more financial instruments as money. However, Hendry & Ericsson (1990) have shown that the 'missing money' and the 'great velocity decline' episodes in the U.S. and U.K. were due to misspecified dynamics and omitted interest rate volatility and not due to financial innovation. Nevertheless, Laidler (1993) contends that the notion of a stable long run demand for money function remains to have empirical content and of policy relevance despite institutional changes.

3.1.II Previous Estimates of Money Demand in Malaysia

It is doubtless that there exists previously estimated money demand functions of Malaysia. However these studies (Semudram, 1981; Ghaffar & Muzaffar, 1987a &1987b; and Rahim, 1986) are subject to methodological and data limitations. None of these studies explored the time series properties of the data mobilised by them let alone the use of cointegration technique. Thus they may suffer from spurious regression problems. All the studies above possibly with the exception of the one by Rahim suffer severely from the problem of limited degrees of freedom. The study by Semudram (1981) merely makes use of annual data spanning from 1959 through 1977 while those of Ghaffar & Muzaffar from 1960 through

1984. Though Rahim's study makes use of quarterly data spanning from 1965.I through 1984.IV, like the other Malaysian studies cited, the validity of the estimation period is questionable since the Central Bank of Malaysia only began assuming its currency-issuance power in 1967 and that there was a significant revision of the M1 data series in 1971. No attempt was made by them to assess the possible influence of exchange rate movements on domestic money demand bearing in mind that Malaysia is a very open economy. These researchers did not even subject their estimates to proper diagnostic tests for problems of autocorrelation, heteroscedasticity and normality of residuals. All of them merely focussed upon first order serial correlation problems when higher order autocorrelation problems may be present. Furthermore, no attempt was even made by them to check the ability of their estimated functions to track the historical data.

Though these previous works are subject to technical and data limitations as discussed above, perhaps it may be of interest to highlight their results. Semudram (1981) found the long run income elasticities of demand for real M1 and real M2 to be 0.9685 and 1.4956 respectively. Interest rate as proxied by the one-year Treasury Bill rate is also found by him to have a negative bearing on these demands with long run elasticities of -0.4434 and -0.3954 respectively. Following the partial adjustment approach, the short run income elasticities are estimated at 0.5121 and 0.8845 for real M1 and M2 respectively. With regard to short run interest rate elasticities, they are estimated at -0.3681 and -0.2816 respectively.

Turning to the results of Ghaffar & Muzaffar (1987a), income elasticities of demand for real M1, M2 and M3 are estimated at 1.156, 1.702 and 1.861 respectively while their respective short run income elasticities are 0.615, 0.664 and 0.48. Proxied by a 3-month Treasury Bill rate, the alternative rate of return is also found to have a negative influence on real M1, M2 and M3 demands with the long run elasticity for each of these aggregates estimated at -0.36, -0.293 and -0.320 respectively. Their respective short run interest rate elasticities are -0.192, -0.114 and -0.083. However their estimated inflation elasticities of real M2 and M3 demands are rather large at -1.777 and -3.505 respectively. In a subsequent study, Ghaffar & Muzaffar

(1987b) estimated the short run income, inflation and interest rate elasticities of real currency demand at 0.513, -1.022 and -0.312 respectively. Their respective long run elasticities are 1.646, -3.277 and -1.001. With regard to the demand for real demand deposits, they estimated 0.902, -0.719 and -0.279 as short run income, inflation and interest rate elasticities respectively. Their corresponding long run elasticities are 1.447, -1.154 and -0.447 respectively. The study by Rahim (1986) reveals a long run income elasticity of real M1 demand of 1.14 while the long run interest elasticity is estimated at 0.19. Their respective short run elasticities are estimated at 0.311 and -0.053.

More recent works on money demand for a group of developing countries in which Malaysia is included include those of Tseng & Corker (1991) and Arrau & Gregorio (1991). In respect of Malaysia, the work by Arrau, et.al involved quarterly data spanning from the first quarter of 1980 through the second quarter of 1988. Their focus was merely on M1 and perhaps a major limitation of their analysis was that theirs was couched in per capita terms. Moreover no consideration was given to the possible influence of expected exchange rate depreciation on money demand. All in all, Arrau, et.al achieved disappointing results in the case of Malaysia as they failed to establish any cointegrating relationship at all. This could be due to the fact that their analysis was inappropriately couched in per capita terms.

Tseng & Corker (1991) investigate the effect of financial liberalisation on money demand in the SEACEN countries with a focus on the stability and predictability of broad and narrow monetary aggregates during the 1980s. Though they did explore the possibility of the influence of foreign interest rates on local money demand via an incorporation of the London Interbank Offer Rate (LIBOR), they merely made use of the Engle & Granger (1987) approach that does not provide for the possibility of multiple cointegrating vectors. While they could distinctly establish a cointegration between real M1 demand and income with an elasticity of 1.11, they could not ascertain clearly whether there exists some cointegrating relationship in respect of real M2 demand.

3.2 The Long-Run Money Demand Estimation Framework

The following is a general representation of the long run money demand functions that we attempt to estimate:

$$(M/P)_t^d = f(Y_t, r_t^o, r_t^a, s_t^*)$$

M = money demand (M0, M1 & M2)

P = domestic consumer price index (1985=1.00)

Y = gross domestic product at 1985 constant prices

r^o= money's own rate of return

r^a= rate of return on alternative assets

s_t^*=expected exchange rate proxied by a one-period lead in an index computed on the basis of exchange rates between M$ and UK pound, US$ and S$ with an equal weight being assigned to each of the foreign currencies.

Except for interest rates, all variables have been transformed into natural logarithm terms.

In estimating the money demand functions, three alternative monetary aggregates have been explored namely, M0, M1 and M2. Since the demand for money is essentially a demand for real balances (Laidler, 1993), our estimates of money demand functions are couched in real terms. Theoretically the demand for money however defined varies directly with income as a scale variable. If the income elasticity of demand for money is less than unity, economies of scale in cash management or holdings is implied (Baumol, 1952; Tobin, 1956). An alternative to income as a scale variable is wealth. It is contended by Friedman that a more inclusive concept of wealth that embodies both human as well as nonhuman wealth be adopted when gauging the constraint on money demand. However no attempt is made to incorporate wealth in our analysis as its measurement is problematic especially in the case of a developing economy such as Malaysia.

With regard to the coefficients of the other variables, their directions and significance would hinge upon the monetary aggregate being examined. Since M0 and M1 are non interest bearing, f_2 is expected to be null in their regressions. For M2, money's own rate of interest can be proxied by some deposit rate of interest and is expected to yield a positive influence on the demand for M2. Specifically the rate of interest on M2 may be proxied by some deposit rate of interest offered by commercial banks. However it may be contended that money's own rate of interest may be more appropriately represented by the negative of the rate of inflation in the context of developing countries. In the case of developing countries, interest rates are rarely regarded as a significant determinant of the demand for money for two major reasons. In one respect, agents are restricted to the holding of monetary claims mainly currency and bank deposits owing to a lack of alternative financial instruments. In another, interest rates are typically regulated and set below their equilibrium level. These may lead to an immateriality of interest rates in decisions pertaining to the amount of money to be held.

An acceleration in the rate of inflation may depress money demand especially if it leads to the formation of inflationary expectations. Under such circumstances, agents may prefer to hold their wealth in physical forms which may be referred to generally as inflation hedges. In fact the traditional view of money as a transaction asset regards money as a constant, generally zero rate of return riskless asset. However amid uncertainty in price movements, this assumption may lose its tenability. Mizrach & Santomero (1990) contend that money demand is depressed by inflation risk, and hence the justification for the inclusion of the rate of inflation in the money demand function. However the rate of inflation may also yield a positive influence on money demand. Klein (1977) argued that the quality of cash balances would deteriorate when there is unexpected inflation which would induce consumers to hold a larger quantity of money. In his empirical endeavors, he discovered a positive relationship between price variability and money demand. This may be true if there is a lot of uncertainty in the developments of the price level and especially when money is being held mainly for transactionary purposes. However the relationship is discovered to be negative by Smirlock (1982) based upon the use of several measures of inflation uncertainty in Goldfeld's money demand specification. Specifically in the context of developing countries, the anticipated rate of inflation has in fact been widely used as a proxy for the opportunity cost of holding money and found to yield a significant explanatory power in the money demand function (Wong, 1977).[1]

With regard to the rate of return on alternative assets which is an opportunity cost variable, the interest rate offered by commercial banks may be the appropriate proxy in respect of M0 and M1 though undeniably there is a multiplicity of interest rates existing in the market at any one time. Nevertheless so long as all the rates are moving together, any one of them may probably be as appropriate as the other to be deployed in the money demand function. This seems to be the general tendency in Malaysia. Anyhow in general, results pertaining to the opportunity cost influence on holding money are not very sensitive to the precise choice of the variable. It seems rather more important to include an interest rate variable in a money demand function than to be concerned with the appropriate measure of the opportunity cost variable (Laidler, 1993). In the case of M2, the appropriate opportunity cost variable may then be the interest rate offered by finance companies. However since interest rates offered by these companies are not reported prior to 1978, we have decided to use the 3-month Treasury Bill rate as a proxy.

Since Malaysia is an open economy and has been maintaining a liberal exchange control regime since 1973, foreign interest rate developments may have a bearing upon domestic money demand. Hamburger (1977) maintains that the rate of return earnable from holding foreign securities may constitute another opportunity cost variable when modelling money demand in an open economy context. Nevertheless if world's capital markets are closely integrated, cross-border interest rate differentials may tend towards zero. Under such circumstances, it is adequate to have just a domestic interest rate variable incorporated in the

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[1]In our empirical endeavors later, the rate of inflation is not incorporated into the long run money demand function since it is found to be an I(0) variable. However when modelling the short run dynamics of money demand, the rate of inflation is postulated to have an influence on money demand and duly incorporated into our analysis.

money demand function. However if foreign interest rate considerations are relevant, future movements in the exchange rate would also become pertinent. The impact of exchange rate depreciation on money demand could be negative if a domestic currency depreciation leads the public to anticipate a further reduction, prompting them to demand more foreign currency against domestic currency. On the other hand, a positive impact could also be envisaged if a depreciation arouses expectations that the domestic currency would rebound thus inducing people to hold more domestic money. In our empirical implementation later, it is implicitly assumed that exchange rate movements do reflect domestic-overseas interest rate differentials. Hence we do not include interest rates abroad.

3.3 Data Considerations

Our period of review generally spans from 1971 through 1991 subject to the availability of individual data series. Though this is a quarterly-based study, monthly data have been gathered to derive quarterly series as published quarterly data are mainly end-of-period rather than periodic average observations. Data are drawn from the numerous issues of the Quarterly and Monthly Economic Bulletins of the Central Bank of Malaysia and the International Financial Statistics published by the International Monetary Fund (IMF). Annual income series namely real gross domestic product has been interpolated over the missing quarterly observations based upon the industrial production index. This is effected by apportioning annual real gross domestic product figures to each quarter of a year based upon the industrial production index reported for the corresponding quarter. Prior to this, an attempt was also made to interpolate based upon the method developed by Goldstein & Khan (1976) method. However the results turned out to be disappointing when the conventional unit root test was applied to the generated series as severe serial correlation problems were encountered.

As our research is concerned with private sector demand for money, official series of M1 and M2 have not been relied upon as these series include balances held by Federal and State public authorities. These authorities have been officially defined as part of the private sector. Our definitions are as follows:

M0 - Currency-in-circulation;

M1 - M0 plus demand deposits of the private sector placed with commercial banks. (The official definition of demand deposits of the private sector includes demand deposits placed with the Central Bank of Malaysia by the Federal and State public authorities though the amount involved is negligible); and

M2 - M1 plus quasi money placed with commercial banks.

The consumer price index forms the basis of our computation of the rate of inflation and also acts as a price deflator for the nominal money series. This is mooted by the fact that it has a greater influence on the majority of people.

Two interest rate series are being mobilised in our analysis namely the 3-month fixed deposit rate offered by commercial banks and the 3-month Treasury Bill rate. In our estimation process, these two series are being tried upon to capture the opportunity cost influence on real M0 and M1 demands. However in the process of estimating the real M2 demand function, the 3-month fixed deposit rate and the 3-month Treasury Bill rate are designed to capture the own rate of return and opportunity cost influences respectively. This is because unlike M0 and M1 which are non interest bearing, M2 has an interest bearing component.

Owing to Malaysia's traditional trading and financial ties with U.K., the reserve currency position of the U.S.$ and the geographical proximity of Malaysia to Singapore, there lies the possibility that exchange rate movements of the Malaysian currency vis-a-vis those of these countries will have an impact on real money balances in Malaysia. As mentioned earlier, an exchange rate index is computed based upon the exchange rates between the M$ on one hand and U.K. pound, U.S.$ and S$ on the other with weights equally assigned to these foreign currencies. This is because financial resource movements rarely respect fundamentals in an economy. Since the exchange rates published in the IFS are bilateral rates between a currency vis-a-vis the U.S.$, the bilateral rates between the Malaysian ringgit vis-a-vis the U.K. pound and S$ are derived as cross rates. The expected exchange rate is then proxied by a one-period lead of this index assuming perfect foresight.

3.4 Conventional and Seasonal Unit Root Tests

This section discusses the unit root tests applied to the data mobilised by us namely the conventional (Dickey-Fuller-based) tests for unit roots and the seasonal unit root test. The latter is also attempted as the presence of seasonal unit roots may call for the use of seasonal cointegration technique instead. In the subsequent paragraphs, the techniques employed are first discussed followed by a discussion of their results.

Prior to assessing relationships amongst variables based upon the notion of cointegration, their univariate time series properties have to be examined, i.e. their order of integration. Granger (1983) put forth the concept of cointegration which acknowledges the possibility that though an unit root may be present in individual time series, a linear combination may not display an unit root behavior. An univariate test for unit roots was first advocated by Fuller (1976) and Dickey & Fuller (1981). Economic time series are typically integrated of order one, I(1). This implies that non stationarity in this variable is typically stochastic rather than deterministic and it can be rendered stationary by first differencing.

Apart from conducting the usual unit root tests, seasonal unit root tests are also attempted to ascertain whether the series in question possess an unit root at some frequency other than the usual zero frequency, namely biannual and or annual frequencies which may be the case with quarterly data. For instance there are a few U.K. macroeconomic variables which exhibit nonstationary stochastic seasonality (see inter alia Osborn, 1990). If unit root at these other frequencies is found for a set of variables, an application of the seasonal cointegration technique may be called for. The standard procedure of testing for cointegration may become inappropriate. However for two series to be seasonally cointegrated, they must have an unit root at the same frequency.

Here the Dickey-Fuller based approaches are relied upon to test for conventional unit roots. In principle, it involves running the following univariate regression:

$$\Delta y_t = \alpha_0 + \alpha_1 y_{t-1} + \sum_{i=1}^{n} \psi_i \Delta y_{t-i} + u_t \qquad (3.4.1)$$

where y_t is the natural logarithm of the variable of interest and u_t is a white noise stationary error term. Equation (3.4.1) may also be augmented by a deterministic trend term. If y_t is non stationary, α_1 will assume a zero value and y_t is deemed to have an unit root. The null hypothesis that $\alpha_1 = 0$ can be tested by reference to its usual t-statistics computed as the ratio of α_1 to its estimated standard error. This statistic is referred to as the Augmented Dickey-Fuller (ADF) statistic. However the distribution of ADF does not follow the usual student's t. Approximate critical values of this statistic can be found originally in Fuller (1976). The number of lags (n) in (3.4.1) has to be selected such that the regression yields non-serially correlated errors. If n=0, the t-value is referred to just as the Dickey-Fuller (DF) statistic though its critical values are similar to cases requiring augmentation.

Equation (3.4.1) is just designed for testing whether a series is I(1) or I(0) though an I(1) outcome need not suggest that the series is inherently I(1). However in the implementation of the test, the possibility that the series is integrated of higher order is also explored along the lines of Dickey & Pantula (1988). We proceed on the assumption that the order of integration of each series is at most 2. Dickey and Pantula propose the procedure of moving from the highest level of differencing that one would contemplate to the lowest level and not vice-versa, guided by a sequence of one-sided t-tests.

Before discussing the results of these tests, we discuss briefly the seasonal unit root test procedure employed by us as developed by Hylleberg, Engle, Granger and Yoo (1990) referred to as the HEGY procedure. As pointed out earlier, the standard cointegration technique may not be applicable if the relevant data series are plagued with seasonal unit root problems. In the literature, a few attempts to develop such tests exist for instance the one proposed by Dickey, Hasza and Fuller (1984). The HEGY test may be administered to a series y_t by estimating the following equation:

$$\varphi^{*}(B)y_{4t} = \Pi_1 y_{1t-1} + \Pi_2 y_{2t-1} + \Pi_3 y_{3t-2} + \Pi_4 y_{3t-1} + u_t + \varepsilon_t \qquad (3.4.2)$$

where $y_{1t} = (1 + L + L^2 + L^3)x_t$

$y_{2t} = -(1 - L + L^2 - L^3)x_t$

$y_{3t} = -(1 - L^2)x_t$

$y_{4t} = (1 - L^4)x_t$

and u_t may consist of deterministic terms such as seasonal dummies, time trend and constant. Additional lags of y_{4t} may be introduced in the estimation process to whiten the errors. Based upon estimates of the above, the following null hypotheses may be evaluated:

I $H_o: \Pi_1 = 0$ $\qquad H_A: \Pi_1 \prec 0$

II $H_o: \Pi_2 = 0$ $\qquad H_A: \Pi_2 \prec 0$

III $H_0: \Pi_3 = \Pi_4 = 0$ $\qquad H_A: \Pi_3 \neq 0$

$\Pi_4 \neq 0$

The first null hypothesis corresponds to a test that the series in question has an unit root at zero frequency while the second relates to one that it possesses an unit root at biannual frequency. The third deals with the test for the presence of unit root at annual frequency. An alternative course to III is to pursue a two-sided test of Π_4=0 and conditional upon its acceptance, proceed to a one-sided test of Π_3=0 vis-a-vis the alternative $\Pi_3 \prec$0. Seasonal unit roots are said to be absent if Π_2 and either Π_3 or Π_4 are different from zero. This calls for a rejection of both a test for Π_2 and a joint test for Π_3 and Π_4 .

Table 3.I furnishes the results of the Dickey-Fuller-based unit root tests at three different orders, namely second difference, first difference and levels despite the general conviction that most economic time series are I(1). The results are arrived at after subjecting each regression to a spate of Lagrangean Multiplier (LM) tests for serial correlation at the 5 per cent

significance level ranging from the first to the fourth order. This is to ensure that no serial correlation is present that could render a bias to our inferences. Deterministic seasonal dummies have been included for those series namely M0, M1 and M2 and real GDP as their inclusion drastically reduced the number of lags required to generate non-autocorrelated errors.

Table 3.I

Dickey-Fuller Tests (Without Time Trend)

	Levels	First Difference	Second Difference
LRM0	-2.2423	-7.7588	-10.6738
LRM1	-1.3612	-5.7908	-10.2027
LRM2	-2.2051	-7.2258	-9.4562
LCP	-1.1399	-3.4663	-8.5071
R3FD	-2.4849	-5.3242	-7.6451
LRGDP	-0.7727	-4.4561	-7.5635
LS	-2.3690	-6.4656	-7.2290
R3TB	-1.6756	-6.2678	-5.7915

Notes: I) All variables are in natural logarithm except for interest rates

II) LRM0 - real M0

LRM1 - real M1

LRM2 - real M2

LCP - consumer price index

R3FD - 3-month fixed deposit rate offered by commercial banks

LRGDP - real gross domestic product

LS - exchange rate index

R3TB - 3-month Treasury Bill rate

III) Critical values at the 5 per cent significance level for 50 and 100 observations are -
-2.93 and -2.89 respectively

It can be discerned from the table that all the variables are I(1). Since the consumer price index (LCP) is I(1), we may deduce that the rate of inflation is I(0). The results based upon the inclusion of the deterministic time trend in respect of non interest rate variables are presented in Table 3.II. It is suggested by the table that all the variables are indeed I(1).

Table 3.II

Dickey-Fuller Tests (With Time Trend)

	Levels
LM0	-1.8524
LRM0	-1.5569
LM1	-2.8895
LRM1	-2.0289
LM2	-1.6396
LRM2	-1.0779
LCP	-1.7673
LRGDP	-1.8955
LS	-2.0442

Notes: I) LM0 - nominal M0

LM1 - nominal M1

LM2 - nominal M2

II) Critical values at the 5 per cent significance level for 50 and 100 observations are -3.50 and -3.45 respectively.

Table 3.III presents the results of seasonal unit root tests, allowing for five different configurations for each series namely, when all deterministic terms are absent, when only an intercept (I) is included, when an intercept (I) and seasonal dummies (SD) are included, when an intercept (I) and a trend term (Tr) are included and when all the deterministic terms are present. All the series unambiguously have an unit root at zero frequency as indicated by the t-statistics of Π_1. The inclusion of deterministic seasonal dummies appears to render most series clear from seasonal unit root problems though certain series namely real and nominal M2 and the exchange rate index are inherently free from seasonals as even no seasonal

dummies are required for such variables. Perhaps it can be deduced that generally seasonal influence on these series can be adequately captured by an incorporation of deterministic seasonal dummies.

Table 3.III

Seasonal Unit Root Tests

(The HEGY Procedure)

	't':π_1	't':π_2	't':π_3	't':π_4	'F':$\pi_3 n \pi_4$
LMO-	1.707	-0.204	0.410	-0.172	0.098
I	-0.411	-0.026	0.799	-0.425	0.406
I,SD	-2.618	-4.093*	-1.856	-1.957	3.630
I,Tr	-1.759	-0.054	0.867	-0.452	0.473
I,SD,Tr	-3.633	-3.468*	-3.171	-2.773*	8.799*
LRMO-	0.932	0.409	0.692	0.079	0.242
I	-1.011	0.404	0.731	0.043	0.268
I,SD	-2.118	-3.118*	-2.855	-2.822*	9.120*
I,Tr	-2.449	0.465	0.745	0.147	0.287
I,SD,Tr	-2.887	-3.069**	-3.521	-2.339*	8.849*
LM1-	2.890	-0.263	-0.974	-1.322	1.372
I	-1.473	-0.238	-0.978	-1.290	1.333
I,SD	-2.128	-2.936**	-3.245	-3.139*	11.908*
I,Tr	-1.745	-0.266	-1.010	-1.231	1.291
I,SD,Tr	-3.633	-4.612*	-2.807	-4.359*	13.447*
LRM1-	3.345	-0.299	-1.386	-1.455	2.105
I	-0.396	-0.311	-1.361	-1.448	2.058
I,SD	-0.306	-3.153*	-3.227	-2.610*	10.072*
I,Tr	-1.784	0.186	-0.893	-0.555	0.561
I,SD,Tr	-2.750	-6.616*	-4.068*	-5.182*	30.337*
LM2-	2.000	-2.135*	-1.965*	-2.079**	4.326*
I	-1.856	-2.072*	-2.142*	-2.029**	4.615*
I,SD	-1.732	-4.150*	-2.299	-4.475*	12.674*
I.Tr	-1.972	-2.107*	-2.047*	-1.985**	4.296*
I,SD,Tr	-2.316	-3.972*	-2.321	-4.146*	11.282*

		't': π_1	't': π_2	't': π_3	't': π_4	'F': $\pi_3 \cap \pi_4$
LRM2	-	3.022	-2.465*	-2.639*	-2.280*	6.785*
	I	-1.501	-2.410*	-2.772*	-2.245*	7.102*
	I,SD	-1.811	-5.226*	-4.187*	-5.760*	37.072*
	I,Tr	-1.375	-2.417*	-2.706*	-2.167*	6.674*
	I,SD,Tr	-1.364	-5.262*	-4.291*	-5.643*	37.231*
LCP	-	-2.147*	-1.406	-0.312	-4.233*	8.992*
	I	-1.114	-2.602*	-2.239*	-4.427*	13.690*
	I,SD	-1.015	-3.736*	-2.314	-5.137*	18.283*
	I,Tr	-1.723	-1.399	-0.476	-4.133*	8.632*
	I, SD,Tr	-1.825	-5.676*	-3.296	-7.632*	46.722*
LRGDP	-	2.758	-0.924	-0.255	-1.118	0.652
	I	-0.511	-0.934	-0.246	-1.128	0.661
	I,SD	-0.884	-4.464*	-4.393*	-2.902*	16.8462*
	I,Tr	-2.084	-0.921	-0.297	-1.068	0.609
	I,SD,Tr	-1.896	-4.506*	-4.540*	-2.809*	17.308*
LS	-	-1.186	-4.675*	-2.786*	-4.917*	15.767*
	I	-2.348	-4.586*	-2.916*	-4.682*	15.059*
	I,SD	-2.332	-4.543*	-2.912	-4.593*	14.601*
	I,Tr	-2.168	-4.532*	-2.862*	-4.584*	14.343*
	I,SD,Tr	-2.131	-4.490*	-2.856	-4.499*	13.901*

* Significant at the 5 per cent level
** Significant at the 10 per cent level

In brief, the exercise in this section has shown that all the variables are I(1). This implies that the series could be rendered stationary by just first differencing. Moreover no seasonal unit root problem is found.

3.5 Estimates of Long Run Money Demand Functions

An attempt is made here to estimate the long run Malaysian money demand functions using the cointegration technique developed by Johansen. A major advantage of the Johansen's maximum likelihood approach to cointegration over the Ordinary Least Squares approach is that it allows for the possible existence of multiple cointegrating vectors and their identification especially in regressions involving more than two variables (Cuthbertson et.al, 1992). The procedure begins from the following standard vector autoregression:

$$X_t = \Pi_1 X_{t-1} + \ldots\ldots\ldots\ldots\ldots + \Pi_k X_{t-k} + e_t \qquad (3.5.1)$$

where X is an Nx1 vector of the I(1) variables and Π_i is an NxN matrix of parameters.

Reparameterisation of the system of equations (3.5.1) in an ECM form yields the following:

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \ldots\ldots\ldots + \Gamma_{k-1} \Delta X_{t\ k-1} + \Gamma_k X_{t-k} + e_t \qquad (3.5.2)$$

where $\Gamma_i = -(I - \Pi_1 - \ldots\ldots\ldots\ldots - \Pi_i)$, i=1,..............k

The long run (levels) relationship amongst the variables in the VAR is embodied in Γ_k. By virtue that X_t is a vector of I(1) variables, the left-hand side and the first (k-1) terms of (3.5.2) must be I(0) while the last represents a linear combination of I(1) variables. All the possible distinct combinations of the levels of X that yield high correlations with the I(0) elements in (3.5.2) are then estimated. These combinations are referred to as the cointegrating vectors.

The rank of the vector Γ_k is determined by the number of cointegrating vectors, r, amongst the elements of X. There are three possible scenarios subject to the rank of Γ_k. If Γ_k is of full rank N, the matrix is then stationary and by implication, the elements in vector X are not I(1). On the other hand, if its rank is zero, then all the individual variables in X are I(1) but not cointegrated. However if its rank, r is greater than zero but less than N, then there exists r cointegrated vectors which are identifiable and incorporatable into an error correction model.

Except for the final term, all terms on the right hand side of (3.5.2) are clearly I(0). Hence the final term must also be I(0), i.e. $\Gamma_k X_{t\ k} \propto I(0)$. For it to be I(0), either Γ_k must harbor a number of cointegrating vectors or Γ_k must be a null matrix.

Now let β be an Nxr matrix such that $\beta X_{t\ k} \propto I(0)$. If all the elements of X_t are I(1), then the columns of β must form cointegrating parameter vectors for $X_{t\ k}$ and by implication X_t. Since the maximum number of cointegrating vectors can only be (N-1), β must have r smaller than N. However β must be a matrix of zeroes if X_t is I(1) and yet no cointegration exists amongst the elements.

Next consider another (Nxr) matrix α such that

$$-\Gamma_k = \alpha\beta \qquad (3.5.3)$$

The Johansen technique is premised upon estimating the factorisation (3.5.3). This implies estimating the matrix (β) that contains all the possible cointegrating vectors and the α matrix containing the corresponding set of error correction coefficients. If elements in X_t indeed do cointegrate, at least one of the β_i vectors will be statistically significant. Then by virtue of the Granger representation theorem, α_i must contain at least one non zero element. An isomorphism is established between ECMs and cointegrated processes by Engle & Granger (1987). The Granger representation theorem (Granger, 1983 & Engle & Granger, 1987) states that if a set of variables are cointegrated of order 1,1 (CI (1,1)), then a valid error correction representation of the data exists.

In general, (3.5.2) may be rewritten as

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \Gamma_2 \Delta X_{t-2} + \ldots\ldots + \Gamma_{k-1} \Delta X_{t-k-1} (-\alpha\beta) X_{t-k} + e_t \qquad (3.5.4)$$

The rank of the matrix Γ_k can be determined by reference to the eigenvalues λ_i derived from the maximisation of the concentrated likelihood function of (3.5.4). The likelihood ratio statistic for the null hypothesis of at most r cointegrating vectors is given by

$$\eta_r = -T \sum_{i=r+1}^{N} \ln(1-\lambda_i) \qquad (3.5.5)$$

This statistic is known as the trace statistic. An alternative test statistic to the above is the maximal eigenvalue statistic computed as:

$$\zeta_r = -T \ln(1-\lambda_{r+1}) \qquad \text{where } r = 0,1,2,\ldots\ldots\ldots n\text{-}2,n\text{-}1 \qquad (3.5.6)$$

The critical values for the above tests have been tabulated by Johansen (1988) and Osterwald-Lenum (1992) for a range of values n and are also available in Banerjee, et.al (1993). Tables 3.IVA through 3.IVC provide the results of the application of the Johansen procedure to the identification of long run demand relationships of real M0, M1 and M2 respectively with all the possible cointegrating vectors normalised with respect to the monetary aggregate in question. They have all been estimated upon the assumption that there is trend in the series but no trend in the data generation process (DGP). Table 3.IVA suggests that one cointegrating vector exists in the case of real M0 based upon the trace statistic at the 5 per cent significance level (Panel I). The cointegrating vector has been estimated with a provision for 8 lags with a dummy variable (D7841) and the rate of inflation (ΔLCP) included alongside the centered seasonal dummies. The inclusion of this number of lags is found appropriate as no serial correlation and serious normality problems arise (Panel V). The dummy variable (D7841) is intended to reflect a switch in the interest rate regime initiated in October 1978. The estimated cointegrating vector has theoretically plausible coefficients (Panel II). However the validity of the income homogeneity restriction on M0 demand has also been tested for and it appears to be a valid restriction as the likelihood ratio test has a marginal significance level of 31.5% (Panel IV). The cointegrating vector is plotted in Figure 3A and is indeed stable. The null hypothesis that all the independent variables in the M0 demand equation are weakly exogenous can also be upheld (Panel VI). Hence the estimated long run real M0 demand function is as follows:

$$LRM0_t = 1.000LRGDP_t - 0.083R3FD_t - 0.945LERIS_t^e$$

As suggested by the above equation, the long run income elasticity of real M0 demand is unity and expected exchange rate movements have a significantly negative bearing on the demand in the long run with an elasticity of -0.95. Though this elasticity appears large, it is noteworthy that in our subsequent modelling of the short run dynamics, expected exchange rate changes do not yield any contemporaneous influence on real M0 demand (unlike the case of real M1 demand); they merely influence the demand for real M0 via the error correction process. The error correction coefficient is rather small, estimated at -0.08. The deposit rate of interest also seems to yield a negative influence on the long run demand with a semi-interest rate elasticity of -0.08.

Table 3.IVA

The Johansen Procedure
Real MO
VAR with 8 lags, seasonal dummies, D7841 and ΔLCP included

Sample period: 1973Q1 - 1991Q4 (76 observations)
Trended Case, no trend in DGP

I EIGENVALUES: 0.28857 0.21453 0.086799 0.015929

Test statistics for the number of cointegrating vectors

Ho:	$r = 0$	$r \leq 1$	$r \leq 2$	$r \leq 3$
Trace	52.3499	26.4735	8.1211	1.2204
	(48.2800)	(31.5250)	(17.9530)	(8.1760)
λmax	25.8764	18.3524	6.9007	1.2204
	(27.1360)	(21.0740)	(14.9000)	(8.1760)

II ESTIMATED COINTEGRATING VECTOR

LRMO	-1.0000
LRGDP	0.8648
R3FD	-0.0993
LERIS(+1)	-0.8326

III ESTIMATED ADJUSTMENT MATRIX

LRMO	-0.0582
LRGDP	0.0315
R3FD	-0.0719
LERIS(+1)	-0.0812

IV RESTRICTED COINTEGRATING VECTOR

LRMO	-1.0000
LRGDP	1.0000
R3FD	-0.0832
LERIS(+1)	-0.9450

LR Test of Restriction $\chi^2(1) = 1.0080$ [0.315]

V TESTS FOR APPROPRIATE LAG LENGTH (8)

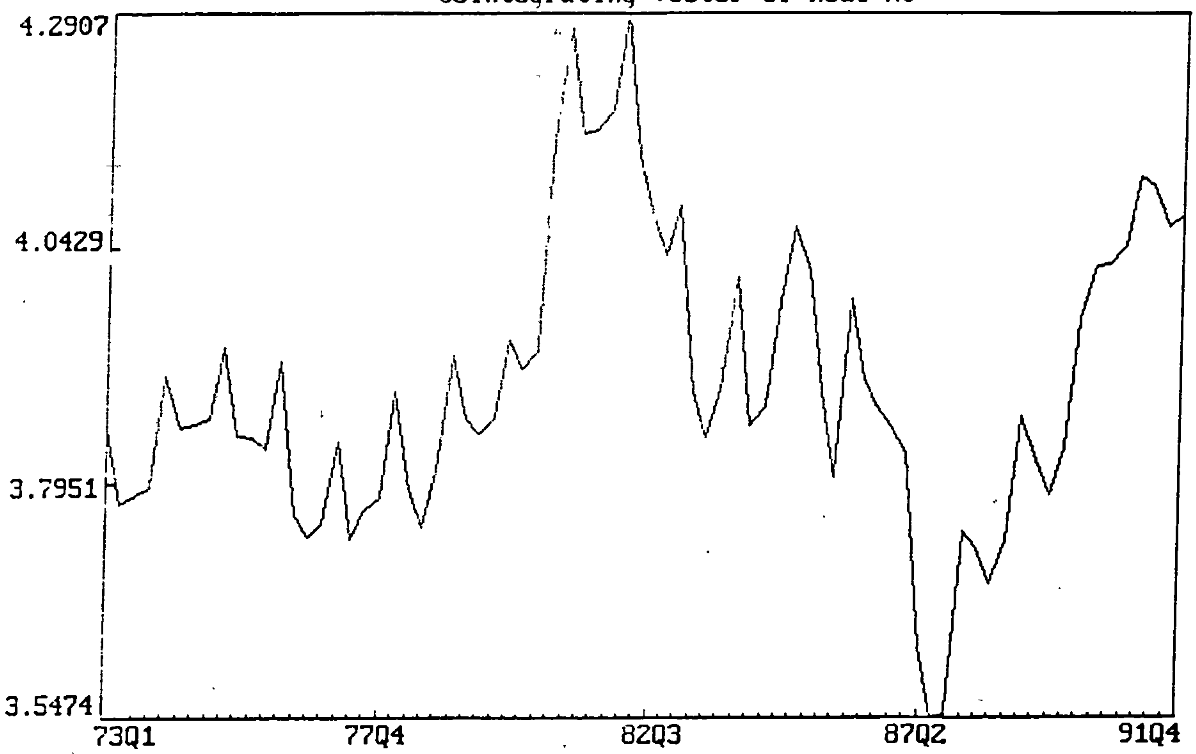
	ΔLRM0	ΔLRGDP	ΔR3FD	ΔLERIS(+1)
Serial Corr: $\chi^2(4)$	8.018 [0.091]	9.273 [0.055]	4.849 [0.303]	8.583 [0.072]
$F(4,35)$	1.032 [0.405]	1.216 [0.322]	0.596 [0.668]	1.114 [0.366]
Normality: $\chi^2(2)$	4.062 [0.131]	0.323 [0.851]	41.311 [0.000]	0.770 [0.681]

VI EXOGENEITY TESTS

Ho: $\alpha_2 = \alpha_3 = \alpha_4 = 0$ $\chi^2_{0.05}$ with 3d.f. =6.5169
(7.81)

Notes: i) Figures in normal parentheses ( ) below test statistics refer to 95% critial values
ii) Figures in square parentheses [ ] refer to marginal significance levels.

Figure 3A
Cointegrating Vector of Real M0



Results of the cointegration tests for real M1 demand are given in Table 3.IVB. Akin to the case of real M0 demand, the trace statistic alludes to the presence of one cointegrating vector (Panel I) estimated on the basis of 6 lags, with D7841 and ΔLCP included alongside the centered seasonal dummies as I(0) variables. The imposition of income homogeneity restriction as in the case of M0 is found to be valid at the marginal significance level of 68% (Panel IV). Figure 3B shows the estimated cointegrating vector and it satisfies the stability condition. Weak exogeneity of all the arguments in the real M1 demand function is confirmed (Panel VI). The estimated long run real M1 demand function is thus as follows:

$$LRM1_t = 1.000\,LRGDP_t - 0.077\,R3FD_t - 0.442\,LERIS_t^e$$

The equation above indicates an unit long run income elasticity of real M1 demand as in the case of real M0. The deposit rate of interest also yields a negative influence albeit with a nominal semi-interest elasticity of -0.077 on the demand. Though in the long run, the demand for real M1 is also negatively affected by expected exchange rate depreciation, the influence seems to be less than in the case of real M0 demand with an elasticity of -0.442.

Table 3.IVB

The Johansen Procedure

Real M1

VAR with 6 lags, seasonal dummies, D7841 and ΔLCP (incuded)

Sample period: 1973Q1 - 1991Q4 (76 observations)
Trended Case, no trend in DGP

I EIGENVALUES: 0.26736 0.22860 0.071767 0.0006643

Test statistics for the number of cointegrating vactors

Ho:	r = 0	r ≤ 1	r ≤ 2	r ≤ 3
Trace	49.0796	25.4358	5.7104	0.050506
	(48.2800)	(31.5250)	(17.9530)	(8.1760)
λmax	23.6438	19.7254	5.6599	0.050506
	(27.1360)	(21.0740)	(14.9000)	(8.1760)

II ESTIMATED COINTEGRATING VECTOR

LRM1	-1.0000
LRGDP	0.8503
R3FD	-0.1344
LERIS(+1)	-0.4358

III ESTIMATED ADJUSTMENT MATRIX

LRM1	-0.0218
LRGDP	0.0167
R3FD	-0.1656
LERIS(+1)	-0.0424

IV RESTRICTED COINTEGRATING VECTOR

LRM1	-1.0000
LRGDP	1.0000
R3FD	-0.0774
LERIS(+1)	-0.4421

LR Test of Restriction $\chi^2(1) = 0.1702$ [0.680]

V TESTS FOR APPROPRIATE LAG LENGTH (6)

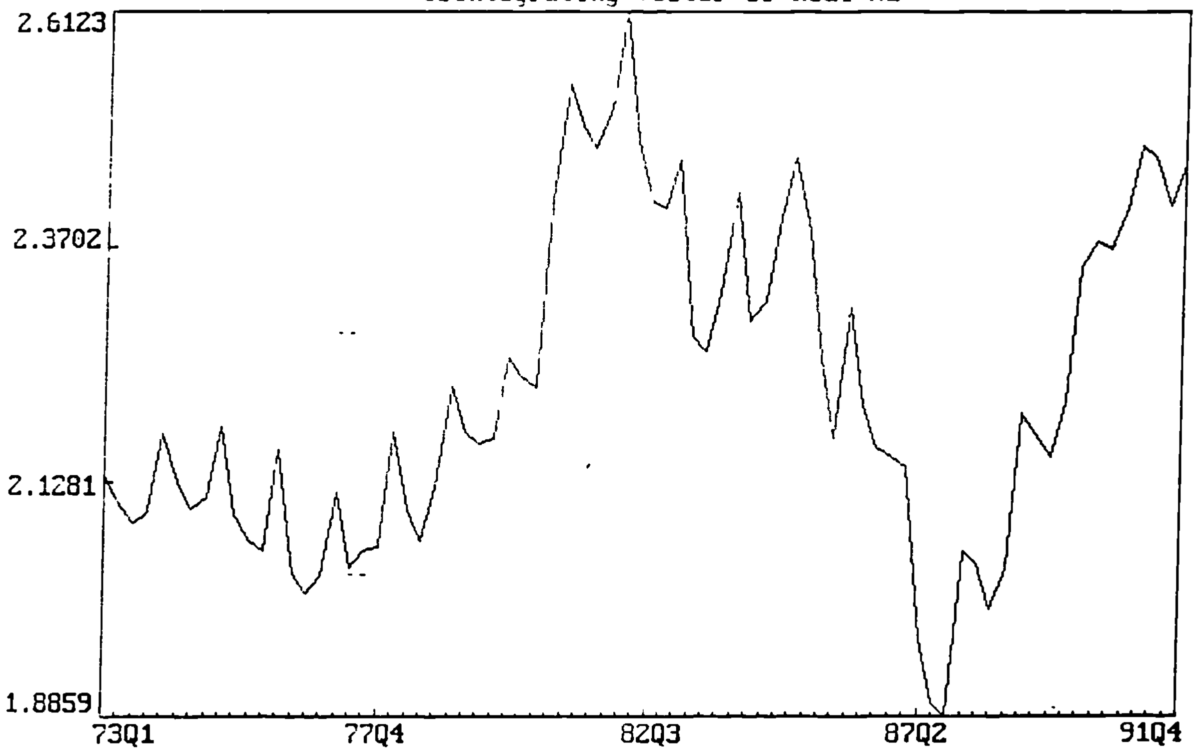
	ΔLRM1	ΔLRGDP	ΔR3FD	ΔLERIS(+1)
Serial Corr: $\chi^2(4)$	4.183 [0.382]	13.957 [0.007]	5.293 [0.259]	5.376 [0.251]
$F(4,43)$	0.626 [0.646]	2.418 [0.063]	0.805 [0.529]	0.818 [0.521]
Normality: $\chi^2(2)$	1.706 [0.426]	0.429 [0.807]	28.960 [0.000]	0.008 [0.996]

VI EXOGENEITY TESTS

Ho: $\alpha_2 = \alpha_3 = \alpha_4 = 0$ $\chi^2_{00.5}$ with 3d.f = 7.2402
(7.81)

Notes: i) Figures in normal parentheses ( ) below test statistics refer to 95% critical values
ii) Figures in square parenthese [ ] refer to marginal significance levels

Figure 3B
Cointegrating Vector of Real M1



At the 5 per cent significance level, an examination of the trace and maximal eigenvalue statistics in Table 3.IVc reveals the existence of one cointegrating vector in the case of real M2 demand (Panel I). The cointegrating vector has been estimated with a lag length of 6 without any serious serial correlation and normality problems. Coefficients which are theoretically consistent are found in the estimated cointegrating vector (Panel II). While the imposition of a zero restriction on the coefficient of expected exchange rate movements is found to be valid at a marginal significance level of 94.5% (Panel IV), the imposition of income homogeneity restriction can be dismissed as invalid at a marginal significance level of 1.4%. The estimated cointegrating vector is plotted in Figure 3C and is indeed stable. Contrary to the cases of real M0 and M1, weak exogeneity tests carried out reveal that income is not a weakly exogenous variable in the real M2 demand function while the others are (Panel VI).[2] The estimated long run real M2 demand function is reproduced below:

$$LRM2_t = 1.672 LRGDP_t + 0.027 R3FD_t - 0.061 R3TB_t$$

The long run income elasticity of real M2 demand is estimated at 1.672. In the long run, the demand for real M2 is positively and negatively influenced by its own rate of return (R3FD) and the rate of return on some alternative assets (proxied by R3TB) respectively though the magnitudes are rather small.

[2]This calls for an application of the instrumental variables estimation technique instead of the OLS estimation technique in the process of estimating the short run M2 demand function.

Table 3.IVC

The Johansen Procedure

Real M2

VAR with 6 lags and seasonal dummies included

Sample period: 1973Q1 - 1991Q4 (76 observations)

Trended Case, No Trend in DGP

I <u>EIGENVALUES: 0.39675 0.25358 0.20084 0.063951 0.018907</u>

Test statistics for the number of cointegrating vectors

Ho:	$r = 0$	$r \leq 1$	$r \leq 2$	$r \leq 3$	$r \leq 4$
Trace	84.1518	45.7394	23.5123	6.4733	1.4507
	(70.5980)	(48.2800)	(31.5250)	(17.9530)	(8.1760)
λmax	38.4124	22.2271	17.0390	5.0226	1.4507
	(33.3190)	(27.1360)	(21.0740)	(14.9000)	(8.1760)

II <u>ESTIMATED COINTEGRATING VECTOR</u>

LRM2	-1.0000
LRGDP	1.6730
R3FD	0.0272
R3TB	-0.0611
LERIS(+1)	0.0068

III <u>ESTIMATED ADJUSTMENT MATRIX</u>

LRM2	-0.2466
LRGDP	0.4543
R3FD	0.4579
R3TB	0.8482
LERIS(+1)	0.0655

IV RESTRICTED COINTEGRATING VECTOR

LRM2	-1.0000
LRGDP	1.6717
R3FD	0.0270
R3TB	-0.0606
LERIS(+1)	0.0000

LR Test of Restriction $\chi^2(1) = 0.0047$ [0.945]

V TESTS FOR APPROPRIATE LAG LENGTH (6)

	ΔLRM2	ΔLRGDP	ΔR3FD	ΔR3TB	ΔLERIS(+1)
Serial Corr: $\chi^2(4)$	6.307 [0.177]	5.185 [0.269]	10.582 [0.032]	17.848 [0.001]	6.147 [0.188]
F (4,39)	0.882 [0.483]	0.714 [0.588]	1.577 [0.200]	2.993 [0.030]	0.858 [0.498]
Normality $\chi^2(2)$	1.735 [0.420]	0.544 [0.763]	10.855 [0.004]	1.774 [0.412]	0.633 [0.729]

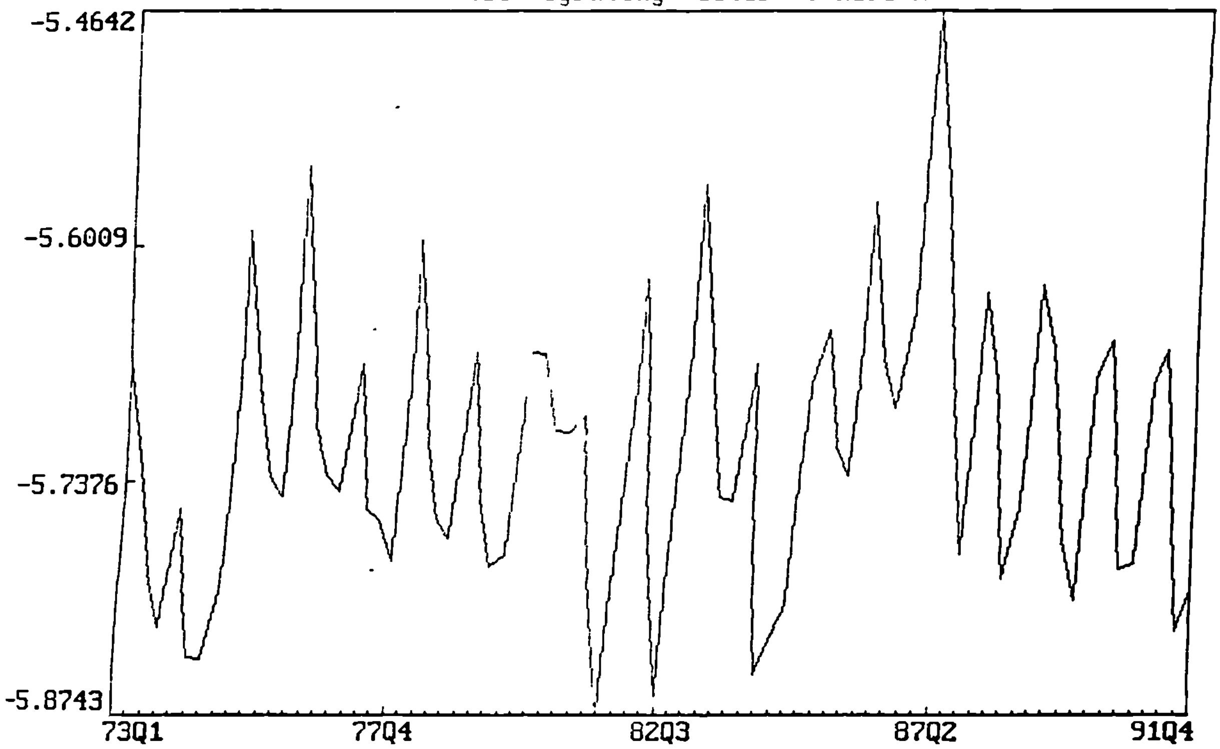
VI EXOGENEITY TESTS

Ho: $\alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$	$\chi^2_{0.05}$ with 4d.f. = 15.4597 (9.49)
Ho: $\alpha_2 = 0$	$\chi^2_{0.05}$ with 1d.f. = 15.1163 (3.84)
Ho: $\alpha_3 = 0$	$\chi^2_{0.05}$ with 1d.f. = 0.0398 (3.84)
Ho: $\alpha_4 = 0$	$\chi^2_{0.05}$ with 1d.f. = 0.2364 (3.84)
Ho: $\alpha_5 = 0$	$\chi^2_{0.05}$ with 1d.f. = 0.3141 (3.84)

Notes: i) Figures in normal parentheses ( ) below test statistics refer to 95% critical values

ii) Figures in square parentheses [ ] refer to marginal significance levels.

Figure 3C
Cointegrating Vector of Real M2



A comparison across all the three equations above suggests that expected exchange rate depreciation has a greater impact on the long run demand for narrow money than on the demand for money more broadly defined. The high income elasticity of the demand for real M2 may reflect the growing degree of monetisation in the Malaysian economy with a more extensive branching of banking networks to remote areas and the drawing of an increasing number of rural folks into the mainstream of economic development.

3.6 Estimates of Short Run Money Demand Functions:The General-to-Specific Approach

Following the general to specific procedure, the short run dynamics of demand for each of the monetary aggregates is modelled. The procedure departs from the following general autoregressive distributed lag representation with an error correction term (EC) formed by the relevant cointegrating vector estimated in the preceding section, rate of inflation (ΔLCP), and dummy variable (D7841) embedded in it:

$$A(L)\Delta(m-p)_t = \alpha_0 + B(L)\Delta LRGDP_t + C(L)\Delta R_t + D(L)\Delta R_t^{\prime} + E(L)\Delta LERIS_t^{\prime} + \alpha_1 EC_t + \alpha_2 \Delta LCP_t + \alpha_3 D7841_t + \Sigma\theta_i S_i + \varepsilon_t$$

.........(3.6.1)

where A(L).....E(L) are lag polynomials and S_i 's refer to seasonal dummies. In the case of real M0 and M1, the term $C(L)\Delta R_t^o$ does not arise. The rate of inflation and the dummy variable which are I(0) variables that do not constitute elements in the VAR for estimating the long run relationships are however 'tagged' onto the model herein as they potentially influence the short run dynamics.

Table 3.V provides some summary statistics contrasting between the initially overparameterized model based upon equation (3.6.1) and the parsimonious model reached finally for each of the money demand functions. While there has been a significant reduction in the parameters from more than 30 to about 11, final specifications still maintain superiority over initial specifications both in terms of equation standard error and explanatory power.

Given that income is not weakly exogenous in the real M2 demand function, its short run function has been estimated using both the Instrumental Variables (IV) technique and the OLS technique for comparison purposes.

Table3.V

General-to-Specific Reductions of Overly-Parameterized

ADL for LRMO, LRM1 and LRM2

	LRMO**	LRM1**	LRM2*	LRM2**
Initial Specification				
No of Parameters	38	30	36	36
Std. Error of Regression	0.0155	0.0134	0.0166	0.0164
$\bar{R}^2$	0.7944	0.8070	0.4492	0.4579
Final Model				
No. of Parameters	11	12	11	9
Std. Error of Regression	0.0147	0.0129	0.0153	0.0153
$\bar{R}^2$	0.8154	0.8187	0.5320	0.5297

* Instrumental Variables Method
** Ordinary Least Squares Method

The 'final' estimates are given in Appendix 3A. The dummy variable (D7841) has been dropped in the sequential reduction process. All the estimated coefficients are highly significant generally and all the four models passed a battery of diagnostic tests for functional form misspecification, normality of residuals, autocorrelation, autoregressive conditional heteroscedasticity, homoskedasticity and the joint significance of all the explanatory variables.

The estimated short run equations are concisely reproduced below:

$$\Delta LRM0_t = 0.31 + 0.15\Delta LRGDP_t - 0.01\Delta R3FD_t - 0.08ECM0_{t-1} + 0.01\Delta R3FD_{t-1}$$
$$+0.01\Delta R3FD_{t-5} + 0.23\Delta LRM0_{t-5} - 0.25\Delta LRM0_{t-6} + 0.06S1 - 0.04S2 + 0.03S3$$

(OLS method)

$$\Delta LRM1_t = 0.08 + 0.2\Delta LRGDP_t - 0.01\Delta R3FD_t - 0.75\Delta LCP_t - 0.16\Delta LERIS_t^e - 0.03ECM1_{t-1}$$
$$+0.01\Delta R3FD_{t-4} + 0.22\Delta LRM1_{t-1} + 0.27\Delta LRM1_{t-3} + 0.32\Delta LRM1_{t-4} + 0.05S1 - 0.03S2$$

(OLS method)

$$\Delta LRM2_t = -0.99 + 0.30\Delta LRGDP_t - 0.02\Delta R3TB_t - 0.62\Delta LCP_t - 0.18ECM2_{t-1}$$
$$+0.17\Delta LERIS_{t-4}^e + 0.28\Delta LRM2_{t-1} + 0.23\Delta LRM2_{t-4} + 0.03S1 - 0.01S2 - 0.01S3$$

(IV method)

$$\Delta LRM2_t = -1.11 + 0.29\Delta LRGDP_t - 0.02\Delta R3TB_t - 0.68\Delta LCP_t - 0.2ECM2_{t-1}$$
$$+0.19\Delta LERIS^e_{t-4} + 0.26\Delta LRM2_{t-1} + 0.28\Delta LRM2_{t-4} + 0.03S1$$

(OLS method)

With respect to short run real M2 demand equations, it is interesting to note that both the OLS and IV techniques do not yield any significant difference in terms of estimated parameters and variables of statistical significance. Acknowledging the possible influence of the switch in the interest rate regime in October 1978 in Malaysia, both types of Chow test are administered to the M0 and M1 models taking 1978Q3 as the breakpoint. While the Chow's second (predictive failure) test appears to dismiss the notion of a structural break in the Malaysian real M0 and M1 demand functions as a consequence of the regime switch at the 5 per cent significance level, Chow's first test suggests otherwise.

A more rigorous mode for testing parameter stability is the recursive estimation technique which may be regarded as a special case of the Kalman filter (see Cuthbertson et.al, 1992) as unlike the Chow tests, no a priori knowledge of the possible breakpoint is required. Plots of the recursive coefficients of the variables of interest for real M0 and M1 are furnished in Figures 3D, 3E, 3F, 3G, 3H, 3I, 3J and 3K. The recursive coefficients for both the money demand models do fall within their 2 standard error bounds. With respect to the real M0 demand, the coefficients of changes in real GDP and the error correction term have never exhibited any twist in the direction while the coefficient of changes in the 3-month fixed deposit rate did experience a temporary switch in the direction from negative to positive over the 1979Q4-1981Q4 period. This may call for a re-deployment of Chow tests for parameter stability, this time shifting the breakpoint from 1978Q4 to 1979Q4 and 1981Q4. The evidence in favor of parameter stability is mixed with Chow's first test suggesting the non existence of a structural break in 1979Q4 while the second test suggests otherwise (Table 3.VI). In the case of 1981Q4, while Chow's first test rejects the notion of parameter stability, the second test suggests the contrary.

Table 3.VI

Chow Test Statistics of Possible Break Points

	Break Points	1st Test	2nd Test
ΔLRMO	1979Q4	F(11,54) = 1.8254 [0.072]	F(48,17) = 2.2092 [0.038]
	1981Q4	F(11,54) = 2.9558 [0.004]	F(40,25) = 1.6350 [0.098]
ΔLRM1	1978Q3	F(12,52) = 2.5333 [0.010]	F(53,11) = 2.2025 [0.077]
	1981Q3	F(12,52) = 1.9423 [0.050]	F(41,23) = 1.2407 [0.295]

Note: Figures in square parentheses refer to marginal significance levels

Figure 3D

Coef. of DLRGDP and its 2 S.E. Bands based on Recursive OLS (for M0)

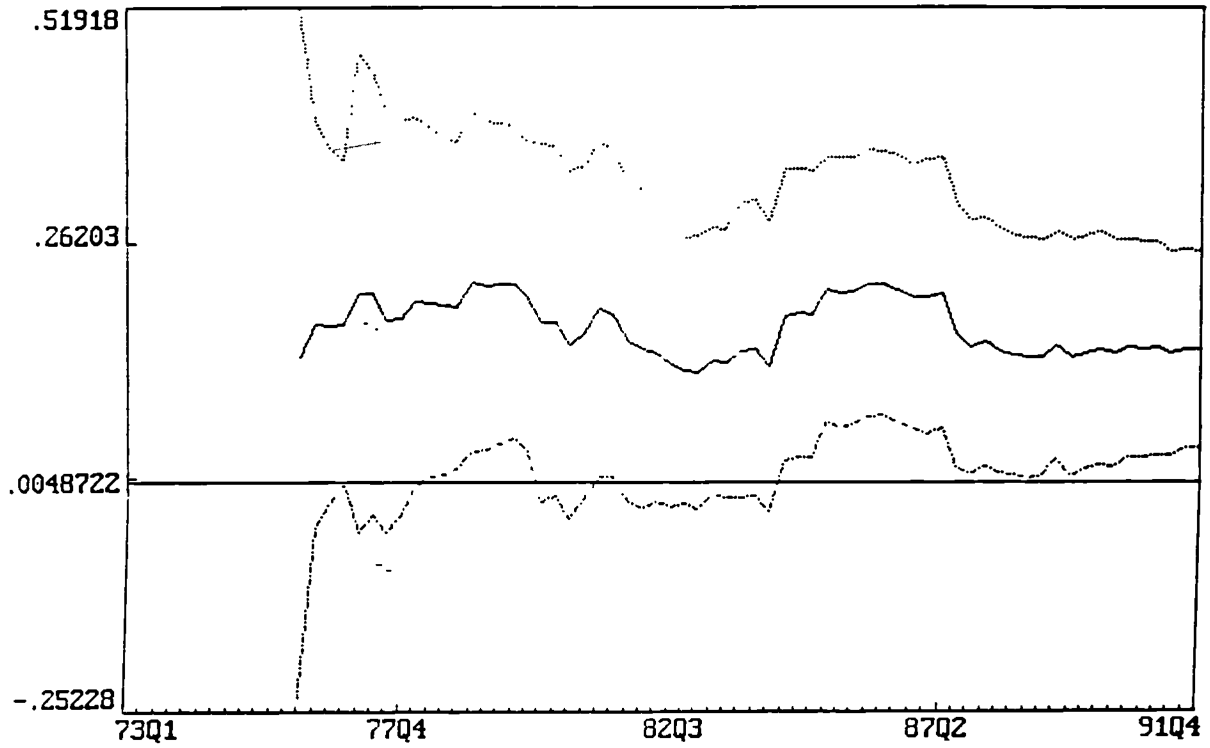


Figure 3E

Coef. of DR3FD and its 2 S.E. Bands based on Recursive OLS (for M0)

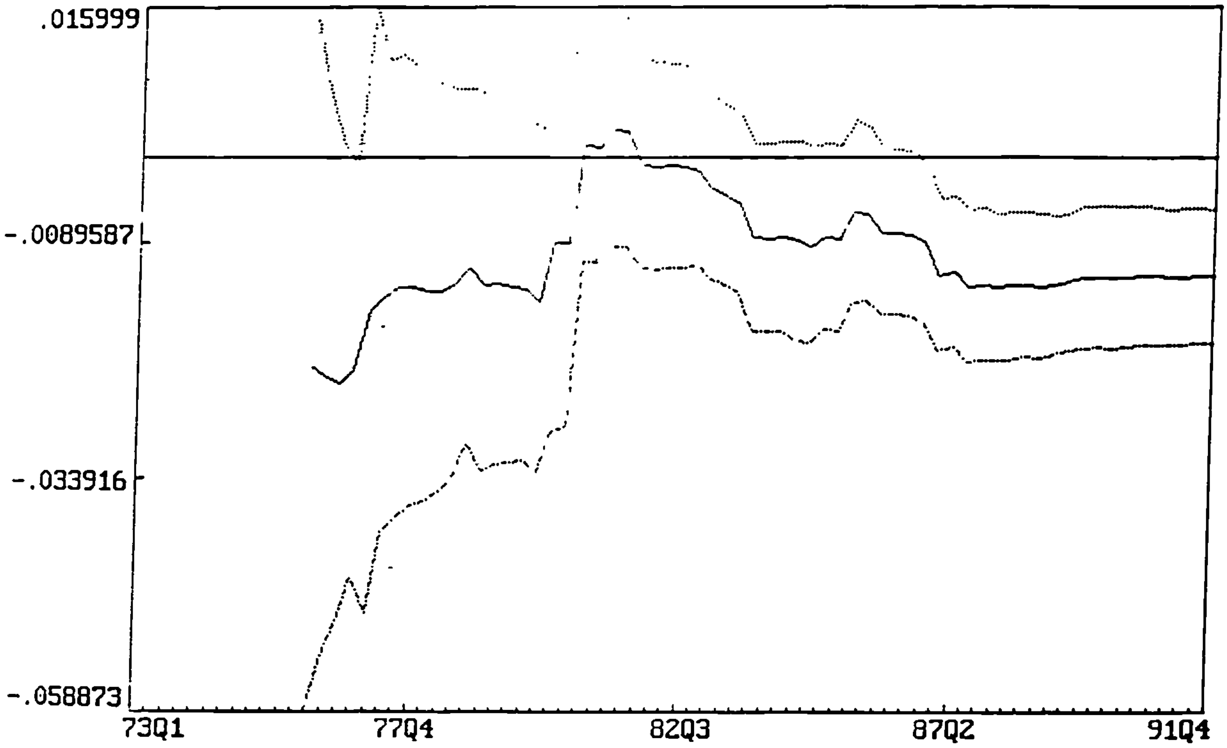


Figure 3F

Coef. of Lagged EC Term & its 2 S.E. Bands based on Recursive OLS (M0)

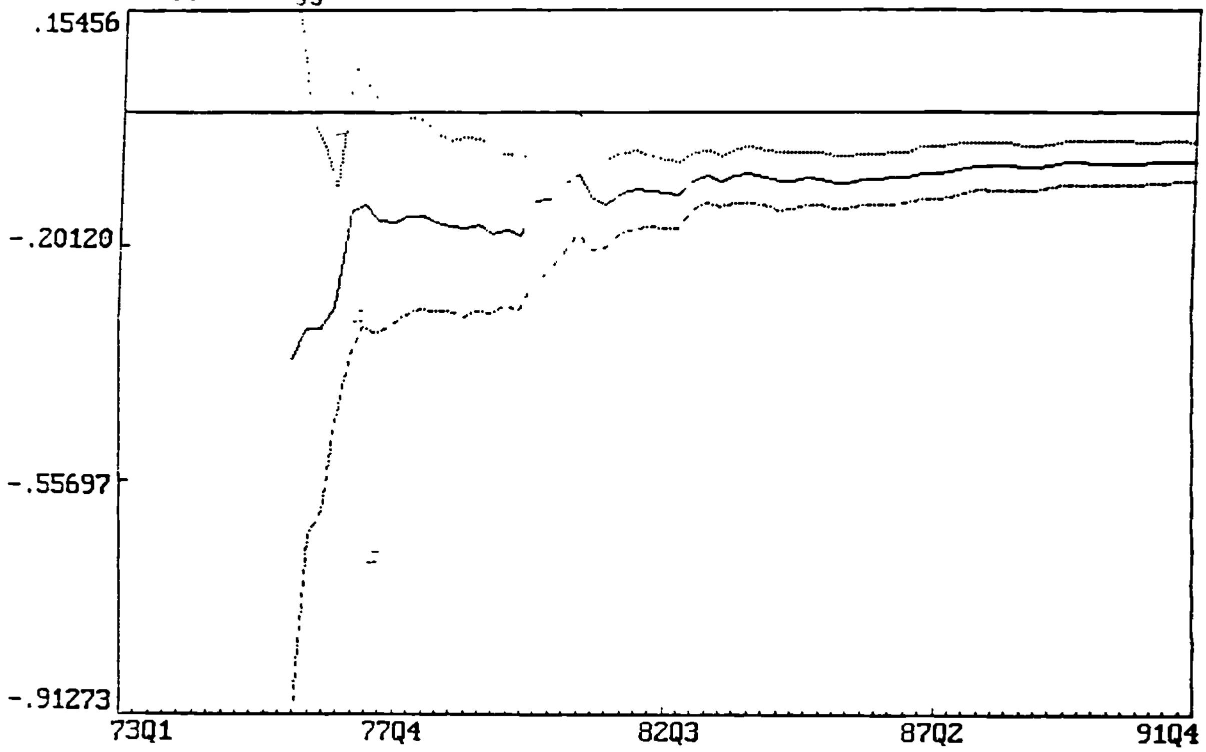


Figure 3G

Coef. of DR3FD and its 2 S.E. Bands based on Recursive OLS (for M1)

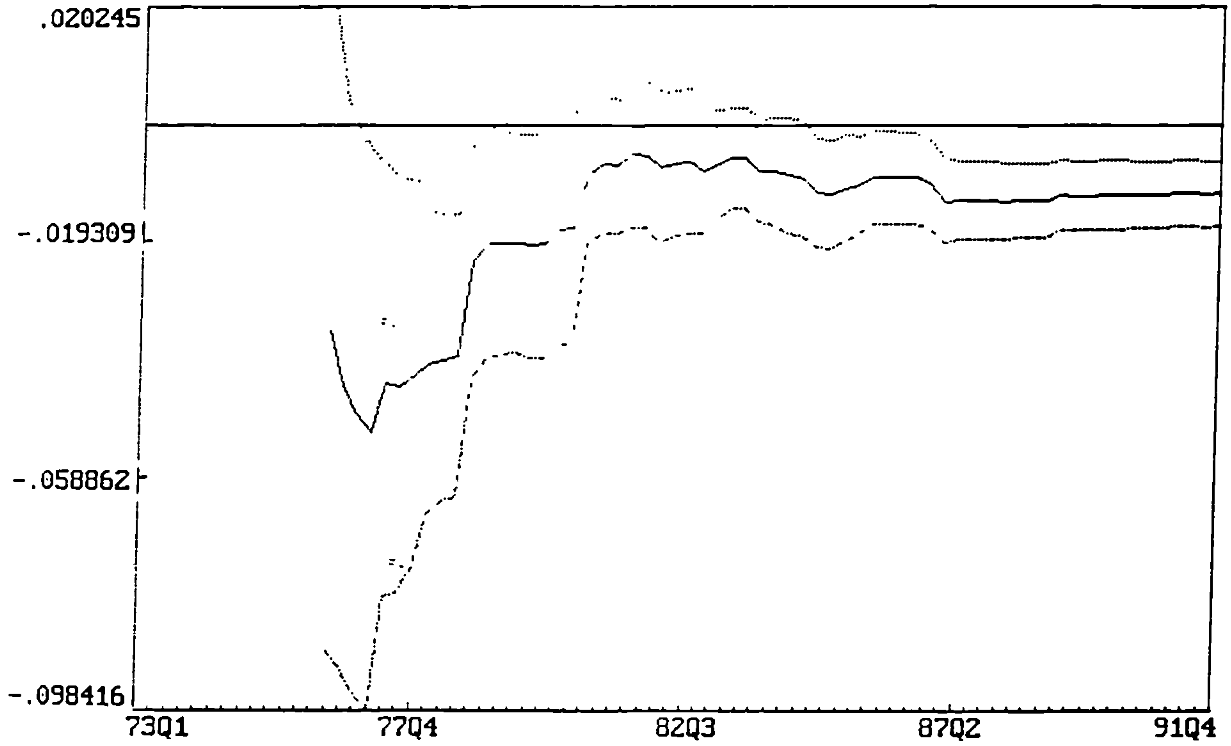


Figure 3H
Coef. of DLRGDP and its 2 S.E. Bands based on Recursive OLS (for M1)

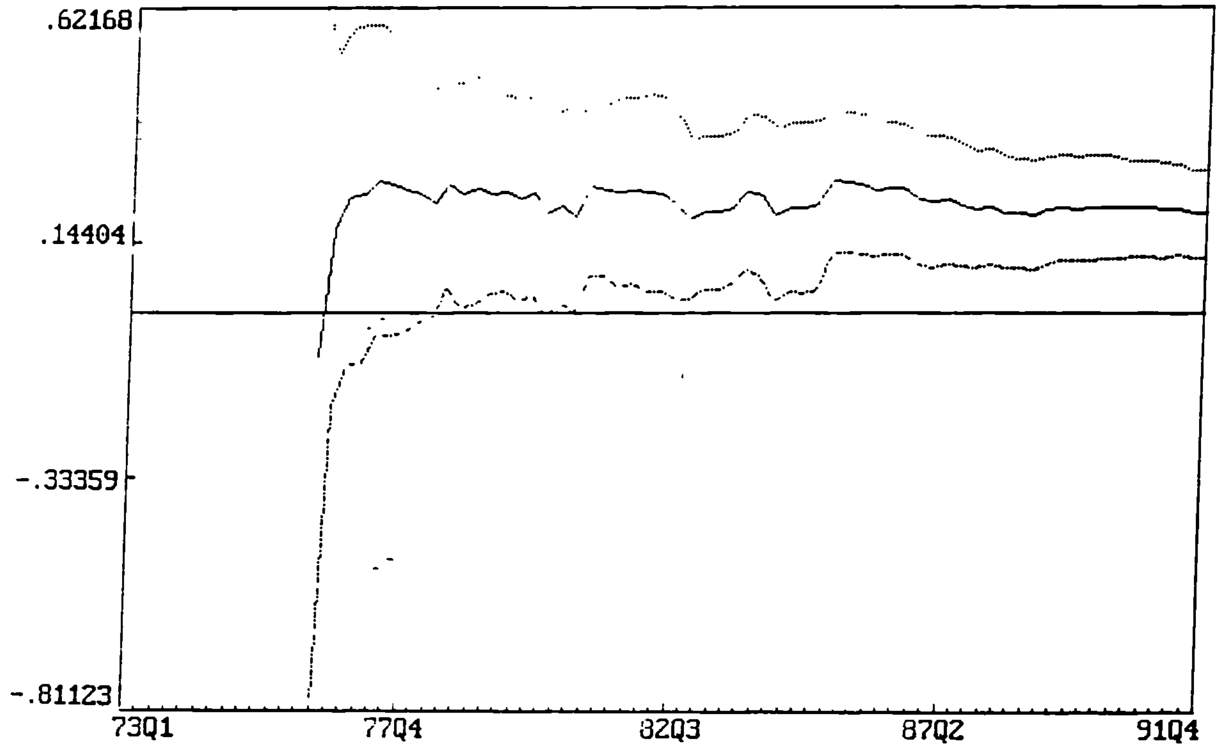


Figure 3I
Coef. of DLCP and its 2 S.E. Bands based on Recursive OLS (for M1)

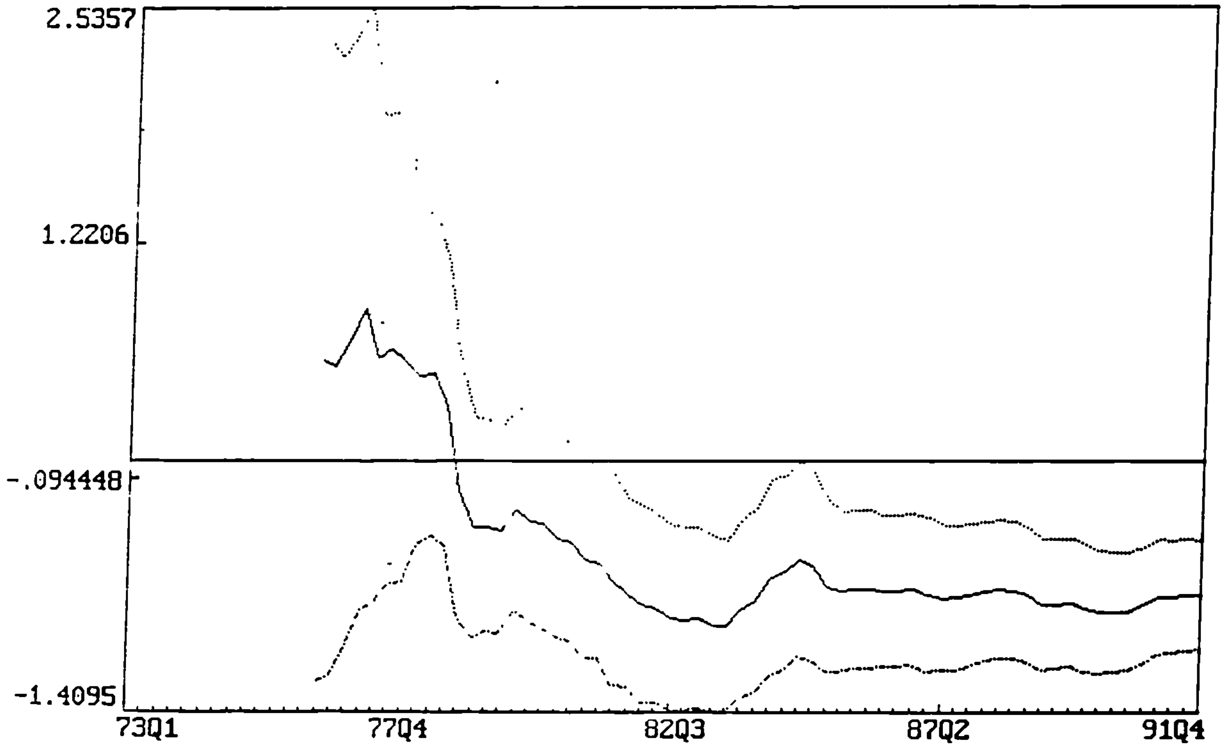


Figure 3J

Coef. of DLERIS(+1) and its 2 S.E. Bands based on Recursive OLS (M1)

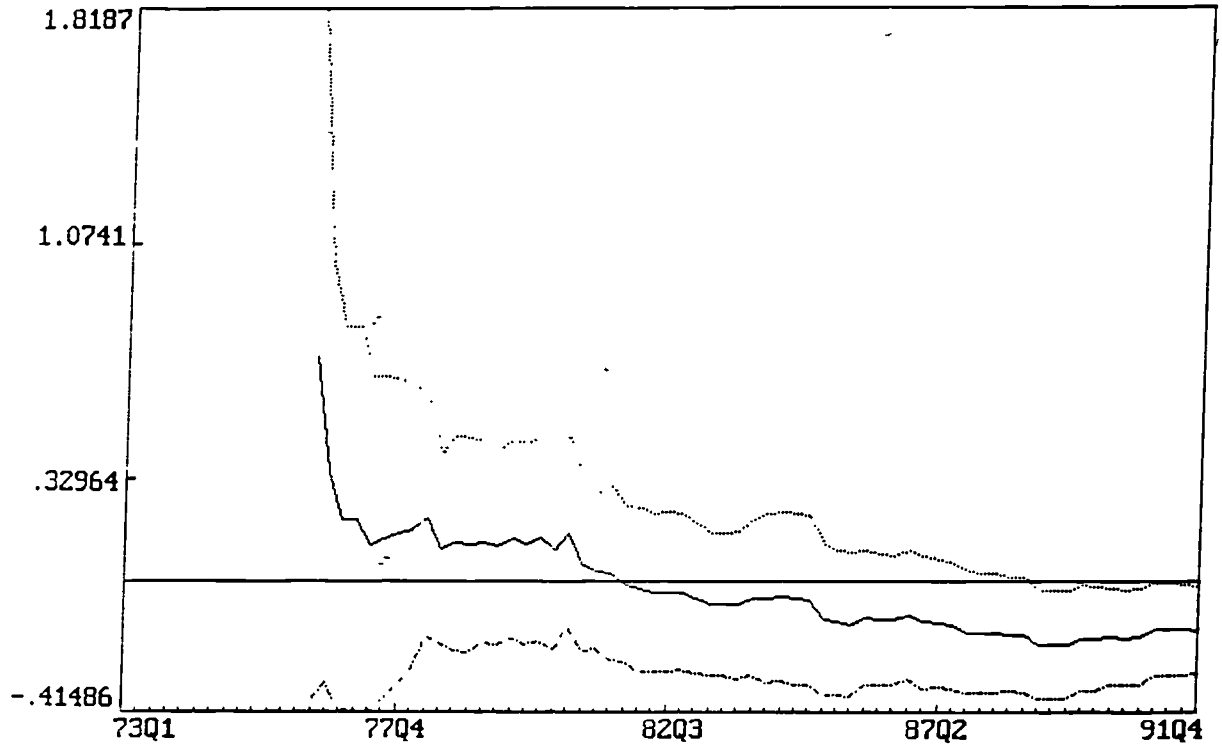
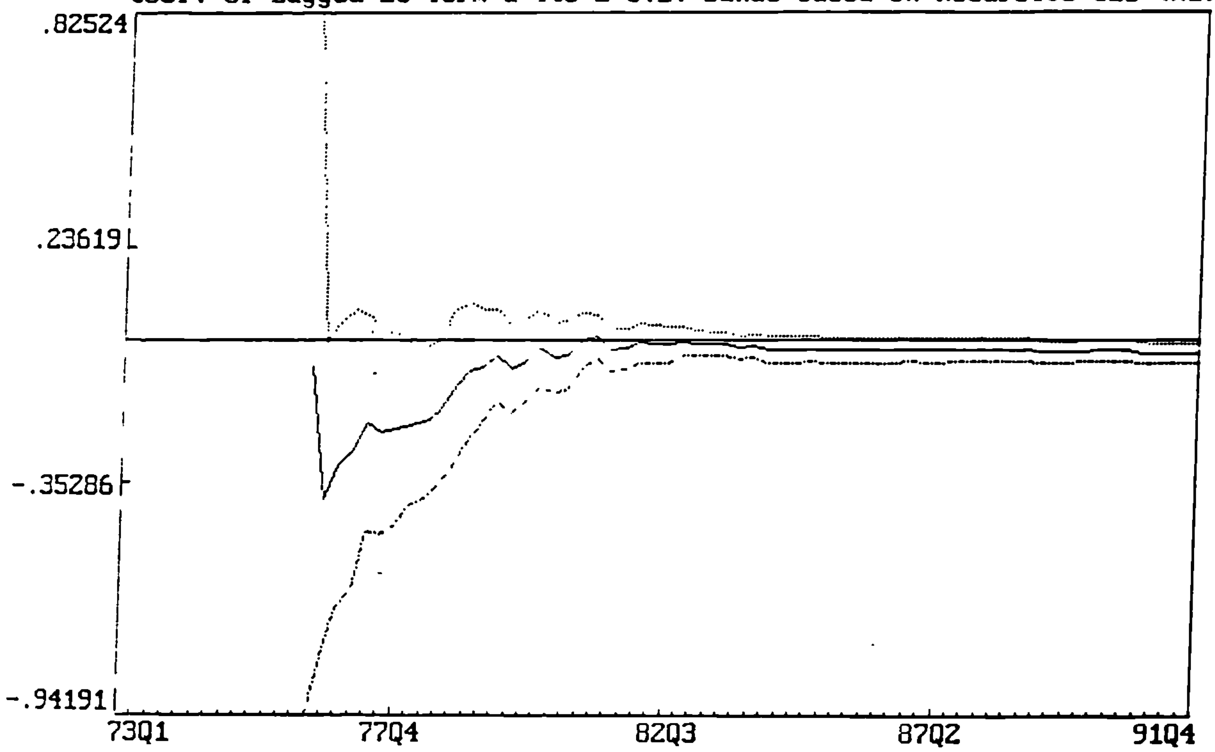


Figure 3K

Coef. of Lagged EC Term & its 2 S.E. Bands based on Recursive OLS (M1)



Hence proceeding on the assumption that there indeed exists a structural break, the short run real M0 demand function is reestimated from 1981Q4 through 1991Q4. Full details of the revised estimates are presented in Appendix 3B and they are presented concisely below:

Period: 1981Q4-1991Q4

$$\Delta LRM0_t = 0.2 + 0.18\Delta LRGDP_t - 0.02\Delta R3FD_t - 0.05ECM0_{t-1} + 0.01\Delta R3FD_{t-1} + 0.01\Delta R3FD_{t-5} + 0.27\Delta LRM0_{t-5} - 0.04\Delta LRM0_{t-6} + 0.06S1 - 0.06S2 - 0.003S3$$

Based upon the revised estimates, the short run income elasticity of real M0 demand is 0.18. Though nominal in magnitude, interest rates also have a bearing on real M0 demand with an estimated semi-interest rate elasticity of -0.02.

With respect to real M1 demand, the coefficients of the rate of inflation and expected exchange rate changes in particular appear to display a sustained switch in their direction from positive to negative. This occured in 1978Q3 and 1981Q3 for the rate of inflation and expected exchange rates respectively. Accordingly, the Chow tests have been reconducted for these two possible structural break points. Evidence from these tests is also mixed with the Chow's first test suggesting a structural break at 1978Q3 while this is refuted by the second test (Table 3.VI). As for 1981Q3, a structural break is ruled out by both tests. Hence the short run real M1 demand function is reestimated over the period from 1978Q4 through 1991Q4. Appendix 3C furnishes the full details of the revised estimates while they are summarised below:

Period: 1978Q4-1991Q4

$$\Delta LRM1_t = 0.14 + 0.16\Delta LRGDP_t - 0.01\Delta R3FD_t - 0.23\Delta LERIS^e_{t+1} - 0.27\Delta LCP_t - 0.06ECM1_{t-1} + 0.01\Delta R3FD_{t-4} + 0.11\Delta LRM1_{t-1} + 0.30\Delta LRM1_{t-3} + 0.29\Delta LRM1_{t-4} + 0.06S1 - 0.02S2$$

It is indicated by these revised estimates that real M1 demand has an estimated short run income elasticity of 0.16. Expected exchange rate depreciation also seems to yield a contemporaneous influence on the demand with the elasticity estimated at -0.23. While inflation does not have any bearing on real M1 demand by virtue of the statistical insignificance of its coefficient, interest rates do have albeit nominally with an estimated short-run semi elasticity of -0.01.

Over to the demand for real M2, estimates based upon the IV technique as reported earlier suggest 0.30 as its short run income elasticity. Though it is not sensitive to the own interest rate of M2, it is nominally sensitive to movements in alternative rates of interest as proxied by the R3TB. The relatively large coefficient (-0.62) of the rate of inflation possibly reflects the averseness of the Malaysian public to inflation that potentially erodes the purchasing power of their savings.

Plots of the actual changes in real money (M0, M1 and M2) demand vis-a-vis their fitted values are presented in Figures 3L through 3N. The plots of fitted values of changes in real M0 and M1 demand are based upon their second period estimates as they would be of current relevance. Whilst the plot for changes in real M2 demand is based upon the full sample estimate via the Instrumental Variables (IV) estimation technique. By visual inspection of these figures, our estimated models seem to have a good ability to track the direction of changes in the demand for money as variously defined.

Figure 3L
Plot of Actual and Fitted Values for Changes in LRMO

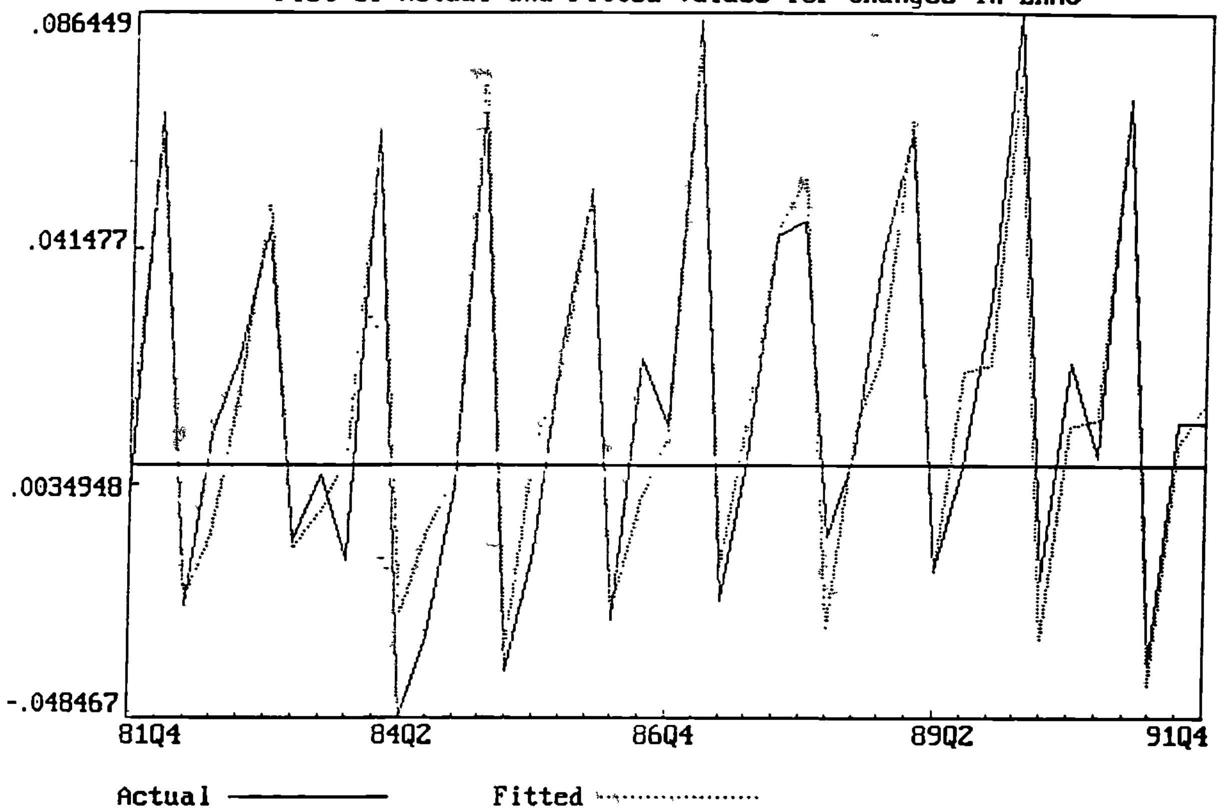
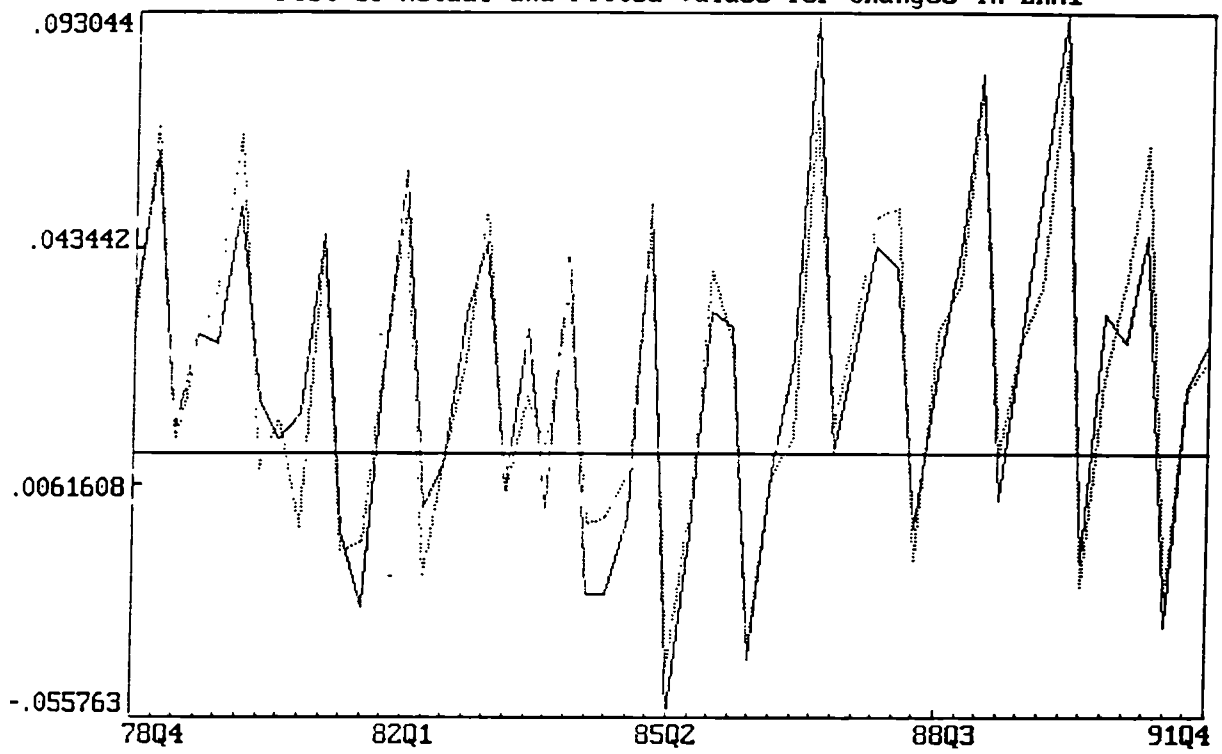


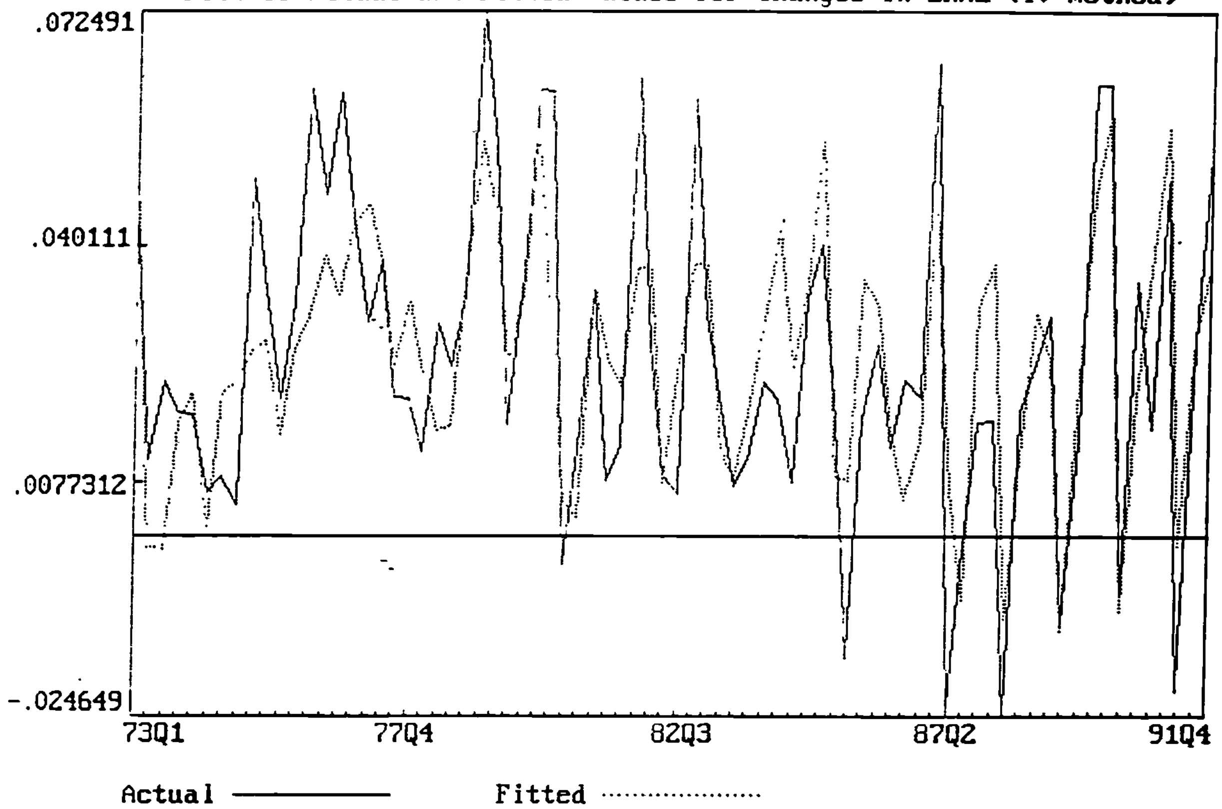
Figure 3M

Plot of Actual and Fitted Values for Changes in LRM1



Actual ——— Fitted ·········

Figure 3N
Plot of Actual and Fitted Values for Changes in LRM2 (IV method)



In the light of our earlier findings that the parameters estimated via the OLS and IV techniques do not differ much in respect of the short run M2 demand function, a series of Chow tests is administered at several possible structural breakpoints. They are 1978Q3 to account for the possible influence of the October 1978 interest rate liberalisation exercise, 1977Q1 and 1977Q4 owing to a switch in the direction of the coefficient of changes in LRGDP at these points and 1976Q2 and 1977Q1 owing to a directional switch in respect of the error correction term (Figures 3O, 3P, 3Q and 3R). The results of these Chow tests are presented in Table 3.VII. Both Chow tests seem to rule out the possibility of a structural break at all these points except 1976Q2 in which the occurance of a structural break is suggested by Chow's second test. Hence proceeding on the assumption that a structural break did occur at this point, the short run M2 demand function is reestimated over the 1976Q3-1991Q4 period. The revised estimates are fully presented in Appendix 3D and are summarised below:

Table 3.VII

Chow Test Statistics of Possible Break Points for M2

	Break Points	First Test	Second Test
ΔLRM2	1976Q2	F(9,58) = 1.8665 [0.070]	F(62,5) = 8.3839 [0.010]
	1977Q1	F(9,58) = 1.1634 [0.330]	F(59,8) = 0.9042 [0.620]
	1977Q4	F(9,58) = 1.1832 [0.323]	F(56,11) = 1.2539 [0.358]
	1978Q3	F(9,58) = 1.2613 [0.277]	F(53,14) = 1.3717 [0.264]

Note: Figures in square parentheses refer to marginal significance levels.

Figure 30
Coef. of DLRGDP and its 2 S.E. Bands based on Recursive OLS (for M2)

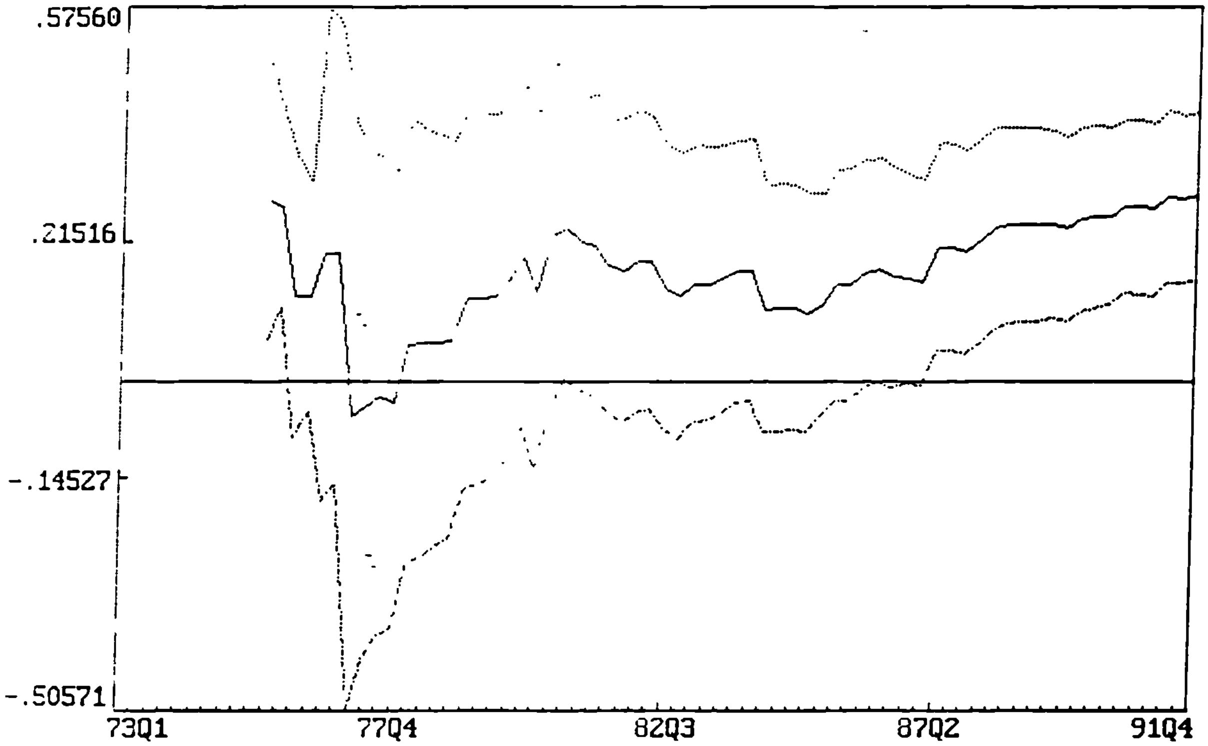


Figure 3P

Coef. of DR3TB and its 2 S.E. Bands based on Recursive OLS (for M2)

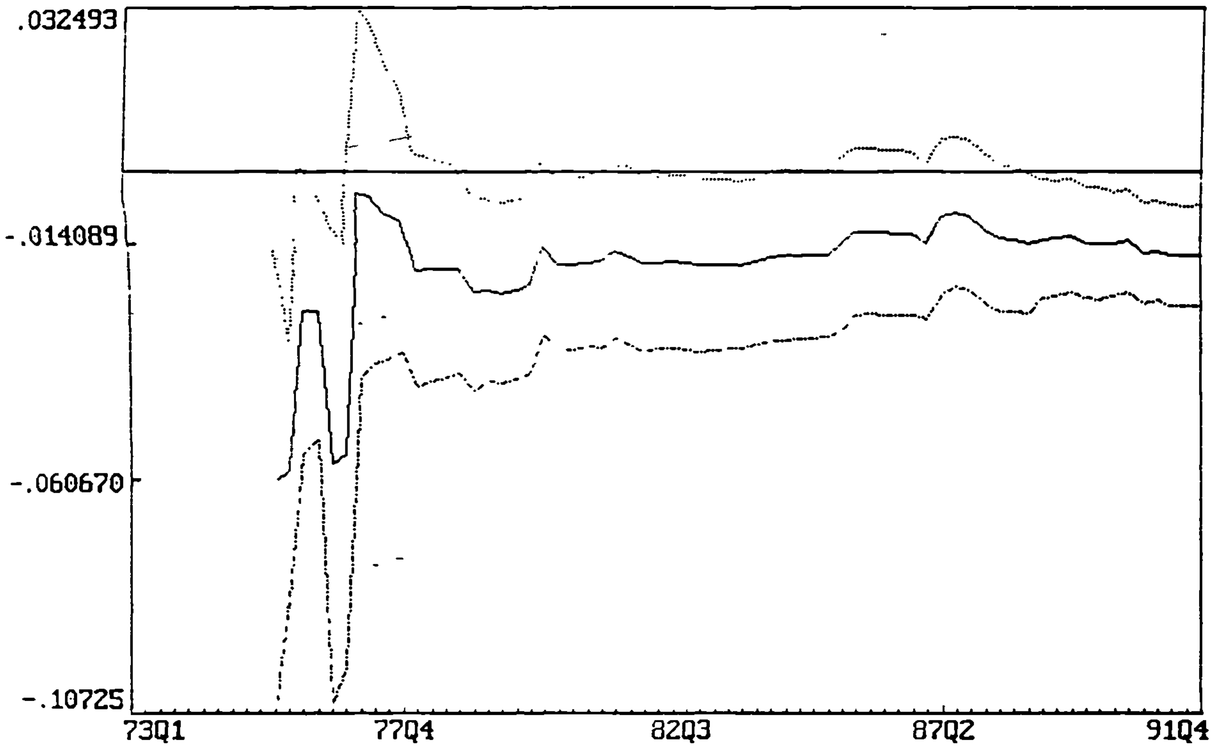


Figure 3Q

Coef. of DLCP and its 2 S.E. Bands based on Recursive OLS (for M2)

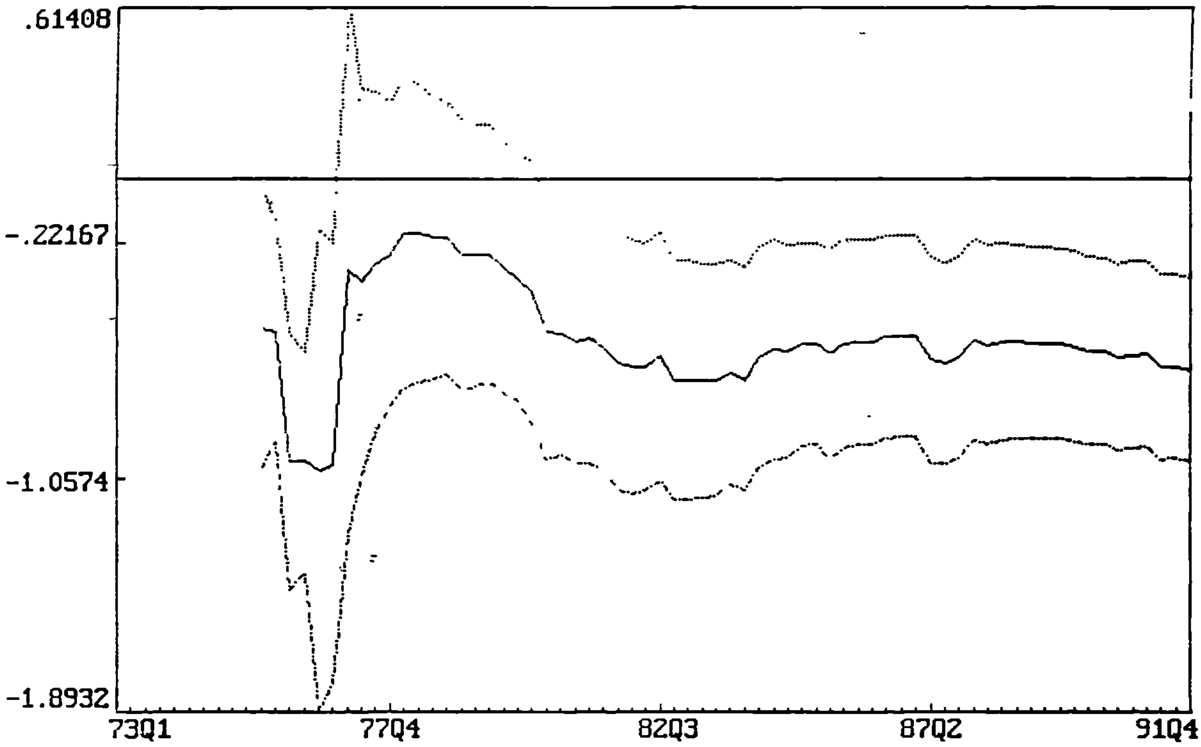
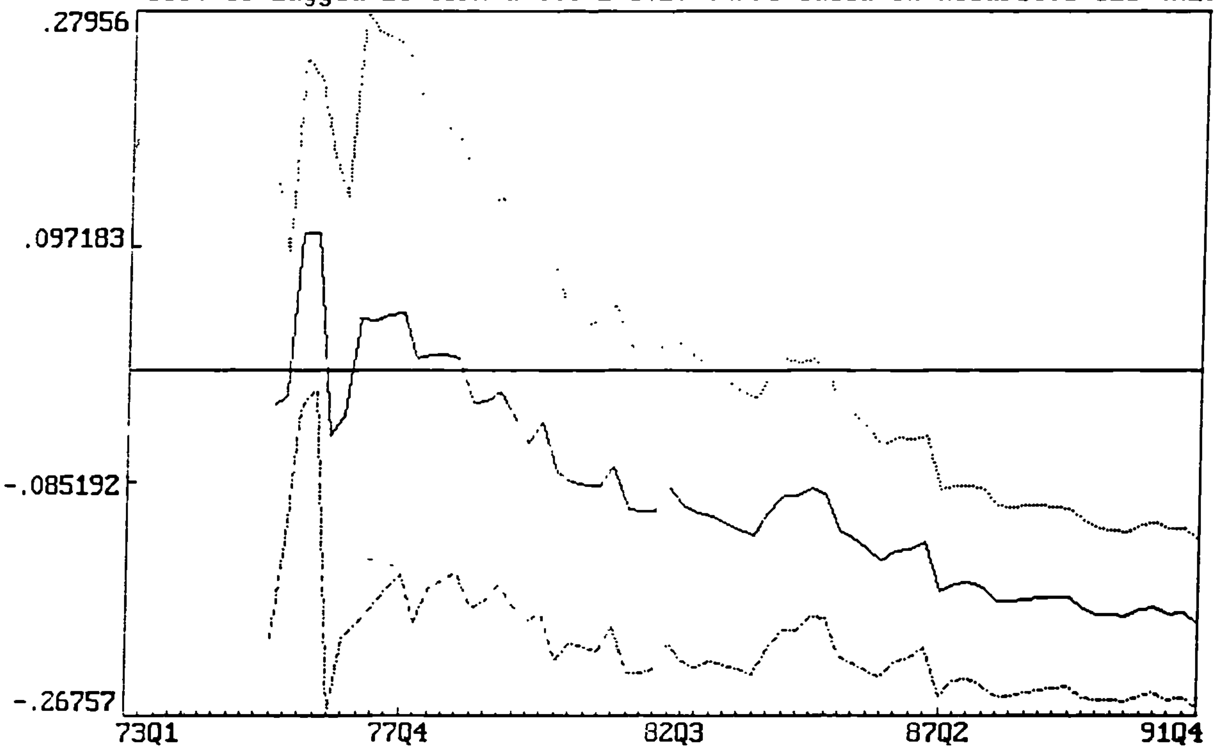


Figure 3R
Coef. of Lagged EC Term & its 2 S.E. Bands based on Recursive OLS (M2)

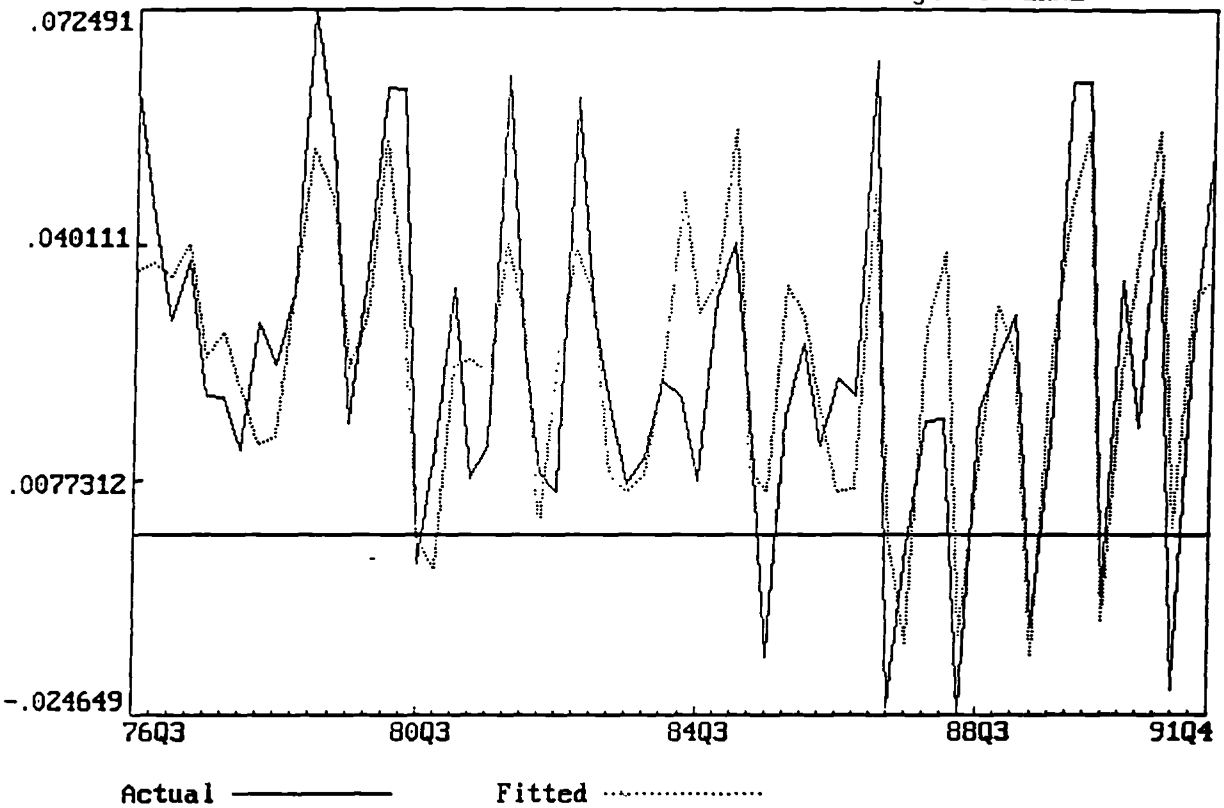


Period: 1976Q3-1991Q4

$$\Delta LRM2_t = -1.26 + 0.31\Delta LRGDP_t - 0.02\Delta R3TB_t - 0.96\Delta LCP_t -$$
$$0.22ECM2_{t-1} + 0.27\Delta LERIS^e_{t-4} + 0.31\Delta LRM2_{t-1} + 0.29\Delta LRM2_{t-4} + 0.03S1$$

It is on the basis of these revised estimates that we shall be making inferences pertaining to real M2 demand. The estimated short run income and interest rate elasticities of 0.31 and -0.02 respectively do not differ markedly from those estimated via the IV method over the full sample period though the coefficient of the rate of inflation (-0.96) is significantly larger. This in fact underscores the concern amongst the Malaysian public over the capability of M2 to assume a storehouse of value role. It is shown by Figure 3S that these new estimates could also track the direction of actual movements in real M2 demand reasonably well.

Figure 3S
Plot of Actual and Fitted Values of Changes in LRM2



3.7 Concluding Remarks

This chapter represents a modest attempt to model long run real money demand relationships and their associated short-run dynamics with money variously defined as M0, M1 and M2 using recent econometric techniques. Quarterly data generally spanning from 1971 through 1991 have been utilised for this purpose. Since readily published quarterly data are mostly end-of-period observations, monthly data have been gathered instead to derive periodic average data. This study is also intended to fill the research vacuum left by other researchers in respect of money demand relationships in Malaysia.

Given the fact that Malaysia is a small open developing economy, the possibility of money demand being affected by expected exchange rate movements is also explored. In our attempt to capture this influence, we simply postulate the existence of perfect foresight in the formation of exchange rate expectations.

Prior to the actual modelling exercise, the time series properties of the data have been explored to establish their order of integration and also to establish whether seasonal unit root problems are present. The results of these analyses suggest that none of the series considered is integrated of order beyond 1 and that most series do not exhibit stochastic seasonals once deterministic seasonal dummies are introduced.

The long run real money demand relations have subsequently been estimated using the Johansen Procedure. Primarily the results suggest that cointegrations exist between real money demand as variously defined on one hand and real gross domestic product, interest rates and expected movements in the exchange rate on the other, thus suggesting the existence of a stable long run relationship amongst them in spite of the financial liberalisation and innovation process that the Malaysian financial system has been undergoing. The income homogeneity assumption of money is upheld in the long run in the case of M0 and M1 but not in the case of M2 which has an income coefficient exceeding unity. This may be due to continued improvements made to the banking infrastructure in Malaysia over the years that facilitate access to banking facilities by a larger segment of the Malaysian population. It is interesting to note that all the arguments in the real M0 and M1 demand functions are weakly exogenous while in the case of real M2, only income has failed to satisfy the weak exogeneity assumption.

In adherence to the general-to-specific procedure, the short run demand functions for M0, M1 and M2 are derived which could withstand a battery of diagnostic tests. In the case of short run real M2 demand function, both instrumental variables and OLS techniques have been deployed for its estimation. Though stable long run money demand relationships exist despite the process of financial liberalisation and innovation experienced by the Malaysian financial system as suggested by the presence of cointegrating vectors, such process did render the short run real money demand functions unstable. Hence this calls for a reestimation of short run functions over more recent periods as a stable money demand function is a prerequisite for a monetary policy to attain its short run targets. In our case, this has necessitated a reestimation of these demand functions over more recent periods namely, 1981Q4-1991Q4 for real M0, 1978Q4-1991Q4 for real M1 and 1976Q3-1991Q4 in the case of real M2. All these estimates could also satisfactorily withstand the battery of diagnostic tests.

Subject to the caveats of our study, the following are some interesting policy implications that can be drawn from our analysis of short run dynamics based upon recent period estimates:

1. While a one-percent rise in income would contemporaneously lead to a 0.18% rise in the demand for M0, it would precipitate a 0.16% increase in the demand for M1 and 0.30% for M2. Assuming that domestic liquidity has a profound impact on the economy, the monetary authority will have to somehow ensure that the various monetary aggregates grow by these percentages just to avert any liqudity squeeze that may originate from a current 1% rise in income alone;

2. Interest rates on deposits do have an instantaneous impact on the demand for real M0 and M1 though none on M2 demand. However the impact is only nominal with a one percentage point rise in the interest rate on deposits expected to reduce the demand for M0 by 0.015% and for M1 by 0.012%. This implies that any monetary policy that affects interest rates may however not affect the demand for these aggregates materially;

3. Inflation has a significant dampening impact on the demand for real M2. A 1% rise in the price level could precipitate a 0.96% decline in the demand for real M2. Hence to preserve the demand for real M2 if desired, it is crucial that price stability be safeguarded by the monetary authority. Otherwise financial disintermediation may set in; and

4. Expected exchange rate depreciation can be expected to yield a negative influence on real M1 demand instantaneously with a contemporaneous expected exchange rate elasticity of -0.23. Thus the effectiveness of an expansionary monetary policy may be compromised to some extent if it is implemented in a situation when confidence in the domestic currency is lacking.

APPENDIX 3A

Parsimonious Equations

OLS Method

$$
\begin{aligned}
\Delta LRMO_t = \; & \underset{(5.3084)}{0.3109} + \underset{(2.7059)}{0.1456}\ \Delta LRGDP_t \underset{(-3.5621)}{-0.0126}\ \Delta R3FD_t \\
& \underset{(-5.0990)}{-0.0760}\ ECMO_{t-1} \underset{(3.1459)}{+0.0120}\ \Delta R3FD_{t-1} \\
& \underset{(3.6421)}{+0.0124}\ \Delta R3FD_{t-5} \underset{(2.5310)}{+0.2309}\ \Delta LRMO_{t-5} \\
& \underset{(-2.7436)}{-0.2493}\ \Delta LRMO_{t-6} \underset{(7.9057)}{+0.0562}S1 \\
& \underset{(-4.7637)}{-0.0369}S2 + \underset{(2.6819)}{0.0259}S3
\end{aligned}
$$

$\bar{R}^2 = 0.8154$

F (10,65) = 34.1366 [0.000]

S.E. of Regression = 0.0147

Autocorr: $\chi^2(1) = 0.7232$ [0.395]
$\chi^2(2) = 1.3544$ [0.508]
$\chi^2(3) = 1.4245$ [0.700]
$\chi^2(4) = 1.4248$ [0.840]

Normality: $\chi^2(2) = 0.9650$ [0.617]

Heteroscedasticity: $\chi^2(1) = 0.1666$ [0.683]

ARCH: $\chi^2(1) = 1.1519$ [0.283]
$\chi^2(2) = 2.0437$ [0.360]
$\chi^2(3) = 2.0315$ [0.566]
$\chi^2(4) = 2.1150$ [0.715]

Functional Form: $\chi^2(1) = 0.0679$ [0.794]

Chow's First Test*: F(11,54) = 1.9349 [0.055]

Second Test*: F(53,12) = 1.8624 [0.119]

* Breakpoint: 1978Q3

Notes: I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

II) Figures in square parentheses [ ] refer to marginal significance levels

OLS Method

$$\Delta LRM1_t = \underset{(2.9663)}{0.078} + \underset{(4.5970)}{0.1997}\ \Delta LRGDP_t \ \underset{(-4.1997)}{-0.0115}\ \Delta R3FD_t$$

$$\underset{(-4.9176)}{-0.7516}\ \Delta LCP_t \quad \underset{(-2.2145)}{-0.1551}\ \Delta LERIS^e_{t+1}$$

$$\underset{(-2.7594)}{-0.0325}\ ECM1_{t-1} \quad \underset{(3.5773)}{+0.0104}\ \Delta R3FD_{t-4}$$

$$\underset{(2.9098)}{+0.2164}\ \Delta LRM1_{t-1} \quad \underset{(3.6011)}{+0.2703}\ \Delta LRM1_{t-3}$$

$$\underset{(3.7502)}{+0.3156}\ \Delta LRM1_{t-4} \quad \underset{(6.9560)}{+0.0497S1}$$

$$\underset{(-4.4188)}{-0.0297S2}$$

$\bar{R}^2 = 0.8188$
F (11,64) = 31.7999 [0.000]
S.E. of Regression = 0.0130

Autocorr: $\chi^2(1) = 0.2969$ [0.586]
$\chi^2(2) = 0.5276$ [0.768]
$\chi^2(3) = 0.5290$ [0.912]
$\chi^2(4) = 0.7523$ [0.945]

Normality: $\chi^2(2) = 1.0553$ [0.590]

Heteroscedasticity: $\chi^2(1) = 1.3500$ [0.245]

ARCH: $\chi^2(1) = 0.0332$ [0.856]
$\chi^2(2) = 0.7670$ [0.681]
$\chi^2(3) = 1.2875$ [0.732]
$\chi^2(4) = 1.1784$ [0.882]

Functional Form: $\chi^2(1) = 0.0021$ [0.964]

Chow's First Test*: F(12,52) = 2.5333 [0.010]

Second Test*: F(53,11) = 2.2025 [0.077]

* Breakpoint: 1978Q3

Notes: I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

II) Figures in square parentheses [ ] refer to marginal significance levels

Instrumental Variables Method

$$\Delta LRM2_t = \underset{(-3.0025)}{-0.9894} + \underset{(1.7697)}{0.3026}\ \Delta LRGDP_t \quad \underset{(-2.9146)}{-0.0165}\ \Delta R3TB_t$$

$$\underset{(-3.6969)}{-0.6214}\ \Delta LCP_t \quad \underset{(-3.0658)}{-0.1756}\ ECM2_{t-1} \quad \underset{(1.9211)}{+0.1713}\ \Delta LERIS^{e}_{t-4}$$

$$\underset{(2.6375)}{+0.2794}\ \Delta LRM2_{t-1} \quad \underset{(1.9810)}{+0.2288}\ \Delta LRM2_{t-4}$$

$$\underset{(2.3607)}{+0.0286 S1} \quad \underset{(-1.1390)}{-0.0089 S2} \quad \underset{(-1.2056)}{-0.0086 S3}$$

$\bar{R}^2 = 0.5320$

F (10,65) = 9.5258 [0.000]

S.E. of Regression = 0.0153

Autocorr: $\chi^2(1) = 0.2505$ [0.617]
$\chi^2(2) = 1.7005$ [0.427]
$\chi^2(3) = 1.7151$ [0.634]
$\chi^2(4) = 2.0554$ [0.726]

Normality: $\chi^2(2) = 1.1324$ [0.568]

Heteroscedasticity: $\chi^2(1) = 0.1098$ [0.740]

Functional Form: $\chi^2(1) = 0.0355$ [0.851]

Instruments: C, $\Delta LRM2_{t-1}$, $\Delta LRM2_{t-4}$, $\Delta LRFGTE_t$, $\Delta R3TB_t$, $\Delta LERIS^{e}_{t-4}$, ΔLCP_t, $ECM2_{t-1}$.

S1, S2 and S3

Notes: I) LRFGTE = Log of real federal governement total expenditure

II) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

III) Figures in square parentheses [ ] refer to marginal significance levels

OLS Method

$$\Delta LRM2_t = \underset{(-5.9316)}{-1.1109} + \underset{(4.4513)}{0.2846}\ \Delta LRGDP_t \ \underset{(-3.3680)}{-0.0165}\ \Delta R3TB_t$$

$$\underset{(-4.1314)}{-0.6752}\ \Delta LCP_t \qquad \underset{(-6.0312)}{-0.1969}\ ECM2_{t-1}$$

$$\underset{(2.3191)}{+0.1919}\ \Delta LERIS^{e}_{t-4} \qquad \underset{(2.9938)}{+0.2632}\ \Delta LRM2_{t-1}$$

$$\underset{(2.8889)}{-0.2754}\ \Delta LRM2_{t-4} \qquad \underset{(4.8101)}{+0.0314S1}$$

$\bar{R}^2 = 0.5297$
$F\,(8,67) = 11.5594\ [0.000]$
S.E. of Regression = 0.0153

Autocorr: $\chi^2(1) = 1.3600\ [0.244]$
$\chi^2(2) = 2.9677\ [0.227]$
$\chi^2(3) = 2.9747\ [0.396]$
$\chi^2(4) = 3.7071\ [0.447]$

Normality: $\chi^2(2) = 1.5626\ [0.458]$

Heteroscedasticity: $\chi^2(1) = 0.5353\ [0.464]$

ARCH: $\chi^2(1) = 1.2601\ [0.262]$
$\chi^2(2) = 1.7910\ [0.408]$
$\chi^2(3) = 4.3263\ [0.228]$
$\chi^2(4) = 4.6435\ [0.326]$

Functional Form: $\chi^2(1) = 0.0907\ [0.763]$

Notes: I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

II) Figures in square parentheses [ ] refer to marginal significance levels

Period: 1981Q4 - 1991Q4

$$\Delta LRM0_t = \underset{(2.9213)}{0.1946} + \underset{(3.0835)}{0.1831}\ \Delta LRGDP_t \underset{(-3.4762)}{-0.0149}\ \Delta R3FD_t$$

$$\underset{(-2.8253)}{-0.0479}\ ECMO_{t-1} \underset{(2.3632)}{+0.0102}\ \Delta R3FD_{t-1}$$

$$\underset{(2.2619)}{+0.0082}\ \Delta R3FD_{t-5} \underset{(1.9379)}{+0.2716}\ \Delta LRM0_{t-5}$$

$$\underset{(-0.3166)}{-0.0425}\ \Delta LRM0_{t-6} \underset{(6.9132)}{+0.0572}S1$$

$$\underset{(-4.5822)}{-0.0570}S2 - \underset{(-0.2072)}{0.0031}S3$$

$\bar{R}^2 = 0.8758$
F (10,30) = 29.2046 [0.000]
S.E. of Regression = 0.0130

Autocorr: $\chi^2(1) = 0.0136$ [0.907]
$\chi^2(2) = 2.6233$ [0.269]
$\chi^2(3) = 2.8153$ [0.421]
$\chi^2(4) = 4.5573$ [0.336]

Normality: $\chi^2(2) = 0.0988$ [0.952]

Heteroscedasticity: $\chi^2(1) = 3.5554$ [0.059]

ARCH: $\chi^2(1) = 1.5896$ [0.207]
$\chi^2(2) = 2.6630$ [0.264]
$\chi^2(3) = 3.3836$ [0.336]
$\chi^2(4) = 2.7805$ [0.595]

Functional Form: $\chi^2(1) = 1.6608$ [0.198]

Notes: I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

II) Figures in square parentheses [ ] refer to marginal significance levels

Period: 1978Q4 - 1991Q4

$$\Delta LRM1_t = \underset{(3.8713)}{0.1413} + \underset{(3.5071)}{0.1612}\ \Delta LRGDP_t \quad \underset{(-4.3907)}{-0.0120}\ \Delta R3FD_t$$

$$\underset{(-2.8366)}{-0.2296}\ \Delta LERIS^{e}_{t+1} \quad \underset{(-1.1570)}{-0.2713}\ \Delta LCP_t$$

$$\underset{(-3.7626)}{-0.0598}\ ECM1_{t-1} \quad \underset{(4.2956)}{+0.0135}\ \Delta R3FD_{t-4}$$

$$\underset{(1.0068)}{+0.1069}\ \Delta LRM1_{t-1} \quad \underset{(3.5307)}{+0.3043}\ \Delta LRM1_{t-3}$$

$$\underset{(2.8034)}{+0.2943}\ \Delta LRM1_{t-4} \quad \underset{(6.4691)}{+0.0561S1}$$

$$\underset{(-1.7383)}{-0.0186S2}$$

$\bar{R}^2 = 0.8723$
$F(11,41) = 33.2880$ [0.000]
S.E. of Regression = 0.0119

Autocorr: $\chi^2(1) = 0.3796$ [0.538]
$\chi^2(2) = 0.4168$ [0.812]
$\chi^2(3) = 1.5543$ [0.670]
$\chi^2(4) = 4.2178$ [0.377]

Normality: $\chi^2(2) = 1.7132$ [0.425]

Heteroscedasticity: $\chi^2(1) = 0.5241$ [0.469]

ARCH: $\chi^2(1) = 0.1733$ [0.677]
$\chi^2(2) = 1.1019$ [0.576]
$\chi^2(3) = 1.3664$ [0.713]
$\chi^2(4) = 2.8795$ [0.578]

Functional Form: $\chi^2(1) = 0.4603$ [0.498]

Notes: I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

II) Figures in square parentheses [ ] refer to marginal significance levels

Appendix 3B

Revised Estimates of Short Run Money (MO) Demand Function
Period 1981Q4 - 1991Q4

$$\Delta LRMO_t = \underset{(2.9213)}{0.1946} + \underset{(3.0835)}{0.1831}\,\Delta LRGDP_t - \underset{(-3.4762)}{0.0149}\,\Delta R3FD_t$$

$$- \underset{(-2.8253)}{0.0479}\,ECMO_{t-1} + \underset{(2.3632)}{0.0102}\,\Delta R3FD_{t-1}$$

$$+ \underset{(2.2619)}{0.0082}\,\Delta R3FD_{t-5} - \underset{(1.9379)}{0.2716}\,\Delta LRMO_{t-5}$$

$$- \underset{(-0.3166)}{0.0425}\,\Delta LRMO_{t-6} + \underset{(6.9132)}{0.0572}S1$$

$$- \underset{(-4.5822)}{0.0570}S2 - \underset{(-0.2072)}{0.0031}S3$$

$\bar{R}^2 = 0.8758$
F (10,30) = 29.2046 [0.000]
S.E. of Regression = 0.0130

Autocorr: $\chi^2(1) = 0.0136$ [0.907]
$\chi^2(2) = 2.6233$ [0.269]
$\chi^2(3) = 2.8153$ [0.421]
$\chi^2(4) = 4.5573$ [0.336]

Normality: $\chi^2(2) = 0.0988$ [0.952]

Heteroscedasticity: $\chi^2(1) = 3.5554$ [0.059]

ARCH: $\chi^2(1) = 1.5896$ [0.207]
$\chi^2(2) = 2.6630$ [0.264]
$\chi^2(3) = 3.3836$ [0.336]
$\chi^2(4) = 2.7805$ [0.595]

Functional Form: $\chi^2(1) = 1.6608$ [0.198]

Notes: I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

II) Figures in square parentheses [ ] refer to marginal significance levels

Appendix 3C

Revised Estimates of Short Run Money (M1) Demand Function
Period 1978Q4 - 1991Q4

$$
\begin{aligned}
\Delta LRM1_t \quad = \quad & 0.1413 + 0.1612\ \Delta LRGDP_t - 0.0120\ \Delta R3FD_t \\
& (3.8713)\ (3.5071) \qquad\qquad (-4.3907) \\[1em]
& -0.2296\ \Delta LERIS^e_{t-1} - 0.2713\ \Delta LCP_t \\
& (-2.8366) \qquad\qquad (-1.1570) \\[1em]
& -0.0598\ ECM1_{t-1} - 0.0135\ \Delta R3FD_{t-4} \\
& (-3.7626) \qquad\quad (4.2956) \\[1em]
& + 0.1069\ \Delta LRM1_{t-1} + 0.3043\ \Delta LRM1_{t-3} \\
& (1.0068) \qquad\qquad (3.5307) \\[1em]
& + 0.2943\ \Delta LRM1_{t-4} + 0.0561S1 \\
& (2.8034) \qquad\qquad (6.4691) \\[1em]
& - 0.0186S2 \\
& (-1.7383)
\end{aligned}
$$

$\bar{R}^2 = 0.8723$
$F(11,41) = 33.2880$ [0.000]
S.E. of Regression = 0.0119

Autocorr: $\chi^2(1) = 0.3796$ [0.538]
$\chi^2(2) = 0.4168$[0.812]
$\chi^2(3) = 1.5543$ [0.670]
$\chi^2(4) = 4.2178$ [0.377]

Normality: $\chi^2(2) = 1.7132$ [0.425]

Heteroscedasticity: $\chi^2(1) = 0.5241$ [0.469]

ARCH: $\chi^2(1) = 0.1733$ [0.677]
$\chi^2(2) = 1.1019$ [0.576]
$\chi^2(3) = 1.3664$ [0.713]
$\chi^2(4) = 2.8795$ [0.578]

Functional Form: $\chi^2(1) = 0.4603$ [0.498]

Notes: I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

II) Figures in square parentheses [ ] refer to marginal significance levels

Appendix 3D

Revised Estimates of Short Run Money (M2) Demand Function (OLS Method)
Period: 1976Q3 - 1991Q4

$$
\begin{aligned}
\Delta LRM2_t \quad = \quad & -1.2617 + 0.3111\ \Delta LRGDP_t - 0.0161\ \Delta R3TB_t \\
& \ \ (-6.5383)\ \ (4.4925) \qquad\qquad\quad (-3.2351) \\
- \quad & 0.9608\ \Delta LCP_t - 0.2231\ ECM2_{t-1} \\
& (-3.7589) \qquad\quad (-6.6270) \\
+ \quad & 0.2729\ \Delta LERIS^{e}_{t-4} + 0.3118\ \Delta LRM2_{t-1} \\
& (2.8836) \qquad\qquad\quad (3.1678) \\
+ \quad & 0.2847\ \Delta LRM2_{t-4} + 0.0312\ S1 \\
& (2.8436) \qquad\qquad\ (4.3834)
\end{aligned}
$$

$R^2 = 0.5801$

$F(8,53) = 11.5354$ [0.000]

S.E. of Regression = 0.0151

Normality: $\chi^2(2) = 1.8956$ [0.388]

Heteroscedasticity: $\chi^2(1) = 1.9386$ [0.164]

ARCH: $\chi^2(1) = 0.5367$ [0.464]
$\chi^2(2) = 0.7743$ [0.679]
$\chi^2(3) = 1.6928$ [0.639]
$\chi^2(4) = 1.5120$ [0.825]

Functional Form: $\chi^2(1) = 0.7945$ [0.373]

Autocorr: $\chi^2(1) = 0.1695$ [0.681]
$\chi^2(2) = 1.0632$ [0.588]
$\chi^2(3) = 1.0759$ [0.783]
$\chi^2(4) = 2.0397$ [0.728]

Notes:

(I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

(II) Figures in square parentheses [ ] refer to marginal significance levels

Chapter 4

CREDIT

4.0 Overview

This chapter has a dual objective namely:

1) to assess the possibility that banks in Malaysia do practise equilibrium credit rationing in particular the notion of equilibrium credit rationing as advanced by Stiglitz & Weiss (1981 & 1983) and to infer the extent of excess demand for loans that this potentially brings; and

2) to evaluate the significance of bank credit to the Malaysian economy relative to a broader credit aggregate (defined to include credit extended by finance companies and merchant banks apart from commercial banks), money supply (M1 and M2), and the lending rate imposed by commercial banks and to identify the causal links between these variables and economic activity.[1]

Equilibrium credit rationing implies that the lending rate may not be responsive to loan demand and supply factors and there could be an implicit "lid" placed on the average of lending rates chargeable by banks. In our opinion, the effect of equlibrium credit rationing on the amount of deposits (loanable funds) that banks mobilise and the interest rate payable on them could depend on the interest rate elasticity of their flows.[2]

[1]The study of credit availability in an economy and its links to economic activity may be important as it potentially represents some harbingers of economic development so essential for economic planning.
[2]In a separate vein however, the presence of equlibrium credit rationing may defeat the objective of pursuing financial liberalisation as if banks have limited leeway to raise their lending rates, neither would they be able to do the same for deposit rates. Thus financial liberalisation may not yield the desired results if an economy is plagued with asymmetric information problems.

The first objective is accomplished via an estimation of interest rate elasticities of deposits received by commercial banks, an exploration of the loan demand and supply factors that determine the lending rate, and by forming a Vector Autoregression (VAR) System to capture the credit transmission mechanism in the Malaysian economy. With regard to the latter objective, the VAR approach will also be utilised.

There are at least two alternative conditions under which we think equilibrium credit rationing may not entail any severe excess demand for loans:

I) A deregulated interest rate and an either interest inelastic (zero elasticity) or highly interest elastic supply of deposits (funds) environment. In the case of zero elasticity, if it is unprofitable for banks to raise the lending rate for fear of adverse selection effects, banks may instead lower the interest rate payable on deposits especially if interest rates are deregulated and if the supply of funds to the banks by depositors is interest inelastic. Within this context, one may conclude that a liberalised interest rate regime may entail less credit being rationed and hence more credit being extended compared with a regulated one. However, we must emphasise that this strand of argument differs from the conventional argument for removing the lid placed on deposit rates that normally presumes that both loan supply and deposit demand will rise as a consequence. Our notion of a liberalised interest regime is premised simply upon the freedom of banks to set the interest rates on deposits and on lending. In fact the traditional argument for financial liberalisation with the hope of seeing a subsequent rise in the interest rate on deposits may fall short of expectations when equilibrium credit rationing is in operation. Hence it may be pertinent to assess the interest rate elasticity of Malaysian deposits. The 1978 interest rate deregulation undertaken by Malaysia when the ceiling on deposit rates was removed might not have contributed to any significant shift in the credit policy of banks. If deposits have been interest inelastic, interest rate liberalisation may not yield any perceptible change in the lending policy.[3] On the other hand, the higher is the interest rate elasticity of deposits, the greater will be the amount of deposits secured and the interest rate payable on them by the banks (see Appendix 4.1 for a mathematical proof). Cateris paribus, the excess demand for loanable funds may be relatively less compared to a low interest rate elasticity situation.[4] Moreover a small increase in the optimal lending rate that can be charged by the bank would lead to a larger increase in the interest rate payable on deposits by banks in an interest elastic condition. The interest rate elasticity of deposits may also be crucial to the determination of the extent of depressibility of the deposit rate for a given optimal lending rate that banks may charge as dictated by the gravity of asymmetric information problems. In fact for a given optimal lending rate, the larger is the elasticity, the higher can be the interest rate on deposits payable by banks.

II) The second possible condition is the lack of alternative modes of investment available to banks. Hence a greater supply of loanable funds. Developments in the asset and liability positions of banks may be mutually independent if a well-developed securities market exists and or access to overseas financial markets is facilitated. For instance if banks are granted the liberty to channel their surplus funds abroad, an increase in deposits (liability) harnessed by banks may not yield a commensurate rise in loans (asset) granted domestically by them. Within the Malaysian context, the number of alternative portfolio investment opportunities available to banks may be limited owing to legal restrictions imposed on banks to indulge in the stock market and that there is only a captive market for government securities (thus their lack of popularity) though efforts have been made in recent years to develop the market. Moroever the process of privatisation and

[3]On the lending front, the 1978 deregulatory policy was one of removing the floor set for the loan rate.
[4]However a credit crunch may be more severe in the event of an adverse twist in the optimal lending rate which may be brought about by an economic recession if deposits are interest elastic. Compared to a situation of low responsiveness, a decline in the optimal rate may entail a more substantial loss of loanable funds. Hence equilibrium credit rationing may have a procyclical effect on the economy as both upward and downward swings of the economy are being accentuated when deposits are highly interest elastic.

government expenditure rollbacks are gaining momentum in the Malaysian economy and unless the government chooses to finance its core expenditures predominantly by issuing securities, the supply of government securities may be expected to be relatively limited in the future.

This chapter is configured as follows. Section 4.1 provides a historical review of the lending and deposit-taking performance of commercial banks in Malaysia. A review of the literature is provided in Section 4.2. Since the methodology used in the present exercise has already been discussed in the money demand chapter earlier (except the VAR by Sims approach), Section 4.3 is devoted to a description of this approach. Section 4.4 presents the empirical results of the deposit-based study while those related to the lending rate in Section 4.5. Results of the VAR analysis are presented in Section 4.6. Finally the chapter has some concluding remarks in Section 4.7.

Data utilised in this chapter are of monthly frequency drawn from numerous issues of the Monthly and Quarterly Economic Bulletin issued by the Central Bank of Malaysia. Where quarterly data are involved, they are derived as a periodic average of monthly data. The period of estimation in this Chapter generally spans from 1979 to 1992 except for the VAR analyses that in certain cases involve monthly data from 1987. Unlike demand, savings and fixed deposits used to compute M0, M1 and M2 in our earlier exercise on money demand, the deposit series used here are more inclusive as deposits held by statutory authorities and other state and federal government agencies are included.

4.1 Lending and Deposit-Taking by Malaysian Commercial Banks: A Historical Review

Gerschenkron (1968) maintains that bank credit contributed significantly to the industrial development in Germany during the industrial revolution. This may be true also in the case of Malaysia. Generally over the past two decades , there has been a steady rise in the ratio of bank credit to GDP in Malaysia reflecting the growing significance of the banking system as a major source of financing for economic activity and investment. Total loans and advances granted by commercial banks as a proportion of nominal GDP rose dramatically from about 19.41% in 1970 to about 70.68% in 1993 (Figure 4A). The rising trend was only interuptted briefly over the 1973-74 period which coincided with the first oil price shock and during the Malaysian recessionary years in the mid 1980s. The figure also seems to suggest a dramatic pick-up in the lending activities of commercial banks during the post-1978 interest rate liberalisation period which is somewhat consistent with the McKinnon-Shaw hypothesis of financial liberalisation. The significance of bank loans is further manifest in Figure 4B which depicts parallel movements between total bank credit and nominal GDP except during the mid 1980s recession when bank loans did not seem to fall with GDP though their growth did decelerate.

Banks in Malaysia have also appeared to be more aggressive in their lending policy in recent years as highlighted by the rising trend in the loans-deposit ratios (excluding trade bills) observed by them (Figure 4C). From about 60% in the early 1970s, the ratio rose though not steadily to 87.33% when computed on the basis of total deposits (excluding negotiable certificates of deposit) and to about 78.84% (when NCDs are included) in 1993. Government securities also seem to be losing its prominence in the asset portfolio of banks as Figure 4D indicates. Over the years, direct lending to the government has never exceeded 3.5% of total loans and advances extended by the banks. However this increased aggressiveness has not been unaccompanied by an improvement in their equity position (defined as capital and reserves as a proportion of total liabilities) from about 3.17% in 1970 to about 4.10% in 1993 (Figure 4E). Furthermore there is evidence of a growing preference amongst banks in meting out longer term loans over granting short-term loans (Figure 4F). The share of total loans granted for a period of between one and four years in total loans and advances rose from 2.39% in 1970 to 5.76% in 1993 while that of term

Figure 4A
Total Loans and Advances as a Percentage of Nominal GDP

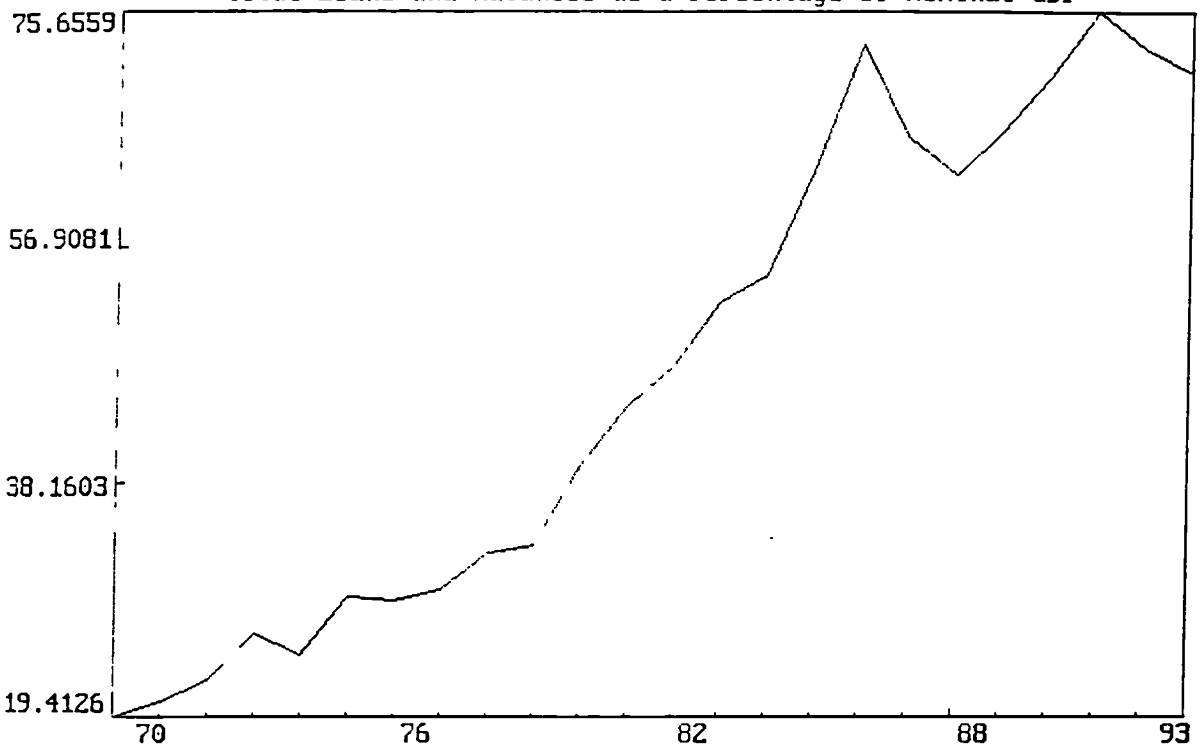


Figure 4B
Total Loans and Advances vis-a-vis Nominal GDP in M$ million

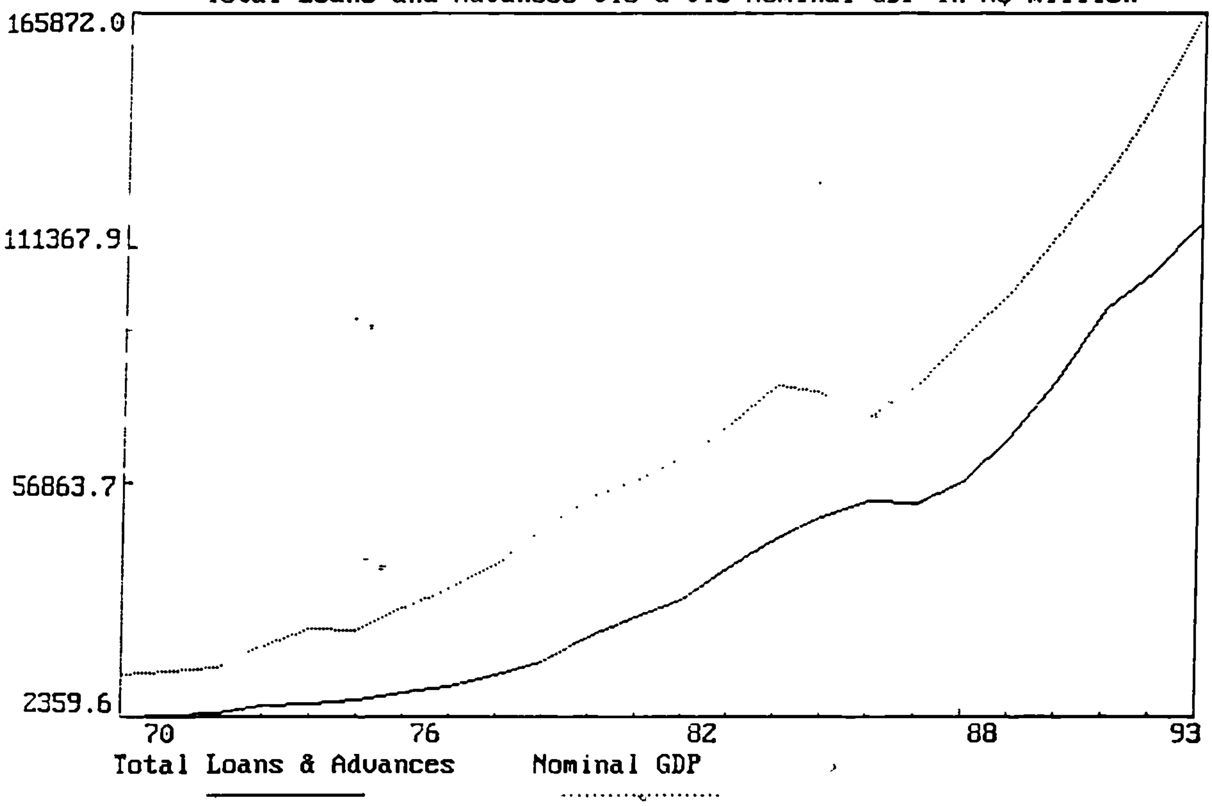


Figure 4C

Total Loans & Advances (excldg.Trade Bills) as a % of Total Deposits

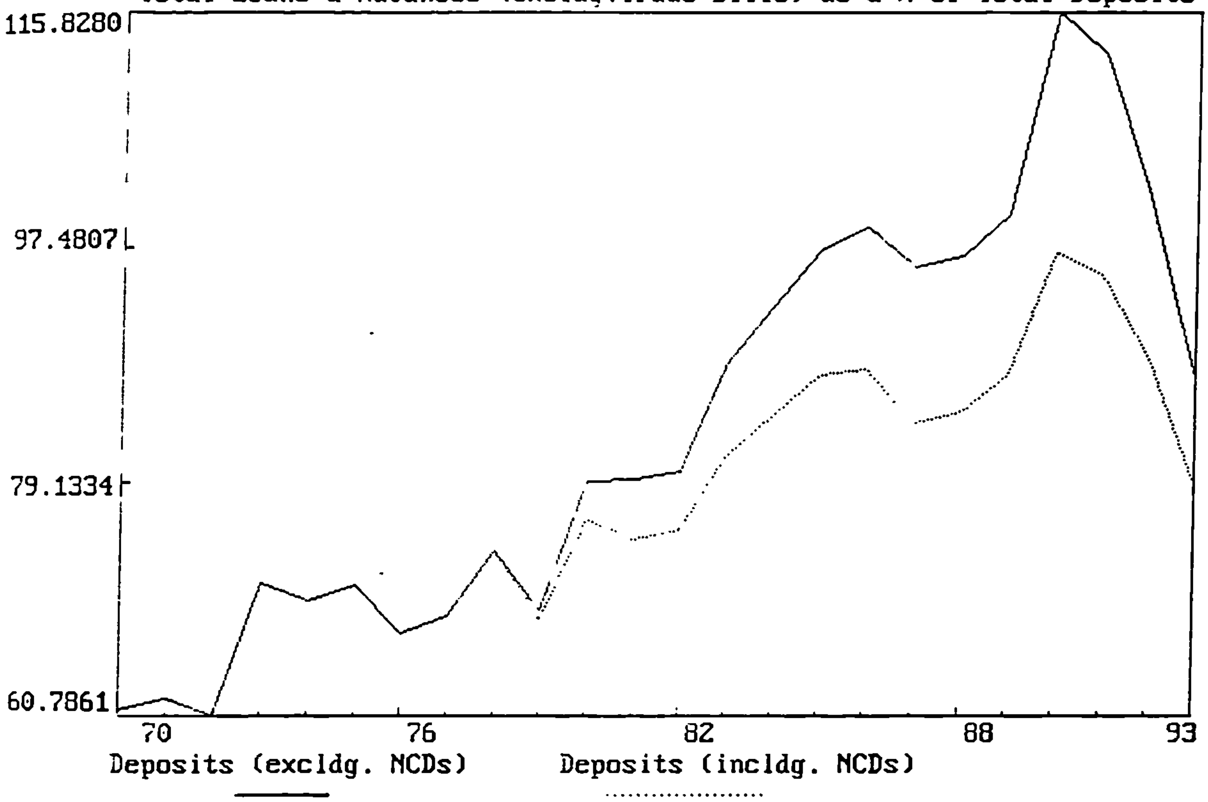


Figure 4D
Government Securities as a Percentage of Total Loans and Advances

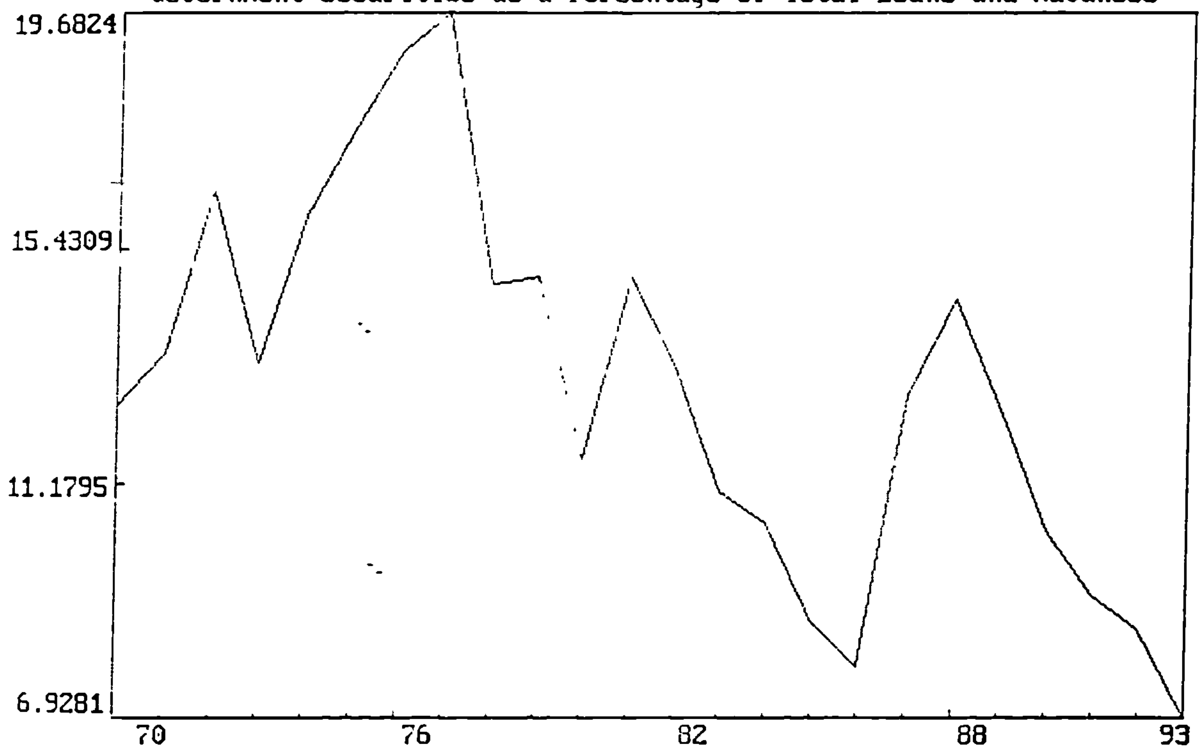


Figure 4E
Capital and Reserves as a Percentage of Total Liabilities

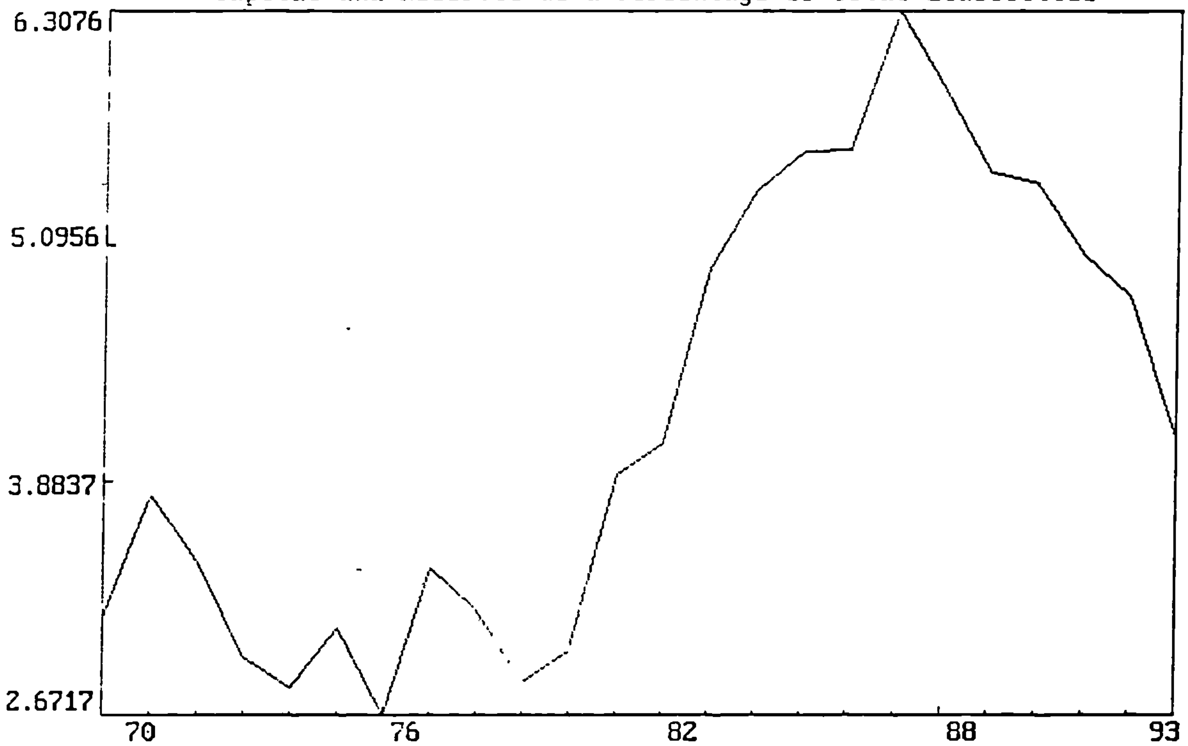
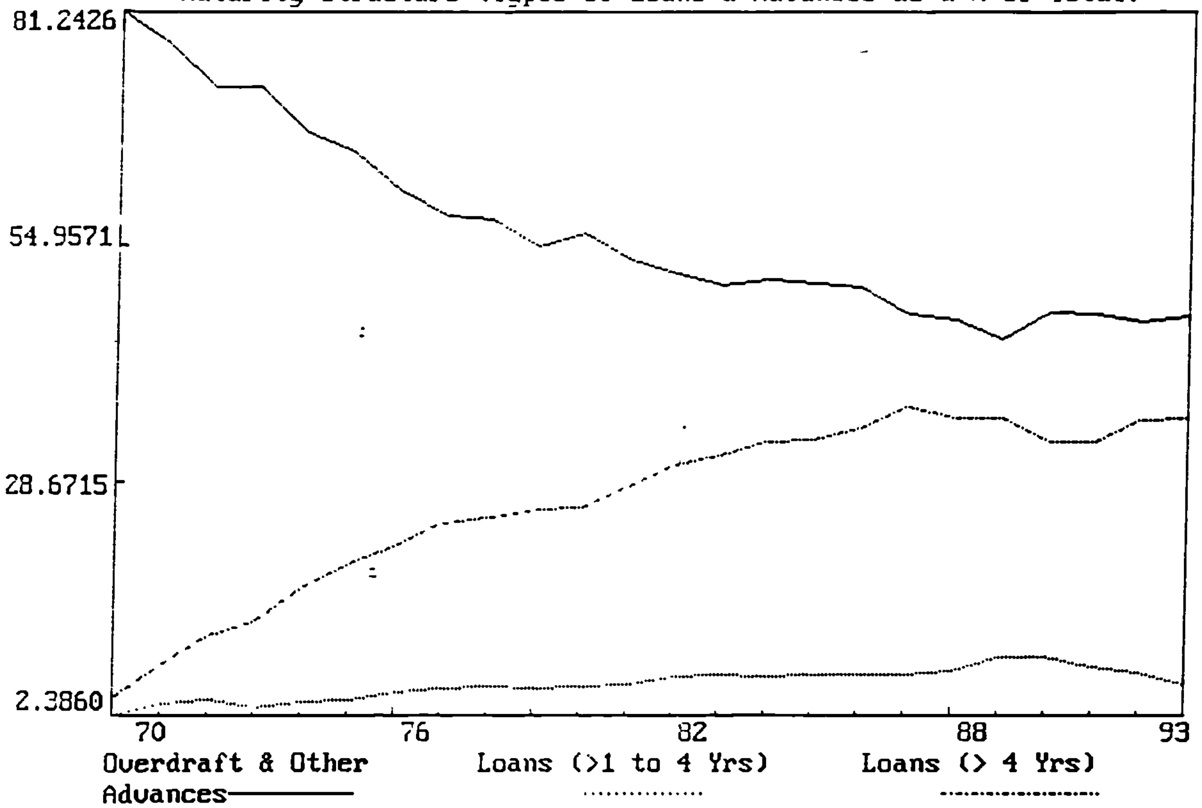


Figure 4F
Maturity Structure (Types of Loans & Advances as a % of Total)



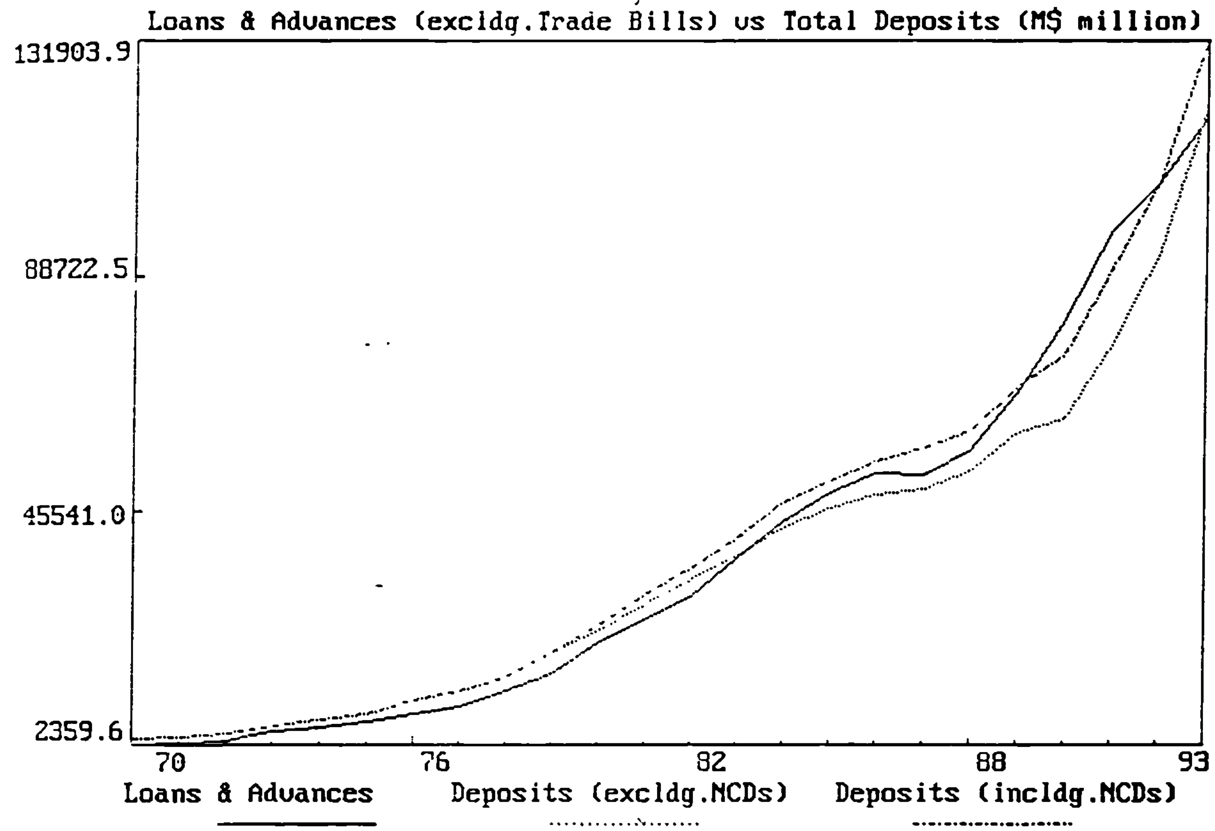
loans exceeding four years rose more markedly from 4.33% to 35.75% though short term loans remain dominant.

The Malaysian banking scene also suggests a close correlation between the deposit-taking activities of banks and their lending operations. As projected by Figure 4G, the volume of deposits accepted by these institutions varies closely with the volume of their lending. This underscores the importance of deposits in funding their lending operations. Hence banks in Malaysia do play the role as financial intermediaries with an increasing degree. By a visual inspection of Figure 4H, funds received by these institutions are predominantly long term in the form of fixed deposits as opposed to more volatile deposits such as demand and savings deposits. In fact fixed deposits as a percentage of total deposits mobilised has displayed a moderately rising trend and this could have contributed to the greater willingness of banks in issuing longer term loans.

Not only has there appeared to be a positive correlation between GDP and loans but a similar correlation seems to exist between deposits and GDP as attested to by Figure 4I. Akin to the former relationship, economic recession in the mid 1980s did not seem to provide a damper to the absolute level of deposits though not in growth terms. All this speaks of a direct relationship amongst loans, deposits and economic activity which is possibly governed by or or dictating the lending policy of banks.

Our attention has so far been centered on commercial banks in line with our research objective. Finance companies and to a much smaller extent merchant banks are gaining prominence in the Malaysian financial system as mobilisers and providers of funds (Figures

Figure 4G


Loans & Advances (excldg.Trade Bills) vs Total Deposits (M$ million)
131903.9
88722.5
45541.0
2359.6
70
76
82
88
93
Loans & Advances
Deposits (excldg.NCDs)
Deposits (incldg.NCDs)

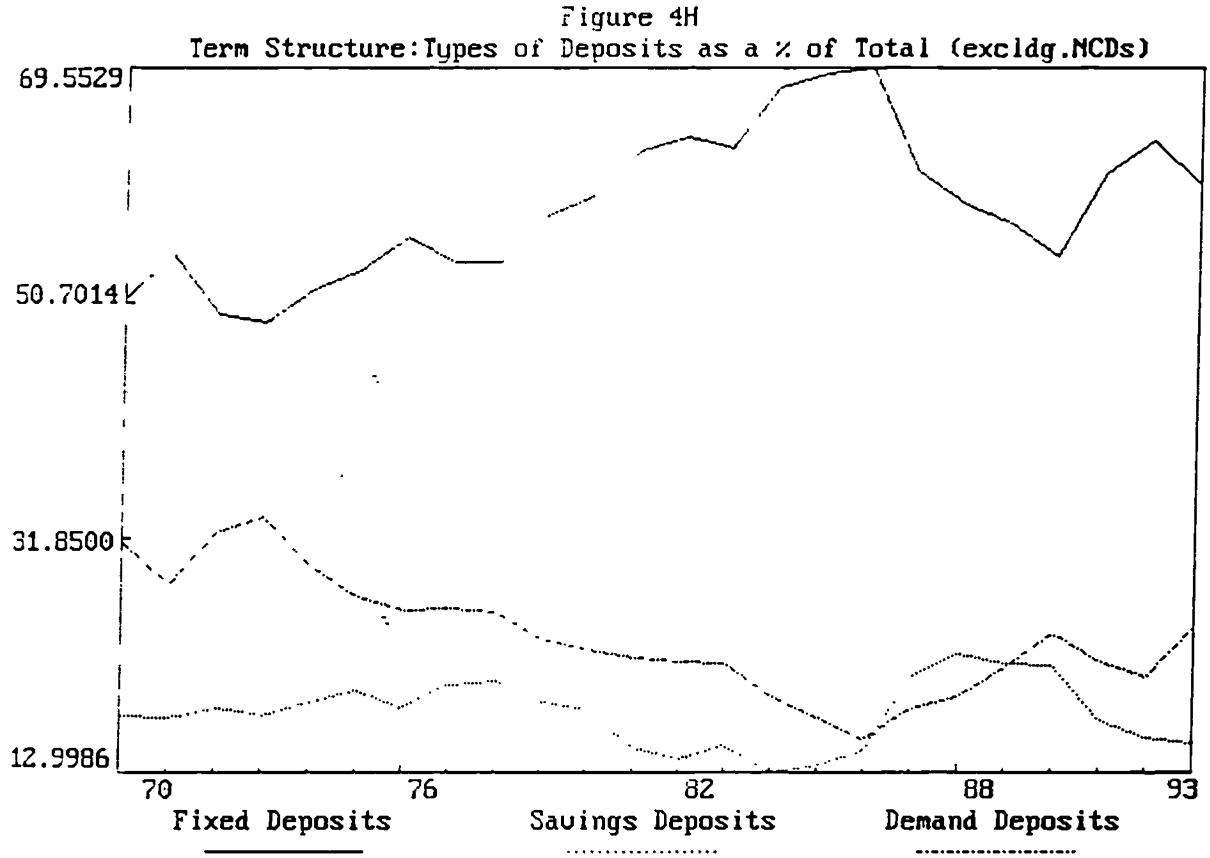
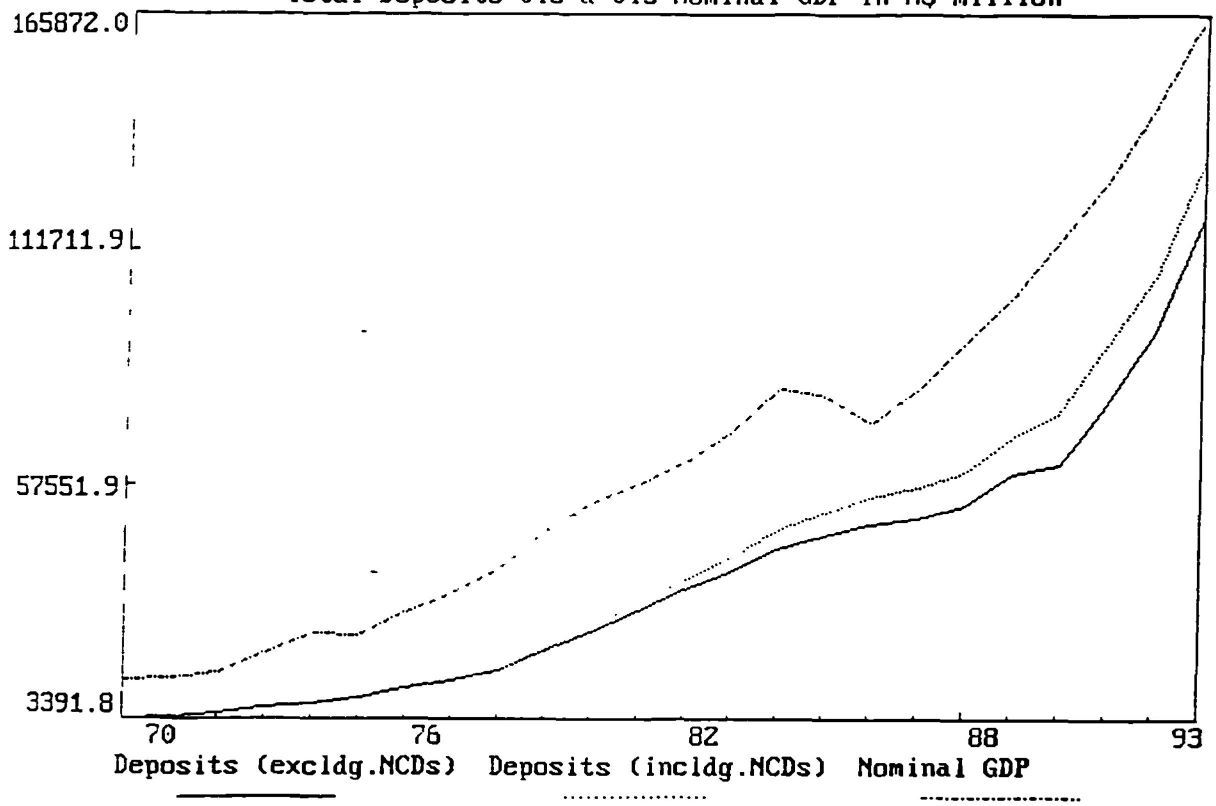


Figure 4H
Term Structure:Types of Deposits as a % of Total (excldg.NCDs)
69.5529
50.7014
31.8500
12.9986
70
76
82
88
93
Fixed Deposits
Savings Deposits
Demand Deposits

Figure 4I
Total Deposits vis-a-vis Nominal GDP in M$ million



4J & 4K). Nevertheless their role is relatively minor to that of commercial banks as loans granted by finance companies and merchant banks only constituted about 37.34% and 7.79% respectively of total loans and advances offered by commercial banks in 1993. In terms of nonbank deposits, finance companies only commanded 35.57% of the total amount of deposits placed with commercial banks.

4.2 Literature Review

4.2.1 Credit Rationing

Broadly defined, credit rationing is characterised by a situation of excess demand for loans as loan rates are quoted below the Walrasian market clearing level (Jaffee & Stiglitz, 1991). Numerous definitions of credit rationing exist and they include inter alia:

1) Interest rate (or price) rationing. Under this condition, a borrower would only be extended a loan smaller than the desired amount at a loan rate but would have to pay a higher rate to secure a larger loan. This may be a standard price rationing or the rationing idea of Freimer and Gordon (1965). They attribute the upward sloping interest rate schedule that borrowers may face to the perception by banks that default probabilities vary directly with the amount of loans extended to a particular borrower;
2) Divergent views rationing. This prevails when certain individuals fail to borrow on interest rate terms they deem appropriate to their self-perceived probability of default;

Figure 4J
Loans & Deposits of Finance Companies as a % of Those of Comm. Banks

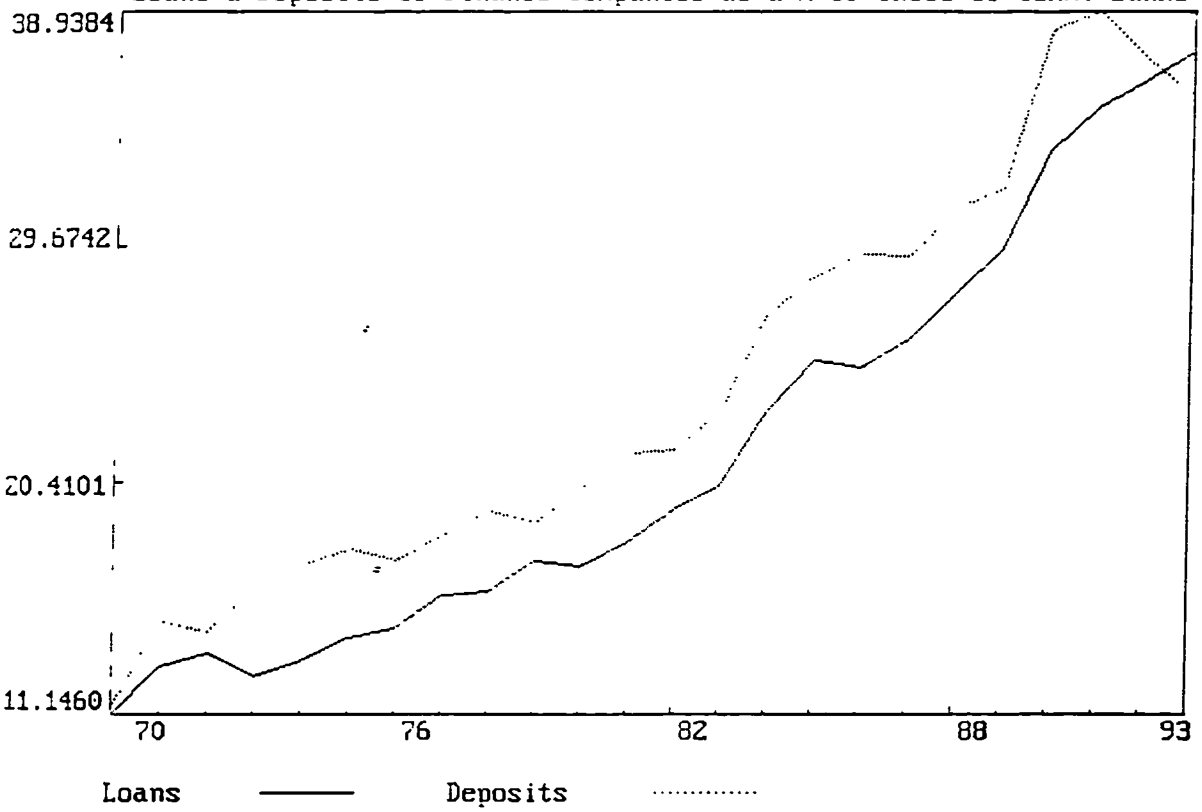
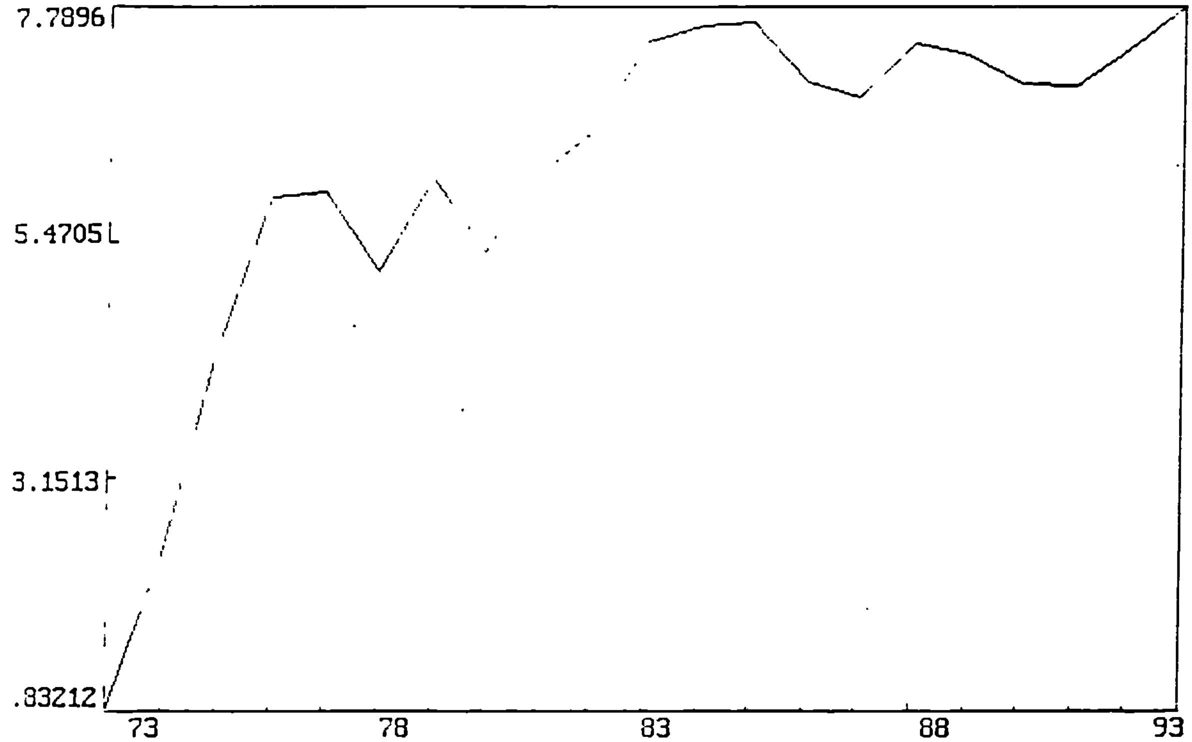


Figure 4K

Loans of Merchant Banks as a % of Loans & Advances of Comm. Banks



3) Redlining. This phenomenon arises when a borrower is refused credit due to a failure in meeting the required rate of return of the lender at any interest rate given their risk classification. Moreover loans previously viable might lose their viability when the required rate of return is revised upwards; and

4) Pure credit rationing. This arises when some individuals manage to obtain loans while others who are apparently identical fail to borrow at precisely the same terms due to imperfect information. In fact imperfect information is one of the plausible explanations for the maintenance of loan rate below the market clearing level.[5]

Pure credit rationing may also be referred to as equilibrium rationing. It arises when the return on a loan does not increase monotonically with the interest rate charged owing to adverse selection and incentive effects (King, 1986). An increase in the lending rate may precipitate a decline in the return on a bank's portfolio since this may attract riskier pool of borrowers (adverse selection) and encourage existing borrowers to undertake riskier ventures (adverse incentive) especially in the absence of perfect and costless monitoring. Under such circumstances, it may not pay banks to levy high interest rates and market equlibrium may be characterised by credit rationing (Stiglitz, 1988). The loan rate would then be set by the bank to the point where an increase in the loan rate would yield a zero marginal return and the bank would equate the marginal net return on loans to the opportunity cost of funds - the rate on open market securities plus the expected cost of entering open markets as a borrower (King, 1986). In the absence of rationing, an increase in core deposits would lead the bank to reduce its loan rate due to a decline in the probability of deposit insufficiency and hence the expected cost of open market borrowing. However the loan rate may not vary in response to an influx of deposits in the presence of rationing as it would then be determined solely by risk factors and the securities rate. Hence the complete dichotomy emerged between the loan and deposit

[5]In fact there is another type of credit rationing which is a policy-induced phenomenon referred to by Galbis (1977). It is associated with a government's direct move to restrict credit supplies following a restriction on interest rates payable by banks.

markets (or the asset and liability sides of banks' balance sheets). Any increase in deposits may not lead to a corresponding increase in the volume of loans and these new deposits may be invested in securities and required reserves. A swing in favor of holding liquid securities may have a depressive impact on the economy over and above the effect from a contractionary monetary policy as happened during the Great Depression (Bernanke, 1983; Hein & Mercado-Mendez, 1992).

It is in fact also uncertain that banks could resolve the asymmetric information problem via a demand for more collateral or for a greater equity participation of the borrower in the project to be financed. Stiglitz & Weiss (1981) pointed out that more stringent requirements as such may even instead contribute to a decline in the returns to the banks as again this may reduce the average degree o`risk aversion of the pool of borrowers. For instance if smaller projects happen to be high risk projects, collateral and equity requirements for securing loans to finance them may be more easily satisified. Hence banks may find themselves ending up with a pool of debtors made up predominantly of the high risk. Another possibility is that those who could afford to satisfy these requirements are those who have earlier succeeded in highly risky ventures that brought them significant profits. Their risk-loving attitude may perpetuate and in this case, banks may find their expected returns undermined.

It is noteworthy that information-based credit rationing has also earlier been postulated by Jaffee and Russell (1976). They explain how unobserved differences in the quality of borrowers might give rise to rationing. They demonstrated a situation under which the probability of default by borrowers varies directly with the loan size. Even default probabilities may differ across borrowers for a given loan size due to factors unobservable by lenders. Owing to this indistinguishability of borrowers ex ante, the market interest rate may actually be carrying a risk premium. Thus low risk borrowers may feel disadvantaged in terms of cost to participate in the market alongside high risk borrowers. Given this scenario, banks may find it rational to ration credit by restricting the loan size as this could alleviate the default incidence in the market and hence the reduced need to incorporate a risk premium in the lending rate. This may appease high quality borrowers and encourage their participation.

4.2.2 Financial Aggregates and Economic Activity

Traditionally there are two views regarding the influence of financial aggregates on economic activity namely the money view and the credit view (Morgan, 1992). The money view differs from the credit view simply in one important respect, i.e. the former holds that only money matters while the latter attaches importance to bank loans. While proponents of the money view hold that firms have borrowing recourses in the event of a reduced availability of bank loans, proponents of the latter hold that many firms lack such recourses. Even if for some reason that market rates do not rise, a reduction in spending could still be precipitated by a slack in the supply of loans. However two necessary conditions have to prevail before bank loans could constitute a channel of monetary policy transmission mechanism:

1) Loans and securities should be regarded by banks as imperfect substitutes on the asset side of their balance sheets for a contractionary monetary policy to dampen loan supplies; and
2) Loans and non-bank sources should also be viewed by firms as imperfect substitutes on the liability side of their balance sheets for loan supplies to yield any real effect.

It is shown by Bernanke and Blinder (1988) that portfolio adjustments made by banks to the asset side of their balance sheets can impart a channel of monetary influence distinct from the conventional money demand route. This is premised on the notion that banks are better positioned to overcome the adverse selection and moral hazard problems inherent in the financial market. They possess the expertise to gather information about firms and are capable of screening borrowers and monitoring the loan performance at relatively low cost (Diamond, 1984; Bernanke, 1986 & Vale, 1992). According to Fama (1985), bank credit is special for certain classes of borrowers and is not permutable with open market credit. The presence of financial intermediation could help overcome informational problems that might cause the incomplete nature of financial markets. By virtue of their specialisation in information gathering about loan projects and their ability to pool and distribute risks, these intermediaries in fact aid in curbing market imperfections and in the promotion of a better resource allocation. While a firm may face a heavy risk burden by borrowing as it has to face all profit eventualities itself, the severity of imperfections in the credit market has led to an unpopularity amongst firms to raise capital by new equity issues (Greenwald, et.al, 1984 & Stiglitz, 1992). In fact if equilibrium credit rationing does exist in the loans market, it may also imply a difficulty for firms to raise equity in the open market. Asymmetric information problems may adversely affect the value of a firm's existing assets and hence hampering its ability to seek financing from the equity market.[6]Anyhow the credit view may be more inclined to prevail in a developing economy like Malaysia as firms and consumers rely chiefly on bank loans as its private bond and other commercial paper markets have yet to be developed.

With the onstream of financial liberalisation, new financial products which are close substitutes for money have emerged. Banks have also been shedding their dependence on the traditional deposit base as a source of financing their lending operations in favor of funds raised from the wholesale market (Blundell-Wignall, Browne & Manasse, 1990). This could have also impaired the relationship between traditional monetary aggregates and economic activity, sparking off beliefs that credit instead of monetary aggregates is a more appropriate barometer for monetary policy actions (King, 1986; Friedman, 1983;

[6]Cho (1986) in contrast has stressed the importance of developing a well-functioning equity market and the potential role it could play in the promotion of efficient capital allocation and risk sharing in a liberalised financial environment. He argued that for a given degree of imperfect information, capital would flow more efficiently through an equity market as equity finance is free from adverse selection and moral hazard problems unlike debt finance.

Brunner & Meltzer, 1988; Bernanke & Blinder, 1988 and Blundell-Wignall & Gizycki, 1992).

Changes in the availability of credit may have significant effects on economic activity while changes in real interest rates may be a relatively minor explanatory factor for economic fluctuations (Stiglitz, 1988). In the event of a move by the Central Bank to mop up reserves from the banking system through the sale of bonds in an open market operation, banks may be forced to reduce their loan supplies when banks are fully-loaned up. This may curb investment and consumption activities as well as other operations requiring working capital. Hence economic activity would be contained by a tight monetary policy though interest rates may display only very little movements due to credit rationing (Blinder & Stiglitz, 1983; Blanchard & Fischer, 1989). If there is some truth in this, interest rate liberalisation in Malaysia and its occasional reversals in the subsequent years might not have yielded any parametric change in the links between monetary policy and economic activity in a direct fashion. It is noted by Bernanke & Blinder (1988) that market interest rates could even decline after some monetary policy tightening owing to spending declines following a reduced supply of bank loans. The presence of credit rationing also explains the way credit shocks may affect output without involving any significant change in lending rates. Credit rationing due to asymmetric information may in fact provide a larger scope for monetary policy to have real effects via the credit supply channel (Bernanke, 1986; Gertler, 1988; and Vale, 1992). From the vantage point of credit, the economy might respond sluggishly to an easy monetary policy depending partly on the lending policy of banks (Morgan, 1992). The more cautious are banks towards lending, the weaker would be the response of the economy to such policy. Credit crunches may also result from bank runs, a combination of tight monetary policy and ceilings imposed on bank deposit rates (Morgan, 1992) and a shortage of bank capital (Bernanke & Lown, 1991; and Johnson, 1991).

When considered in relation to economic activity, perhaps we could liken credit granted by financial institutions to the monetary base in a money multiplier framework. More precisely, total credit granted in an economy is some multiple of total credit granted by the banking system. There are transactions such as sales of goods and services in an economy which are effected without involving money. However it can be stressed that credit issued by the banking system constitutes the core or base of total credit granted in the economy as the effect of a credit squeeze in the banking system would be trickled down to other parts of the economy. This is somehow consistent with the notion expressed by Stiglitz (1992) that there is a parallel between banks and firms. If firms face restricted access to bank credit, not only will they scale down their investments in machines but also the credit they grant to their customers. Thus the "benevolence" of banks in granting credit has a ripple effect on total credit available in the economy.

The significance of credit in the determination of economic activity is further underscored by a theoretical study of how credit constraints as dictated by the price of collateral may interact with economic activity over the business cycle (Kiyotaki & Moore, 1993). The dampening effect of the constraint could also magnify as the price of these assets may itself be influenced by the credit condition in the economy.[7] Hence the dynamic interaction between credit limits and asset prices may constitute a very strong transmission mechanism via which the effects of shocks in a particular sector may persist and amplify with spillover effects on other sectors of the economy.

More recent evidence on the existence of a loan supply channel of monetary policy transmission mechanism is provided by Kashyap, et.al (1993). They maintain that a tightening of monetary policy could affect the external financing mix of firms by favoring commercial paper issuances vis-a-vis bank loans. This may however indicate that a contractionary monetary policy can be relied upon to induce a decline in loan supply and

[7]However, a borrower's net worth and thus the collateral that he is able to furnish may help reduce borrowing costs as the informational risks faced by lenders may be correspondingly curtailed (Bernanke & Gertler, 1986).

hence investment especially when commercial paper issuances are not a handy alternative as may be true in the case of Malaysia.

Monetarists however acknowledge that credit tightening does prevail during a recession but view the event as an endogenous development (Hein & Mercado-Mendez, 1992). In their opinion, commercial bank lending decisions are not exogenous forces influencing the business cycle. It is rather the monetary forces that affect their lending decisions. The traditional and most familiar analysis of central bank policy focuses upon the quantity of the medium of exchange. This is predicated upon the belief that the central bank can regulate the economy to the extent that it can control the quantity (Bernanke & Gertler, 1987). Hence the traditional focus has been on the liability side of banks' balance sheets. However as initially contended by Gurley & Shaw (1956), this approach might have lost its relevance with the emergence of substitutes for conventionally-defined money in consumers' portfolios concomitant with financial innovations. Specifically, the money stock may no longer be a precise yardstick for the flow of intermediary credit and that non bank financial intermediaries might also have become an important repository and source of loanable funds (Gertler, 1988). Coupled with the identification of asymmetric information problems in financial markets, there has been an upsurge of interest in examining the "asset" side of banks' balance sheets as well. Nevertheless this does not amount to a dismissal of the effectiveness of monetary policy in influencing the real activity. The potential influence remains via an influence on the extent of financial intermediation though not on the quantity of the medium of exchange. In fact as early as the 1960s apart from Gurley & Shaw, other economists such as Patinkin (1961) and Brainard & Tobin (1963) also recognised the quality and quantity of services offered by financial intermediaries as being crucial to macroeconomic performance. More specifically, factors influencing the ability and cost of banks in the supply of intermediary services have real effects (Bernanke & Gertler, 1987).

However within the academic circle that centers on the relationship between financial intermediation and economic development, two viewpoints prevail that may also be referred simply to as the "traditional" view and the "new" view (King & Levine, 1993). While the traditional view holds that changes in intermediation yield merely small growth effects relative to the effects of economic development on the demand for financial services, the new view on the other hand believes that financial intermediation has a causal role to play in the development process. Hence those who favour the traditional view would contend that the underlying relationship of most of the observed correlations between growth and financial intermediation actually reflect the direction of causality running from the former to the latter. Small interest rate elasticities of savings and investment and weak effects of physical capital accumulation on economic development have been cited as reasons why distortions in the financial sector are viewed as farfetched to investment and development. On the contrary, the new view assigns financial market developments a greater causal role as it is believed that they influence capital accumulation within the economy and hence productivity.

Finally however it is worth mentioning that neither money nor credit has been attached any significance to in the determination of economic activity by the real business cycle theory. Money is thought by the theory to be passive and its correlation with output exists merely because agents increase their demand for transaction services when current or expected future output is high (Bernanke, 1986). Advocates of this theory also maintain that empirical findings of a money-income correlation actually refer to the correlation between income and inside money rather than the base or outside money and the correlation is merely a reflection of some collinearity between money and credit. In spite of this contention, credit is not being regarded as a causal variable but like money a purely endogenous one (King & Plosser, 1984). The real business cycle view is then somehow akin to the Modigliani-Miller theorem (1958) which asserts that economic decisions are made independently of the financial structure (Bernanke & Gertler, 1987). By implication then, financial intermediaries are inconsequential to economic activity.

4.3 The VAR Methodology

The use of VAR technique has been promoted out of disillusionment with the ability of large scale macroeconomic models to yield accurate forecasts (Hakkio & Morris,1984). While in the 1970s most large-scale macroeconomic models underpredicted inflation and unemployment, they failed to predict the strength of U.S. economic recovery in 1983. In the light of these events, the use of vector time series models as an alternative to structural econometric models as advocated by Sims (1980) gained popularity.

Formally a vector autoregression (VAR) may be represented as follows:

$$y_t = \sum_{s=1}^{L} B_s y_{t-s} + u_t \qquad (4.3.1)$$

where y refers to a column vector of n variables and B_s is a matrix of n x n dimension. $E(u_t u_t') = \Sigma$ and altogether there are $n^2 L$ free coefficients in this model.

Assuming y consists of stationary series, an equivalent vector moving average representation of the above system of equations (4.3.1) by virtue of Wold's decompositon theorem is as follows:

$$y_t = X_t \beta + \sum_{s=0}^{t} A_s u_{t-s} \qquad (4.3.2)$$

where y = an N-variate stochastic process;

$X_t \beta$ = deterministic component of y;

$\{u_t\}$ = an N-variate white noise process;

and u_t and u_s are uncorrelated for $t \neq s$.

u may be referred to as the innovation process for y. In order to perform variance decomposition and to derive impulse response functions which represent the primary purpose of estimating a VAR, innovations have to be orthogonalised as orthogonalised innovations are not correlated across time and equations. This may be effected by applying Cholesky decomposition to the contemporaneous covariance matrix, Σ. Given a nonsingular and lower triangular matrix H, A_s is replaceable by A_sH and u by H^{-1}u. The matrix H is obtained by Cholesky decomposition which satisfies the following condition:

$$H^{-1}\Sigma H'^{-1} = I$$

or $$HH' = \Sigma$$

The orthogonalised innovations will then be $v_t = u_t H^{-1}$ with $E(v_t v_t') = I$.

Based upon orthogonalised innovations, variance decomposition analyses may then be conducted and impulse response functions derived. While impulse response functions depict the responses of the system to a particular initial shock, a variance decomposition analysis allows us to decompose the forecast error variance of a variable into parts attributable to each of the innovation processes.

For guidance in ordering the variables in the system, we shall refer to both the F- and Likelihood Ratio tests for exogeneity.[8] These tests will be described in the subsequent paragraphs of this section. Variables perceived to have no predictive power about other variables are positioned last in the ordering. Hence the first variable in the order will be one that explains all of its own one step variance.

[8]Both the outcome of variance decomposition and impulse response functions are sensitive to the arrangement of variables in the system. However Spencer (1989) noted that results based upon semiannual or annual data are likely to display greater sensitivity to the choice of ordering compared to those based upon higher frequency data. This is in view of the fact that contemporaneous correlation amongst pre-orthogonalised innovations is likely to increase with the level of temporal aggregation of the data.

In fact the use of this methodology also facilitates the process of determining whether a variable z aids in the forecasting of another variable x in the causal sense of Granger. The process can be effected either by conducting block F-tests on individual equations in the VAR or Likelihood Ratio tests that take into account cross-equation relationships. The latter are meant for determining the block exogeneity of a group of variables and it is in fact a multivariate generalisation of Granger-Sims causality test.[9]

The likelihood ratio test statistic assumes an asymptotic χ^2 distribution with degrees of freedom equal to the number of restrictions.[10] It is computed as follows:

$$\chi^2 = (T - C)(\ln \det \Sigma r - \ln \det \Sigma u) \qquad (4.3.3)$$

where Σr and Σu are the covariance matrices from the restricted and unrestricted VAR respectively, T is the total number of observations and C is a correction factor for improving small sample properties. Sims (1980) suggested equating C to the number of variables in each equation of the unrestricted VAR.

As forthmentioned, these tests will be relied upon by us as a guidance for ordering the variables in a VAR.

4.4 A Deposit-Based Analysis

The methodology involved here is similar to that of our earlier analysis on money demand namely the error correction approach. Though we are concerned chiefly with the interest rate elasticity of total deposits received by commercial banks, we have also attempted to establish these elasticities for different types of deposits. The various types of deposits considered here are demand deposits (CBTDD), savings deposits (CBTSD), fixed

[9] In some sense, such tests may be regarded as tests for the exogeneity of a set of variables.
[10] This test will also be relied upon by us for identifying the optimal lag length to be used in the estimation of the VAR apart from the Ljung-Box test for serial correlation.

deposits (CBTFD) and that of our central concern namely total deposits which is an aggregation of the former three elements plus negotiable certificates of deposits (CBTD) received by commercial banks. Their assumed general functional forms are as follows:

$$CBTDD_t = f(CBR3FD_t, NGDP_t) \tag{4.4.1}$$

$$CBTSD_t = g(CBR3FD_t, CBSDR_t, NGDP_t, FCSDR_t, UKTB_t) \tag{4.4.2}$$

$$CBTFD_t = h(CBR3FD_t, FCR3FD_t, NGDP_t, UKTB_t) \tag{4.4.3}$$

$$CBTD_t = i(CBR3FD_t, FCR3FD_t, UKTB_t, NGDP_t) \tag{4.4.4}$$

where $f_1 \langle 0, f_2 \rangle 0, g_1 \langle 0, g_2 \rangle 0, g_3 \rangle 0, g_4 \langle 0, g_5 \langle 0,$

$h_1 \rangle 0, h_2 \langle 0, h_3 \rangle 0, h_4 \langle 0, i_1 \rangle 0, i_2 \langle 0, i_3 \langle 0$ and $i_4 \rangle 0$.

In line with the broad theme of our study, the entire analysis is couched only in nominal terms. Demand deposits which are non interest bearing are assumed to respond negatively to the 3-month fixed deposit rate offered by commercial banks (CBR3FD) and positively to movements in nominal GDP (NGDP). This is in recognition of the possibility that economic agents may economise on holdings of demand deposits when interest rates on other forms of deposits rise. Owing to the cash-quality of demand deposits, its holdings may vary directly with the buoyancy of the economy.

With respect to the interest-bearing savings deposits (CBTSD), it is assumed to vary directly with its own rate of return proxied by savings deposit rate (CBSDR), nominal GDP for its storehouse of value role while moving inversely with the fixed deposit rate offered by commercial banks (CBR3FD), the savings deposit rate of finance companies (FCSDR) and a foreign interest rate proxied by the UK Treasury Bill (UKTB) rate owing to the relatively liberal exchange control regime maintained by Malaysia. It is also felt that an inclusion of a foreign interest rate may assist in capturing some foreign market ramifications on the domestic financial system.[11]

Fixed deposits (CBTFD) in turn can be expected to respond positively to its own rate of return proxied by the commercial banks' 3-month fixed deposit rate (CBR3FD), to nominal GDP in the wealth accumulation process and negatively to movements in foreign interest rates (UKTB) and rates offered by finance companies as proxied by finance companies' 3-month fixed deposit rate (FCR3FD). This is to entertain the possibility of competition posed by finance companies to commercial banks in deposit-taking activities.

Finally total deposits received by commercial banks are assumed to respond positively to the interest rate offered by commercial banks (CBR3FD) and NGDP and negatively to alternative domestic and foreign interest rates proxied respectively by finance companies' 3-month fixed deposit rate (FCR3FD) and the UK Treasury Bill rate (UKTB).

To steer clear of spurious regression problems, all the series involved are subject to both conventional and seasonal unit root tests. The results of conventional unit root tests up to second order without the inclusion of a time trend are presented in Table 4.I while those of selected series with the time trend included are presented in Table 4.II.

Table 4.I
Dickey-Fuller Tests (Without Time Trend)

	Levels	First Difference	Second Difference
LCBTDD	-1.1675	-3.9154	-5.8861
LCBTSD	-1.9607	-4.9186	-13.7868
LCBTFD	-1.2376	-6.6647	-5.8552
LCBTD	-1.7471	-2.8645	-11.6465

[11]Initially it was felt that we should derive a foreign interest rate series based upon the higher of the rates prevailing in U.K. and U.S. at every point in the sample. However a plot of the two series reveals that the rate in U.K. was most of the time higher in the sample period. Hence the idea was shelved.

LNGDP	-1.4727	-3.6150	-14.1402
CBR3FD	-2.5410	-5.4225	-7.9867
CBSDR	-0.4574	-6.4470	-10.5524
FCSDR	-0.1970	-8.7115	-6.8209
UKTB	-1.9297	-7.3783	-7.0601
FCR3FD	-2.0001	-5.7130	-8.9217
DIFF	-4.8958	-7.2385	-3.3996

Notes:

(I) All variables are in natural logarithm except for interest rates.

(II) LCBTDD - Total Demand Deposits with Commercial Banks
LCBTSD - Total Savings Deposits with Commercial Banks
LCBTFD - Total Fixed Deposits with Commercial Bank
LCBTD - Total Deposits with Commercial Banks
LNGDP - Nominal GDP
CBR3FD - 3-month fixed deposit rate offered by Commercial Banks
CBSDR - Savings deposit rate offered by Commercial Banks
FCSDR - Savings deposit rate offered by finance companies
UKTB - U.K. Treasury Bill rate
FCR3FD - 3-month fixed deposit rate offered by finance companies

(III) Critical values at the 5 per cent significance level for 50 and 100 observations are -2.93 and -2.89 respectively

Table 4.II
Dickey-Fuller Tests (with Time Trend)

	Levels
LCBTDD	-2.5001
LCBTSD	-1.8002
LCBTFD	-1.2857
LCBTD	-1.7571
LNGDP	-2.1155

Note: Critical values at 5 per cent significance level for 50 and 100 observations are -3.50 and -3.45 respectively.

Seasonal unit root test results are furnished in Table 4.III.

As in the money demand analysis, steps were taken to ensure that time series properties of a series are only inferred after appropriate adjustments for serial correlation in the auxillary regressions as reflected in LM tests from the first to the fourth order. As can be discerned from these tables, the series concerned can all be regarded as I(1) and none of them suffers from acute seasonal unit root problems. This motivates our cointegration tests.

Table 4.III
Seasonal Unit Root Tests (The HEGY Procedure)

		't': Π_1	't': Π_2	't': Π_3	't': Π_4	'F': $\Pi_3 \cap \Pi_4$
LCBTDD	-	2.4703	-1.5180	-1.4696	-1.6102	2.3736
	I	-1.5629	-2.0790*	-1.9760*	-2.1096*	4.4353*
	I,SD	-0.5686	-5.1586*	-5.0591*	-6.7242*	59.2760*
	I,Tr	-2.5001	-2.3699*	-2.9521*	2.6417*	8.6252*
	I,SD,Tr	-2.3093	-5.2559*	-5.4994*	-6.3922*	61.9360*
LCBTSD	-	2.4572	-5.5081*	-3.4859*	-8.3831*	57.4905*
	I	-1.8309	-5.3608*	-3.5109*	-8.2130*	55.3622*
	I,SD	-1.7099	5.4540*	-3.0519	-8.1343*	49.4021*
	I,Tr	-1.7960	-5.4665*	-3.7930*	-7.8685*	55.8547*
	I,SD,Tr	-1.8618	-5.5606*	-3.3726	-7.7889*	49.8140*

		't': Π_1	't': Π_2	't': Π_3	't': Π_4	'F': $\Pi_3 \cap \Pi_4$
LBCTFD	-	3.1802	-5.8146*	-3.8847*	-7.1018*	46.0504*
	I	-1.3312	-5.6549*	-3.8635*	-7.0236*	44.8969*
	I,SD	-1.2841	-5.3998*	-3.7924*	-7.1617*	46.3415*
	I,Tr	-1.4291	-5.6883*	-3.9764*	-6.8836*	44.8691*
	I,SD,Tr	-1.4241	-5.4304*	-3.9098*	-7.0199*	46.3404*
LCBTD	-	2.1505	-2.4533*	-2.0095*	-3.1580*	7.5322*
	I	-1.9627	-2.3478*	-2.2037*	-3.0158*	7.5601*
	I,SD	-1.8727	-2.4799	-2.5217	-3.4435*	10.2088*
	I,Tr	-1.2314	-2.3660*	-2.1517*	-3.0009*	7.3800*
	I,SD,Tr	-1.6728	-3.3564*	-2.0872	-5.0634*	15.0051*
LNGDP	-	2.7466	-3.4576*	-2.7376*	-2.6901*	7.3810*
	I	-1.5487	-3.5056*	-2.7961*	-2.6920*	7.5496*
	I,SD	-1.4140	-5.3793*	-4.8699*	-4.7058*	32.2971*
	I,Tr	-2.1155	-3.4093*	-2.8556*	-2.5187*	7.2734*
	I,SD,Tr	-1.4859	-5.3920*	-4.9691*	-4.6341*	32.6642*

* Significant at the 5 per cent level.

Preliminary attempts to estimate long-run functions by using the Engle & Granger technique proved disappointing as the hypothesis of cointegration could not be established[12]. Subsequently we decided to use the Johansen's Maximum Likelihood Procedure instead on the assumption that there is trend in the series but not in the data generation process. However this approach has by no means been straightforward. Our selection of appropriate cointegrated vectors is based upon multi-faceted criteria of statistical satisfactions, theoretical plausibilities and valid adjustment coefficients of the cointegrated vectors selected as representing long run relationships. In the identification process, each possible function has been estimated with a varying lag length running from 2 to usually 8. We shall now discuss the empirical results for each type of deposits separately as follows:

[12]In the estimation process, all variables except interest rates have been log transformed.

a) Commercial Banks' Total Demand Deposits (CBTDD)

In the case of CBTDD, the null hypothesis that a cointegrating vector exists can be upheld based upon the maximal eigenvalue statistic (Table 4.IV) at the 5% significance level. Five lags and centered seasonal dummies are included in the estimation. There does not seem to be any serial correlation problem with this number of lags as attested to by the LM and F tests. The estimated long run relationship as implied by the cointegrating vector (plotted in Fig 4L) is as follows:

$$LCBTDD_t = 1.2597 LNGDP_t$$

Table 4.IV

The Johansen Procedure
CBTDD
VAR with 5 lags and seasonal dummies included
Sample Period: 1979Q1 - 1992Q4 (56 observations)

I EIGENVALUES: 0.23527 0.0008407

Test statistics for the number of cointegrating vectors

Ho:	$r = 0$	$r \leq 1$
Trace	15.0683	0.0471
	(17.9530)	(8.1760)
λ max	15.0212	0.0471
	(14.900)	(8.1760)

II ESTIMATED COINTEGRATING VECTORS

LCBTDD	-1.0000
LNGDP	1.2597

III ESTIMATED ADJUSTMENT MATRIX

LCBTDD	-0.1152
LNGDP	0.4131

IV TESTS FOR APPROPRIATE LAG LENGTH (5)

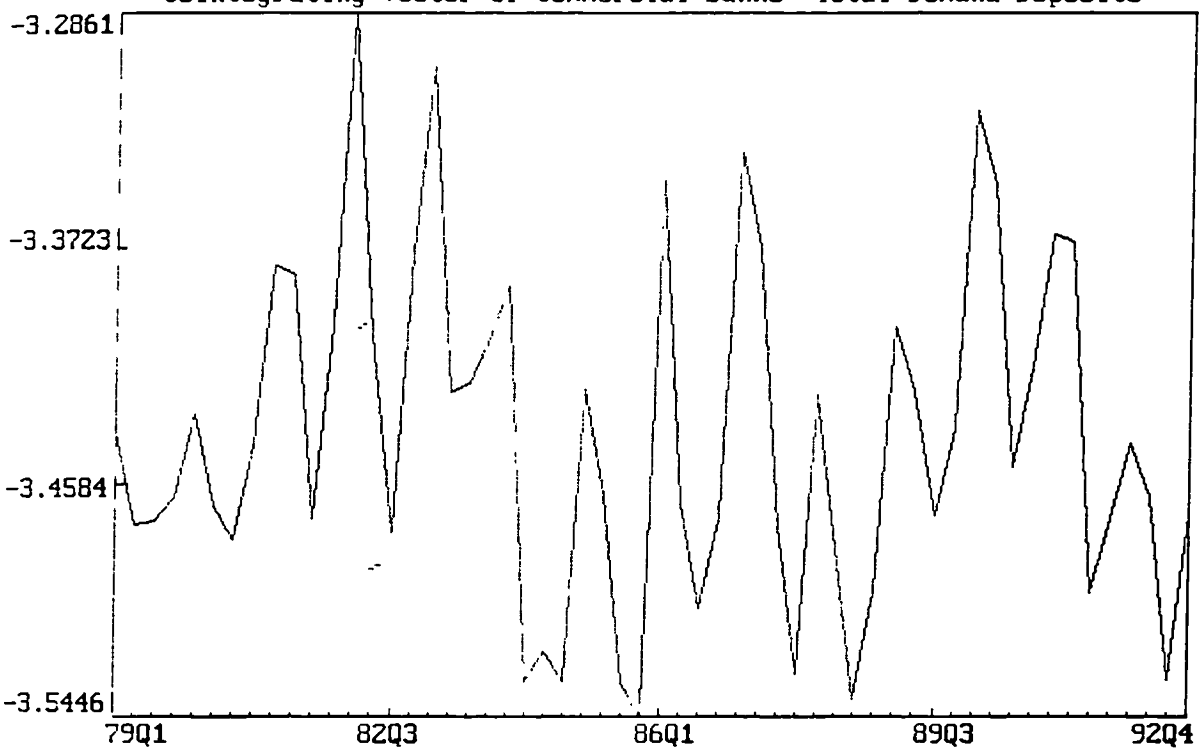
		ΔLCBTDD	ΔLNGDP
Serial Correlation:	χ^2 (4)	5.8347 [0.212]	7.8163 [0.099]
	F(4,39)	1.1340 [0.355]	1.5816 [0.198]
Normality (J-B):	χ^2(2)	5.1995 [0.074]	8.5444 [0.014]

Notes:

(I) Figures in normal parentheses ( ) below test statistics refer to 95% critical values.

(II) Figures in square parentheses [ ] refer to marginal significance levels.

Figure 4L
Cointegrating Vector of Commercial Banks' Total Demand Deposits



The estimated long run income elasticity of 1.26 is not unreasonable in view of the growing popularity of checking facilities. The interest rate variable (CBR3FD) which was originally being included as an argument in the function has been dropped owing to its insignificance and the interpretational difficulties it poses upon its inclusion on numerous occasions. This may however not be an unreasonable move as demand deposits are non interest bearing and agents are merely maintaining them as a payments instrument, the volume of which is largely determined by the level of economic activity.

In our quest for short-run elasticity estimates, the general-to-specific procedure has been followed with the initial number of parameters set at 14 comprising 4 lags of change in total demand deposits, current and 4 lags of change in nominal GDP, the cointegrating vector selected as the error correction term, three seasonal dummies plus a constant. In moving from the general to the specific, we have chosen two alternative courses, i.e. by incorporating the error correction term first with a lag of one and then with a lag of 5. The exercise based upon the 5th lag could yield a final equation satisfying the parsimonious criterion on the basis of adjusted R-squared of 0.62 and the standard error of regression of 0.023. This should be contrast with the initial specification that yields an adjusted R-squared of 0.59 and the regression standard error of 0.024 (Table 4.V). Details of the final estimates are given in Appendix 4.2 and the preferred set of estimates is as below:

$$\Delta LCBTDD_t = -0.92 + 0.51\Delta LNGDP_t + 0.35\Delta LNGDP_{t-1} +$$
$$0.18\Delta LNGDP_{t-2} + 0.25\Delta LNGDP_{t-3} - 0.27EC_{t-5} - 0.23\Delta LCBTDD_{t-2} + 0.06S1C$$

Table 4.V
General-to-Specific Reductions of Overly-Parameterized ADL

	CBTDD	CBTFD	CBTD
Initial Specification			
No of Parameters	14	9	9
Equation Standard Error	0.0244	0.0395	0.0172
$\bar{R}^2$	0.5866	0.3657	0.5055
Final Model			
No of Parameters	8	6	5
Equation Standard Error	0.0234	0.0393	0.0168
R^2	0.6176	0.3715	0.5277

Hence it can be deduced that demand deposits are not income elastic in the short run with an estimated magnitude of 0.51. Adjustments to long run equilibrium also appears to be sluggish with the coefficient of the error correction (EC) term estimated at 0.27.

b) Commercial Banks' Total Savings Deposits (CBTSD)

With respect to savings deposits (CBTSD), its estimated long run function is contained in Table 4.VI. The estimates are based upon 4 lags with seasonal dummies included. At the 95% significance level, the null hypothesis of one cointegrated vector is upheld by both test statistics. No serial correlation problem appears with this lag length. The cointegrated vector is plotted in Figure 4M and the long-run relationship that it implies is as follows:

$$lnCBTSD_t = 0.2347CBSDR_t - 0.3403FCSDR_t + 1.1902\,lnNGDP_t$$

Figure 4M
Cointegrating Vector of Commercial Banks' Total Savings Deposits

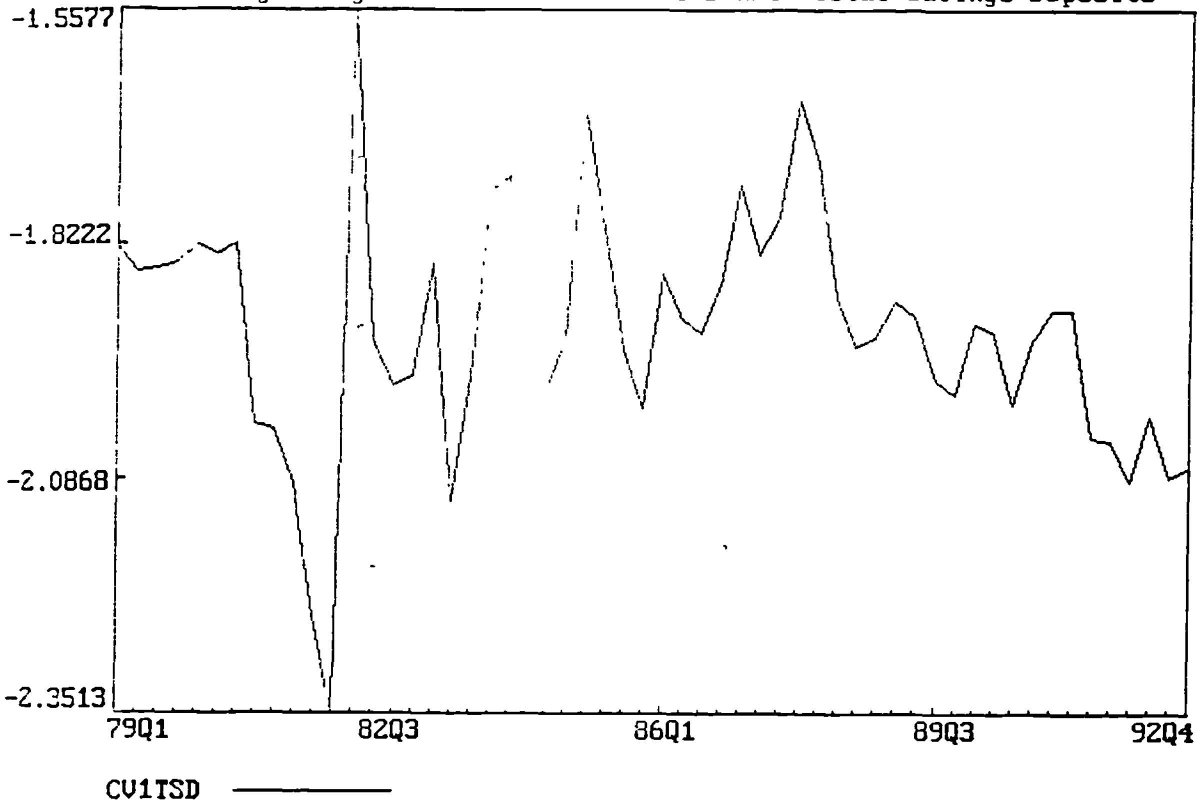


Table 4. VI

The Johansen Procedure

CBTSD

VAR with 4 lags and seasonal dummies included

Sample Period: 1979Q1 - 1992Q4 (56 observations)

I EIGENVALUES: 0.51844 0.25467 0.15911 0.030467

Test statistics for the number of cointegrating vectors

Ho:	r = 0	r ≤ 1	r ≤ 2	r ≤ 3
Trace	68.8178	27.8970	11.4371	1.7327
	(48.2800)	(31.5250)	(17.9530)	(8.1760)
λ max	40.9208	16.4599	9.7045	1.7327
	(27.1360)	(21.0740)	(14.9000)	(8.1760)

II ESTIMATED COINTEGRATING VECTOR

LCBTSD	-1.0000
CBSDR	0.2347
FCSDR	-0.3403
LNGDP	-1.1902

III ESTIMATED ADJUSTMENT MATRIX

LCBTSD	-0.0165
CBSDR	0.0855
FCSDR	2.7342
LNGDP	0.0951

IV RESTRICTED COINTEGRATING VECTOR

LCBTSD	-1.0000
CBSDR	0.6344
FCSDR	-0.6344
LNGDP	1.4926

LR Test of Restrictions: $\chi^2(1) = 10.4128$ [0.001]

V TESTS FOR APPROPRIATE LAG LENGTH (4)

	ΔLCBTSD	ΔCBSDR	ΔFCSDR	ΔLNGDP
Serial Correlation:				
$\chi^2(4)$	6.1551 [0.188]	8.5197 [0.074]	2.7521 [0.600]	3.6540 [0.455]
F(4,33)	1.0188 [0.412]	0.1741 [0.679]	0.4264 [0.788]	0.5759 [0.682]
Normality (J-B):				
$\chi^2(2)$	2.5966 [0.273]	5.3613 [0.069]	2.5173 [0.284]	41.7086 [0.000]

Notes:

(I) Figures in normal parentheses ( ) below test statistics refer to 95% critical values.

(II) Figures in square parentheses [ ] refer to marginal significance levels.

Both the CBR3FD and UKTB which were originally postulated for inclusion in the estimation have been ultimately excluded also owing to their insignificance and interpretational difficulties they posed in most instances. The long run income elasticity of savings deposit is estimated at around unity (1.19). These deposits also seem to be responsive in the long run though not considerably to their own rate of return (CBSDR) and the rate of return on savings deposits offered by finance companies (FCSDR) with estimated long run coefficients of 0.24 and -0.34 respectively. Attempts to impose a homogenous restriction on these semi interest rate elasticities however failed as it has been overwhelmingly rejected by the likelihood ratio test at 0.1%. The estimated cointegrating vector also seems to be appropriate as it enters the savings deposit function with an appropriate sign (-0.02).

The process of moving from the general to the specific however proved disappointing. A total of 20 arguments have been incorporated at the initial stage. They include 3 lags of change in LCBTSD, current and 3 lags of change in CBSDR, FCSDR and LNGDP, the error correction term , 3 centered seasonal dummies plus a constant. Two sequences of reduction have also been followed, one with the error correction term incorporated as the first lag and the other with it being incorporated as the fourth lag. However coefficients of both CBSDR and LNGDP persistently display a perversity in their direction. Hence we do not report the estimates of the short run CBTSD function.

c) Commercial Banks' Total Fixed Deposits (CBTFD)

Based upon the maximal eigenvalue statistics, the null hypothesis that one cointegrating vector exists can be found for CBTFD (Table 4.VII). These estimates involve 2 lags and a set of I(0) variables such as DIFF (CBR3FD-FCR3FD) and centered seasonal dummies. There is no indication that serial correlation problems exist with this number of lags. The cointegrating vector identified also departs from the originally postulated long run function with the exclusion of UKTB. Again its exclusion is due to its insignificance and the problem it posed in the estimation. Figure 4N plots the cointegrating vector and the implied long run relationship is as follows:

$$LCBTFD_t = 1.1311 LNGDP_t$$

Table 4.VII

The Johansen Procedure
CBTFD
VAR with 2 lags, DIFF, and seasonal dummies included
Sample Period: 1979Q3 - 1992Q4 (54 observations)

I EIGENVALUES: 0.25565 0.0042657

Test statistics for the number of cointegrating vectors

Ho:	r = 0	r ≤ 1
Trace	16.1743	0.2308
	(17.9530)	(8.1760)
λ max	15.9435	0.2308
	(14.900)	(8.1760)

II ESTIMATED COINTEGRATING VECTORS

LCBTFD	-1.0000
LNGDP	1.1311

III ESTIMATED ADJUSTMENT MATRIX

LCBTFD	-0.1221
LNGDP	0.0401

IV TESTS FOR APPROPRIATE LAG LENGTH (2)

		ΔLCBTFD	ΔLNGDP
Serial Correlation:	χ^2 (4)	2.4950 [0.646]	5.0459 [0.283]
	F(4,44)	0.5129 [0.727]	1.0893 [0.374]
Normality:	χ^2(2)	1.5521 [0.460]	10.9939 [0.004]

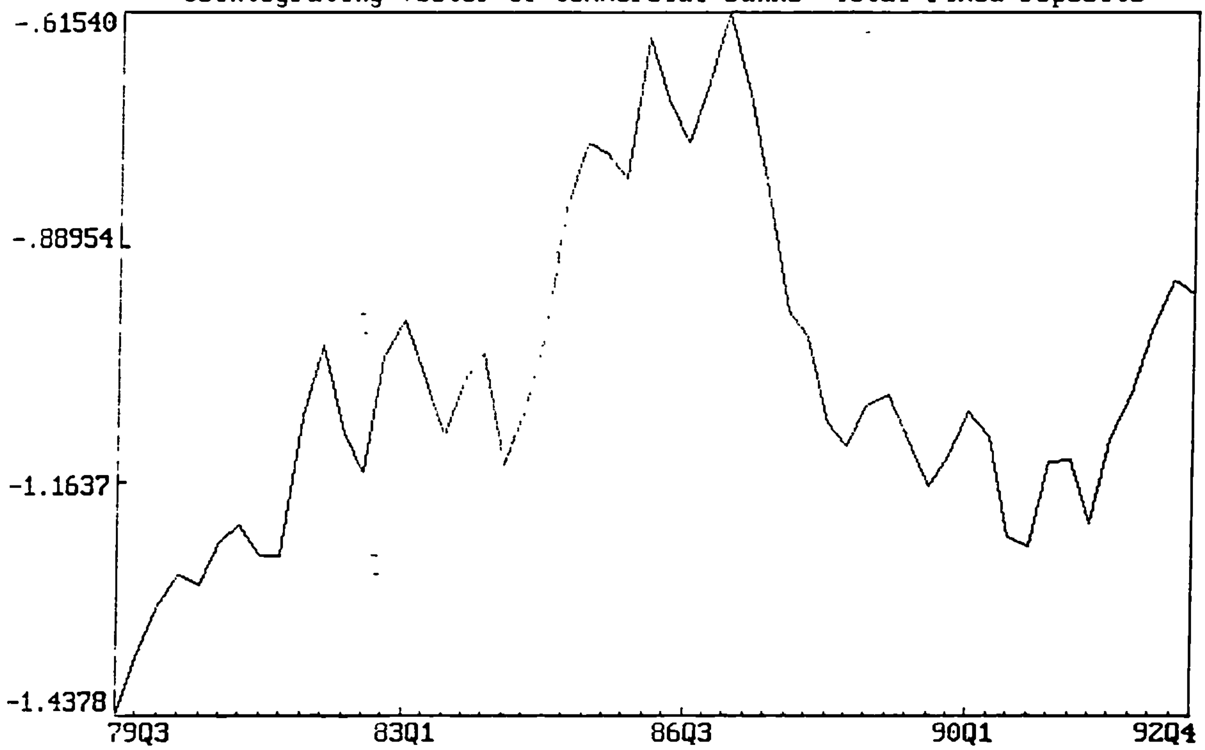
Notes:

(I) Figures in normal parentheses ( ) below test statistics refer to 95% critical values.

(II) Figures in square parentheses [ ] refer to marginal significance levels.

Figure 4N

Cointegrating Vector of Commercial Banks' Total Fixed Deposits



The long run income elasticity of fixed deposits is estimated at 1.13. Two alternative courses are also taken to model the short run function, one with the error correction term incorporated at a lag of 1 and the other at a lag of 2. However only the former alternative yields slightly more superior final estimates in terms of adjusted R-squared and standard error of regression compared with the most general representation (Tables 4.V). Initial specifications involve 9 variables namely one lag of change in LCBTFD, current and one lag of change in LNGDP, the error correction term, DIFF, 3 centered seasonal dummies and a constant. Nevertheless the final estimates are uninteresting without any contemporaneous influence of NGDP or DIFF on CBTFD (Appendix 4.3).

d) Commercial Banks' Total Deposits (CBTD)

The most encouraging results in our exercise and incidentally the results of our main concern relate to total deposits received by commercial banks (CBTD). Based upon the trace and maximal eigenvalue statistics, one cointegrating vector appears to exist between CBTD and NGDP (Table 4.VIII). The estimates are derived with 2 lags, DIFF and seasonal dummies included as I(0) variables. The hypothesis of no serial correlation problem in the estimates is also confirmed. UKTB as an originally postulated argument in the function also appears to fall out of favor in the process of estimating the long run relationship. Plot of the cointegrating vector is given in Figure 4O and the implied long run relationship is as follows:

$$LCBTD_t = 1.2520 LNGDP_t$$

Table 4.VIII

The Johansen Procedure
CBTD
VAR with 2 lags, DIFF, and seasonal dummies included
Sample Period: 1979Q3 - 1992Q4 (54 observations)

I EIGENVALUES: 0.35657 0.0035798

Test statistics for the number of cointegrating vectors

Ho:	$r_0 = 0$	$r \leq 1$
Trace	24.0049	0.1937
	(17.9530)	(8.1760)
λ max	23.8112	0.1937
	(14.9000)	(8.1760)

II ESTIMATED COINTEGRATING VECTORS

LCBTD	-1.0000
LNGDP	1.2520

III ESTIMATED ADJUSTMENT MATRIX

LCBTD	-0.1094
LNGDP	-0.0096

IV TESTS FOR APPROPRIATE LAG LENGTH (2)

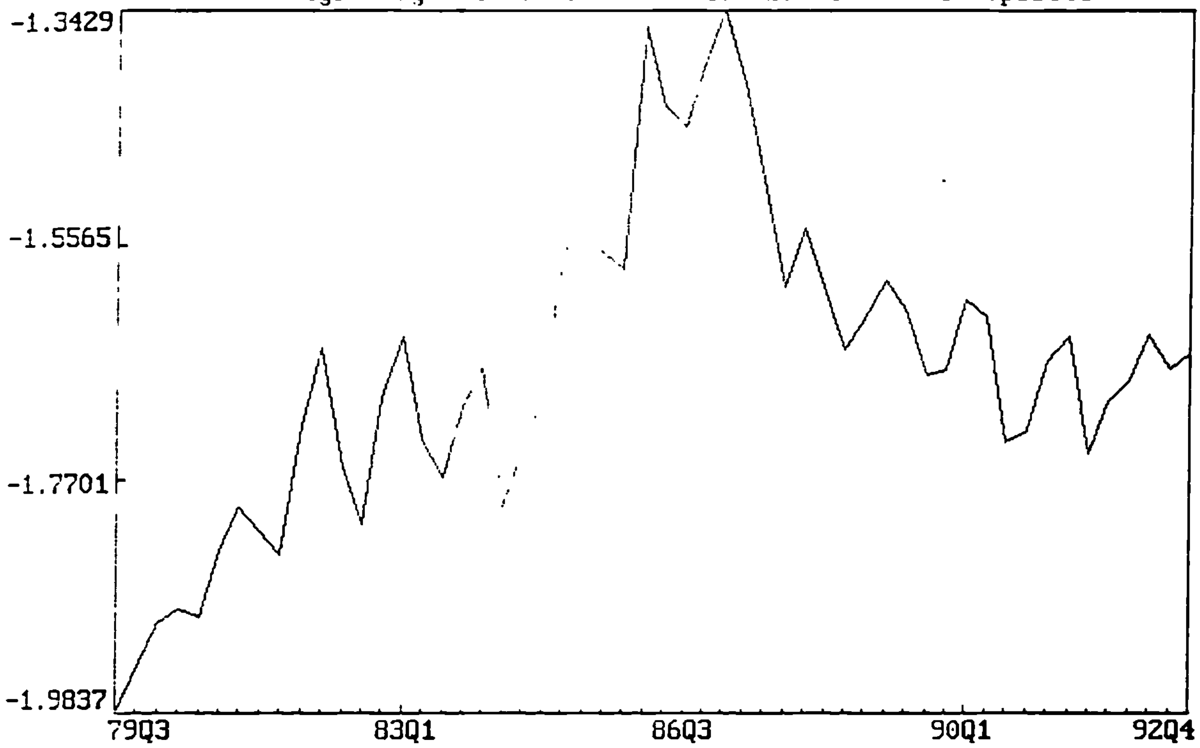
		ΔLCBTD	ΔLNGDP
Serial Correlation:	χ^2 (4)	4.4412 [0.350]	4.6497 [0.325]
	F(4,42)	0.9409 [0.450]	0.9893 [0.424]
Normality (J-B):	χ^2(2)	0.5370 [0.765]	15.7109 [0.000]

Notes:

(I) Figures in normal parentheses ( ) below test statistics refer to 95% critical values.

(II) Figures in square parentheses [ ] refer to marginal significance levels.

Figure 40
Cointegrating Vector of Commercial Banks' Total Deposits



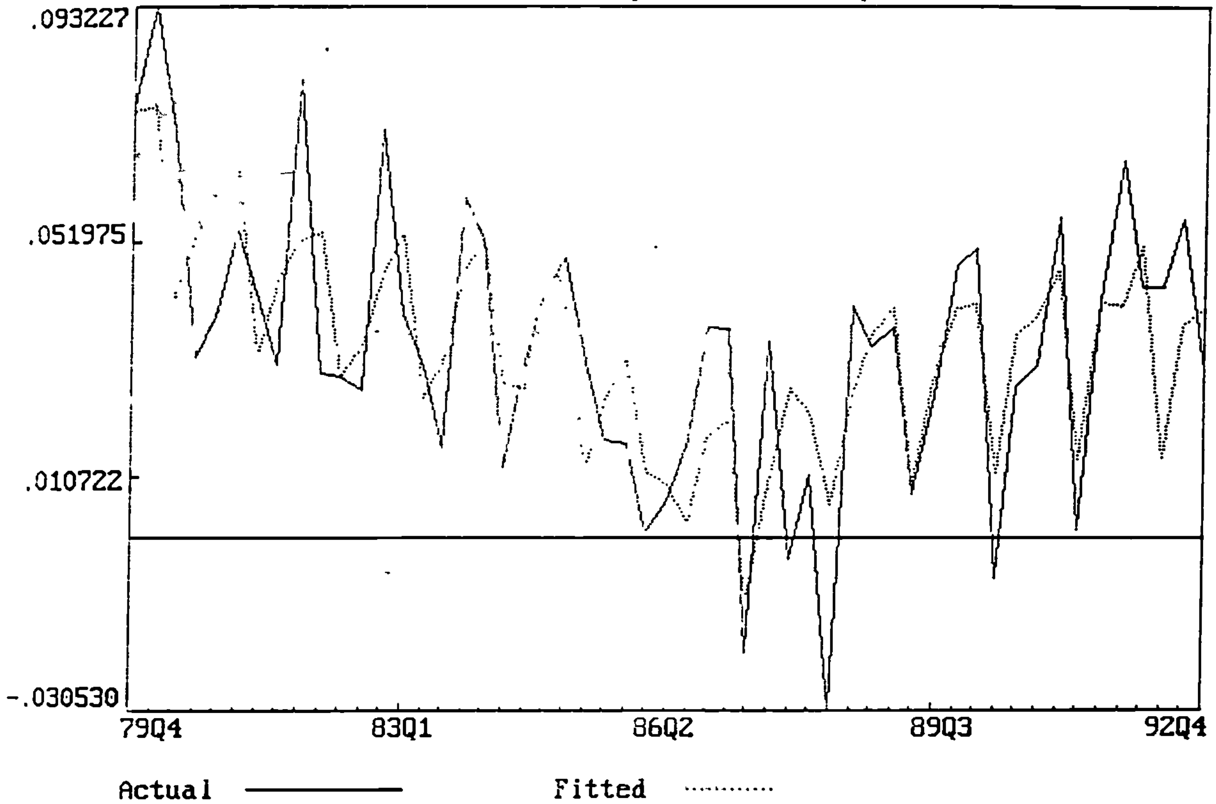
The long run income elasticity of 1.25 appears to be quite consistent with our earlier estimates of real M2 demand. Final estimates of the short run function be they based on the first lag or the second lag also seem to exhibit lower standard errors and higher explanatory powers as opposed to their initial specification though the one based upon the second lag has a higher adjusted R-squared and lower standard errors and hence is reported (Table 4.V). It appears to satisfy the basic statistical criteria such as non serially correlated errors, normality of residuals, and homoscedasticity (Appendix 4.4) and is concisely reported as below:

$$\Delta LCBTD_t = -0.13 + 0.12\Delta LNGDP_t - 0.09EC_{t-2} - 0.03S2 - 0.01S3$$

The above estimate suggests a short-run income elasticity of 0.12 and a slow rate of adjustment towards equilibrium. In terms of goodness of fit, they appear to fare reasonably well with an adjusted R-squared of 0.53 and with a reasonable ability to track the turning points of the actual data series (Figure 4P).

Hence based upon our analyses so far, there is an overwhelming evidence that deposits whatever the type is are not interest elastic at least in the short run and they only respond to income movements.

Figure 4P
Actual vs Fitted Values of Changes in Total Deposits with Comm.Banks



4.5 Lending Rate Adjustments

This section analyses the sensitivity of lending rates to changes in the loan demand and supply factors. Equilibrium credit rationing arising from asymmetric information problems (Stiglitz & Weiss, 1981 & 1983), may manifest itself in sluggish interest rate adjustments especially when banks are wary to do so in response to changes in the factors determining loan demand and supply in particular demand.

In empirical endeavors, the following disequilibrium framework of the loan market is usually adopted:

$$L_t^d = X_t'\alpha_1 + \alpha_2 R_t + u_{1t} \qquad (4.5.1)$$

$$L_t^s = Z_t'\beta_1 + \beta_2 R_t + u_{2t} \qquad (4.5.2)$$

$$L_t = \min(D_t, S_t) \qquad (4.5.3)$$

$$R_t = \mu R_{t-1} + (1-\mu)R_t^* \qquad (4.5.4)$$

Equation 4.5.1 represents the demand for commercial bank loans while their supply is represented by (4.5.2). Equation 4.5.3 is the "short-side" rule commonly introduced in the quantity rationing literature. It specifies that the actual quantity transacted is demand- or supply-determined depending on the minimum between the two. R refers to the actual transacted lending rate and owing to gradual adjustments, deviations from the equilirbrium rate (R*) are often expected. Factors other than the lending rate that determine the demand and supply of loans are contained within vectors X' and Z' respectively. Equation 4.5.4 characterises the adjustment mechanism of the lending rate under disequilibrium conditions. It is a direct adaptation from Bowden (1978) disequilibrium price adjustment mechanism. The Bowden partial adjustment scheme postulates that the price in each period adjusts towards the equilibrium level from the level prevailing in the preceding period.

A reduced form loan rate equation as follows may be derived by first solving for R* by equating 4.5.1 and 4.5.2 and then substituting R* into 4.5.4:

$$R_t = \mu R_{t-1} + \theta(X_t'\alpha_1 - Z_t\beta_1) + \theta(u_{1t} - u_{2t}) \qquad (4.5.5)$$

where $\theta = (1-\mu)/\beta_2 - \alpha_2$.

Equation 4.5.5 permits us in fact to ascertain whether the loan rate is in equilibrium or otherwise by evaluating the null hypothesis that $\mu=0$. If $\mu=0$, R^* and by implication the market has been in equilibrium.

However in our empirical endeavors, we shall adopt the error correction approach in place of (4.5.5) as a mere estimation of (4.5.5) may involve spurious regression problems as the data series may not exhibit a common order of integration. The following loan demand and supply functions are postulated:

$$L_t^d = f^d(CBALR_t, FCALR_t, LFINSA_t, EGR4_t)$$

where L^d = loan demand (in nominal terms)

CBALR = the lending rate imposed by commercial banks proxied by the average lending rate imposed by them

FCALR = the lending rate levied by finance companies proxied by the average lending rate imposed by them

LFINSA = financial savings defined as a summation of total deposits (inclusive of NCDs) with commercial banks, finance companies and merchant banks

EGR4 = anticipated economic growth rate proxied by the difference between the log of NGDP 4 periods ahead and the log of current NGDP and

$$f_1^d < 0,\ f_2^d < 0,\ f_3^d < 0 \text{ and } f_4^d > 0.$$

Demand for bank loans is expected to vary inversely with the rate imposed by commercial banks and directly with the rate imposed by finance companies. The rationale for incorporating the rate imposed by the latter is to recognise the possibility of competition posed by the latter against the former in the loans market. However this may be quite contentious as loans granted by commercial banks and finance companies are generally different in nature except perhaps in recent years. Total financial savings held by other economic agents may also have a negative influence on loan demand if the availability of financial savings alleviates the need to borrow from commercial banks. In fact, Moore and Threadgold (1985) suggests the inclusion of variables that capture the working capital needs of firms which are partially financed by short term bank borrowings. Finally the inclusion of anticipated economic growth rate (we shall be assuming perfect foresight) is to address the idea that agents borrow in anticipation of future prospect of the economy.

With respect to loans supply, the variables included are such that the portfolio management behavior of banks which is subject to resource, risk and institutional policy considerations is captured within the following general functional form:

$$L_t^s = f^s(CBALR_t, RA_t, R7D_t, RAO_t, RC_t, CO_t)$$

where L^s = loan supply (in nominal terms)

RA = rate of return on alternative assets proxied by the 3-month Malaysian Treasury Bill rate (R3TB) or what is preferable the excess liquidity ratio maintained by commercial banks (CBELR)

R7D = 7-day interbank rate which is to capture the cost of borrowing by banks to meet whatever resource shortfall that banks may encounter transiently

RAO = rate of return on foreign assets accessible to banks proxied by UK Treasury Bill rate (UKTB) or overdraft and other advances extended by banks abroad (LCBEOD)

RC = resource constraints proxied by log of total deposits received by commercial banks adjusted for statutory and minimum liquidity reserve requirements (LCBADEP) or capital and reserves of commercial banks as a proportion of their total assets/liabilities (CARTL) or the ratio of total loans less capital to demand deposits net of reserve requirements minus 1 (LIQ) (King's suggestion) or log of adjusted assets of commercial banks computed by total assets of commercial banks minus statutory reserves minus total loans and advances (LASSET) in conjunction with Melitz and Pardue (1973)

CO = current prospect of the economy proxied by current rate of economic growth (EGR1). This is also to represent collateral availability of borrowers assuming that the value of collateralisable assets vary directly with the macroeconomic performance and

$$f_1^s > 0,\ f_2^s < 0,\ f_3^s < 0,\ f_4^s < 0,\ f_5^s > 0 \text{ and } f_6^s > 0.$$

Notice that we have not included the deposit rate in the loans supply function because in our opinion, banks have the leverage to manipulate deposit rates in the light of our earlier findings that deposits are not interest elastic.

Taking both the demand and supply factors together into consideration would result in the following lending rate rate function to be estimated:

$$CBALR_t = f(FCALR_t, LFINSA_t, EGR4_t, RA_t, R7D_t, RAO_t, RC_t, CO_t)$$

where $f_1 > 0$, $f_2 < 0$, $f_3 > 0$, $f_4 > 0$, $f_5 > 0, f_6 > 0, f_7 < 0$ and $f_8 >$ or < 0.

In the estimation process, lagged stock of bank credit was also examined as a probable explanatory factor as adjustment costs may thwart full adjustments to the desired demand and supply levels. However its inclusion did not yield any interpretable set of results. The function is estimated generally over the period from 1979Q1 to 1991Q4. As usual the time series properties of the data have been first examined via conventional and seasonal unit root tests and the results of these tests are presented in Tables 4.IX (without a time trend), 4.X (with time trend for selected series) and 4.XI (for seasonal unit roots). While the presence of seasonal unit roots in the data can somehow be ruled out, LFINSA and LCBADEP are found to be I(2) variables. Hence in the subsequent empirical exercise, these variables are transformed into I(1) variables by log differencing. On the other hand, EGR4, R7D, EGR1 are found to be I(0) variables. Hence they have been included alongside centered seasonal dummies as I(0) variables in the process of estimating the long run lending rate function. The rest of the variables are indeed I(1).

Table 4.IX

Dickey-Fuller Tests (Without Time Trend)

	Levels	First Difference	Second Difference
CBALR	-1.7187	-3.9095	-9.2613
FCALR	-1.9800	-6.1980	-8.8764
LFINSA	-0.6965	-1.5645	-10.8167
EGR4	-4.5334	-6.0777	-5.0346
R3TB	-1.6756	-6.2678	-5.7915
CBELR	-2.1958	-4.9390	-7.1659
R7D	-3.6413	-7.9473	-7.8747
UKTB	-1.9297	-7.3783	-7.0601
LCBEOD	-0.3932	-6.9436	-10.8621
LCBADEP	-1.7054	-2.1972	-11.2268
CARTL	-1.1273	-7.6150	-9.5926
LIQ	-2.1397	-5.4300	-8.1655
LASSET	-0.4564	-7.8992	-6.9683
EGR1	-3.6150	-14.1402	-10.3863
LCBDLOA	-2.4856	-3.0110	-5.0529

Notes:

I) All variables are in natural logarithm except for interest rate, growth and ratio variables.

II)

CBALR	-	Average lending rate levied by commercial banks
FCALR	-	Average lending rate levied by finance companies
LFINSA	-	Financial Savings
EGR4	-	Anticipated economic growth rate
R3TB	-	3-month Malaysian Treasury Bill rate
CBELR	-	Excess liquidity ratio maintained by commercial banks
R7D	-	7-day inter-bank rate
UKTB	-	U.K. Treasury Bill rate
LCBEOD	-	Overdraft and other advances extended by commercial banks abroad
LCBADEP	-	Total deposits received by commercial banks adjusted for statutory and minimum liquidity reserve requirements
CARTL	-	Capital and reserves of commercial banks as a proportion of their total assets/liabilities
LIQ	-	Ratio of total loans less capital to demand deposits net of reserve requirements minus 1
LASSET	-	Adjusted assets of commercial banks computed by total assets of commercial banks minus statutory reserves minus total loans and advances
EGR1	-	Current economic growth rate
LCBDLOA	-	Total loans and advances granted by commercial banks domestically

III) Critical values at the 5 per cent significance level for 50 and 100 observations are -2.93 and -2.89 respectively.

Table 4.X
Dickey-Fuller Tests (with Time Trend)

	Levels
LFINSA	-3.2067
LCBEOD	-2.9547
LCBADEP	-1.6780
CARTL	-1.8148
LIQ	-1.5906
LASSET	-2.1234
LCBDLOA	-0.95154

Note: Critical values at the 5 per cent significance level for 50 and 100 observations are -3.50 and -3.45 respectively.

Table 4.XI

Seasonal Unit Root Tests (The HEGY Procedure)

		't': Π_1	't': Π_2	't': Π_3	't': Π_4	'F': $\Pi_3 \cap \Pi_4$
LFINSA	-	1.2175	-2.8434*	-2.3984*	-2.0847*	5.0467*
	I	-0.6965	-2.8225*	-2.3796*	-2.0624*	4.9544*
	I,SD	-1.2686	-4.8694*	-4.6572*	-4.5427*	35.9328*
	I,Tr	-3.2067	-2.5818*	-2.5520*	-1.4673	4.3247*
	I,SD,Tr	-3.0930	-2.8234	-3.3040	-2.1416*	7.7319*
CBELR	-	-1.3870	-4.4942*	-4.5397*	-4.9259*	23.0920*
	I	-1.9706	-4.3868*	-4.5938*	-4.9922*	23.6770*
	I,SD	-1.9865	-4.1995*	-4.4690*	-5.0739*	23.4931*
	I,Tr	-3.9503*	-4.3473*	-4.8430*	-5.3284*	26.6698*
	I,SD,Tr	-3.9166*	-4.1183*	-4.7413*	-5.4102*	26.5919*
LCBEOD	-	0.9954	-5.8023*	-3.3086*	-2.4608*	10.4111*
	I	-0.6321	-5.7436*	-3.3305*	-2.3571*	10.1589*
	I,SD	-0.6535	-5.4570*	-3.3966*	-2.3860*	10.7299*
	I,Tr	-2.9207	-6.0496*	-3.8893*	-2.1117*	11.9214*
	I,SD,Tr	-2.8681	-5.7811*	-4.0012*	-2.0454	12.5451*
LCBADEP	-	1.6518	-3.7546*	-2.1782*	-3.7224*	9.3252*
	I	-1.7054	-2.6556*	-2.7893*	-2.6582*	8.1991*
	I,SD	-1.6512	-3.7215*	-2.4804	-4.1130*	11.6301*
	I,Tr	-1.6780	-3.6431*	-2.3102*	-3.4768*	8.7527*
	I,SD,Tr	-1.6314	-3.6158*	-2.4990	-3.9077*	10.8543*
CARTL	-	0.2014	-6.4224*	-3.3873*	-5.9982*	23.7230*
	I	-0.9064	-6.3428*	-3.3979*	-5.8725*	23.0343*
	I,SD	-0.8760	-6.2800*	-3.4901*	-5.8914*	23.4323*
	I,Tr	-1.3414	-6.2492*	-3.3780*	-5.7049*	21.9498*
	I,SD,Tr	-1.2984	-6.1875*	-3.4679*	-5.7209*	22.3138*
LIQ	-	0.1048	-1.8884	-2.2342*	-2.2093*	5.5184*
	I	-2.6636	-2.8603*	-1.8048	-3.0556*	6.2949*
	I,SD	-2.3370	-4.2531*	-3.5529	-4.7635*	26.5845*
	I,Tr	-2.4573	-2.7946*	-1.7981	-2.9213*	5.8803*
	I,SD,Tr	-2.0137	-4.2582*	-3.5731*	-4.6587*	26.2696*
LASSET	-	4.6064*	-5.1585*	-3.3480*	-6.3124*	33.5578*
	I	-0.7644	-5.0478*	-3.3299*	-6.2486*	32.8582*
	I,SD	-0.6851	-4.3713*	-3.3114	-6.9684*	40.7938*
	I,Tr	-2.0171	-5.1453*	-3.6646*	-5.9977*	33.5890*
	I,SD,Tr	-2.0606	-4.4606*	-3.6954*	-6.6691*	41.8166*

		't': Π_1	't': Π_2	't': Π_3	't': Π_4	'F': $\Pi_3 \cap \Pi_4$
LCBDLOA	-	2.0503	-3.0045*	-1.4818	-4.9080*	14.0911*
	I	-2.4856	-3.0000*	-1.8500*	-4.7042*	14.0137*
	I,SD	-2.3869	-3.2256*	-1.7312	-5.4417*	18.2817*
	I,Tr	-0.8667	-2.9908*	-1.8100*	-4.6772*	13.7730*
	I,SD,Tr	-0.7905	-3.2122*	-1.6945	-5.4046*	17.9458*

* Significant at the 5% level

Similar to the earlier process involved in identifying the long run deposit functions, the process of identifying the long run lending rate function is onerous. For each possible reformulation, the number of lags used in the estimation is generally varied from 2 to the maximum possible which is usually 8. This is to find one or more cointegrating vectors which could satisfy the multi-faceted criteria. Tables 4.XII and 4.XIII present two sets of cointegration estimates deemed the best which we could identify so far.

Table 4.XII

The Johansen Procedure
CBALR
VAR with 2 lags, seasonal dummies and EGR4, EGR1 and R7D included
Sample period: 1979Q2 - 1991Q4 (51 observations)

I EIGENVALUES: 0.76224 0.39740 0.34470 0.21498 0.088001 -0.0000

Test statistics for the number of cointegrating vectors

Ho:	r = 0	r ≤ 1	r ≤ 2	r ≤ 3	r ≤ 4
Trace	137.6918	64.4301	38.5981	17.0423	4.6979
	(76.0690)	(53.1160)	(34.9100)	(19.9640)	(9.2430)
λ max	73.2617	25.8320	21.5558	12.3444	4.6979
	(34.4000)	(28.1380)	(22.0020)	(15.6720)	(9.2430)

II ESTIMATED COINTEGRATING VECTORS

CBALR	-1.0000	-1.0000	-1.0000
PDFINSA	-0.0042	1.2921	-3.0859
CBELR	0.3304	0.4959	0.2791
UKTB	0.1334	-1.0277	-0.1192
PDADEP	-0.0971	-1.0237	2.4157
Intercept	1.3699	19.8519	10.7972

III ESTIMATED ADJUSTMENT MATRIX

CBALR	-0.1172	-0.0184	0.0098
PDFINSA	0.2484	-0.2954	-0.0024
CBELR	0.2796	0.0273	0.0637
UKTB	0.1968	-0.1955	-0.0251
PDADEP	0.2883	-0.4457	0.2152

IV TESTS FOR APPROPRIATE LAG LENGTH (2)

	ΔCBALR	ΔPDFINSA	ΔCBELR	ΔUKTB	ΔPDADEP
Serial correlation:					
χ^2 (4)	5.6853 [0.224]	7.3264 [0.120]	3.1108 [0.539]	3.7920 [0.435]	8.6495 [0.070]
F(4,30)	0.9409 [0.454]	1.2581 [0.308]	0.4872 [0.745]	0.6024 [0.664]	1.5318 [0.218]
Normality:					
χ^2 (2)	23.3832 [0.000]	3.6562 [0.161]	0.2772 [0.871]	4.6768 [0.096]	29.6635 [0.000]

Notes: I) Figures in normal parentheses ( ) below test statistics refer to 95% critical values

II) Figures in square parentheses [ ] refer to marginal significance levels.

Table 4.XIII

The Johansen Procedure

CBALR

VAR with 2 lags, seasonal dummies and EGR4, EGR1 and R7D included

Sample period: 1979Q2 - 1991Q4 (51 observations)

I EIGENVALUES: 0.75587 0.39862 0.35158 0.23341 0.037938 0.0000

Test statistics for the number of cointegrating vectors

Ho:	r = 0	r ≤ 1	r ≤ 2	r ≤ 3	r ≤ 4
Trace	135.4697	63.5571	37.6221	15.5284	1.9725
	(76.0690)	(53.1160)	(34.9100)	(19.9640)	(9.2430)
λ max	71.9126	25.9350	22.0938	13.5558	1.9725
	(34.4000)	(28.1380)	(22.0020)	(15.6720)	(9.2430)

II ESTIMATED COINTEGRATING VECTORS

CBALR	-1.0000	-1.0000	-1.0000
PDFINSA	-0 1350	-1.2505	0.5668
CBELR	0.3063	-0.6531	0.8434
UKTB	0.1412	-0.9569	-0.7409
CARTL	-0.0344	-2.7127	1.1420
Intercept	1.5132	40.9548	7.4971

III ESTIMATED ADJUSTMENT MATRIX

CBALR	-0.1147	-0.0272	-0.0076
PDFINSA	0.2565	-0.3647	-0.1438
CBELR	0.2770	-0.1606	0.1098
UKTB	0.2016	-0.0298	-0.1891
CARTL	0.0129	-0.0466	0.0327

IV TESTS FOR APPROPRIATE LAG LENGTH (2)

	ΔCBALR	ΔPDFINSA	ΔCBELR	ΔUKTB	ΔCARTL
Serial correlation:					
χ^2 (4)	6.0484 [0.196]	7.5127 [0.111]	3.9134 [0.418]	9.6624[0.047]	10.6215 [0.031]
F(4,27)	0.9732 [0.438]	1.2525 [0.313]	0.5992 [0.666]	1.7012 [0.179]	1.9181 [0.136]
Normality:					
χ^2 (2)	5.0648 [0.079]	0.2434 [0.885]	0.1122 [0.945]	3.2455 [0.197]	13.9519 [0.001]

Notes: I) Figures in normal parentheses ( ) below test statistics refer to 95% critical values

II) Figures in square parentheses [ ] refer to marginal significance levels.

They have been estimated based upon the assumption that neither is there a trend in the DGP nor the series itself and with provisions for 2 lags and seasonal dummies. Tests for autocorrelation reveal that it is not an inappropriate lag length. The first involves the use of growth of adjusted deposits (PDADEP) as a resource constraint variable while the latter has capital and reserves of commercial banks as a percentage of their total liabilities/assets (CARTL) incorporated instead. For both sets of estimates, test statistics reveal that 1 or 3 cointegrating relationships possibly exist amongst the variables concerned. Of the 3 possible cointegrating vectors in each set, only the first appears to project a long run lending rate function which is consistent with our theoretical priors. Furthermore it enters the lending rate equation with a correct sign, i.e. negative. Plots of the cointegrating vectors are given in Figures 4Q and 4R and the long run relationships implied by them are as follows:

$$CBALR_t = 1.37 - 0.004PDFINSA_t + 0.330CBELR_t + 0.133UKTB_t - 0.097PDADEP_t$$

$$CBALR_t = 1.513 - 0.135PDFINSA_t + 0.306CBELR_t + 0.141UKTB_t - 0.034CARTL_t$$

In modelling the short run functions, two alternative courses have also been followed. One that involves placing the error correction term as the first lag while the other involves placing it at the second lag. The best estimates are based upon the second cointegrating vector reported above and their full details are presented as equations (a) and (b) in Appendix 4.5 and reproduced concisely below:

$$\Delta CBALR_t = -0.08 + 0.08\Delta CBELR_t + 0.05\Delta UKTB_t + 0.15R7D_t + 0.11\Delta CBELR_{t-1} - 0.13EC_{t-2} + 0.63DUM_t$$

$$\Delta CBALR_t = 0.08\Delta CBELR_t + 0.04\Delta UKTB_t + 0.15R7D_t + 0.11\Delta CBELR_{t-1} - 0.14EC_{t-2} + 0.63DUM_t$$

Figure 4Q
Cointegrating Vector of CBALR based upon PDADEP

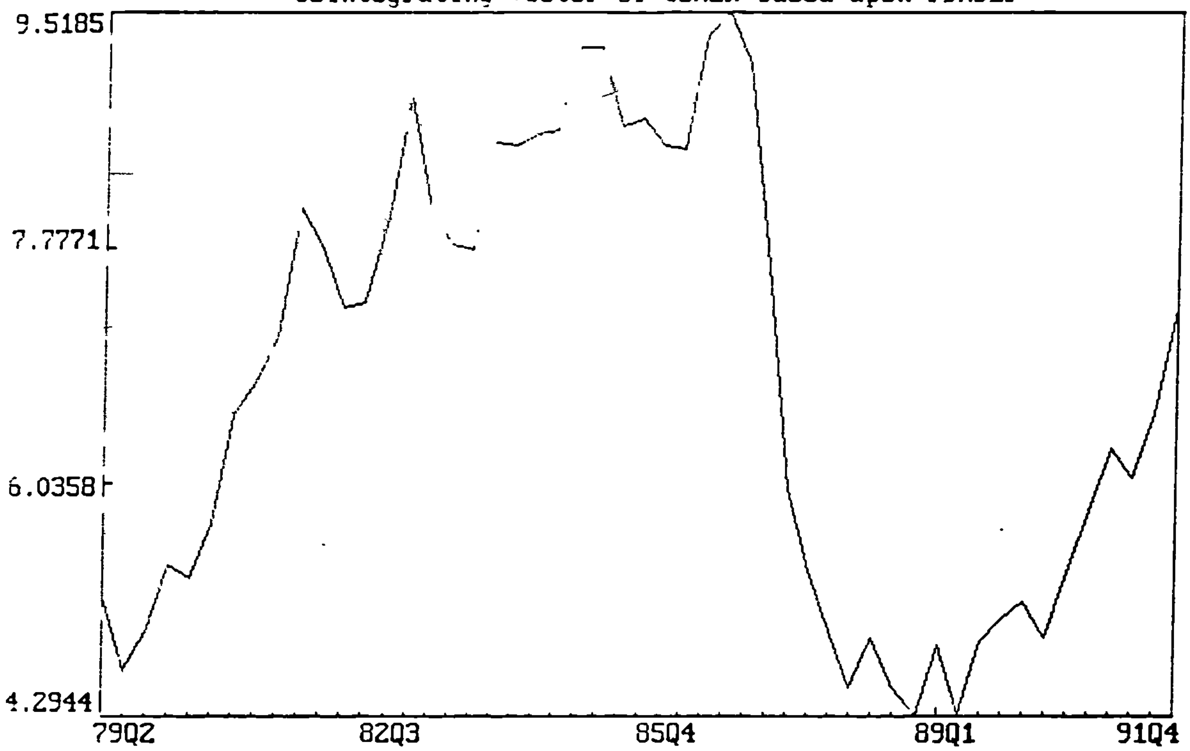
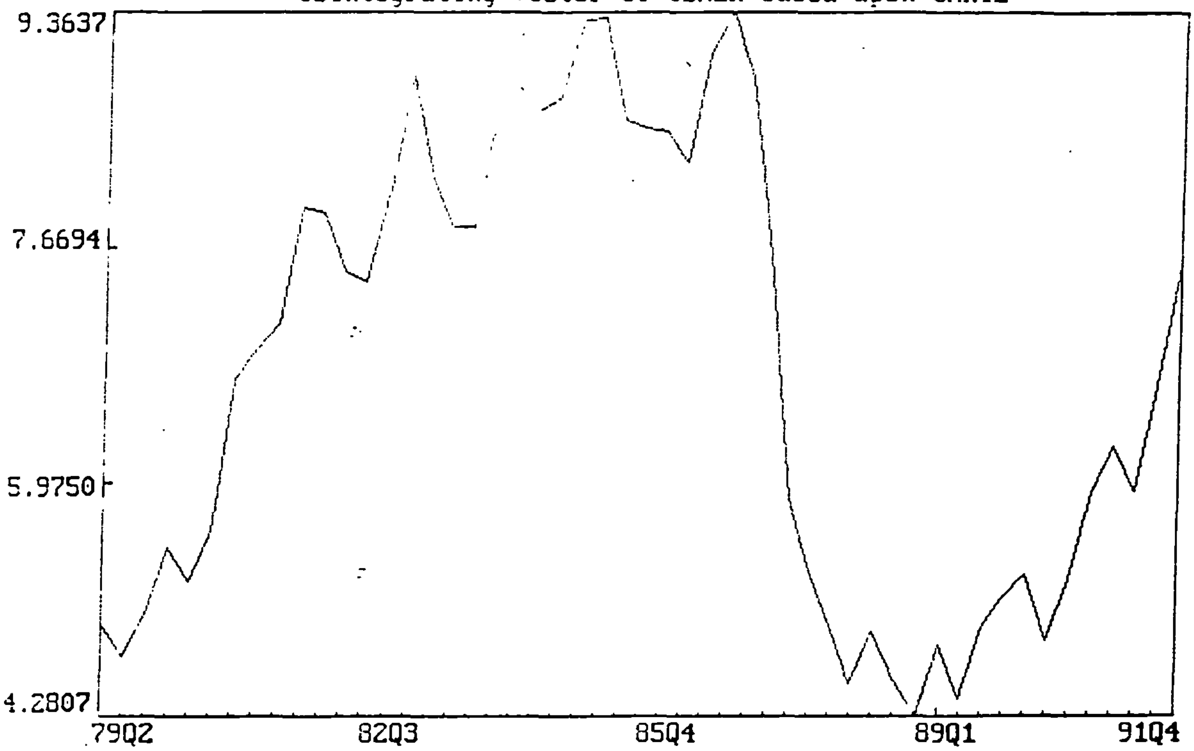


Figure 4R
Cointegrating Vector of CBALR based upon CARTL



It is on the bases of these equations that we shall make our inferences. The first equation is derived from an initial specification involving 17 variables comprising 1 lag of change in CBALR, current and 1 lag of change in the growth of financial savings (DPDFINSA), in the CBELR, in the UKTB, and in the CARTL and current and anticipated economic growth rates (EGR1 and EGR4), 7-day interbank rate (R7D), seasonal dummies, DUM (a dummy variable for outliers spotted in 1980Q4 and 1981Q3) and the error correction (EC) term lagged 2. On the other hand, the initial specification of the second equation involves merely an addition of an intercept to these variables. These estimates seem to satisfy all the statistical criteria of non serially correlated and normally distributed errors and homoscedasticity. The explanatory power of these estimates appears to be good in the region of 80% despite the fact that the equation is couched in terms of change. Furthermore they appear to track turning points in the historical series reasonably well (Figures 4S and 4T).

The estimates suggest that in the short run, the lending rate is sensitive though nominal in magnitude to changes in the rate of return on other assets available domestically to the banks (the coefficient being approximately 0.08) as indicated by the coefficient of change in the CBELR and to overseas rate of interest (with a coefficient approximately 0.04) as projected by the coefficient of UKTB. The lending rate also appears to be responsive to the interbank rate with the coefficient estimated at approximately 0.15 as given by the coefficient of R7D. However despite the statistical significance of these variables, their magnitudes of influence on the lending rate are rather small which may suggest that banks do maintain caution in revising their lending rates despite pressure from the supply-side factors for fear of inducing adverse selection and adverse incentive problems. Considerable

Figure 4S
Actual vs Fitted Values of Changes in CBALR based on (a) of App.4.5

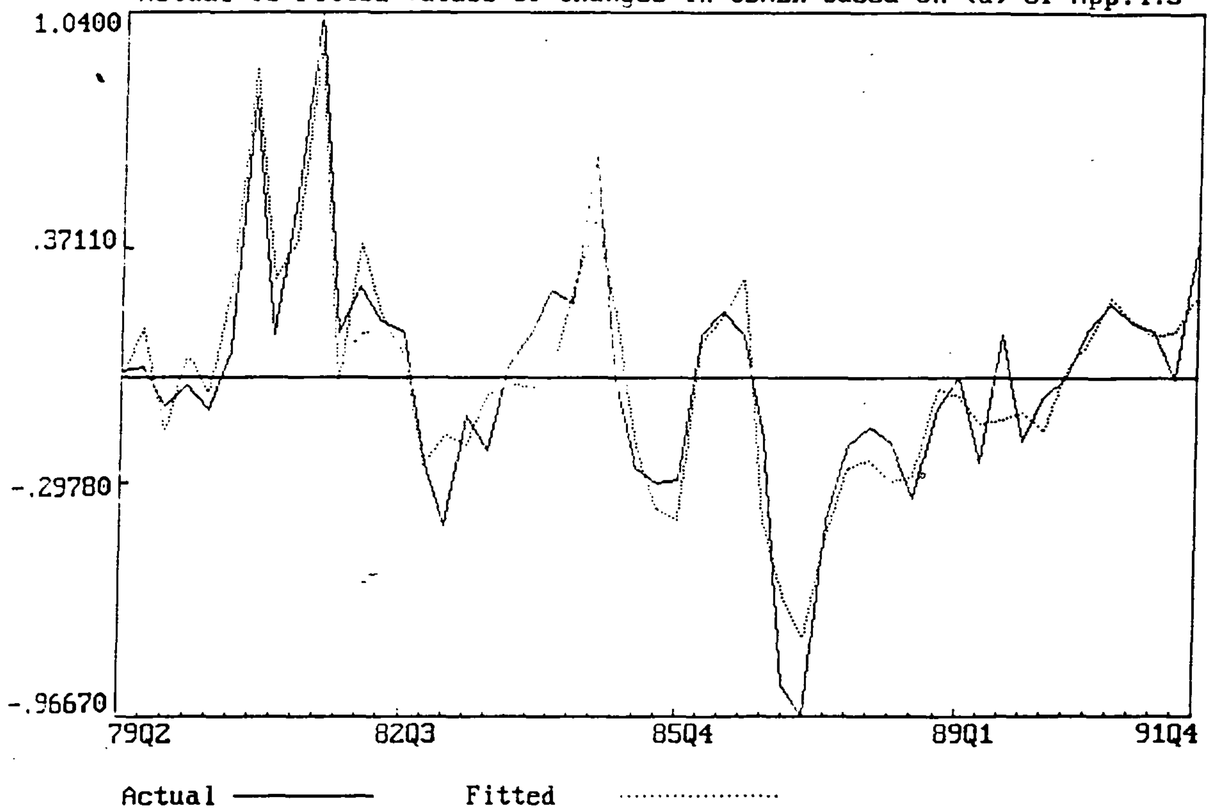
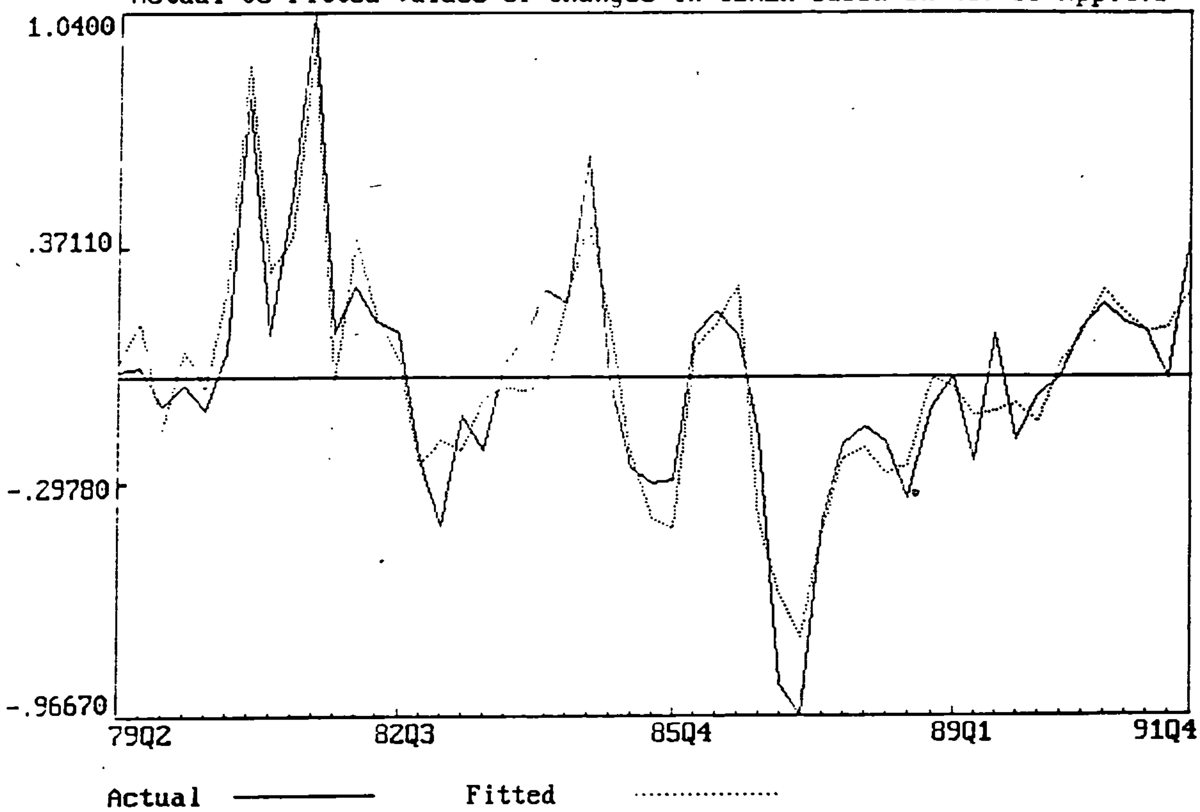


Figure 4T
Actual vs Fitted Values of Changes in CBALR based on (b) of App.4.5



inertia in the adjustment of the lending rate to disequilibrium is also reflected by the small coefficient of the error correction term of between 0.13 and 0.14 in magnitude. Furthermore there is no evidence of loan demand side factors influencing the lending rate contemporaneously as suggested by these estimates. This implies that at least in the short run, lending rates albeit nominally are supply-determined rather than demand-determined.

Hence financial liberalisation (in so far as the Malaysian financial system can be considered as liberalised), by maintaining an open financial system and facilitating access to overseas financial instruments need not lead to a correspondingly higher domestic lending rate as domestic lending rate does not appear to be significantly sensitive to overseas interest rate movements. It is known that equilibrium credit rationing implies that the lending rate should not be responsive to loan demand and supply factors. Incidentally this has somehow been portrayed by our empirical analysis as it seems to suggest that the loan rate appears to respond only neglibly to loan supply factors while not a single loan demand factor appears to have influenced it. Hence one may conclude that equilibrium credit rationing could prevail in the Malaysian financial system. However since deposits are interest inelastic, the magnitude of excess demand may be relatively limited other things being equal. Current and anticipated economic growth have no influence on the lending rate as we might not have thought a priori.

4.6 VAR Analysis

4.6.1 A Multivariate Analysis

The section though representing another attempt to examine the sensitivity of the lending rate (CBALR) to the interbank rate proxied by the 7-day rate (R7DM) and then the sensitivity of loans extended to these rates also incidentally enables us to analyse some sort of a channel of monetary policy transmission mechanism from the inter bank money market to economic activity. A four-variable VAR system comprising R7DM, CBALR, LLOANS (log of commercial bank loans) and LNGDP is estimated

Monthly data generally spanning from April 1987 to December 1992 have been utilised for this purpose. Preliminary test results for determining the optimal lag length to estimate the system are presented in Table 4.XIV.

Table 4.XIV

Ljung-Box and Likelihood Ratio Statistics of the VAR system: R7DM, CBALR, LLOANS and LNGDP

Period (lags) / Eqn	1987:7 - 1992:12 (9)	1987:4 - 1992:12 (6)	1987:4 - 1992:12 (3)
R7DM	Q(24) = 19.5618 [0.7214]	Q(24) = 23.2074 [0.5076]	Q(24) = 29.6728 [0.1958]
CBALR	Q(24) = 21.6881 [0.5978]	Q(24) = 24.5436 [0.4309]	Q(24) = 21.9652 [0.5814]
LLOANS	Q(24) = 15.8253 [0.8943]	Q(24) = 14.8266 [0.9257]	Q(24) = 12.1177 [0.9786]
LNGDP	Q(24) = 10.2485 [0.9934]	Q(24) = 25.2388 [0.3929]	Q(24) = 56.0703 [0.0002]

Likelihood Ratio Statistics

3 vs 6 lags:	$\chi^2(48)$	=	53.4790 [0.2720]
6 vs 9 lags:	$\chi^2(48)$	=	51.9052 [0.3242]

Notes:

I) Figures in parentheses below test statistics refer to the marginal significance level
II) Q is the Ljung-Box test statistic for serial correlation with 24 degrees of freedom

Overall the table shows that the use of 6 lags is optimal as the use of 3 would involve serial correlation problems in the nominal GDP equation as indicated by the Q statistic though the likelihood ratio statistic (χ^2) reveals that 3 may be favored against 6. The use of 6 lags against 9 is supported by the χ^2 statistic of 51.91.

An attempt is then made to evaluate the following hypotheses uing the multivariate generalisation of Granger causality test:

H R7DM and CBALR do not Granger cause LLOANS and LNGDP

H2: R7DM does not Granger cause CBALR, LLOANS and LNGDP

Table 4.XV provides the results of these tests. The results show that these two hypotheses can be rejected at the 5% significance level. Hence there exists a causal relationship running generally from R7DM and CBALR to LLOANS and LNGDP[13].

[13]However in our subsequent analysis of variance decomposition and impulse response functions, it is found that the effect of R7DM on CBALR and other variables are weak thus also suggesting the presence of equilibrium credit rationing. Furthermore it is difficult to conclude on the basis of the results of the test of H2 that R7DM does Granger cause CBALR since the latter is not the sole but one of three target variables.

Table 4XV

Multivariate Generalization of Granger Causality Tests
Var System: R7DM, CBALR, LLOANS, LNGDP

H1	-	χ^2 (24)	=	42.6971 [0.0108]
H2	-	χ^2 (18)	=	31.94093 [0.0223]

Note: Figures in parentheses below test statistics refer to the marginal significance level.

The exogeneity of interest rate variables namely R7DM and CBALR in LLOANS and LNGDP equations may be established by conducting the F-tests for exogeneity in individual equations (Table 4.XVI).

Table 4.XVI

Individual Equation F-tests
VAR System: R7DM, CBALR, LLOANS and LNGDP

Target/ Causal	R7DM	CBALR	LLOANS	LNGDP
R7DM	4.9967 [0.0006]	1.9044 [0.1014]	2.1506 [0.0663]	1.8903 [0.1039]
CBALR	1.5344 [0.1895]	35.3894 [0.0000]	3.1249 [0.0123]	1.8004 [0.1211]
LLOANS	1.0399 [0.4128]	0.3919 [0.8802]	183.2752 [0.0000]	2.90976 [0.0178]
LNGDP	0.4324 [0.8533]	0.28867 [0.9392]	1.9347 [0.0963]	1.4740 [0.2093]

Note: Figures in parentheses refer to the marginal significance level.

The following interesting inferences can be drawn from the table:

1) LNGDP, LLOANS and CBALR do not Granger cause R7DM. Thus there is no feedback influence from the real sector to the interbank money market;
2) R7DM, LLOANS and LNGDP do not Granger cause CBALR. This is somewhat consistent with the view of equilibrium credit rationing that banks do not indiscriminately revise their lending rates as it may adversely affect the mix of borrowers;
3) R7DM and LNGDP do not Granger cause LLOANS though CBALR does;
4) While R7DM and CBALR do not Granger cause LNGDP, LLOANS does. This underscores the significance of the volume of loans (liquidity) instead of interest rates in determining economic activity, a traditional controversy surrounding the monetary economics literature.

Based upon estimated moving average representations, a variance decomposition analysis of each variable in the system is conducted and the results are presented in Table 4.XVII. Variance of the inter-bank rate (R7DM) is accounted predominantly by innovations in the rate itself as shocks in the rate explains about 96.54% and 93.54% of its own variance at the 2- and 3-month horizons respectively. The linkage between the inter-bank rate and the lending rate (CBALR) appears to be weak as innovations in R7DM only explain about 5% of the variation in the CBALR over a 2-month horizon, with 95% being accounted by own innovations.

Table 4.XVII

Variance Decomposition of Variables
VAR System: R7DM, CBALR, LLOANS, LNGDP

Variables Explained	Forecast Horizons (Months Ahead)	Due to Innovations in			
		R7DM	CBALR	LLOANS	LNGDP
R7DM	1	100.00	-	-	-
	2	96.54	2.09	1.32	0.05
	3	93.54	4.11	1.22	1.13
	6	87.06	6.77	1.74	4.43
	9	83.70	9.07	2.33	4.9
	12	79.76	12.03	3.19	5.02
	24	68.44	20.53	4.04	6.99
CBALR	1	5 97	94.03	-	-
	2	4.62	95.1	0.03	0.25
	3	10.96	88.18	0.13	0.73
	6	8.45	86.4	2.81	2.34
	9	7.40	86.93	3.41	2.26
	12	6.58	85.56	5.69	2.17
	24	7.01	73.00	14.2	5.79
LLOANS	1	0.00	4.38	95.62	-
	2	7.38	2.26	89.1	1.26
	3	12.57	1.40	85.26	0.77
	6	20.49	1.35	72.21	5.95
	9	24.99	3.52	53.83	17.66
	12	22.61	8.35	46.92	22.12
	24	18.71	28.96	29.82	22.51
LNGDP	1	0.00	0.70	4.21	95.09
	2	7.86	1.28	5.97	84.89
	3	10.06	1.24	7.68	81.02
	6	9.97	2.53	10.86	76.64
	9	10.06	8.43	10.56	70.95
	12	10.04	10.72	11.69	67.55
	24	11.41	16.41	11.90	60.28

There also seems to be a limited impact of the lending rate on loans extended as shocks in the lending rate merely account for 4.4% of the variance in loans extended at a 1-month horizon. In fact both these findings of a limited influence of the inter-bank rate on the lending rate and then the lending rate on loans granted may constitute an additional evidence that equilibrium credit rationing is being practised. Finally the table has also shed us some light on the relative significance of lending rates and bank loans in the determination of economic activity. Bank loans as opposed to the lending rate seem to be a more significant determinant of economic activity. For instance at a 6-month horizon, innovations in bank loans explain about 10.9% of the variation in NGDP while innovations in the lending rate merely explain 2.53%.

4.6.2 A Bivariate Analysis

In order to determine the direction and magnitude of the relationship between bank credit and economic activity, we have pursued a bivariate VAR analysis between the two variables in real terms. We have however also attempted to ascertain whether movements in a broader credit aggregate (defined to include loans granted by commercial banks, finance companies, and merchant banks), money supply namely M1 and M2 and the lending rate levied by commercial banks have a stronger bearing on economic activity than commercial bank credit[14]. The analyses are pursued for the period generally between 1980 and 1992.

With respect to the relationship between real commercial bank loans (LRCBLO) and real gross domestic product (LRGDP), Table 4.XVIII suggests that the use of 12 lags is appropriate in estimating the VAR system.

[14]Both the M1 and M2 series mobilised in this exercise differ from those of our earlier study on money demand as the series here include parts of M1 and M2 held by statutory authorities and other government agencies.

Table 4.XVIII

Ljung-Box and Likelihood Ratio Statistics
VAR System; LRCBLO and LRGDP

Period (lags) / Eqn	1980:1 - 1992:12 (9)	1980:1 - 1992:12 (12)	1980:4 - 1992:12 (15)
LRCBLO	Q(36) = 19.9847 [0 9858]	Q(36) = 17.1647 [0.9967]	Q(36) = 14.3588 [0.9995]
LRGDP	Q(36) = 147.977 [0.0000]	Q(36) = 41.8009 [0.2334]	Q(36) = 33.9892 [0.5645]

Likelihood Ratio Statistics

9 vs 12 lags: χ^2 (12) = 73.0935
[0.0000]

12 vs 15 lags: χ^2 (12) = 15.1273
[0.2346]

Notes:
I) Figures in parentheses below test statistics refer to the marginal significance level
II) Q is the Ljung-Box test statistic for serial correlation with 36 degrees of freedom.

It is interesting to note that the causal relationship between these two variables is only unidirectional, running from bank loans to economic activity as can be discerned from Table 4.XIX.

Table 4.XIX

Individual Equation F-tests
VAR System: LRCBLO and LRGDP

Target / Causal	LRCBLO	LRGDP
LRCBLO	1607.7883 [0.0000]	1.9564 [0.0333]
LRGDP	1.6210 [0.0931]	24.4948 [0.0000]

Note: Figures in parentheses below test statistics refer to the marginal significance level.

The table shows that while the hypothesis that LRGDP does not Granger cause LRCBLO can be accepted at the 5% significance level, the hypothesis that LRCBLO does not Granger cause LRGDP can be rejected at the same significance level. Based upon variance decomposition, innovations in LRCBLO do have a tangible effect on LRGDP with the innovations explaining 7.57% of the one-step ahead forecast error variance of LRGDP and about 19.9% in respect of a 24-step ahead (Table 4.XX).

Table 4.XX

Variance Decomposition of Variables
VAR System: LRCBLO and LRGDP

Variables Explained	Forecast Horizons (Months Ahead)	Due to Innovations in	
		LRCBLO	LRGDP
LRCBLO	1	100.00	0.000
	2	99.87	0.13
	3	99.92	0.08
	6	99.52	0.48
	9	99.32	0.68
	12	99.44	0.56
	24	90.63	9.37
LRGDP	1	7.57	92.43
	2	8.11	91.89
	3	8.11	91.89
	6	12.08	87.92
	9	18.11	81.89
	12	19.87	80.13
	24	19.90	80.10

The impulse response functions of all the variables in this bivariate VAR system with respect to a one-standard deviation shock in LRCBLO are presented in Table 4.XXI. An impulse response function indicates the timing and direction of movements of a variable over a time horizon following a given shock. Thus the function merely traces out the typical response of a variable to a given shock.

Table 4.XXI

Responses to one-standard deviation shock in LRCBLO

	Impulse Response Functions of	
Months	LRCBLO	LRGDP
1	0.0073	0.0120
2	0.0079	0.0038
3	0.0083	0.0024
4	0.0096	0.0080
5	0.0106	-0.0023
6	0.0112	-0.0054
7	0.0117	-0.0072
8	0.0114	-0.0038
9	0.0107	-0.0108
10	0.0112	-0.0037
11	0.0111	-0.0049
12	0.0106	-0.0056
13	0.0106	0.0016
14	0.0103	-0.0008
15	0.0099	-0.0019
16	0.0098	0.0018
17	0.0090	-0.0036
18	0.0082	-0.0068
19	0.0074	-0.0082
20	0.0066	-0.0062
21	0.0057	-0.0111
22	0.0050	-0.0069
23	0.0044	-0.0069
24	0.0038	-0 0072

To facilitate comparisons, the response functions are normalised by the standard deviation of the innovations in the respective variables. The table suggests that a positive shock in LRCBLO would yield a positive impact on LRGDP that lasts for four months after the shock[15].

With regard to the relationship between a broader credit aggregate (LRTLO) defined as the sum of loans granted by commercial banks, finance companies and merchant banks in

[15]Attempts were also made to re-order the VAR system by placing LRGDP before LRCBLO. However this has not yielded any significant change in our qualitative conclusions with regard to the relationship between the two variables in terms of direction and strength.

real terms, and economic activity (LRGDP), it is found that the use of 12 lags is appropriate for estimation purposes in a bivariate VAR sytem (Table 4.XXII).

Table 4.XXII

Ljung-Box and Likelihood Ratio Statistics
VAR System LRTLO and LRGDP

Period (lags) / Eqn	1980:1 - 1992:12 (9)	1980:1 - 1992:12 (12)	1980:4 - 1992:12 (15)
LRTLO	Q(36) = 20.2433 [0.9841]	Q(36) = 17.7989 [0.9952]	Q(36) = 14.9894 [0.9992]
LRGDP	Q(36) = 151.946 [0.0000]	Q(36) = 40.2659 [0.2870]	Q(36) = 33.7507 [0.5760]

Likelihood Ratio Statistics

9 vs 12 lags: χ^2 (12) = 74.4256 [0.0000]

12 vs 15 lags: χ^2 (12) = 14.2155 [0.2872]

Notes:
I) Figures in parentheses below test statistics refer to the marginal significance level
II) Q is the Ljung-Box test statistic for serial correlation with 36 degrees of freedom.

The table indicates that the use of 9 lags would result in a serial correlation problem while the use of 12 or 15 lags is free from the problem. However the likelihood ratio tests reveal that 12 lags can be preferred to 15 lags. Proceeding with 12 lags, Table 4.XXIII suggests that there is an unidirectional causality running from LRTLO to LRGDP though the null hypothesis to the contrary can only be rejected at a slightly greater than the usual 5% significance level. Based upon variance decomposition, it is noteworthy that innovations in LRTLO could explain slightly more than LRCBLO the variation of LRGDP particularly over a 9-month horizon (Table 4.XXIV).

Table 4.XXIII

Individual Equation F-tests
VAR System: LRTLO and LRGDP

Target Causal	LRTLO	LRGDP
LRTLO	2349.2226 [0.0000]	1.7985 [0.0546]
LRGDP	1.4108 [0.1687]	22.4377 [0.0000]

Notes: Figures in parentheses refer to the marginal significance level

Table 4.XXIV

Variance Decomposition of Variables
VAR System: LRTLO and LRGDP

Variables Explained	Forecast Horizons (Months Ahead)	Due to INNOVATIONs in	
		LRTLO	LRGDP
LRTLO	1	100.00	0.000
	2	99.94	0.06
	3	99.97	0.03
	6	99.73	0.27
	9	99.56	0.44
	12	99.63	0.37
	24	92.37	7.63
LRGDP	1	10.11	89.89
	2	10.38	89.62
	3	10.40	89.60
	6	13.78	86.22
	9	18.16	81.84
	12	19.55	80.45
	24	19.41	80.59

This is somehow confirmed by an analysis of the impulse response function of LRGDP with respect to a one-standard deviation shock in LRTLO (Table 4.XXV). The shock in LRTLO has a slightly greater impact than that of LRCBLO on LRGDP though the positive effect also prevails over a 4-month period.

Table 4.XXV

Responses to one-standard deviation shock in LRTLO

	Impulse Response Functions of	
Months	LRTLO	LRGDP
1	0.0065	0.0139
2	0.0071	0.0033
3	0.0080	0.0029
4	0.0094	0.0082
5	0.0103	-0.0013
6	0.0111	-0.0044
7	0.0118	-0.0054
8	0.0117	-0.0033
9	0.0114	-0.0099
10	0.0122	-0.0025
11	0.0121	-0.0045
12	0.0118	-0.0054
13	0.0121	0.0035
14	0.0119	-0.0010
15	0.0118	-0.0017
16	0.0117	0.0018
17	0.0110	-0.0034
18	0.0104	-0.0067
19	0.0097	-0.0072
20	0.0090	-0.0062
21	0.0081	-0.0109
22	0.0075	-0.0067
23	0.0068	-0.0071
24	0.0062	-0.0075

On the relationship between real M2 (LRM2) and economic activity (LRGDP), table 4.XXVI suggests the appropriateness of using 15 lags to estimate it in a bivariate VAR framework.

Table 4.XXVI

Ljung-Box and Likelihood Ratio Statistics
VAR System: LRM2 and LRGDP

Period (lags) / Eqn	1980:1 - 1992:12 (9)	1980:1 - 1992:12 (12)	1980:4 - 1992:12 (15)	1980:7 - 1992:12 (18)
LRM2	Q(36) = 36.9724 [0.4238]	Q(36) = 35.4246 [0.4958]	Q(36) = 23.6002 [0.9444]	Q(36) = 26.8632 [0.8652]
LRGDP	Q(36) = 146.677 [0.0000]	Q(36) = 45.4966 [0.1334]	Q(36) = 29.2829 [0.7785]	Q(36) = 19.5673 [0.9883]

Likelihood Ratio Statistics

9 vs 12 lags: $\chi^2(12)$ = 59.4377 [0.0000]

12 vs 15 lags: $\chi^2(12)$ = 21.9827 [0.0377]

15 vs 18 lags: $\chi^2(12)$ = 15.1153 [0.2352]

Notes:
I) Figures in parentheses below test statistics refer to the marginal significance level
II) Q is the Ljung-Box test statistics for serial correlation with 36 degrees of freedom.

The use of 9 lags is inadvisable as it is plagued with serial correlation problems. Though the use of 12, 15 and 18 lags would not involve such problems, the likelihood ratio statistics indicate that 12 lags cannot be favored against 15 though 15 lags can be accepted against 18. Nevertheless, F-tests seem to suggest an absence of any relationship between the two variables as they do not seem to have any causal influence on each other in a Granger sense (Table 4.XXVII). Assuming however that LRM2 does have an impact on LRGDP, the variance decomposition analysis shows that innovations in LRM2 explain far less than LRCBLO, LRTLO and even LRM1 (as we shall see) the variance of LRGDP (Table 4.XXVIII). An examination of the impulse response function also highlights the weak link with the shock in LRM2 yielding a positive but negligible impact on LRGDP only in the first month (Table 4.XXIX).

Table 4.XXVII

Individual Equation F-tests
VAR System: LRM2 and LRGDP

Target Causal	LRM2	LRGDP
LRM2	107.6203 [0.0000]	0.9840 [0.4761]
LRGDP	1.3155 [0.2030]	14.2646 [0.0000]

Note: Figures in parentheses below test statistics refer to the marginal significance level.

Table 4.XXVIII

Variance Decomposition of Variables
VAR System: LRM2 and LRGDP

Variables Explained	Forecast Horizons (Months Ahead)	Due to INNOVATIONs in LRM2	Due to INNOVATIONs in LRGDP
LRM2	1	100.00	0.00
	2	99.97	0.03
	3	99.62	0.38
	6	99.09	0.91
	9	95.93	4.07
	12	91.98	8.02
	24	56.87	43.13
LRGDP	1	0.11	99.89
	2	0.87	99.13
	3	1.25	98.75
	6	6.80	93.20
	9	6.35	93.65
	12	7.12	92.88
	24	7.05	92.95

Table 4.XXIX

Responses to one-standard deviation shock in LRM2

	Impulse Response Functions of	
Months	LRM2	LRGDP
1	0.0127	0.0014
2	0.0107	-0.0038
3	0.0107	-0.0031
4	0.0088	0.0012
5	0.0064	-0.0119
6	0.0059	-0.0014
7	0.0061	-0.0010
8	0.0049	0.0009
9	0.0031	0.0009
10	0.0033	0.0029
11	0.0035	0.0028
12	0.0039	0.0037
13	0 0062	0.0015
14	0.0056	-0.0018
15	0.0051	-0.0033
16	0.0047	0.00009
17	0.0040	-0.0084
18	0.0034	-0.0015
19	0.0031	-0.0004
20	0.0020	0.0021
21	0.0015	0.0013
22	0.0014	0.0041
23	0.0015	0.0034
24	0.0018	0.0039

With respect to LRM1, its relationship with LRGDP can be estimated within the bivariate VAR context with the use of 15 lags. While Table 4.XXX shows that no serial correlation exists when estimating with 12 and 15 lags, the likelihood ratio statistics show that 15 lags is appropriate against 12 or 18 lags. There seems to be some evidence of a bidirectional causal relationship existing between LRM1 and LRGDP (Table 4.XXXI). However this could possibly be ruled out as while the hypothesis that LRGDP does not Granger cause LRM1 can be rejected marginally at the 5% significance level, the hypothesis that LRM1 does not Granger cause LRGDP can be overwhelmingly rejected.

Table 4.XXX

Ljung-Box and Likelihood Ratio Statistics
VAR System: LRM1 and LRGDP

Period (lags) Eqn	1980:4 - 1992:12 (12)	1980:4 - 1992:12 (15)	1980:7 - 1992:12 (18)
LRM1	Q(36) = 32.9460 [0.6146]	Q(36) = 37.4098 [0.4042]	Q(36) = 30.8876 [0.7102]
LRGDP	Q(36) = 29.7720 [0.7584]	Q(36) = 26.1199 [0.8871]	Q(36) = 24.4857 [0.9273]

Likelihood Ratio Statistics

12 vs 15 lags: χ^2 (12) = 43.0399
[0.0000]

15 vs 18 lags: χ^2 (12) = 7.3475
[0.8338]

Notes:
I) Figures in parentheses below test statistics refer to the marginal significance level
II) Q is the Ljung-Box test statistic for serial correlation with 36 degrees of freedom.

Table 4.XXXI

Individual Equation F-tests
VAR System: LRM1 and LRGDP

Target Causal	LRM1	LRGDP
LRM1	50.2068 [0.0000]	3.3505 [0.0001]
LRGDP	1.7664 [0.0471]	9.7836 [0.0000]

Note: Figures in parentheses below test statistics refer to the marginal significance level

A variance decomposition analysis reveals that innovations in LRM1 explains 1 through 9 months ahead forecast error variance of LRGDP less than LRCBLO and LRTLO (Table

4.XXXII). This is somehow confirmed by our examination of the impulse response function of LRGDP with respect to LRM1 (Table 4.XXXIII).

Table 4.XXXII

Variance Decomposition of Variables
VAR System: LRM1 and LRGDP

Variables Explained	Forecast Horizons (Months Ahead)	Due to Innovations in	
		LRM1	LRGDP
LRM1	1	100.00	0.00
	2	99.87	0.13
	3	98.86	1.14
	6	95.43	4.57
	9	93.80	6.20
	12	94.63	5.37
	24	96.06	3.94
LRGDP	1	0.59	99.41
	2	3.39	96.61
	3	3.42	96.58
	6	6.41	93.59
	9	16.37	83.63
	12	29.56	70.44
	24	51.10	48.90

Table 4.XXXIII

Responses to one-standard deviation shock in LRM1

	Impulse Response Functions of	
Months	LRM1	LRGDP
1	0.0213	0.0029
2	0.0110	-0.0064
3	0.0120	0.0018
4	0.0127	0.0069
5	0.0112	0.0006
6	0.0125	0.0015
7	0.0115	0.0091
8	0.0103	0.0079
9	0.0110	0.0072
10	0.0104	0.0085
11	0.0102	0.0114
12	0.0164	0.0123
13	0.0189	0.0056
14	0.0209	-0.0024
15	0.0183	0.0111
16	0.0151	0.0048
17	0.0170	0.0080
18	0.0151	0.0067
19	0.0142	0.0113
20	0.0134	0.0131
21	0.0131	0.0124
22	0.0128	0.0130
23	0.0133	0.0159
24	0.0158	0.0145

Particularly the response of LRGDP to a shock in LRM1 in the first four months following the shock is smaller than the responses of LRGDP to LRCBLO and LRTLO. Furthermore, there appears a tendency for LRGDP to decline slightly in the second month after the shock to LRM1.

Finally we explore the relationship between the lending rate (CBALR) and LRGDP. Both the Ljung-Box and Likelihood Ratio statistics point to the optimality of using 12 lags in the estimation (Table 4.XXXIV).

Table 4.XXXIV

Ljung-Box and Likelihood Ratio Statistics
VAR System: CBALR and LRGDP

Period (lags) Eqn	1987:7 - 1992:12 (6)	1987:7 - 1992:12 (9)	1987:10 - 1992:12 (12)	1988:1 - 1992:12 (15)
CBALR	Q(24) = 13.9670 [0.9474]	Q(24) = 15.7751 [0.8960]	Q(21) = 9.6706 [0.9829]	Q(21) = 7.5541 [0.9968]
LRGDP	Q(24) = 66.0369 [0.0000]	Q(24) = 31.7374 [0.1336]	Q(21) = 12.9292 [0.9111]	Q(21) = 11.9052 [0.9421]

Likelihood Ratio Statistics

6 vs 9 lags: χ^2 (12) = 23.8693 [0.0219]

9 vs 12 lags: χ^2 (12) = 45.4722 [0.0000]

12 vs 15 lags: χ^2 (12) = 6.360 [0.8969]

Notes:

I) Figures in parentheses below test statistics refer to the marginal significance level

II) Q is the Ljung-Box test statistic for serial correlation.

However it is interesting to note that these variables do not seem to have any causal link with one another (Table 4.XXXV).

Table 4.XXXV

Individual Equation F-tests
VAR System: CBALR and LRGDP

Target Causal	CBALR	LRGDP
CBALR	56.4309 [0.0000]	1.4743 [0 1769]
LRGDP	1.4039 [0.2067]	18.0395 [0.0000]

Note: Figures in parentheses below test statistics refer to the marginal significance level.

Nevertheless, proceeding on the assumption that the lending rate does influence economic activity, a variance decomposition was conducted and the impulse response function derived for the relationship. As can be discerned from Table 4.XXXVI, innovations in CBALR only explain about 0.07% of the variation in LRGDP at a one-month horizon and 8.1% at a 6-month horizon.

Table 4.XXXVI

Variance Decomposition of Variables
VAR System: CBALR and LRGDP

Variables Explained	Forecast Horizons (Months Ahead)	Due to Innovations in	
		CBALR	LRGDP
CBALR	1	100.00	0.00
	2	99.9	0.1
	3	99.87	0.13
	6	97.77	2.23
	9	95.8	4.2
	12	93.88	6.12
	24	82.29	17.71
LRGDP	1	0.07	99.93
	2	6.66	93.34
	3	6.7	93.3
	6	8.10	91.9
	9	20.41	79.59
	12	25.51	74.49
	24	27.4	72.6

This should be contrasted with those due to innovations in LRCBLO estimated at 7.57% and 12.08% respectively. Even on the basis of impulse response functions, LRGDP seems to respond more to a shock in LRCBLO than in CBALR (Table 4.XXXVII). All this reinforces our earlier findings based upon a multivariate analysis in nominal terms that it is the volume of loans rather than the interest rate that matters to the economy.

Table 4.XXXVII

Responses to one-standard deviation shock in CBALR

	Impulse Response Functions of	
Months	CBALR	LRGDP
1	0.1049	-0.0007
2	0.0459	0.0071
3	0.0455	0.0008
4	0.0316	0.0006
5	0.0392	0.0034
6	0.0384	0.0009
7	0.0208	-0.0094
8	0.0393	-0.0054
9	0.0288	-0.0023
10	0.0108	-0.0084
11	0.0100	0.0011
12	0.0357	-0.0002
13	0.0194	0.0047
14	0.0127	0.0052
15	0.0196	0.0010
16	0.0241	0.0028
17	0.0156	0.0023
18	0.0194	-0.0014
19	0.0271	-0.0076
20	0.0211	-0.0025
21	0.0162	-0.004
22	0.0126	-0.0065
23	0.021	0.0022
24	0.0125	0.0007

Thus if financial aggregates are important factors determining the macroeconomic performance, we may then conclude that monetary policy should focus more on credit aggregates rather than monetary aggregates in the light of our findings.

4.7 Concluding Remarks

The purpose of this exercise has been two-fold namely:

1) to assess the possibility of a practice of equilibrium credit rationing by Malaysian banks and to infer indirectly the seriousness of excess demand for loans as its consequence and

2) to determine the significance of commercial bank credit to the Malaysian economy relative to money supply (M1 & M2), the lending rate and a broader credit aggregate defined as comprising loans granted by commercial banks, finance companies and merchant banks.

One of the major implications of equilibrium credit rationing as postulated by Stiglitz & Weiss (1981 & 1983) is the irresponsiveness of the lending rate to loan demand and supply factors. The practice of equilibrium credit rationing would also implicitly impose a ceiling on the rate that banks could charge for loans as it is to the banks' advantage to observe a 'ceiling'. This may have different implications for the deposit rate that banks could offer their depositors and hence the amount of deposits (loanable funds) they could mobilise depending upon the responsiveness of deposits demanded to deposit rate movements. Cateris paribus, this would dictate the extent of excess demand for loans in the economy. This may be especially true in the case of Malaysia where deposits are a major source of financing for the banks' lending operation. Amid such practices, the volume of loanable funds secured by banks could be greater in a high interest rate elasticity environment vis-a-vis a low one and so is the deposit rate payable by the banks. In a separate vein, in an extreme case of zero interest rate elasticity, the extent of excess demand may also be limited however as banks could always depress the interest rate payable to the lowest possible level without significantly undermining the flow of deposits. Nevertheless, a high interest rate elastic condition may imply that equilibrium credit rationing has a procyclical effect on the economy with a credit crunch or boom tending to be more pronounced.

The empirical inquiry of this chapter in fact commenced with an examination of commercial banks' performance in lending and deposit taking over the years. A steady rise in the ratio of commercial bank loans to GDP was envisaged. There has been a rapid build-up of loans extended by banks subsequent to the interest rate reform in 1978. Banks have also exhibited an increased aggressiveness in lending with the lapse of time by their tendency to lend to full capacity at times as warranted by deposits and their rising preference for long term loans against government securities. This can probably be explained by the fact that deposits placed with them are gradually becoming more long term.

Our subsequent deposit-based analysis reveals that deposits are not interest elastic though the long run and short run income elasticities are 1.25 and 0.12 respectively. Thus evidence that deposits are interest elastic in Malaysia has yet to be found despite the development of the Malaysian financial system over the years. Coupled with our subsequent findings that banks do possibly embrace equilibrium credit rationing as a policy, this implies that the extent of excess demand for loans in the economy arising from such rationing if any may not be very great.

Evidence alluding to the practice of equilibrium credit rationing by Malaysian banks is found in our study related to the responsiveness of the lending rate to loan demand and supply factors and also in our study of credit transmission mechanism. The lending rate only responds negligibly to loan supply factors while not to a single loan demand factor. Current and anticipated economic growth do not seem to have any bearing on the lending rate. In the short run, the lending rate is influenced albeit nominally by supply-side factors such as rates of return on alternative financial instruments (domestic and foreign) and the inter bank rate. There is also a tremendous inertia in lending rate adjustments with the coefficient of the error correction term estimated at only 0.14. If the Malaysian experience is anything to go by, maintaining an open financial system as a financial liberalisation move need not produce a higher lending rate on the domestic front as it is only negligibly sensitive to overseas interest rate movements.

All this may allude to the adoption of cautious attitudes amongst banks in revising their lending rates probably for the sake of minimising risks from adverse selection and adverse incentive. This evidence is corroborated by the outcome of our multivariate VAR analysis intended to establish the sensitivity of the lending rate to the inter bank rate and then the sensitivity of loans granted to these rates with the use of monthly instead of quarterly data. Preliminary Granger causality tests conducted within the VAR analysis reveals that inter-bank rate, loans and nominal GDP do not Granger cause the lending rate. This is somewhat consistent with the view of equilibrium credit rationing that banks do not revise their lending rates indiscriminately as the mix of borrowers may be affected adversely. The linkage between the inter-bank rate and the lending rate is weak as innovations in the inter-bank rate merely account for about 5% of the variation in the lending rate over a 2-month horizon. There is also only a limited impact of the lending rate on loans extended as shocks in the rate only explain about 4.4% of the one-step ahead forecast error variance of loans extended. This also speaks of the possibility that equilibrium credit rationing exists.

Hence given all these suggestions that equilibrium credit rationing does prevail in the Malaysian loans market, the implementation of a liberal interest rate policy by Malaysia might have failed to produce the desired effects on deposit rates as most advocates of interest rate liberalisation believe could. Moreover even if there is an improvement in the optimal lending rate that banks could charge, the fact that deposits are not interest elastic would imply that banks could afford to maintain a 'depressed' rate on deposits.

In order to meet the second objective of our exercise in this chapter, a bivariate VAR analysis using monthly data was pursued by us in real terms between commercial bank loans, total loans granted by commercial banks, finance companies and merchant banks, M1, M2 and the commercial bank lending rate interchangeably on one hand and economic activity on the other. The significance of commercial bank credit to the Malaysian economy is underscored as it yields a greater positive influence on economic activity compared with money supply be it defined as M1 or M2 and the commercial bank lending rate of which their causal links with economic activity are even suspect in terms of existence and direction. However a broader measure of credit that includes loans granted by finance companies and merchant banks as well has a slightly greater impact on the economy. This may call for a greater concern with credit rather than monetary aggregates by the Central Bank in its conduct of monetary policy.

APPENDIX 4.1

We shall consider a simple model of a profit-maximising bank that does not have an alternative mode of investment apart from its lending operations for simplicity. The use of a profit-maximising framework is not inappropriate as Tobin (1963) contends that banks are firms and hence should be analysed in the same way as firms. Moreover this framework is consonant with the banker's approach of asset and liability management. Herein our analysis, the bank is subject to the following balance sheet constraint:

$$D + E = SR + L \qquad (1)$$

where D = Deposits Mobilised

E = Paid-up Capital

SR = Statutory Reserves

L = Loans

Assuming that the bank is compelled by law to commit some proportion (s) of the deposits harnessed as statutory reserves with the monetary authority, equation (1) may be rewritten as:

$$L = D(1-s) + E \qquad (2)$$

Equation (2) suggests that at any point in time, the volume of loanable funds is determined by deposits received, statutory reserve requirements and the bank's paid-up capital. Assuming that the bank is risk-neutral, the profit function of the bank may be written as:

$$\Pi = r_L^* L - r_D(D)D \qquad (3)$$

where Π = profits

r_L^* = the optimal lending rate chargeable by banks as dictated by the degree of asymmetric information problem in the loans market

$r_D(D)$ = the interest rate payable on deposits with $r_D'(D) \succ 0$

Differentiating Π with respect to L and equating the result to zero as follows:

$$\frac{\partial \Pi}{\partial L} = r_L^* - r_D(D)\frac{1}{(1-s)} - Dr_D'(D)\frac{1}{(1-s)} = 0$$

and after some manipulation yields the following first order condition (FOC):

$$r_L^* = \frac{r_D(1+\varepsilon)}{\varepsilon(1-s)} \qquad (4)$$

where ε refers to the interest rate elasticity of deposits.

Comparative Statics:

a) Equation (4) may be rewritten as follows:

$$r_D = \frac{r_L^* \varepsilon(1-s)}{(1+\varepsilon)} \qquad (4')$$

This indicates that r_D varies positively with r_L^*. By implication, the lower is r_L^*, the lower will be the r_D that banks can afford to pay depositors. It also indicates that a small improvement in r_L^* leads to a greater jump in r_D that can be offered by banks in an interest elastic condition. The following is a numerical verification of this point:

State I: ε = 0.3 s = 0.02

Then $\frac{dr_D}{dr_L^*} = \frac{\varepsilon(1-s)}{(1+\varepsilon)} = 0.2262$

State II: $\varepsilon = 0.5$ $s = 0.02$

$$\text{Then } \frac{dr_D}{dr_L^*} = 0.3267$$

b) The elasticity of deposits is crucial to how depressed r_D can be at a given r_L^*. By inspection of the r_D equation at given r_L^* and s, the greater is the elasticity (ε), the higher is r_D offered by the bank. This can be proven by the following numerical example:

State I: r_L^*=0.05 $\varepsilon = 0.3$ $s = 0.02$

$$r_D = \frac{r_L^* \varepsilon(1-s)}{(1+\varepsilon)} = 0.01131$$

State II: r_L^*=0.05 $\varepsilon = 0.5$ $s = 0.02$

$$r_D = 0.01632$$

c) In order to derive the relationship between the volume of deposits and hence the loanable funds on one hand and some other parameters in the model on the other, the FOC given by equation (4') is transformed as follows:

$$D = \frac{dD}{dr_D}\left[r_L^*(1-s) - r_D\right]$$

$$= \frac{dD}{dr_D}\left[\frac{r_L^*(1-s)}{1+\varepsilon}\right]$$

where $\frac{dD}{dr_D} \neq 0$ as if otherwise, a different FOC will entail. The above result reveals that the greater is r_L^* given the other variables, the greater will be the amount of loanable funds

(D) mobilised. And for a given r_l^*, the greater is the responsiveness of deposits to r_D, the larger will also be the volume of loanable funds.

By implication the above equation suggests that a credit crunch is likely to be more severe in the case of an adverse twist in r_L^* which may possibly be engendered by a decline in the economic activity in the case of high responsiveness of deposits to r_D compared to the situation of low responsiveness. Hence equilibrium credit rationing may have a procyclical effect on the economy as both upward and downward swings of the economy are accentuated when deposits are interest responsive.

APPENDIX 4.2

Parsimonious Equation

$$\Delta LCBTDD_t = \underset{(-3.9698)}{-0.9196} + \underset{(5.5439)}{0.5105}\, \Delta LNGDP_t + \underset{(4.8885)}{0.3483}\, \Delta LNGDP_{t-1}$$

$$+ \underset{(2.3207)}{0.1747}\, \Delta LNGDP_{t-2} + \underset{(2.7355)}{0.2449}\, \Delta LNGDP_{t-3}$$

$$- \underset{(-4.0249)}{0.2695}\, EC_{t-5} - \underset{(-2\ 2323)}{0.2333}\, \Delta LCBTDD_{t-2}$$

$$+ \underset{(5.8091)}{0.0555S1}$$

$R^2 = 0.6176$

$F(7,47) = 13.4566$ [0.000]

S.E. of Regression = 0.0234

Normality: $\chi^2(2) = 0.3549$ [0.837]

Heteroscedasticity: $\chi^2(1) = 0.3943$ [0.530]

ARCH: $\chi^2(1) = 1.4298$ [0.238]
$\chi^2(2) = 2.0530$ [0.358]
$\chi^2(3) = 2.6105$ [0.456]
$\chi^2(4) = 3.5816$ [0.466]

Functional Form: $\chi^2(1) = 0.0026$ [0.960]

Autocorr: $\chi^2(1) = 1.5589$ [0.212]
$\chi^2(2) = 1.5598$ [0.458]
$\chi^2(3) = 1.7290$ [0.631]
$\chi^2(4) = 2.0064$ [0.735]

Notes:

(I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

(II) Figures in square parentheses [ ] refer to marginal significance levels

APPENDIX 4.3

Parsimonious Equation

$$\Delta LCBTFD_t = \underset{(-3.0082)}{-0.0952} - \underset{(-2.7260)}{0.3830}\,\Delta LNGDP_{t-1} - \underset{(-3.8834)}{0.1202}\,EC_{t-1}$$

$$- \underset{(-1.8603)}{0.0285}S1 - \underset{(-3.4410)}{0.0572}S2 + \underset{(2.8053)}{0.3327}\,\Delta LCBTFD_{t-1}$$

$\bar{R}^2 = 0.3715$

Autocorr: $\chi^2(1) = 0.7459$ [0.388]

$F(5,47) = 7.1471$ [0.000]

$\chi^2(2) = 0.7479$ [0.688]

S.E. of Regression = 0.0393

$\chi^2(3) = 0.3700$ [0.775]

Normality: $\chi^2(2) = 2.2368$ [0.327]

$\chi^2(4) = 2.1226$ [0.713]

Heteroscedasticity: $\chi^2(1) = 0.4289$ [0.513]

ARCH: $\chi^2(1) = 2.2278$ [0.136]
$\chi^2(2) = 2.0750$ [0.354]
$\chi^2(3) = 2.1302$ [0. 546]
$\chi^2(4) = 2.1453$ [0.709]

Notes:

(I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

(II) Figures in square parentheses [ ] refer to marginal significance levels

APPENDIX 4.4

Parsimonious Equation

$$\Delta LCBTD_t = \underset{(-4.6952)}{-0.1251} + \underset{(2.0523)}{0.1160}\,\Delta LNGDP_t - \underset{(-5.8821)}{0.0932}\,EC_{t-2}$$

$$- \underset{(-4.9432)}{0.0312}S2 - \underset{(-1.9370)}{0.0134}S3$$

$\bar{R}^2 = 0.5277$

$F(4,48) = 15.5235$ [0.000]

S.E. of Regression = 0.0168

Normality: $\chi^2(2) = 1.1545$ [0.561]

Heteroscedasticity: $\chi^2(1) = 0.2386$ [0 625]

ARCH: $\chi^2(1) = 0.3537$ [0.552]
$\chi^2(2) = 0.5922$ [0.744]
$\chi^2(3) = 1.0705$ [0.784]
$\chi^2(4) = 1.1205$ [0.891]

Functional Form: $\chi^2(1) = 0.0862$ [0.769]

Autocorr: $\chi^2(1) = 1.3018$ [0.254]
$\chi^2(2) = 1.5936$ [0.451]
$\chi^2(3) = 5.1148$ [0.164]
$\chi^2(4) = 5.3276$ [0.255]

Notes:

(I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

(II) Figures in square parentheses [ ] refer to marginal significance levels

APPENDIX 4.5

Parsimonious Equation

(a)

$$\Delta CBALR_t = \underset{(-0.9505)}{-0.0828} + \underset{(3.7832)}{0.0784}\,\Delta CBELR_t + \underset{(2.3609)}{0.0453}\,\Delta UKTB_t$$

$$+ \underset{(12.9065)}{0.1481}\,R7D_t + \underset{(4.8678)}{0.1066}\,\Delta CBELR_{t-1}$$

$$- \underset{(-8.9200)}{0.1323}\,EC_{t-2} + \underset{(6.2334)}{0.6323}\,DUMMY_t$$

$R^2 = 0.8406$

$F(6,44) = 44.9599$ [0.000]

S.E. of Regression = 0.1352

Normality: $\chi^2(2) = 0.9484$ [0.622]

Heteroscedasticity: $\chi^2(1) = 1.2090$ [0.272]

ARCH: $\chi^2(1) = 1.3623$ [0.243]
$\chi^2(2) = 1.3198$ [0.517]
$\chi^2(3) = 2.0602$ [0.560]
$\chi^2(4) = 3.3818$ [0.496]

Functional Form: $\chi^2(1) = 3.8825$ [0.049]
$F(1,43) = 3.5432$ [0.067]

Autocorr: $\chi^2(1) = 2.1437$ [0.143]
$\chi^2(2) = 2.4740$ [0.290]
$\chi^2(3) = 4.8482$ [0.183]
$\chi^2(4) = 5.8375$ [0.212]

(b)

$$\Delta CBALR_t = \underset{(4.1239)}{0.083}\,\Delta CBELR_t + \underset{(2.2786)}{0.0434}\,\Delta UKTB_t$$

$$+ \underset{(5.0868)}{0.1099}\,\Delta CBELR_{t-1} + \underset{(12.9634)}{0.1461}\,R7D_t$$

$$- \underset{(-13.1284)}{0.1419}\,EC_{t-2} + \underset{(6.2003)}{0.6286}\,DUMMY_t$$

$R^2 = 0.8410$

$F(5,45) = 53.8869$ [0.000]

S.E. of Regression = 0.1350

Normality: $\chi^2(2) = 1.0581$ [0.589]

Heteroscedasticity: $\chi^2(1) = 1.7712$ [0.183]

ARCH: $\chi^2(1) = 1.8711$ [0.171]
$\chi^2(2) = 1.8529$ [0.396]
$\chi^2(3) = 2.9757$ [0.395]
$\chi^2(4) = 3.7855$ [0.436]

Functional Form: $\chi^2(1) = 4.2325$ [0.040]
$F(1,44) = 3.9820$ [0.052]

Autocorr: $\chi^2(1) = 1.2566$ [0.262]
$\chi^2(2) = 2.0004$ [0.368]
$\chi^2(3) = 3.3551$ [0.340]
$\chi^2(4) = 3.6102$ [0.461]

Notes:

(I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

(II) Figures in square parentheses [ ] refer to marginal significance levels

Chapter 5

EXCHANGE RATE ISSUES

5.0 Overview

This chapter of our thesis has a three-fold objective namely:

1) To discuss the implications for exchange rate, price and income (output) movements amid the prevalence of equilibrium credit rationing in the domestic banking system. The Dornbusch's (1976) model will be adapted as a theoretical basis of our discussions;

2) Following the above discussion which is mainly from a financial perspective, we proceed with a consideration of the fundamental determinants of real exchange rates following Edwards (1988a, 1988b & 1989). This would enable us to ascertain whether there has been a misalignment of Malaysian exchange rates. Both bilateral (M$/US$) and effective real exchange rates will be considered. The effective or multilateral real exchange rates may constitute an indicator of a country's competitiveness vis-a-vis its trading partners on an overall or a broad basis. Under the generalised floating system, multilateral real exchange rates may exhibit significant departures from bilateral rates. The effective rates will be computed on the trade-,export-, and import-weighted bases. There is a tendency amongst developing countries to maintain an overvaluation of their real exchange rates. Hence it is interesting to verify whether countries such as Malaysia which are full of development ambitions do keep their exchange rates undervalued. More specifically, the question whether Malaysia has been maintaining a competitive exchange rate environment that probably explains its "success" story in economic development can be addressed. In order to determine whether an exchange rate is misaligned or otherwise, a priori knowledge of the behavior of the equilibrium real exchange rate is needed. Real exchange rate behavior is often viewed as central to policy evaluation and design (Edwards, 1988 & Cottani, et.al, 1990); and

3) While the second objective above is founded upon the assumption that real exchange rate movements are a crucial determinant of macroeconomic performance, the third objective here is to verify whether exports and economic growths achieved by Malaysia have been influenced by exchange rate movements and to establish the direction of causality between the two. In the process, a causality test will also be conducted to determine the direction of causality between the exchange rate and the merchandise trade balance in order to resolve the controversy surrounding this aspect.

The rest of this chapter is configured as follows. Section 5.1 will discuss the exchange rate experience of Malaysia against the backdrops of external trade and growth performance. A review of the literature related to exchange rates is furnished in Section 5.2. Some implications that can be drawn from Dornbusch's (1976) model in the context of equilibrium credit rationing are discussed in Section 5.3. Section 5.4 will provide empirical estimates of the fundamental determinants of real exchange rates a la Edwards (1988a, 1988b &1989) while Section 5.5 will deal specifically with the issue of real exchange rate misalignment. Section 5.6 addresses the empirical question of Malaysian exchange rate movements and its links to exports and economic growths. The chapter will conclude with remarks in Section 5.7.

Monthly data from 1973 onwards drawn chiefly from the IMF's International Financial Statistics and Bank Negara Malaysia's Quarterly Monthly Economic Bulletins and transformed into quarterly where appropriate will be utilised in our empirical endeavors. Where terms of trade and real exports and imports are concerned, the estimation period may have to end in 1987 as publications of data for unit value of imports have ceased since then. Data needed for the computation of weights in respect of effective exchange rate indices are drawn from the IMF's Direction of Trade Statistics

5.1 Malaysian Exchange Rates, Trade and Economic Growth Performance: A Historical Review

As noted in our background chapter of the Malaysian financial system, Malaysia can be construed as having been maintaining a managed-float exchange rate system. Foreign exchange market intervention by the Central Bank is only a rare occasion aimed at curbing excessive speculation except during the 1981-84 period when it intervened in order to maintain the strength of the ringgit vis-a-vis the Singapore dollar. Contrary to the classification by the World Bank that Malaysia maintains a basket peg system, the Malaysian exchange rate system is one of managed float in practice (Lin, 1989). In fact the degree of variability in the ringgit has led Rana (1981) and De Macedo (1984) to conclude that the ringgit exchange rate system is one of managed float (see also Aghevli, 1981). In fact the degree of volatility of the ringgit effective exchange rates is comparable to that of major currencies such as the Deutschemark and the French franc based upon the variability indices computed by Gan (1989a). Aghevli (1981) also contends that basket pegging may still be regarded as a managed float if the currency composition of the basket is not publicly revealed as by virtue of its confidentiality, the authority may not be committed towards maintaining the peg. Cho & Khatkhate (1989) even went to the extent of maintaining that Malaysia had a fairly open capital account with a floating exchange rate. They also maintain that foreign factors had a major influence on interest rates in Malaysia even prior to interest rate liberalisation in 1978. In spite of interest rate controls then, real interest rates were not low unlike the Korean experience. Short term capital movements have also been quite responsive to international interest rate differentials especially between Malaysia on one hand and Singapore and U.S. on the other though domestic deposit rates have not assumed such sensitivity.

We shall now discuss both the effective and bilateral exchange rate (M$/US$) movements and if any their relevance to trade and economic growth performance of Malaysia in the past.[1] Some statistics related to the mean and variability of effective (of different weighting schemes) and bilateral exchange rate indices of Malaysia since 1976 are furnished in Tables 5.I. Tables 5.IA, 5.IB, 5.IC and 5.ID reveal that the Malaysian nominal effective and bilateral exchange rates have not displayed a distinct appreciable long run depreciating or appreciating trend since

[1]Details related to the derivation of these indices will be furnished in Section 5.4.

1976 based upon a cursory view of the periodic means of these indices. However in terms of 'band', standard deviation and the coefficient of variation, all the three nominal effective indices seem to have experienced a growing variability from 1976 through 1990.[2] This could be due to the increasing volatility of foreign exchange markets over the years, a phenomenon commonly cited in the literature. However vis-a-vis the US$, the Malaysian $ appears to exhibit a growing stability over the period in terms of all the variability measurements. A sharp decline in the variability is witnessed in the1981Q1-1985Q4 period from the 1976Q1-1980Q4 period. This perhaps has been due to some policy of pegging more to the US$ in the 1980s.

[2]The 'band' is defined as the difference between the maximum and the minimum level observed over a period.

Table 5.1A

Mean and Variability of Nominal Effective Exchange Rate Index (Trade-weighted)

1985=1.00

PERIOD / STATISTICS	1976Q1-1980Q4	1981Q1-1985Q4	1986Q1-1990Q4	1991Q1-1993Q3
Maximum	1.1999	1.1363	1.5442	1.5508
Minimum	1.0886	0.9617	1.1134	1.4329
Band	0.1113	0.1747	0.4308	0.1179
Mean	1.1318	1.0280	1.3687	1.5020
Std Deviation	0.0287	0.0494	0.1113	0.0378
Coefficient of Variation	0.0254	0.0480	0.0813	0.0252

Table 5.1B

Mean and Variability of Nominal Effective Exchange Rate Index (Export-weighted)

1985 = 1.00

PERIOD / STATISTICS	1976Q1-1980Q4	1981Q1-1985Q4	1986Q1-1990Q4	1991Q1-1993Q3
Maximum	1.2054	1.1340	1.5386	1.5426
Minimum	1.0907	0.9615	1.1118	1.4250
Band	0.1147	0.1725	0.4268	0.1176
Mean	1.1361	1.0280	1.3657	1.4955
Std Deviation	0.0299	0.0490	0.1104	0.0378
Coefficient of Variation	0.0263	0.0477	0.0808	0.0253

Table 5.1C

Mean and Variability of Nominal Effective Exchange Rate Index (Import- weighted)

1985=1.00

PERIOD / STATISTICS	1976Q1-1980Q4	1981Q1-1985Q4	1986Q1-1990Q4	1991Q1-1993Q3
Maximum	1.1935	1.1413	1 5421	1.5518
Minimum	1.0872	0.9631	1.1140	1.4338
Band	0.1063	0.1782	0.4281	0.118
Mean	1.1279	1.0293	1.3666	1.5007
Std Deviation	0.0278	0.0506	0.1106	0.0376
Coefficient of Variation	0.0246	0.0492	0.0809	0.0251

Table 5.1D

Mean and Variability of Nominal Bilateral Exchange Rate Index (M$/US$)

1985 = 1.00

PERIOD / STATISTICS	1976Q1-1980Q4	1981Q1-1985Q4	1986Q1-1990Q4	1991Q1-1993Q3
Maximum	1.0353	1.0218	1.1016	1.1178
Minimum	0.8618	0.9089	1.0002	1.0072
Band	0.1735	0.1129	0.1014	0.1106
Mean	0.9411	0 9495	1.0579	1.0592
Std Deviation	0.0623	0.0301	0.0335	0.0412
Coefficient of Variation	0.0662	0.0317	0.0317	0.0389

With respect to real effective and bilateral exchange rate movements, no distinct long-run depreciating or appreciating trend can be discerned either as suggested by their periodic means (Tables 5.IIA, 5.IIB, 5.IIC and 5.IID). Over the period 1976-90, all exchange rate indices with the exception of the bilateral index seem to exhibit some increased variability based on all measurements. This implies that any attempt to manage the external competitiveness of the country via an exchange rate management policy has become an increasingly formidable task.

Table 5.IIA

Mean and Variability of Real Effective Exchange
Rate Index (Trade-weighted)
1985=1.00

PERIOD / STATISTICS	1976Q1-1980Q4	1981Q1-1985Q4	1986Q1-1990Q4	1991Q1-1993Q3
Maximum	1.2072	1.2223	1.4524	1.4054
Minimum	1.0392	0 9607	1.0650	1.2131
Band	0 168	0.2616	0.3874	0.1923
Mean	1.0951	1.0488	1.2734	1.2855
Std Deviation	0.0565	0 0779	0.10008	0.0726
Coefficient of Variation	0.0516	0.0742	0.078595	0.0565

Table 5.IIB

Mean and Variability of Real Effective Exchange
Rate Index (Export-weighted)
1985 = 1.00

PERIOD / STATISTICS	1976Q1-1980Q4	1981Q1-1985Q4	1986Q1-1990Q4	1991Q1-1993Q3
Maximum	1.2118	1.2250	1.4407	1.3936
Minimum	1.0414	0.9615	1.0619	1.2051
Band	0.1704	0 2635	0.3788	0.1885
Mean	1.1002	1.0501	1.2667	1.2745
Std Deviation	0.0561	0 0792	0.0976	0.0713
Coefficient of Variation	0.0509	0.0754	0.0771	0.0559

Table 5.11C

Mean and Variability of Real Effective Exchange Rate Index (Import-weighted)

1985=1.00

PERIOD / STATISTICS	1976Q1-1980Q4	1981Q1-1985Q4	1986Q1-1990Q4	1991Q1-1993Q3
Maximum	1.2006	1.2189	1.4633	1.4169
Minimum	1.0343	0.9609	1.0684	1.2202
Band	0.1663	0.2580	0.3949	0.1967
Mean	1.0888	1.0477	1.2794	1.2964
Std Deviation	0.0564	0.0763	0.1024	0.0744
Coefficient of Variation	0.0518	0.0728	0.0801	0.0574

Table 5.11D

Meam and Variability of Real Bilateral Exchange Rate Index (M$/US$)

1985 = 1.00

PERIOD / STATISTICS	1976Q1-1980Q4	1981Q1-1985Q4	1986Q1-1990Q4	1991Q1-1993Q3
Maximum	0.9682	1.0301	1.1406	1.1089
Minimum	0.8471	0.9392	0.9764	0.9506
Band	0.1211	0.0909	0.1642	0.1583
Mean	0.9133	0.9803	1.0573	1.0160
Std Deviation	0.0318	0.0281	0.0579	0.0664
Coefficient of Variation	0.0348	0.0287	0.0548	0.0654

It is interesting to note from Figures 5A and 5B that the choice of bases (trade, export and import) for the computation of effective exchange rate indices does make no material difference at all to the outcome. As shown by the figures, all the three indices have moved in tandem over the years both in nominal and in real terms. Noteworthy is also the fact that real effective exchange rate movements have since the mid 1980s been largely dictated by nominal rate movements with insufficient offseting influence from relative price movements as opposed to the period before then (Figure 5C). In bilateral terms however, nominal exchange rate movements did translate into real exchange rate movements even in the 1970s until 1987 when nominal movements have begun to be reinforced by relative price movements (Figures 5D, 5E & 5F). Hence if one is inclined to believe that exchange rates have a significant bearing on exports and economic growth, all this underscores the importance of managing the exchange rate in order to preserve the external competitiveness of the country.

Figure 5A
Nominal Effective Exchange Rate Indices (1985=1.00)

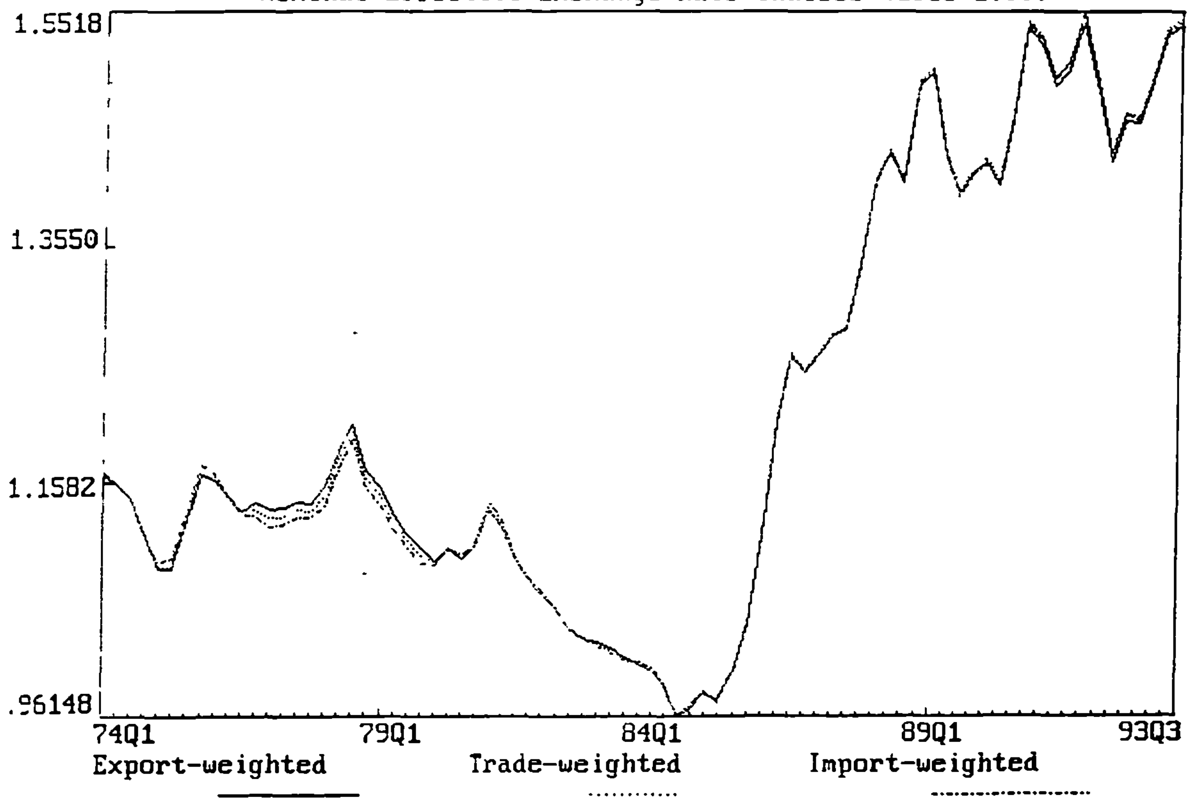


Figure 5B
Real Effective Exchange Rate Indices (1985=1.00)

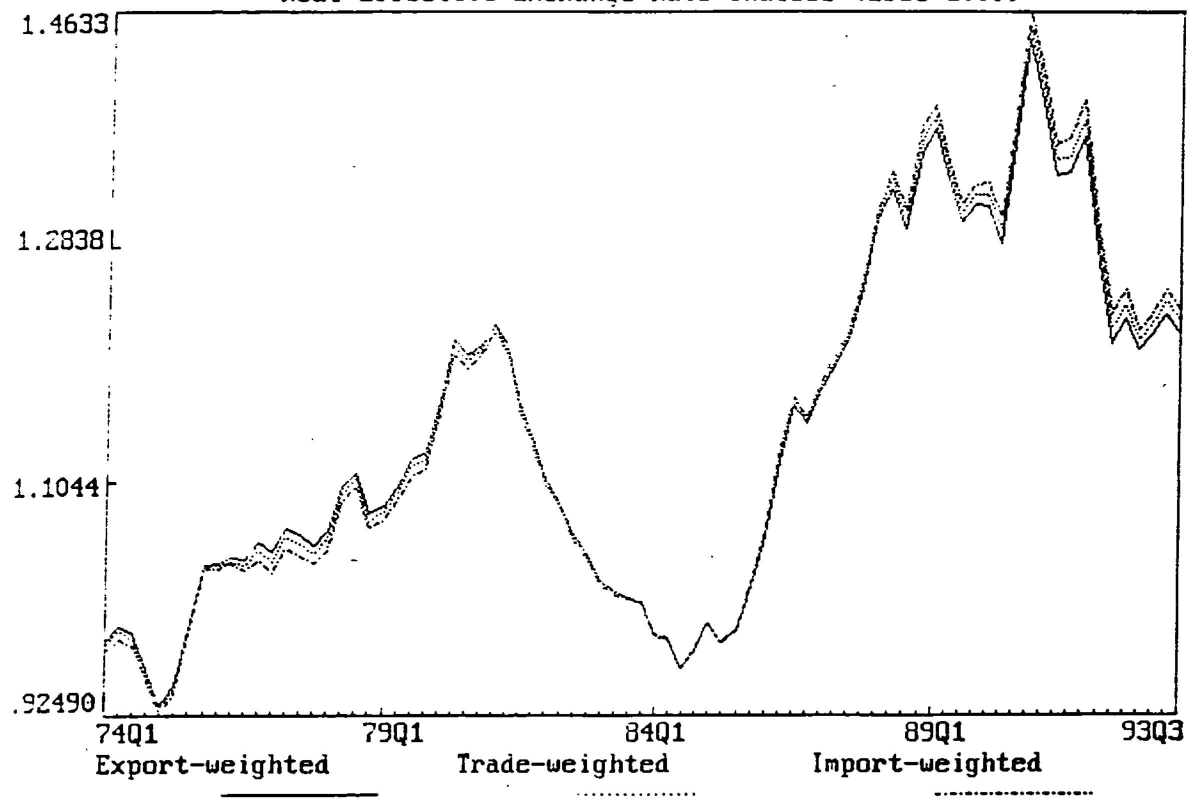


Figure 5C
Relative Prices (Export-, Import- and Trade-Weighted)

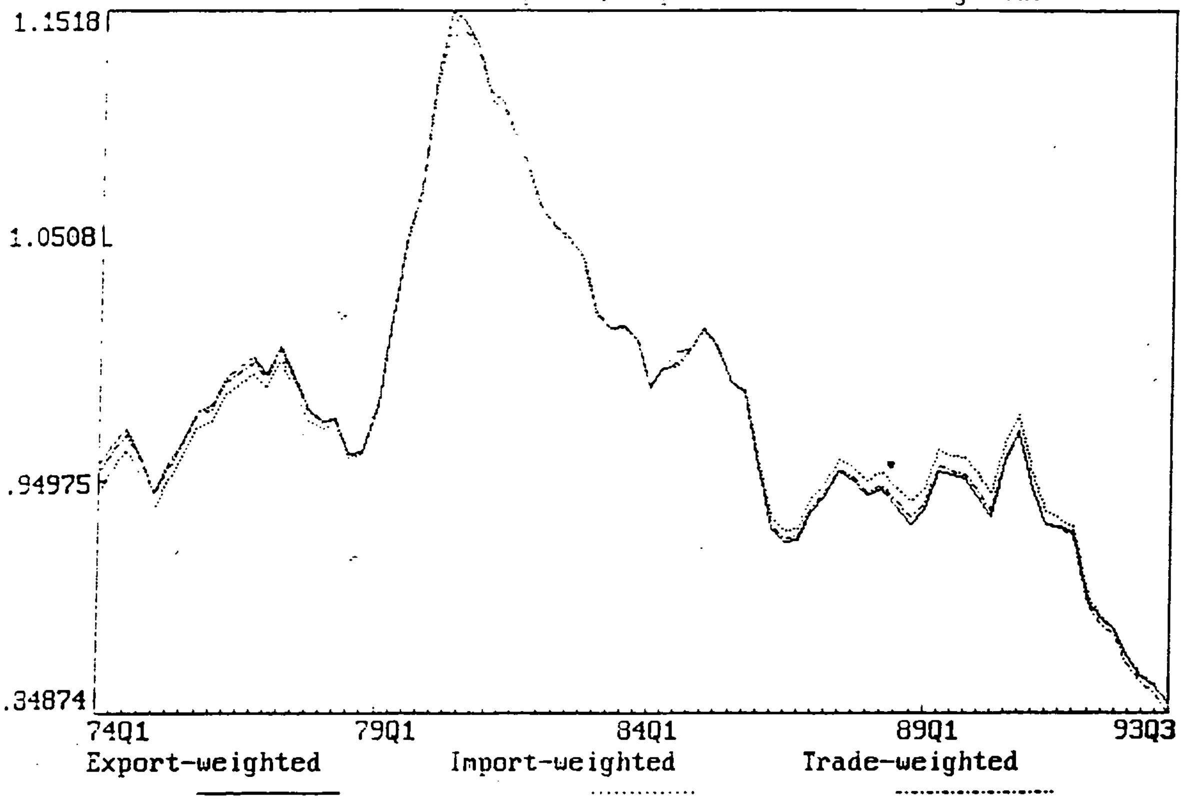


Figure 5D
Nominal Bilateral Exchange Rate (M$/US$) Index (1985=1.00)

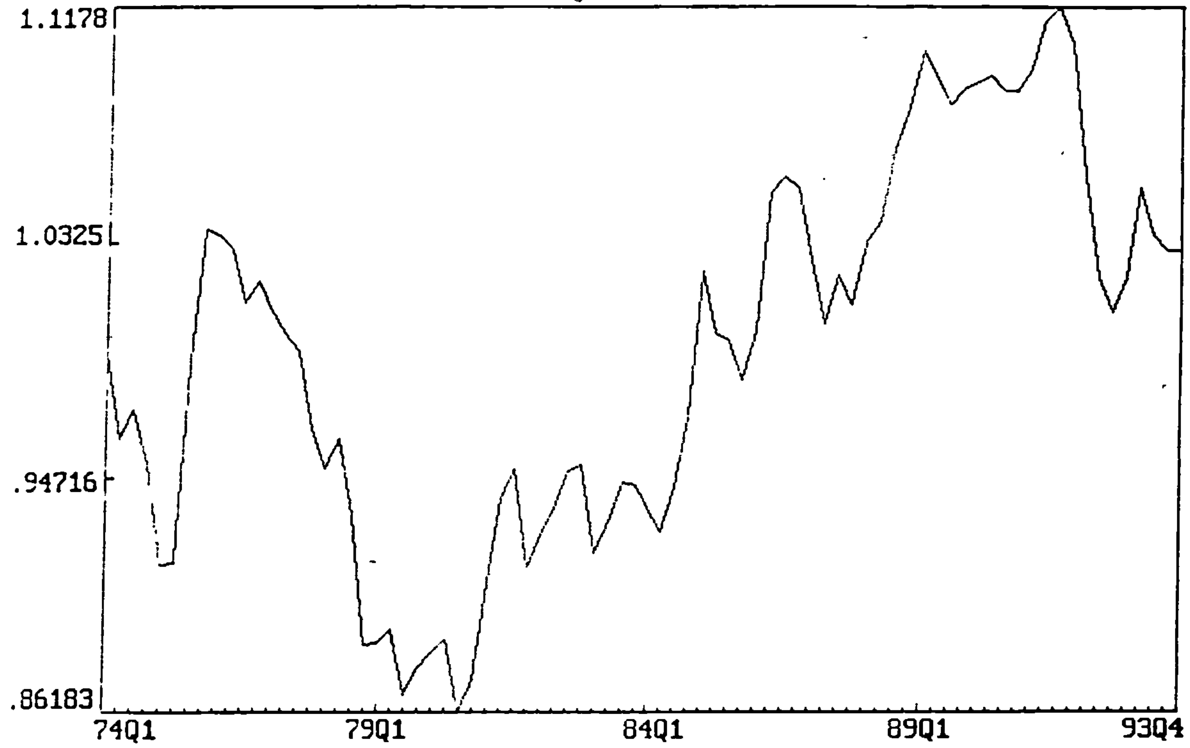


Figure 5E
Real Bilateral Exchange Rate (M$/US$) Index (1985=1.00)

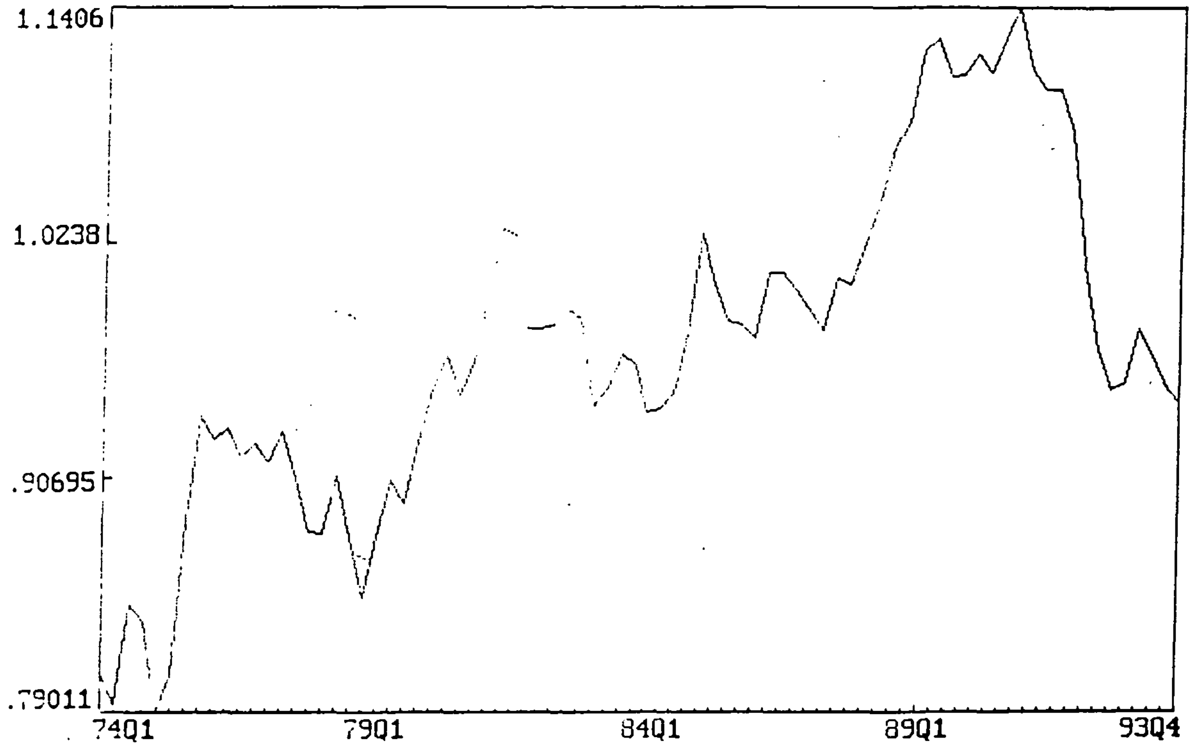
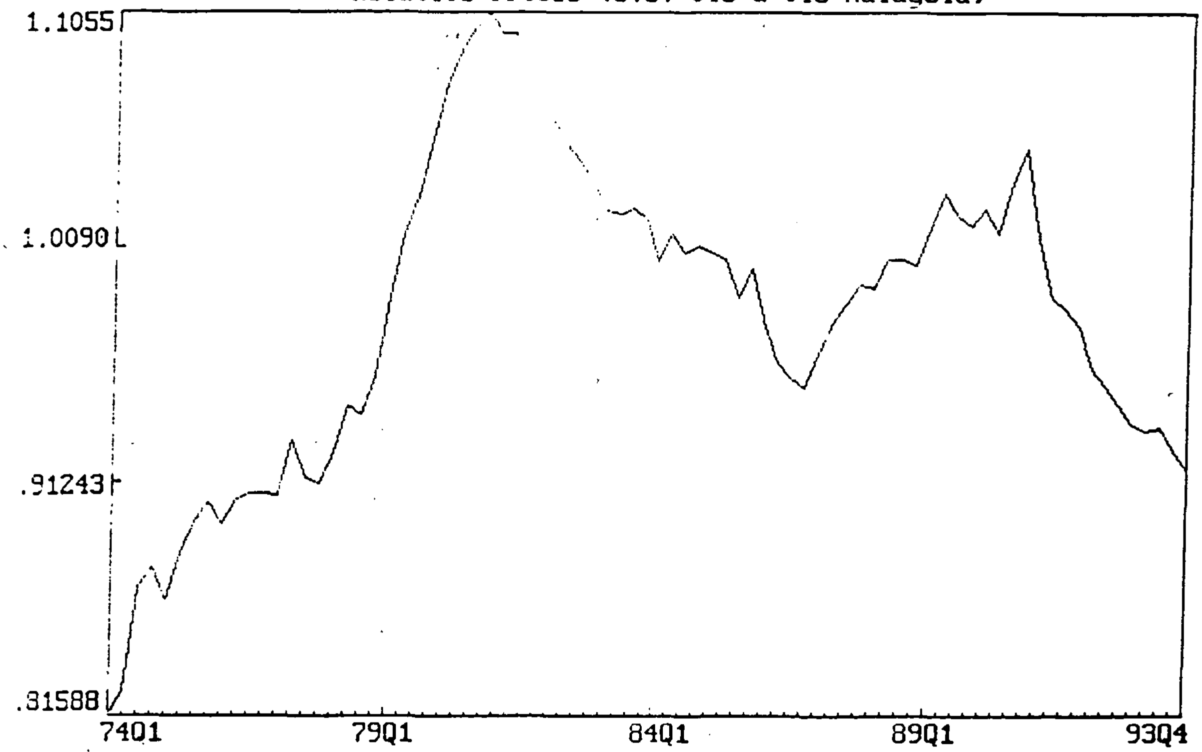


Figure 5F
Relative Prices (U.S. vis-a-vis Malaysia)



It is evident that the Malaysian currency (in real and nominal effective terms) has been undergoing a depreciation since 1984Q3 though it appears to be strengthening since 1990Q3 in real terms. Though exports (in real and nominal terms) also seem to have risen steeply since the mid 1980s (Figures 5G and 5H), it is not however altogether clear that it can be attributed solely to the depreciating tendency of the ringgit. The steep rise in exports was in fact made possible by an intensification in the mid 1980s of the government's export promotion efforts initiated in the early 1970s with a view of broadening the nation's industrial base. Moreover even if the depreciation did auxillariate the export-promotion exercise, it need not lead to a faster economic growth . As Figures 5I and 5J indicate, merchandise imports have also risen steeply both in nominal and real terms. This view is further corroborated by Figures 5K and 5L that show a high positive correlation amongst exports, imports and GDP both in nominal and real terms. Furthermore real and nominal merchandise trade balances have not exhibited any upward surplus trend (Figures 5M and 5N). Hence even if a real exchange rate depreciation does contribute to export growths, by no means is it a sufficient condition for economic growth. Perhaps as a policy lesson for developing countries, real exchange rate depreciation per se could only auxillariate economic growth if the industrial complex is already well established. It is imperative to have an industrial or structural development policy as well. Hence Malaysia's economic growth and development performance has not so far rested solely on real exchange rate management. As will be seen in the empirical section later, periods of undervaluation and overvaluation have been quite commonly observed in the nation's history let alone the weak relationships found amongst real exchange rates, exports and economic growth.

Figure 5G
Real Exports (M$ million)

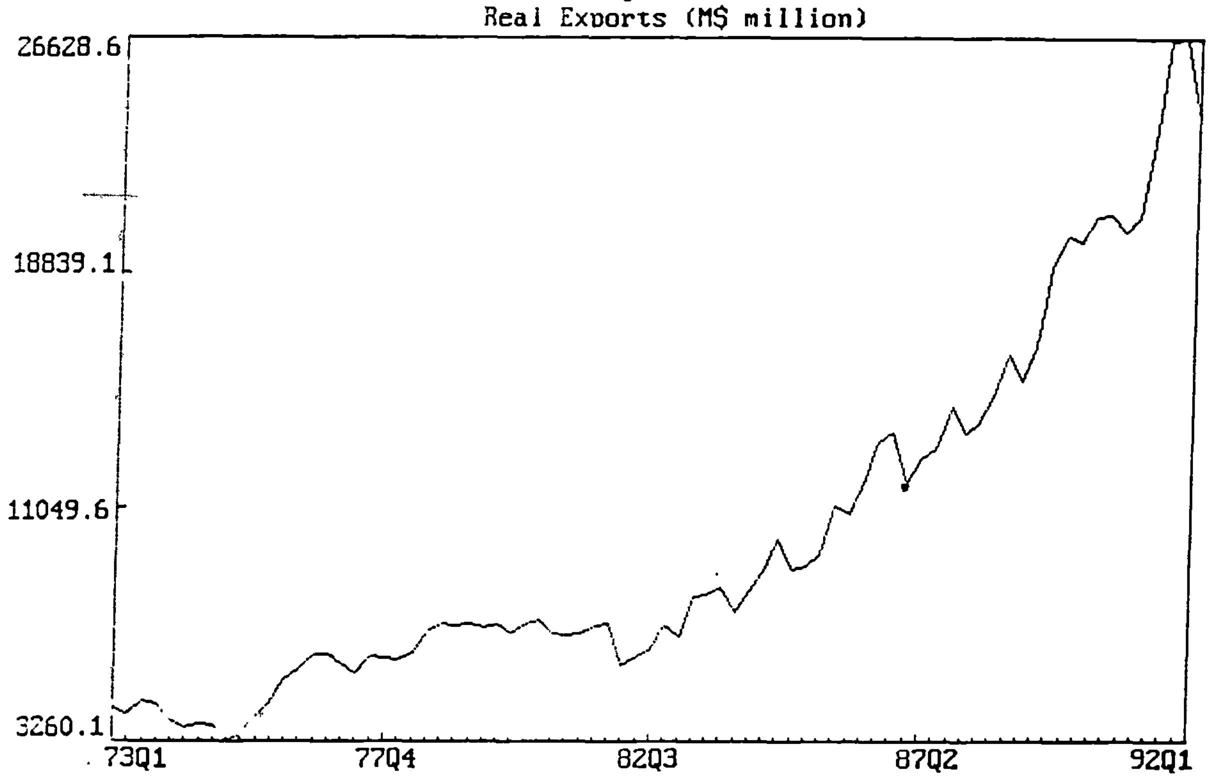


Figure 5H
Nominal Exports (M$ million)

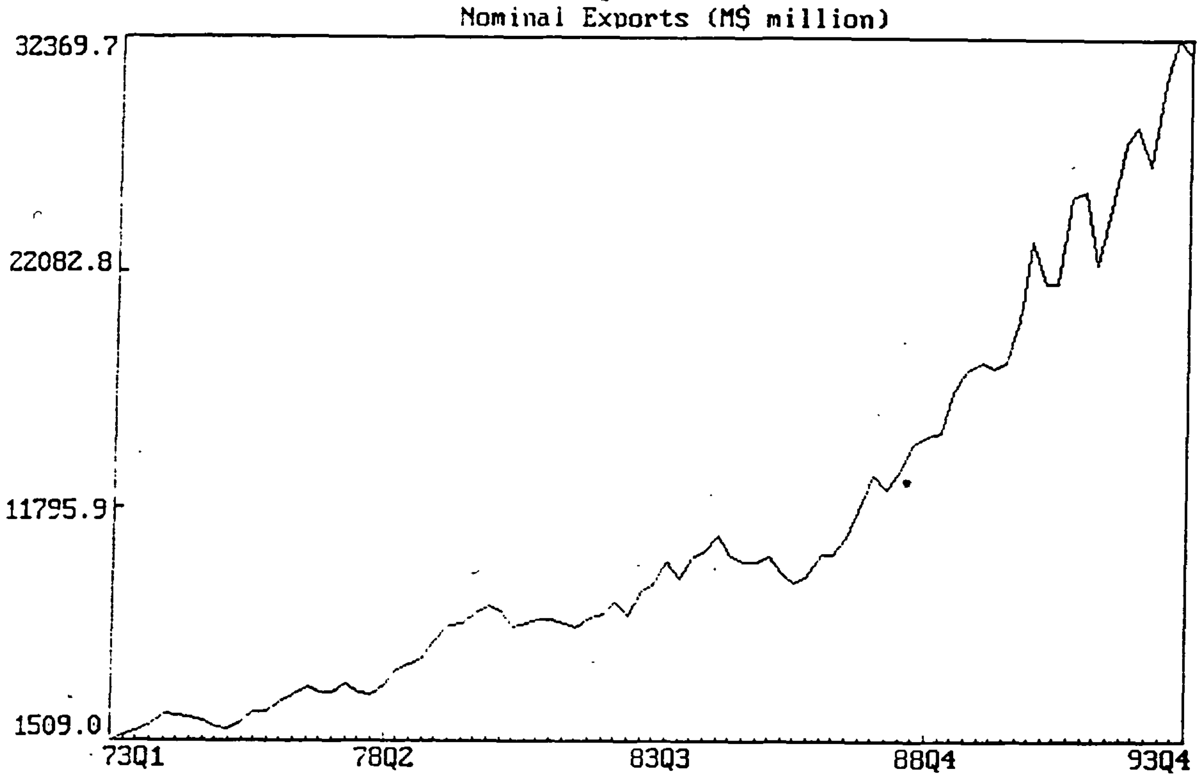


Figure 5I
Nominal Imports (M$ million)

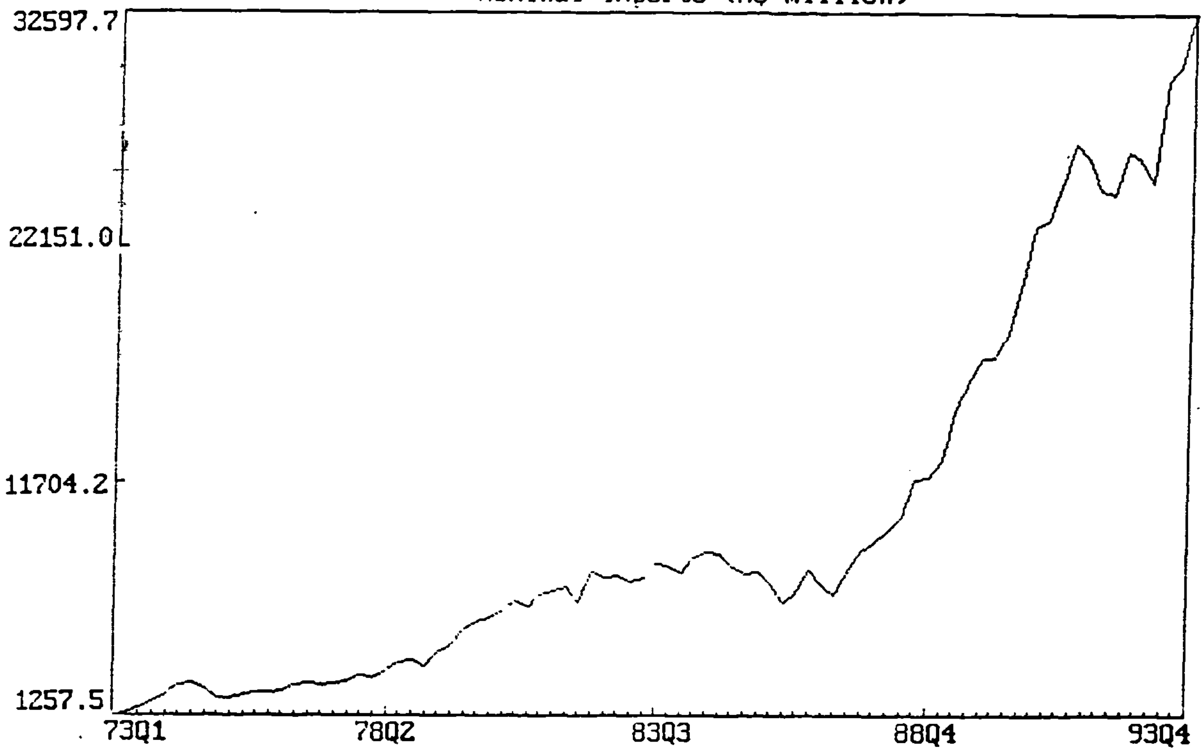


Figure 5J
Real Imports (M$ million)

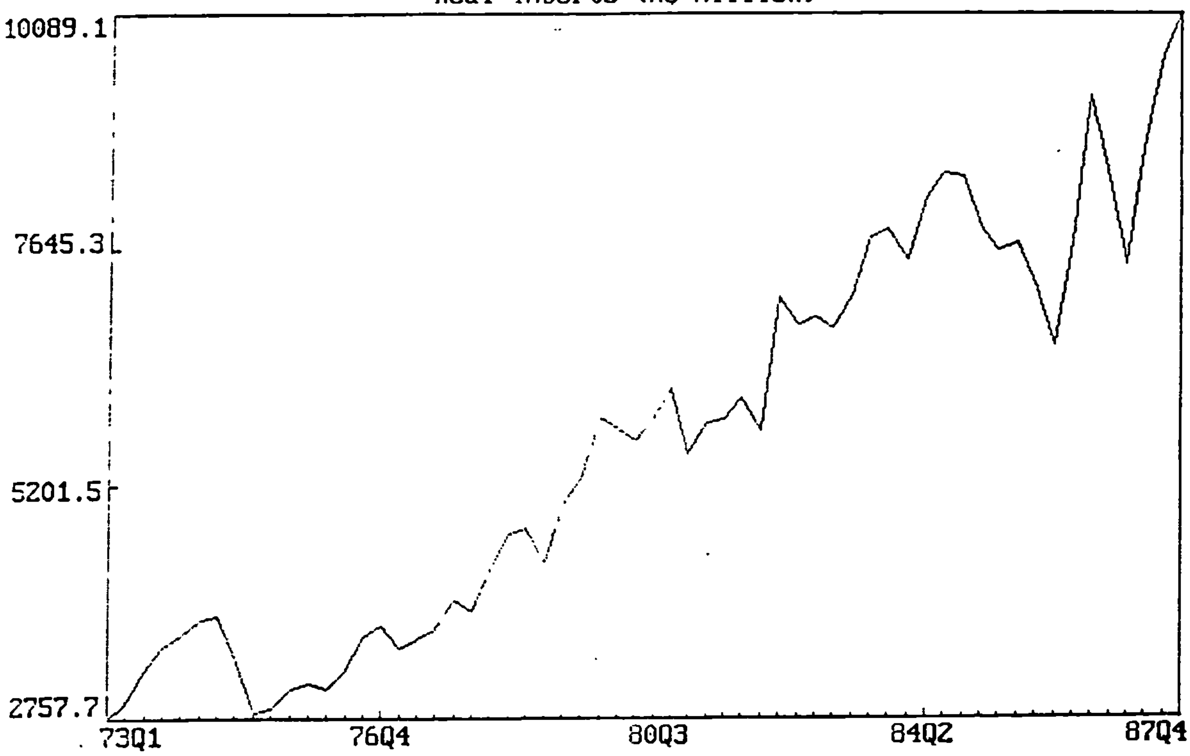


Figure 5K
Nominal Exports, Imports and GDP in M$ million

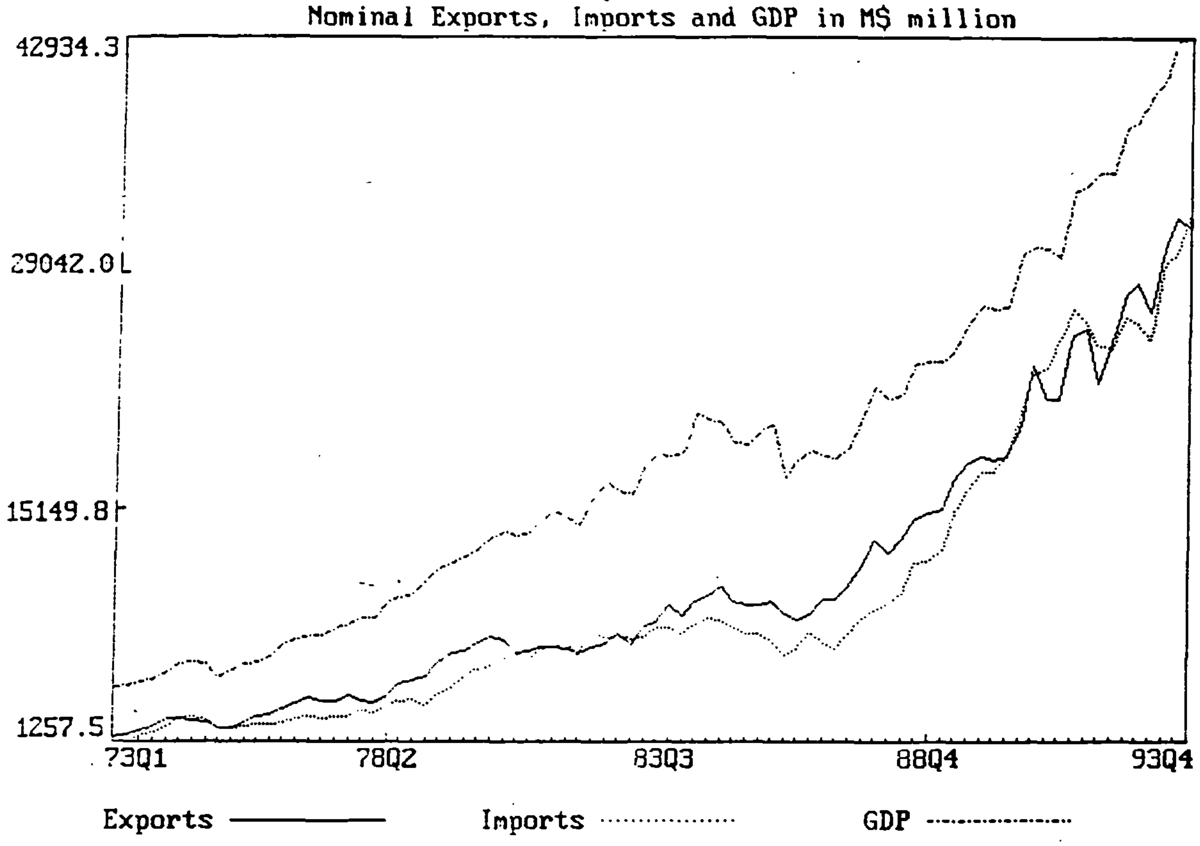


Figure 5L
Real Exports, Imports and GDP in M$ million

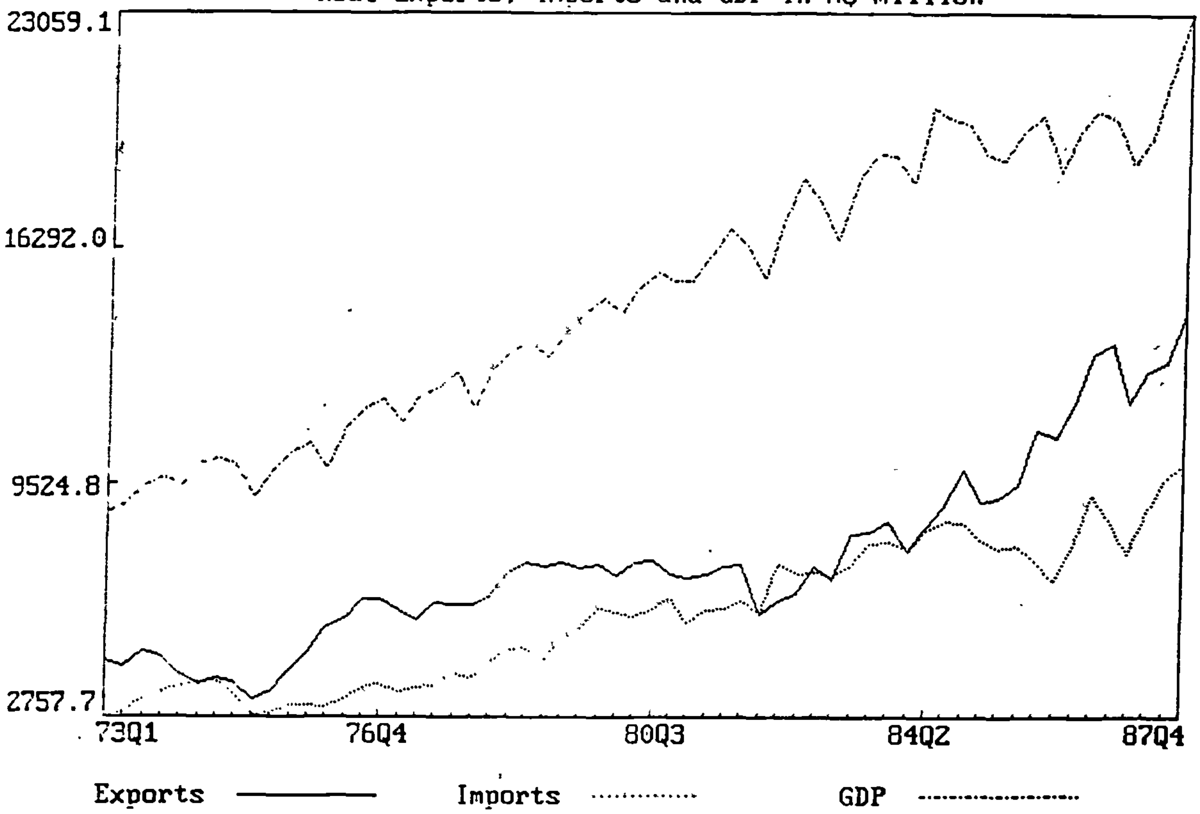


Figure 5M
Real Balance of Trade (M$ million)

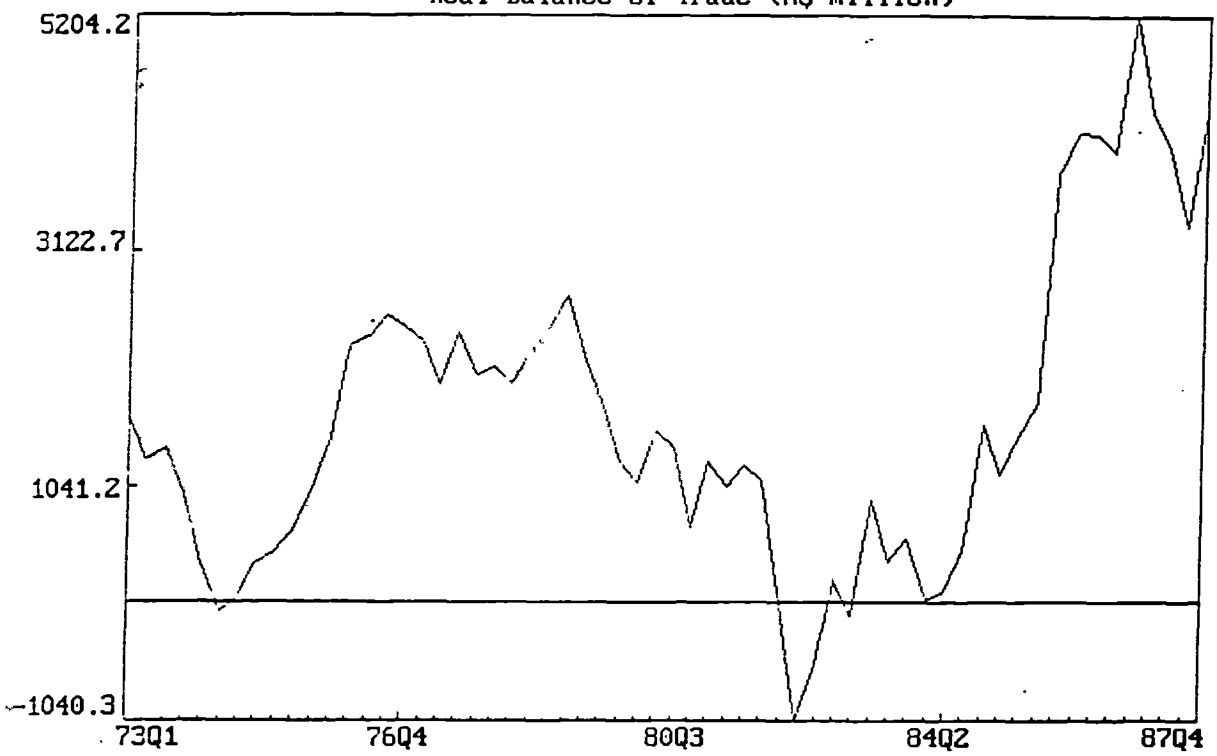
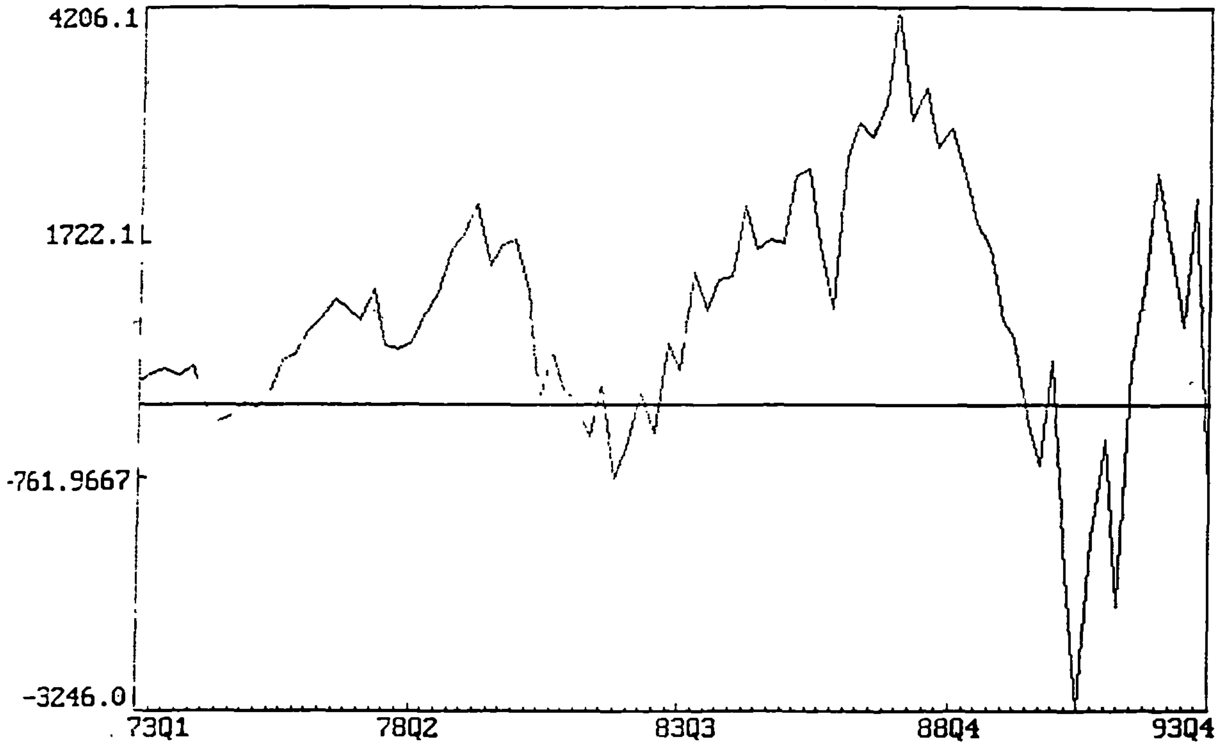


Figure 5N
Nominal Balance of Trade (M$ million)



5.2 Literature Review

The need to understand the real exchange rate situation may at hindsight never be overemphasised for a small open developing economy such as Malaysia with exports and imports accounting for about 70% of GDP and given the strong presence of foreign direct investment in the country. Recent deliberations on exchange rate policy have centered on the relative merits of "real targets" and "nominal anchor" approaches (Corden, 1990 & Tseng, 1992). While the former refers to the use of exchange rates as an instrument to sustain external competitiveness, the latter refers to their use as an anti-inflationary anchor. Hence to rely on the exchange rate policy for these purposes, a clearer understanding of the fundamental determinants of real exchange rate and its feedback mechanism onto the rest of the economy is needed.

The real exchange rate can be expected to display greater short-term variability in a floating exchange rate regime vis-a-vis a fixed exchange rate regime and this is predominantly accounted by persistent variability of nominal exchange rates rather than national price levels (Mussa, 1986). This is because in a floating exchange rate regime, nominal exchange rates assume an asset price behavior as opposed to commodity prices and wages which are more likely to exhibit sluggishness in their movements. Strong correlations exist between nominal and real exchange rate movements. Moreover the differences in the real exchange rate behavior under different nominal exchange regimes appear too substantial and systematic to be accounted solely by exogenous real shocks. Hence all this violates the property of nominal exchange regime neutrality which states that no systematic difference in the behavior of real exchange rate movements should be discerned when moving from a fixed to a floating exchange rate system and vice-versa.

Economic distress in a number of developing countries has largely been attributed to a misalignment of their real exchange rates (Edwards, 1988a; 1988b; & 1989). The vices of exchange rate misalignment have been well documented in Edwards (1988b) and they include considerable losses of a country's welfare when the real exchange rate is maintained at a level inconsistent with its long run equilibrium value. Real exchange rate misalignment is characterised by sustained departures of the actual real exchange rate from its long run sustainable equilibrium level. The misalignment is in turn blamed on to inconsistent macroeconomic policies typically pursued by governments in LDCs. Developing countries especially in Africa tend to favor a fixed exchange rate system and are quite reluctant to devalue their currencies. They prefer trade restrictions and foreign exchange controls against a currency depreciation or devaluation (see e.g. Collier, 1990).

As opposed to the nominal exchange rate which is a monetary concept expressing the relative price of two currencies, the real exchange rate is a real concept expressing the relative price of two goods. The real exchange rate is commonly established as the price of tradables relative to nontradables as follows:

$$RER = E.P_T^* / P_N = P_T / P_N$$

where P_T = domestic price of tradables

P_N = domestic price of nontradables

P_T^* = world price of tradables

E = nominal exchange rate

In fact numerous and often competing definitions of real exchange rate exist. The earliest definition is purchasing power parity-based that regards the real exchange rate as being equal to the nominal exchange rate (E) adjusted by the ratio of foreign price level (P*) to the domestic price level (P), i.e. RER=EP* P. The use of consumer price indices has been popular in this case. The reason put forth for favoring its use is that the index so derived would represent a comprehensive measure of changes in competitiveness as CPIs encompass a broad variety of goods including services (Genberg, 1978). However the use of CPI has a major drawback as the basket of goods used in the computation comprises substantially non traded goods as well (Edwards, 1988b). Harberger (1986), Diaz-Alejandro (1986) and Khan (1986) have strongly recommended the use of the following measure of RER which we shall also be adopting in our empirical analysis as it is commonly relied upon as an indicator of a country's international competitiveness:

$$RER = E.P_T^* \; P_N = E.WPI^* / CPI$$

The foreign price level is proxied by the foreign country's WPI in respect of bilateral real exchange rates or a weighted average of foreign WPIs when effective real exchange rates are considered. With respect to the price of nontradables, the domestic consumer price index has been suggested as a proxy. This is premised upon the notion that foreign countries' WPIs are reasonable proxies for the world price of tradables while the domestic CPI embodies a significant proportion of nontradables. Khan (1986) in defending the use of CPIs further maintains that it is a better yardstick of overall labor costs in the economy.

Movements in the RER may be decomposed into "justified" and "unjustified" changes (Edwards, 1989). The former is induced by real events in the economy such as technological progress, changes in external terms of trade, changes in taxation and etc and such changes may be viewed as an equilibrium phenomenon "Unjustified" changes in the RER on the other hand would result in its departure from the equilibrium value, a phenomenon which may be referred to as a real exchange rate misalignment or disequilibrium.

The equlibrium real exchange rate (ERER) in turn is a general equilibrium concept defined as the relative price of tradables to nontradables that leads to a simultaneous attainment of equilibrium in both the external and domestic (nontradable) sectors of the economy. It is implicit that internal equilibrium involves clearing of the nontradable goods market without unemployment beyond its natural level. On the other hand, external equilibrium implies that the current account balances both present and in the future are compatible with long run sustainable capital flows.

In fact the equilibrium real exchange rate has multiple concepts. A formal analysis of the determination of the equilibrium real exchange rate was earlier effected by Mundell (1971) based upon a macroeconomic model of a monetary economy. In his analysis, the equilibrium real exchange rate is defined as the relative price of international to domestic goods that simultaneously maintains equilibrium in the money market, the domestic goods market and the external goods market. In Dornbusch (1974), the equilibrium real exchange rate is defined as the relative price of tradables to nontradables that equates income to expenditure and at the same time producing equilibrium in the tradable and nontradable goods markets. Williamson (1983, p.14) writes:

"The fundamental equilibrium exchange rate is that which is expected to generate a current account surplus or deficit equal to the underlying capital flow over the cycle, given that the country is pursuing international balance as best as it can and not restricting trade for balance of payments reasons."

Frenkel & Mussa (1984, p.64) express:

"The long run equilibrium real exchange rate is expected to be consistent with the requirement that on average (in present and future periods), the current account is balanced."

However we shall be adhering to the Edwards' (1989) notion of an equilibrium real exchange rate. Edwards maintains that the equilibrium real exchange rate (ERER) should not be perceived as time invariant but rather as a variable that evolves with changes in any of the other variables influencing a country's internal and external equilibria over time. Based upon an inter temporal model, Edwards (1989) contends that there exists a path followed by the ERER over time instead of a single equilibrium value for RER. The ERER in a particular period is then defined as the relative price of tradables to nontradables that produces equilibrium simultaneously in the external and internal (nontradable) sectors given the sustainable values of other variables such as world prices, technology and tariffs. Internal equilibrium refers to the clearing of the nontradable goods market in a current period and that this market equilibrium is expected to be sustained into the future period. By implication, this equilibrium is struck when unemployment is at the "natural level". On the other hand, external equilibrium refers to a condition when the current account balances (present and future) are compatible with long run sustainable capital flows. Specifically, the ERER is a function of a number of variables.These variables are referred to as real exchange rate fundamentals and can be categorised into external and internal. The external fundamentals may include terms of trade, international transfers including flows of foreign aid and real interest rates in offshore financial sectors. Amongst the domestic or internal fundamentals are import tariffs, import quotas, export taxes, exchange and capital controls, other taxes and subsidies, composition of government expenditure and technological progress.

Though the equilibrium real exchange rate may solely be a function of real variables, the actual real exchange rate is a function of both real and monetary variables comprising monetary and fiscal policy variables. A real exchange rate misalignment is then characterised by a situation of large and persistent differences between actual and equilibrium real exchange rates and this wedge may be driven by imprudent macroeconomic policies or more generally nominal disturbances. Lizondo (1989) maintains that exchange rate overvaluations or undervaluations arise from unsustainable macroeconomic policies such as undertaxation or overspending in the public sector rather than being a consequence of failure of markets to clear or failure of economic agents to behave in an optimising manner. There exist certain studies which resort only to the PPP methodology for estimating the extent of real exchange rate overvaluation. However the PPP hypothesis of real exchange rate determination has failed miserably to withstand empirical tests (Edwards, 1989). Moreover, the phenomenon of price stickiness in the goods market and the asset price behavior of exchange rates may combine to generate considerable changes in the RER following monetary policy revisions as an exchange rate overshooting may prevail (Dornbusch, 1976).

Though there is no precise definition of a real exchange rate misalignment, we adhere to Edwards' definition , i.e. a situation characterised by sustained deviations of the actual real exchange rate from its long run equilibrium level. In fact two types of misalignment can be discerned:

1) Macroeconomic-induced misalignment that arise when the actual RER deviates from its equilibrium value owing to inconsistencies between macroeconomic policies and the official nominal exchange rate system. Within a flexible exchange rate regime, monetary policies could

influence both the nominal rate and the domestic goods prices. If an expansionary monetary policy leads to a faster growth of domestic prices beyond the rate of inflation observed in the rest of the world, a decline or an appreciation in the real exchange rate may be precipitated $(E.P_T^{*} \quad P_N)$; and

2) Structural misalignment arising from changes in the fundamentals of the equilibrium RER (ERER) but of which their influence on the actual RER is denied. For instance, a change in the country's international terms of trade should imply a change in the ERER. Hence unless the actual RER is permitted to adjust to these changes in the ERER, the RER wil be structurally misaligned.

A real exchange rate misalignment could imply lower profitability in the industries which relative prices are reduced. More often than not, it assumes the form of domestic currency overvaluation thus undermining tradable activities. This may impair growth performance since productivity improvements are usually concentrated around export-oriented or import-competing industries. Agarwala (1983) demonstrates that a misalignment of the RER is the most important form of distortion influencing economic growth in a diverse group of 31 LDCs. It acts as an implicit tax on exports (Ghura & Grennes, 1993). With an increasing overvaluation of the RER, the profitability of producing exportable goods declines and this discourages production for exports. Imports could at the same time be adversely affected as falling export earnings would contribute to a growing constraint on imports and may even prompt governments to adopt a merchantilistic attitude towards foreign trade. Economic growth would then be hampered by falling imports especially if they are critical inputs to the domestic production process. Hence a 'vicious circle' of falling imports and exports will develop. It has been empirically shown by Khan & Knight (1988), Haque et. al (1990) and Fry (1989) that imports would fall in tandem with the volume of foreign reserves. Moreover it could entail considerable losses of welfare and efficiency especially if it is 'condoned' by an erection of exchange and trade barriers in order to decelerate foreign reserve losses concomitant with a real exchange rate overvaluation. Such controls could involve economic inefficiency costs and promote rent-seeking activities (Krueger, 1978 and Edwards, 1988b).

Moroever exports could be very adversely affected with speculation and massive capital flights as probable outcomes (Cuddington, 1986)

In the empirical literature, three different measures of RER misalignment have been relied upon (Ghura & Grennes, 1993):

1) a PPP-based measure (Balassa, 1990; Agarwala, 1983 and Cottani et.al, 1990);

2) a model-based measure using official nominal exchange rates (Edwards 1988a, 1988b & 1989; Cottani, et.al (1990) and Dollar (1992)) and

3) a model-based measure using black market nominal exchange rates (Edwards, 1989 & 1990).

As mentioned earlier, we shall however be following Edwards (1988a, 1988b & 1989) though without giving any attention to the black market exchange rate as its significance can be ruled out given that Malaysia has been maintaining a liberal exchange control regime.

Nominal devaluation is then often prescribed as a remedy for misalignment as the very process itself assists in the restoration of the equilibrium real exchange rate via an adjustment of the domestic price of tradables. Given that the RER is defined as follows:

$$RER = P_T / P_N = E.P_T^{*}/P_N \; ,$$

a higher RER or a devaluation can be sustained by a rise in P_T or specifically E. A devaluation has as its objective to boost a country's international trade competitiveness and hence bringing about an improvement in the external payments position via expenditure reducing and switching effects. However a devaluation may be contractionary if there is a severe increase in the domestic price of imported intermediate products.

Broadly, the effects of depreciation on the macroeconomic performance in a flexible exchange rate system parallel the macroeconomic effects of a devaluation in a fixed exchange rate regime. It is commonly believed that in the absence of full employment, a nominal devaluation would have both expenditure switching and reducing effects that could boost the production of tradables, exports and the external payments position of a country concerned.[3] A devaluation may also expedite the adjustment of the real economy to disturbances be they exogenous or policy-induced (van Wijnbergen, 1986).

There exists mixed evidence however on the effects of devaluation on economic activity, giving rise to the controversy whether a devaluation is contractionary or expansionary (Edwards, 1986 & van Wijnbergen, 1986). Doubts about the expansionary impact of a devaluation arise from two intermediate negative effects that a devaluation could generate namely the distributional effect (i.e. the effects of initial fiscal or current account deficit) and the real balance effect. The positive expenditure switching effect could be overwhelmed by these two effects. Moreover the contractionary impact of a devaluation on economic activity may be transmitted not only via the demand-side of the economy (Diaz-Alejandro, 1963 and Krugman & Taylor, 1978) but also via the supply side (van Wijnbergen, 1986). The incidence of intermediate goods imports, real wage indexation based upon imported wage goods (namely food) and the significance of the volume of bank credit in real terms in the financing of working capital requirements may constitute those channels via which a nominal devaluation may yield a contractionary aggregate supply impact. This may defeat or undermine the original purpose of a devaluation if domestic inflation is fuelled by the supply shock. Edwards' empirical results suggest that devaluations would have a negative impact on output initially but a positive one in the subsequent period. Hence in general a devaluation is contractionary in the short run but expansionary in the longer run.

Devaluation is also used as a policy instrument to boost the balance of payments position of a country if its currency has been overvalued. However a sustained improvement in the balance of payments can only be envisaged from a nominal devaluation if it is accompanied by a reversal of unsustainable fiscal policies (Edwards, 1989) which in the first place could have

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[3]When the economy is at full employment, a nominal devaluation would not yield any change in the real exchange rate as it would merely lead to an equiproportionate rise in prices (Johnson, 1976).

caused an overvaluation of the currency concerned. Moreover inconsistent macroeconomic policies may fuel expectations of a devaluation sparking off speculative attacks against the currency (Krugman, 1979). Nevertheless in the case of Malaysia, on no occasion has the government ever publicly declared an exchange rate devaluation. Hence in our empirical analysis later, we shall assume that devaluation has never been relied upon as a policy instrument. Doubts about the efficacy of a real exchange rate devaluation have also been cast by a recent study by Faini & de Melo (1990). In a review of countries pursuing structural adjustment policies since 1982, Faini and de Melo contend that sharp devaluations of the exchange rate is probably ineffective for countries exporting primary goods. This may not be true for countries exporting manufactures.

While our attention has so far been focussed on the structural approach to real exchange rate determination, there exists another approach in the literature that views the real exchange rate (RER) as merely following a random walk with or without drift (C) (Stein, 1990). Furthermore, the random walk hypothesis claims that neither is the drift term determined by systematic economic forces. The random walk hypothesis of real exchange rates may be represented as follows:

$$RER_t = C + RER_{t-1} + \varepsilon_t$$

where ε is independently and identically distributed with zero mean. This approach understandably does not concur with the long run purchasing power parity hypothesis where the nominal exchange rate would vary with relative prices causing the convergence of the real exchange rate to a constant value. Nevertheless, the random walk hypothesis could hardly explain the observed movements in both nominal and real exchange rates.

Preservations of exchange rate competitiveness might have been a crucial factor to the economic development success of Hong Kong, Singapore, Taiwan and Korea. Fry's (1988) examination of the monetary and financial policies of these countries reveal that:

1) a complementarity exists between monetary and exchange rate policies and that there has been no pressure for monetary expansion to finance government deficits in these countries; and

2)domestic inflation due to accelerated monetary expansions has not been allowed to cause any appreciation in their currencies in real terms unlike majority of developing countries. Overvaluation of their domestic currencies has been forestalled since the early 1960s. These have been the key to their successful export-led growth. In fact liberalisation of trade and payments regimes has generated a substantial depreciation of the real exchange rates of Singapore and Korea over the 1960-79 period. In fact Korea's exchange rates have been the key to the country's outstanding economic growth performance with its effect on exports outstripping those of other domestic economic variables (Balassa, 1991). The exchange rate has been relied upon as a policy variable for offsetting any differential between domestic and foreign inflation rates. The growing integration of capital markets world wide with an ever increasing degree of capital mobility across national boundaries as its outcome has led to sharp exchange rate fluctuations since the advent of generalised floating (Lin, 1989). This poses a severe challenge to exchange rate management. Real exchange rate movements also potentially dictate the problems and success of capital account liberalisation experiments as highlighted by the experience of Southern Cone countries in the late 1970s (Edwards, 1987).[4] Real exchange rate appreciation has been cited as the major cause behind the frustration of these experiments as observed in Argentina, Chile and Uruguay towards the end of 1970s and early 1980s. Financial liberalisation potentially leads to exchange rate misalignment particularly overvaluation owing to two inter-related factors:

1) Massive influx of foreign funds as induced by the opening of the capital account; and

2) The fixing of nominal exchange rate as a move to curb inflation.

Hence this exercise will also enable us to ascertain whether Malaysia has been able to maintain its real exchange rate competitiveness despite this trans-national capital mobility given its liberal exchange control regime.

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[4]An informal discussion of the impact of trade and capital account liberalisation on the real exchange rate can be found in McKinnon (1973).

Edwards (1988a & 1989) analyses empirically the relative importance of nominal and real variables in determining RER (bilateral and multilateral) movements of twelve developing countries namely Brazil, Colombia, El Salvador, Greece, India, Israel, Malaysia, Philippines, South Africa, Sri Lanka, Thailand and Yugoslavia using data spanning from 1965 through 1984. The pooling regression technique has been used in the estimation. It is discovered that short run real exchange rate movements do respond to both nominal and real disturbances, that expansive and inconsistent macroeconomic policies inevitably lead to a real overvaluation and that the RER would adjust slowly towards its equilibrium level in the event of any deviation.

Edwards (1988b) also examines empirically the effects of real exchange rate misalignment on economic growth in 12 developing nations namely Brazil, Colombia, El Salvador, Greece, India, Israel, Malaysia, Philippines, South Africa, Sri Lanka, Thailand and Yugoslavia using data and pooling regression techniques over the period 1965-85. His empirical results suggest the tendency for countries exhibiting larger and more persistent RER misalignments to exhibit poorer economic performance than those that managed to maintain their real exchange rates closer to the equilibrium level. Hence poor economic performance can be associated with real exchange rate misalignments.

Cottani, et.al (1990) explores the correlation between RER behavior and economic performance for a cross section of LDCs. They merely concentrate on the bilateral exchange rate behavior. The correlation could have arisen from the following circumstances:

1) the RER may constitute one of the links between policy and economic performance. Hence policies that stabilise the RER around a realistic level may enhance growth via this mechanism; and/or

2)both growth and the RER may be influenced by policy measures that somehow enhances the correlation between the two without necessarily implying any causal relationship. For instance policies that generate a stable environment and that promote a better utilisation of scarce resources may also induce an appropriate RER alignment. All in all a strong negative correlation between macroeconomic performance on one hand and RER instability and misalignment on the other is found by them. Ghura & Grennes (1993) by using pooled time series and cross section data for 33 countries in Sub Saharan Africa (SSA) also reveal such an inverse relationship. Their analysis also suggests that macroeconomic instability would retard growth and other indicators of performance.

There has been some other work done on Malaysian exchange rates most notably by Rana (1983) and Gan (1989a;1989b & 1991). Gan's focus was also on the real effective exchange rate of the Malaysian ringgit but his attention was only restricted to the testing of the purchasing power parity (PPP) hypothesis and to the relationship between the ringgit real effective exchange rates on one hand and the external terms of trade and the price of nontradables relative to the price of tradables on the other. Moreover in computing the two real effective exchange rate indices, Gan uses consumer price and wholesale price indices mutually exclusively. His conclusions are that:

1) the ringgit effective exchange rate follows a random walk and there is a high persistence of deviations from the PPP with scanty evidence of mean reversion behavior even in the long run; and

2) there is no econometric evidence of a relationship between the long run swings in the ringgit real effective exchange rate on one hand and the external terms of trade and relative price of nontradables on the other.

Rana (1983) explores empirically the causal relationships between real exchange rates and prices for Malaysia and Singapore. Bilateral exchange rates have been used namely M$/US$, M$/Japanese Yen, S$/US$ and S$/Japanese Yen. It is contended by advocates of the monetary approach to exchange rate determination that the causal relationship between exchange rates and prices runs from the latter to the former though a bidirectional causality is also a theoretically plausible view which may be referred to as the vicious/virtuous circle hypothesis. This is because an exchange rate depreciation or devaluation may boost the cost of imported inputs which may in turn contribute to a higher price of domestically-produced goods. This may render the price of these goods less attractive relative to foreign ones in the eyes of both domestic and foreign consumers. In turn this may cause a deficit in the merchandise trade balance thus exerting a depreciating pressure on the domestic currency. Based on his study, Rana concludes that there exists an undirectional causality running from relative price changes to exchange rate changes except in the case of M$/US$ which the vicious/virtuous circle hypothesis seems to hold.

5.3 Possible Macroeconomic Implications of Equilibrium Credit Rationing: The Dornbusch's Model

This section discusses the possible implications for exchange rate, price and output movements in an economy where equilibrium credit rationing prevails in the domestic banking system. To meet this objective, the Dornbusch's (1976) model is adapted. The basic assumptions involved in our analysis are:

I) The country is small in the world capital market such that foreign interest rates may be treated as exogenously given;

II) Asymmetric information in the domestic banking system prevails;

III) The smallness of the domestic economy implies that it faces a given price for imports;

IV) Imperfect substitutability between domestic output and imports;

V) Both the absolute and relative prices of domestic goods are determined by aggregate demand;

VI) Prevalence of perfect foresight;

VII) Output responds in the short run to aggregate demand movements;

Our adapted version of the Dornbusch's model may be represented as follows in natural logarithmic form:

International Arbitrage Condition: $r + \alpha = r^* + x$ (1)

where r = domestic interest rate

α= a constant capturing the severity of asymmetric information problem in the domestic financial market

r^* = foreign interest rate

x = expected rate of depreciation

α represents a wedge that prevents the domestic interest rate from matching the foreign level. The larger is its magnitude, the greater the degree of asymmetric information problem it reflects of the domestic financial market. This is premised on the notion that equilibrium credit rationing in the bank credit market places a lid on the lending rate which also implies a supression of other interest rates in the economy. For instance if banks find lending operations unattractive, they may prefer to invest their loanable funds in alternative financial instruments that guarantee a safe return. The increased demand for such financial instruments would push up the price of these instruments, thus limiting their rates of return. In fact implicit in equation (1) is also the assumption that domestic financial institutions are 'encouraged' to disburse their funds locally though they retain some liberty to invest abroad.

Money Demand Equation: $m - p = \phi y - \lambda r$ (2)

where m = money supply

p = price level

y = income

r = domestic interest rate

There is constant clearing in the domestic money market.

Goods Market Condition: $y = \ln D = u + \delta(e-p) + \gamma y - \sigma r$ (3)

$\dot{p} = \Pi(y - \bar{y})$ (4)

where y = output

u = constant

e = exchange rate expressed as the price of foreign currency in terms of domestic currency

$\dot{p}$ = rate of inflation

$\bar{y}$ = full employment or potential output

Equation (3) is the short run goods market equilibrium condition suggesting the responsiveness of output to changes in aggregate demand. The rate of inflation that varies directly with the deviation between the current output level and the full employment output level is depicted by equation (4). It may also be perceived as depicting the relationship between wage and price inflation, and unemployment in a Phillips curve relationship and a relation between unemployment and departures from potential output $(y-\bar{y})$ as described by Okun's law.

Consistent Expectations: $x = \theta(\bar{e} - e)$ (5)

where $\bar{e}$ the known long run exchange rate at which the economy will converge.

To begin our analysis, we transform (3) to arrive at the following output equation:

$$y = \mu(u+\delta(e-p)-\sigma r) \qquad (3A)$$

where $\mu = 1/(1-\gamma)$

Substituting (5) in (1) and then incorporating the result in (2), a new money demand equation is obtained:

$$m-p = \phi y-\lambda r^{*}-\theta\lambda(\bar{e}-e)+\lambda\alpha \qquad (2A)$$

Equation (2A) may be rearranged as follows:

$$p-m+\phi y = \lambda r^{*}+\theta\lambda(\bar{e}-e)-\lambda\alpha \qquad (2B)$$

Since in the long run equilibrium, $y = \bar{y}$ and $r = r^{*}-\alpha$, the long run goods market relation can be obtained from (3A):

$$\bar{y} = \mu(u+\delta(\bar{e}-\bar{p})-\sigma(r^{*}-\alpha)) \qquad (3B)$$

The short run goods market equilibrium condition expressed in terms of deviation from long run equilibrium may be derived by subtracting (3B) from (3A):

$$y-\bar{y}=\mu(\delta+\sigma\theta)(e-\bar{e})+\mu\delta(\bar{p}-p) \qquad (3C)$$

Given a fixed money supply, long run equilibrium implies that the domestic interest rate will equal the foreign interest rate minus the asymmetric information interest rate dampening factor by virtue of the equality between current and expected rates. Hence the long run price level may be derived from (2B) with $\bar{e} = e$ as follows:

$$\bar{p}=m+\lambda(r^{*}-\alpha)-\phi\bar{y} \qquad (2C)$$

In order to obtain the money-market equilibrium condition in terms of deviation from long run equilibrium, we subtract (2C) from (2B) and the following is derived:

$$(p-\bar{p})+\phi(y-\bar{y})=\lambda\theta(\bar{e}-e) \qquad (2D)$$

Equations (3C) and (2D) can be solved simultaneously to yield the level of output and the spot exchange rate as a function of the price level as follows:

$$y-\bar{y} = -(\mu(\delta+\theta\sigma)+\mu\delta\theta\lambda)(p-\bar{p})/(\lambda\theta+\phi\mu(\delta+\theta\sigma))$$

$$= -\omega(p-\bar{p}) \qquad (3D)$$

where $\omega=(\mu(\delta+\theta\sigma)+\mu\delta\theta\lambda)/\Delta$ and $\Delta=\lambda\theta+\phi\mu(\delta+\theta\sigma)$

Substituting (3D) in (2D) yields the following for the spot exchange rate:

$$e-\bar{e} = -((1-\phi\mu\delta)/\Delta)(p-\bar{p}) \qquad (2E)$$

We shall now consider the impact and long run effects of some policy aimed at eradicating asymmetric information problems in the financial market. Substituting (3B) in (4) we arrive at the following:

$$\dot{p}=\Pi(y-\mu(u+\delta(\bar{e}-\bar{p})-\sigma(r^*-\alpha)))$$

Letting $\dot{p}=0$, $\quad y = \mu(u+\delta(\bar{e}-\bar{p})-\sigma(r^*-\alpha))$

Henceforth, $\bar{e} = \bar{p}+(1/\delta)(\sigma(r^*-\alpha)+(1-\gamma)\bar{y}-u) \qquad (6)$

Substituting (2C) in (6), a new long run equilibrium exchange rate equation is obtained:

$$e = m + \left[\lambda + \frac{\sigma}{\delta}\right](r^* - \alpha) - \left[\phi - \frac{(1-\gamma)}{\delta}\right]\bar{y} - \frac{u}{\delta} \qquad (6A)$$

Differentiating e with respect to α:

$$\frac{d\bar{e}}{d\alpha} = -\left[\lambda + \frac{\sigma}{\delta}\right]$$

This implies that measures taken to curb information asymmetries (in this context a decline in α) would precipitate a depreciation in the long run equilibrium exchange rate. The magnitude of the influence depends upon the interest elasticity of money demand and the interest and real exchange rate elasticities of goods demand. The lower the interest elasticity of money demand, the smaller will be the extent of the depreciation.

Then by differentiating (2C) with respect to α,

$$\frac{d\bar{p}}{d\alpha} = -\lambda$$

we note that an increase in the long run price level would be the outcome of any improvement in the financial market condition. The magnitude of the increase hinges upon the interest elasticity of money demand.

In order to consider the impact effect of a fall in α on the exchange rate, the following can be derived from (2E):

$$\frac{de}{d\alpha} = \frac{d\bar{e}}{d\alpha} + \frac{(1-\phi\mu\delta)}{\Delta}\frac{d\bar{p}}{d\alpha}$$

$$= -\lambda\left[1 + \frac{1-\phi\mu\delta}{\Delta}\right] - \frac{\sigma}{\delta}$$

Since the square-bracketed term is always positive, a reduction in α would lead to an instantaneous depreciation of the spot rate. The extent of depreciation would be correspondingly higher the greater is the interest elasticity of money demand.

By virtue of equation (3D), the impact effect on real output may be derived as follows:

$$y-\bar{y}=-\omega(p-\bar{p})$$

$$\frac{dy}{d\alpha}=-\omega\frac{d\bar{p}}{d\alpha}$$

$$=-\lambda\omega$$

Hence $dy/d\alpha=-\omega\lambda$. This implies that any policy measures taken to reduce α would result in an instantaneous hike in the output level. The magnitude of the increase would also vary directly with the interest elasticity of money demand.

5.4 Fundamental Determinants of Equilibrium Real Exchange Rates

Our real effective exchange rate indices have been computed as follows:

$$RER_t=\sum_{i=1}^{k}\beta_i E_{it}P_{it}^{*}/P_t$$

where RER_t = the real effective exchange rate index of Malaysia in period t (1985=1.00)

E_{it} = index of nominal exchange rate (price of foreign currency in terms of domestic currency) between the Malaysian ringgit and country i's currency in period t (1985=1.00)

i=1,......,k refers to the k partner countries used in the construction of the RER index

β_i = weight assigned to partner i in the computation of RER index

P_{it}^{*} =wholesale price index of partner i period t (1985=1.00)

P_t=consumer price index of Malaysia in period t (1985=1.00)

The foreign countries and weights assigned to each of them in the computation of the various RER indices are as follows:

Trade-Weighted - U.S. (16.5%), Australia (3.3%), Japan (28.4%), France (1.9%), Germany (4.1%), Netherlands (4.5%), U.K. (3.8%), India (2.3%), Singapore (21.2%), Thailand (4.1%), Korea (5.1%), Italy (1.2%), Philippines (2.6%) and Canada (1%);

Export-Weighted - U.S.(14.64%), Australia (1.96%), Japan (28.12%), France (1.20%), Germany (3.01%), Netherlands (6.69%), U.K (2.95%), India (3.21%), Singapore (22.22%), Thailand (3.92%), Korea (6.73%), Italy (0.94%), Philippines (2.74%), Canada (0.78%) and Pakistan (0.90%); and

Import-Weighted - U.S. (18.91%), Australia (5.02%), Japan (28.48%), France (2.86%), Germany (5.53%), Netherlands (1.37%), U.K. (4.89%), India (1.00%), Singapore (19.59%), Thailand (4.38%), Korea (2.77%), Italy (1.46%), Philippines (2.31%), and Canada (1.42%).

The countries taken into consideration for the computation of trade-, export- and import-weighted indices accounted for about 84.02%, 87.35% and 80.85% of total external trade, exports and imports of Malaysia respectively in 1985.

The dynamics of the RER behavior is generally specified by Edwards (1988a & 1989) as follows:

$$\Delta \ln e_t = \theta\{\ln e_t^* - \ln e_{t-1}\} - \lambda\{Z_t - Z_t^*\} + \phi\{\ln E_t - \ln E_{t-1}\} - \psi\{PMPR_t - PMPR_{t-1}\} \quad (5.4a)$$

The first term on the right hand side of the equation above (a partial adjustment term) is aimed at capturing the autonomous tendency of the actual real exchange rate (e) to correct for existing misalignments, i.e. to restore itself to its equilibrium level (e*). The rapidity of this self adjustment is indicated by the estimate of θ. The larger is the magnitude of θ, the faster is the adjustment speed. The short run impact of inconsistent macropolicies on the real exchange rate is captured by the second term i.e. $-\lambda\{Z_t - Z_t^*\}$. It suggests that the pursuit of unsustainable macropolicies in the medium to longer run that is inconsistent with a pegged rate {i.e. if $Z_t \succ Z_t^*$} would result in a real appreciation. The preponderance of this term over the former could generate an increasing degree of overvaluation over time. The third term of the equation, $\phi\{\ln E_t - \ln E_{t-1}\}$ relates to the possible effect of nominal devaluation on the RER movements. However since Malaysia has never openly declared a devaluation of its currency and furthermore since it does not maintain a fixed exchange rate regime, this term will be excluded from our empirical analysis. Finally the term, $-\psi\{PMPR_t - PMPR_{t-1}\}$ relates to the possible influence of movements in the parallel market premium on the real exchange rate. Neither will this be considered in our analysis as the significance of the parallel market may be ruled out by Malaysia's maintenance of a liberal exchange control regime. This is in fact reinforced by the findings of Phylaktis & Kassimatis (1994) that a black market exists for foreign exchange in both Malaysia and Singapore albeit limited. Moreover the margin between official and black market rates may not be significant and their movements are parallel. Phylaktis and Kassimatis plot both the black and official exchange rates of a number of countries namely Korea, Taiwan, Indonesia, Malaysia, Philippines, Singapore and Thailand. In the case of Malaysia and Singapore, both rates appear to move remarkably closely with one another. It is even maintained by Ng (1988) that the black market for foreign exchange is almost non existent in Malaysia and Singapore as a large proportion of the demand for foreign exchange can be satisfactorily met in the official market.

To prepare the groundwork for estimating equation (5.4a), Edwards then specifies the following equilibrium RER equation:

$$ln\, e_t^* = \beta_0 + \beta_1 \ln TOT_t + \beta_2 \ln NGCDP_t + \beta_3 \ln TAR_t + \beta_4 \ln TPRO_t + \beta_5 \ln KAPF_t + \beta_6 \ln INVY_t + u_t \qquad \text{..........(5.4b)}$$

The effect of a terms of trade (TOT) movement on the equilibrium real exchange rate (e_t^*) is ambiguous as both an equilibrium real depreciation or appreciation could result from a TOT improvement, i.e. $\beta_1 \succ or \prec 0$. The direction of the effect depends on the relative strength of income and substitution effects. A preponderance of the income effect over the substitution effect emanating from an improved TOT may lead to an appreciation of e_t^*. For instance, an adverse twist in the external TOT may exert a negative income effect on demand for nontradables irrespective of whether there is a rise in import prices or a decline in export prices. The substitution effect may also reduce the demand for nontradables if export prices fall. If however import prices rise, then the magnitude of the net effect depends on the substitutability between imports and nontradables So long as the income effect is stronger than the substitution effect, the RER will depreciate when TOT deteriorates.

An increase in government consumption relative to GDP (NGCDP) may lead to either an equilibrium real appreciation or depreciation depending upon the composition of increased government expenditure, $\beta_2 \succ or \prec 0$. If the increased expenditure is mainly on nontradables, an equilibrium real appreciation may be precipitated. However if it is mainly on tradables, an equilibrium real depreciation may result.

High import tariffs (TAR) potentially result in an equilibrium real appreciation, $\beta_3 \prec 0$. Such trade restrictions would exert a downward pressure upon the prices of tradables relative to those of nontradables.

The variable technological progress (TPRO) has been included in acknowledgement of its possible influence on the e_t^*, the so-called Ricardo-Balassa effect. The Ricardo-Balassa hypothesis states that an equilibrium RER appreciation may be envisaged by countries experiencing a faster rate of technological progress (Balassa, 1964). Technological changes may boost the demand for nontradables also via a real income effect (Bergstrand, 1991). Nevertheless technological progress that enhances the availability of nontradables may precipitate a decline in the price of nontradables. This implies that a real depreciation remains a possibility.Hence an ambiguity arises as to the overall effect of technological progress, $\beta_4 \succ or \prec 0$.

An equilibrium real appreciation may also be induced by exogenous inflows of capital, $\beta_5 \prec 0$. The inclusion of capital flows (KAPF) is aimed at capturing the effect of capital controls on the equilibrium RER. In the case of Malaysia since it has been maintaining a liberal exchange control regime that permits free inflow and outflow of capital, its inclusion in our empirical analysis may not be appropriate. Moreover the absence of quarterly data on external capital flows precludes its inclusion. Nevertheless its exclusion in our empirical analysis entails an implicit assumption that capital flows lead to RER movements which are inconsistent with the fundamentals.

Finally the ratio of investment to GDP (INVY) has been included in order to capture the possible influence of capital accumulation on the RER movements. The direction of its influence is however also unclear a priori depending upon the sector in which the investment is taking place, tradable or nontradable. Hence $\beta_6 > or < 0$.

Edwards then makes use of the following variables in order to capture the short run influence of inconsistent macroeconomic policies as represented by the term, $-\lambda\{Z_t - Z_t^*\}$ in equation 5.4a:

1) Excess supply of domestic credit (EXCRE) measured as the rate of growth of domestic credit (DC) net of the lagged rate of growth of real GDP as follows:

$$EXCRE_t = \{d\,log\,DC_t - d\,log\,GDP_{t-1}\}$$

This is premised on the assumption that the demand for domestic credit has a unit real income elasticity. As an alternative, Edwards also makes use of the rate of growth of domestic credit. In most LDCs, domestic credit is being expanded by governments either to finance fiscal deficits or boost lending to the private sector. This may contribute to a real exchange rate appreciation.

2) To allow for the possible fiscal policy ramifications on short run RER movements, Edwards incorporates the ratio of fiscal deficit to lagged high powered money (DEH).

Edwards then proceeds to a direct estimation of equation 5.4a based upon the following operational equation:

$$\ln e_t = \gamma_1 \ln TOT_t + \gamma_2 \ln NCGDP_t + \gamma_3 \ln TAR_t + \gamma_4 \ln KAPF_t + \gamma_5 \ln TPRO_t + \gamma_6 \ln INVY_t + (1-\theta)\ln e_{t-1} - \lambda_1 EXCRE_t - \lambda_2 DEH_t + \phi NOMDEV_t - \psi(PMPR_t - PMPR_{t-1}) + u_t$$

where NOMDEV represents nominal devaluation. Equilibrium RERs are then computed based upon the estimated coefficients of the fundamentals and the values of the latter perceived as appropriate. Edwards suggests three possible ways of setting the appropriate values of the fundamentals as follows:

1) The use of actual values of the fundamentals. This will involve the assumption that these values are sustainable values;

2) An arbitrary choice of values based perhaps upon some historical characteristics; and

3) The use of some averaging procedure to smoothen the series of the RER fundamentals.

However in our subsequent empirical exercise, we shall be deriving the equilibrium RER series from estimated cointegrating vectors coupled with actual values of the fundamentals. This will not be an unreasonable move as it appeals to our qualitative judgment that the Malaysian fundamentals have generally been assuming sustainable values given that Malaysia has at least never been plaqued with any severe long term macroeconomic disequilibria both on the external and the domestic front. Furthermore, it has been commended by international agencies as a well-managed economy and that its trade tariff policy has in fact not thwarted its industrial development or progress. The use of the second and third approaches may only serve to introduce another round of distortion to our analysis given the fact that the parameters used in conjunction with them are also estimated from actual rather than the desired values of the fundamentals. Nevertheless just to satisfy our curiosity, we shall attempt the second approach as well in our computation of the degree of real exchange rate misalignment if any.

The long run equilibrium exchange rate to be estimated by us via the Johansen Procedure is as follows:[5]

$$ln\, RER_t = \beta_0 + \beta_1\, ln\, TOT_t + \beta_2\, ln\, FGCY_t + \beta_3\, ln\, MEAXRM_t + \beta_4\, ln\, INVGDP_t$$

[5]The fitted values of this equation is then treated as representing the long run equilibrium real exchange rate while the discrepancy between the fitted and actual is regarded as an overvaluation or undervaluation phenomenon.

where RER_t =the actual real exchange rate (effective or bilateral)

TOT_t=terms of trade expressed as the ratio of unit value of exports to unit value of imports

$FGCY_t$ =federal government consumption as a proportion of national income proxied by current budget (FGCBY) or total expenditure (FGTEY) of the federal government as a proportion of nominal GDP (NGDP)

$MTAXRM_t$= the ratio of total import duties collected to total retained imports

$INVGDP_t$=the ratio of total imports of investment goods to nominal GDP (NGDP) as a proxy for technological progress and or rate of capital accumulation.

A priori expectations of the signs of the various coefficients are as follows:

$$\beta_1 \succ or \prec 0, \beta_2 \succ or \prec 0, \beta_3 \prec 0, and \beta_4 \succ or \prec 0$$

Akin to our earlier chapters on money demand and credit, all the variables involved in this section are subject to both autoregressive and seasonal unit root tests to ensure a non existence of spurious regression problems. Table 5.III presents the results of the conventional unit root tests without the inclusion of any time trend up to the second order while the results with the time trend are presented in Table 5.IV. As can be discerned from the tables, all the variables that are to be considered in long run estimates are I(1) variables while EXCRE (excess supply of domestic credit) and EXM1O (excess M1 supply) are essentially I(0) variables and hence their suitability in our subsequent short run analysis to be incorporated as factors that drive the wedge between the actual and the long run equilibrium rates[6]. The results of seasonal unit root tests are presented in Table 5.V. Generally all the variables are not laden with seasonal unit root problems except for LFGCBY (natural log of the ratio of the federal government current budget expenditure to total income) and LFGTEY (natural log of the ratio

[6]Both EXCRE and EXM1O are operationally defined as the rate of growth of domestic credit and M1 respectively net of the lagged rate of growth of real GDP.

of the federal government total expenditure to total income). However since they only constitute one of the variables involved in our analysis, their seasonal unit root characteristics can be ignored.

Table 5.III

Dickey-Fuller Tests (Without Time Trend)

	Levels	First Difference	Second Difference
LMUSI	-1.9345	-7.0047	-7.3851
LRMUSI	-2.3968	-7.7483	-3.8480
LNERXWI	-0.3933	-3.4469	-7.6510
LREXWI	-2.0394	-3.5521	-12.333
LNERTWI	-0.7899	-3.6564	-12.0126
LRETWI	-2.0045	-3.5518	-12.3427
LNERMWI	-0.8039	-3.6549	-12.0152
LREMWI	-1.9810	-3.5550	-12.2975
LTOT	-2.6319	-6.3452	-8.5148
LFGCBY	-2.9771	-4.4028	-9.5808
LFGTEY	-2.9163	-4.6357	-15.2902
LMTAXRM	2.3649	-6.8065	-7.9350
LINVGDP	0.30461	-10.8941	-7.4599
LFDEBTY	-1.7833	-2.7362	-12.5602
EXCRE	-3.1081	-14.3625	-6.9035
EXM1O	-4.1286	-6.5051	-8.6400

Notes: I) All variables are in natural logarithm except for EXCRE and EXM1O

II) LMUSI - Bilateral exchange rate (M\$/US\$) index
LRMUSI - Real bilateral exchange rate index
LNERXWI - Nominal effective exchange rate index (export-weighted)
LREXWI - Real effective exchange rate index (export-weighted)
LNERTWI - Nominal effective exchange rate index (trade-weighted)
LRETWI - Real effective exchange rate index (trade-weighted)
LNERMWI - Nominal effective exchange rate index (import-weighted)
LREMWI - Real effective exchange rate index (import-weighted)
LTOT - Terms of trade
LFGCBY - Ratio of federal government current budget expenditure to nominal GDP
LFGTEY -Ratio of federal government total expenditure to nominal GDP
LMTAXRM - Ratio of total import taxes to total retained imports
LINVGDP - Ratio of total imports of investment good to nominal GDP
LFDEBTY - Ratio of total federal government debt to nominal GDP
EXCRE - Excess domestic credit
EXMIO - Excess M1 supply

III) Critical values at the 5 per cent significance level for 50 and 100 observations are -2.93 and -2.89 respectively.

Table 5.IV

Dickey-Fuller Tests (With Time Trend)

	Levels
LMUSI	-2.5470
LRMUSI	-1.4957
LNERXWI	-1.8177
LREXWI	-2.2986
LNERTWI	-1.8276
LRETWI	-2.3025
LNERMWI	-1.8585
LREMWI	-2.3164
LTOT	-2.363
LFGCBY	-2.554
LFGTEY	-2.9326
LMTAXRM	-0.4707
LINVGDP	-1.8026
LFDEBTY	-0.8240
EXCRE	-3.2766
EXM10	-3.9329

Notes: Critical values at the 5 per cent significance level for 50 and 100 observations are -3.50 and -3.45 respectively.

Table 5.V

Seasonal Unit Root Tests (The HEGY Procedure)

		't': Π_1	't': Π_2	't': Π_3	't': Π_4	'F': $\Pi_3 \cap \Pi_4$
LREXWI	-	-0.8165	-8.421*	-3.0195*	-4.3459*	16.8888*
	I	-2.0394	-8.4371*	-3.1926*	-4.2408*	17.1418*
	I,SD	-2.0437	-8.3651*	-3.1404	-4.1513*	16.4398*
	I,Tr	-2.2986	-8.5086*	-3.3287*	-4.1075*	17.2593*
	I,SD,Tr	-2.306	-8.4400*	-3.2810	-4.0098*	16.5488*
LRETWI	-	-0.80014	-8.4353*	-3.0164*	-4.3376*	16.83*
	I	-2.0045	-8.4468*	-3.1815*	-4.2343*	17.0528*
	I,SD	-2.0092	-8.4064*	-3.1177	-4.1353*	16.242*
	I,Tr	-2.3025	-8.5266*	-3.3307*	-4.0942*	17.2033*
	I,SD,Tr	-2.3126	-8.4908*	-3.2721	-3.9873*	16.3843*
LREMWI	-	-0.79124	-8.4264*	-2.9927*	-4.3481*	16.7857*
	I	-1.981	-8.4347*	-3.1499*	-4.2448*	16.9661*
	I,SD	-1.9859	-8.4238*	-3.0754	-4.1357*	16.0526*
	I,Tr	-2.3164	-8.5236*	-3.3152*	-4.0961*	17.1538*
	I,SD,Tr	-2.3286	-8.5185*	-3.2464	-3.9794*	16.2313*

		't': Π_1	't': Π_2	't': Π_3	't': Π_4	'F': $\Pi_3 \cap \Pi_4$
LTOT	-	-1.0325	-3.0314*	-3.5591*	-2.6289*	9.8116*
	I	-3.0756*	-4.8109*	-4.5097*	-4.1892*	28.8887*
	I,SD	-3.0028	-4.6791*	-4.3467*	-4.1174*	27.6858*
	I,Tr	-3.6429*	-4.9561*	-4.8783*	-3.9127*	30.5882*
	I,SD,Tr	-3.6462*	-4.8484*	-4.7794*	-3.8216*	29.7757*
LFGCBY	-	-0.4182	-0.7999	-1.1692	0.2847	0.7250
	I	-2.9771*	-1.2748	-1.4093	0.4849	1.1162
	I,SD	-2.8930	-2.8673	-3.0195	0.3210	4.6181
	I,Tr	-2.5540	-1.2667	-1.4001	0.4816	1.1016
	I,SD,Tr	-1.6553	-2.6326	-4.5978*	-0.0318	10.5719*
LFGTEY	-	-0.4394	-0.6121	-0.9724	0.2001	0.4933
	I	-2.9163*	-0.9831	-1.1670	0.2682	0.7184
	I,SD	-2.1667	-2.0876	-5.0598*	0.0854	12.8071*
	I,Tr	-2.9326	-0.9459	-1.0950	0.3087	0.6492
	I,SD,Tr	-1.8894	-2.7184	-5.2273*	0.8638	14.4824*
LMTAXRM	-	3.4315	-3.3386*	-3.3189*	-3.6950*	15.9017*
	I	2.3649	-3.1705*	-3.0365*	-3.6036*	13.9697*
	I,SD	2.2638	-2.7908	-3.1052	-3.9285*	16.8061*
	I,Tr	-0.4707	-3.0548*	-3.0832*	-3.4695*	13.5581*
	I,SD,Tr	-0.4804	-2.6780	-3.1701	-3.7939*	16.4237*
LINVGDP	-	-1.3734	-4.9067*	-6.6041*	-2.8292*	34.2447*
	I	0.1809	-4.8439*	-6.4243*	-2.7586*	31.7389*
	I,SD	0.0248	-5.0825*	-6.6405*	-2.7294*	33.7673*
	I,Tr	-1.7215	-4.7404*	-6.3805*	-2.4997*	29.5977*
	I,SD,Tr	-1.6933	-4.9700*	-6.5848*	-2.5041*	31.6141*
EXCRE	-	-2.4022*	-2.7182*	-3.5412*	0.8715	6.7811*
	I	-3.1081*	-2.7997*	-3.5756*	0.8278	6.8597*
	I,SD	-3.3606*	-3.5860*	-5.6602*	1.1179	17.2243*
	I,Tr	-3.2766	-2.7975*	-3.5674*	0.8111	6.8135*
	I,SD,Tr	-3.443	-3.5856*	-5.6003*	1.1041	16.8511*
LFDEBTY	-	-0.2209	-4.0908*	-2.8741*	-2.3730*	7.0258*
	I	-1.7833	-3.9589*	-2.8843*	-2.2109*	6.6663*
	I,SD	-1.6732	-3.9809*	-3.8718*	-2.9350*	12.2107*
	I,Tr	-0.8240	-3.9310*	-2.8601*	-2.2000*	6.5802*
	I,SD,Tr	-0.8105	-3.9524*	-3.8271*	-2.9086*	12.0377*
LNERXW	-	0.1199	-9.0086*	-1.7565	-5.0934*	15.8822*
	I	-0.7974	-9.0173*	-1.8455	-5.0092*	15.7216*
	I,SD	-0.7912	-8.5372*	-1.7707	-5.0138*	15.6557*
	I,Tr	-1.8046	-8.9445*	-1.8676	-4.9455*	15.4313*
	I,SD,Tr	-1.7571	-8.4749*	-1.7984	-4.9305*	15.2771*

		't': Π_1	't': Π_2	't': Π_3	't': Π_4	'F': $\Pi_3 \cap \Pi_4$
LNERTW	-	0.1175	-9.0432*	-1.7498	-5.0752*	15.7643*
	I	-0.7899	-9.0508*	-1.8375	-4.9924*	15.6066*
	I,SD	-0.7826	-8.5905*	-1.7656	-4.9875*	15.4948*
	I,Tr	-1.8276	-8.9783*	-1.8614	-4.9268*	15.3120*
	I,SD,Tr	-1.7810	-8.5289*	-1.7951	-4.9025*	15.1139*
LNERMW	-	0.0963	-9.0547*	-1.7400	-5.0734*	15.7334*
	I	-0.8039	-9.0625*	-1.8280	-4.9912*	15.5780*
	I,SD	-0.7949	-8.6376*	-1.7568	-4.9729*	15.3896*
	I,Tr	-1.8585	-8.9928*	-1.8530	-4.9233*	15.2742*
	I,SD,Tr	-1.8138	-8.5793*	-1.7873	-4.8860*	15.0026*
EXMIO	-	-2.8627*	-2.6345*	-2.4448*	0.1595	3.0024
	I	-4.1286*	-2.7234*	-2.5496*	0.1603	3.2643*
	I,SD	-4.4431*	-2.9542*	-4.7374*	0.0117	11.2215*
	I,Tr	-3.9329*	-2.7055*	-2.5325*	0.1581	3.2207*
	I,SD,Tr	-4.2143*	-2.9321*	-4.7042*	0.0121	11.0647*
LMUSI	-	-1.3229	-5.9530*	-2.7121*	-6.4806*	28.8311*
	I	-1.2774	-5.9097*	-2.6950*	-6.4361*	28.4460*
	I,SD	-1.2586	-5.9504*	-2.5709	-6.2867*	26.7710*
	I,Tr	-1.8776	-5.8830*	-2.6927*	-6.4345*	28.4117*
	I,SD,Tr	-1.8695	-5.9312*	-2.5709	-6.2850*	26.7476*
LRMUSI	-	-2.5904*	-6.5248*	-3.4847*	-5.0714*	23.9126*
	I	-2.4307	-6.4826*	-3.4638*	-5.0353*	23.6072*
	I,SD	-2.3822	-6.3552*	-3.4130*	-4.9244*	22.7066*
	I,Tr	-1.6061	-6.4532*	-3.4681*	-4.9660*	23.3939*
	I,SD,Tr	-1.5798	-6.3259*	-3.4170*	-4.8587*	22.4991*

* Significant at the 5 per cent level.

To maintain some elegance in our presentation, this section will be subdivided into two sections. The following subsection will discuss the empirical results pertaining to effective exchange rates while those of bilateral rates will be dwelt upon in the section that follows next.

5.4.1 Effective Exchange Rates

The best available estimates of long run equilibrium exchange rate equations (based upon cointegrating vectors) in terms of trade- and export- weighted indices are presented in Tables 5.VIA and 5.VIB.

Table 5.VIA

The Johansen Procedure (Non-trended Case)
LRETWI
VAR with 3 lags and seasonal dummies included
Sample Period: 1975Q4 - 1987Q4 (49 observations)

I EIGENVALUES: 0.5059 0.3176

Test statistics for the number of cointegrating vectors

Ho:	r = 0	r ≤ 1
Trace	79.3052	44.7563
	(76.0690)	(53.1160)
λ max	34.5488	18.7275
	(34.4000)	(28.1380)

II ESTIMATED COINTEGRATING VECTOR

LRETWI	-1.0000
LTOT	-1.3238
LFGTEY	-1.6407
LMTAXRM	-1.6765
LINVGDP	-0.5380
Intercept	-6.8598

III ESTIMATED ADJUSTMENT MATRIX

LRETWI	-0.0426
LTOT	-0.1031
LFGTEY	-0.0521
LMTAXRM	0.0030
LINVGDP	0.0179

IV EXOGENEITY TESTS

Ho: $\alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$	6.6714 (9.49)

V TESTS FOR APPROPRIATE LAG LENGTH (3)

	Serial Correlation $\chi^2(4)$	Serial Correlation F(4,27)	Normality $\chi^2(2)$
ΔLRETWI	1.5983 [0.809]	0.2276 [0.921]	0.4910 [0.782]
ΔLTOT	2.7843 [0.595]	0.4067 [0.802]	1.0546 [0.590]
ΔLFGTEY	4.9412 [0.293]	0.7570 [0.562]	0.4669 [0.792]
ΔLMTAXRM	4.3273 [0.364]	0.6539 [0.629]	0.0330 [0.984]
ΔLINVGDP	14.4845 [0.006]	2.8327 [0.044]	0.6429 [0.725]

Notes:

(I) Figures in normal parentheses ( ) below test statistics refer to 95% critical values.

(II) Figures in square parentheses [ ] refer to marginal significance levels.

Table 5.VIB

The Johansen Procedure (Non-trended Case)

LREXWI

VAR with 3 lags and seasonal dummies included

Sample Period: 1975Q4 - 1987Q4 (49 observations)

I EIGENVALUES: 0.5090 0.3147

Test statistics for the number of cointegrating vectors

Ho:	r = 0	r ≤ 1
Trace	79.3396 (76.0690)	44.4890 (53.1160)
λ max	34.8506 (34.4000)	18.5137 (28.1380)

II ESTIMATED COINTEGRATING VECTOR

LREXWI	-1.0000
LTOT	-1.5238
LFGTEY	-1.8431
LMTAXRM	-1.7619
LINVGDP	-0.4446
Intercept	-7.0735

III ESTIMATED ADJUSTMENT MATRIX

LREXWI	-0.0391
LTOT	-0.0992
LFGTEY	-0.0457
LMTAXRM	-0.0019
LINVGDP	0.0217

IV EXOGENEITY TESTS

Ho: $\alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$ 7.1201
(9.49)

V TESTS FOR APPROPRIATE LAG LENGTH (3)

	Serial Correlation		Normality
	$\chi^2(4)$	F(4,27)	$\chi^2(2)$
ΔLREXWI	1.6458 [0.801]	0.2346 [0.916]	0.4650 [0.793]
ΔLTOT	2.8206 [0.588]	0.4123 [0.798]	1.1016 [0.576]
ΔLFGTEY	4.9081 [0.297]	0.7514 [0.566]	0.5106 [0.775]
ΔLMTAXRM	4.5601 [0.335]	0.6926 [0.604]	0.0422 [0.979]
ΔLINVGDP	14.3684 [0.006]	2.8005 [0.046]	0.6409 [0.726]

Notes:

(I) Figures in normal parentheses ( ) below test statistics refer to 95% critical values.

(II) Figures in square parentheses [ ] refer to marginal significance levels.

No attempt has been made by us to estimate in terms of import-weighted index as our overriding concern is with competitiveness and exchange rate linkages with economic growth. They have been estimated on a quarterly basis from 1975Q4-1987Q4 with government consumption proxied interchangeably by the ratios of federal government current budget expenditure (FGCBY) and federal government total expenditure (FGTEY) to nominal GDP with the number of lags fixed at three assuming no trend in the DGP and in the series.[7] The use of this number of lags can be deemed appropriate as no serious serial correlation and normality problems arise. In all the cases reported in the Tables, the null hypothesis that one cointegrating vector exists cannot be ruled out by virtue of the trace and maximal eigenvalue statistics. Moreover exogeneity tests conducted on all the independent variables reveal that the null hypothesis of their weak exogeneity can be upheld. Plots of the residuals of the cointegrating vectors are furnished in Figures 5O and 5P and they all exhibit stationarity.

The estimated long run equilibrium exchange rate equations are reproduced concisely below:

$$LRETWI_t = -6.86 - 1.32 LTOT_t - 1.64 LFGTEY_t - 1.68 LMTAXRM_t - 0.54 LINVGDP_t$$

$$LREXWI_t = -7.07 - 1.52 LTOT_t - 1.84 LFGTEY_t - 1.76 LMTAXRM_t - 0.45 LINVGDP_t$$

where LRETWI = log of real effective exchange rate index (trade-weighted)

LREXWI = log of real effective exchange rate index (export-weighted)

As suggested by the above equations, terms of trade, the share of federal government total expenditure in the nominal GDP and the incidence of import tariff do yield a very strong

[7]Since there is a tendency for those estimates based upon FGTEY to yield higher explanatory power of short run real exchange rate movements as will be subsequently seen, those estimates based upon FGCBY are not reported. Attempts have also been made to estimate on the assumption that there is trend in the series though no trend in the DGP. However while this approach does not yield any significant difference in terms of estimated parameters, it persistently results in serial correlation problems in the real exchange rate equation. Attempts have also been made to incorporate EXCRE or EXM1O and DLFDBTY (change in the log of the ratio of total federal government debt to nominal GDP) alongside centered seasonal dummies in the estimation process. However this involves a loss of the weak exogeneity property of the independent variables.

Figure 50
Overvaluation and Undervaluation (Trade-Weighted)

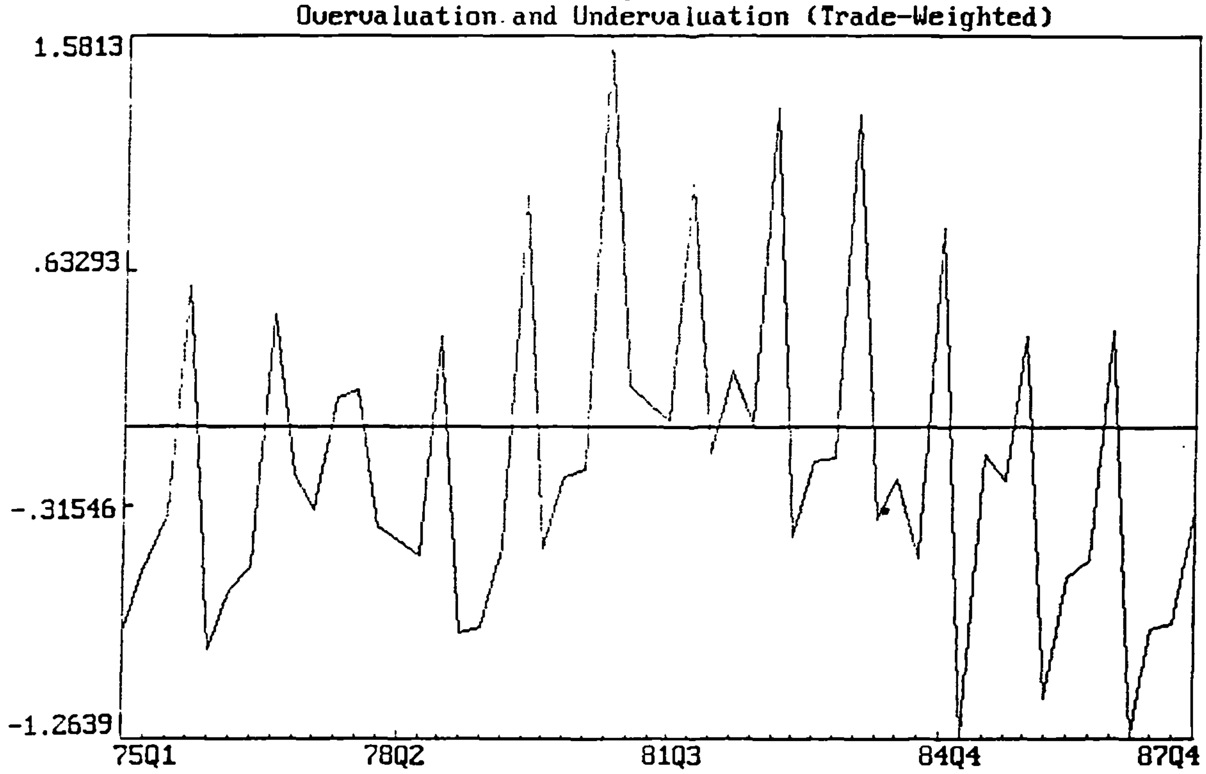


Figure 5P
Overvaluation and Undervaluation (Export-Weighted)

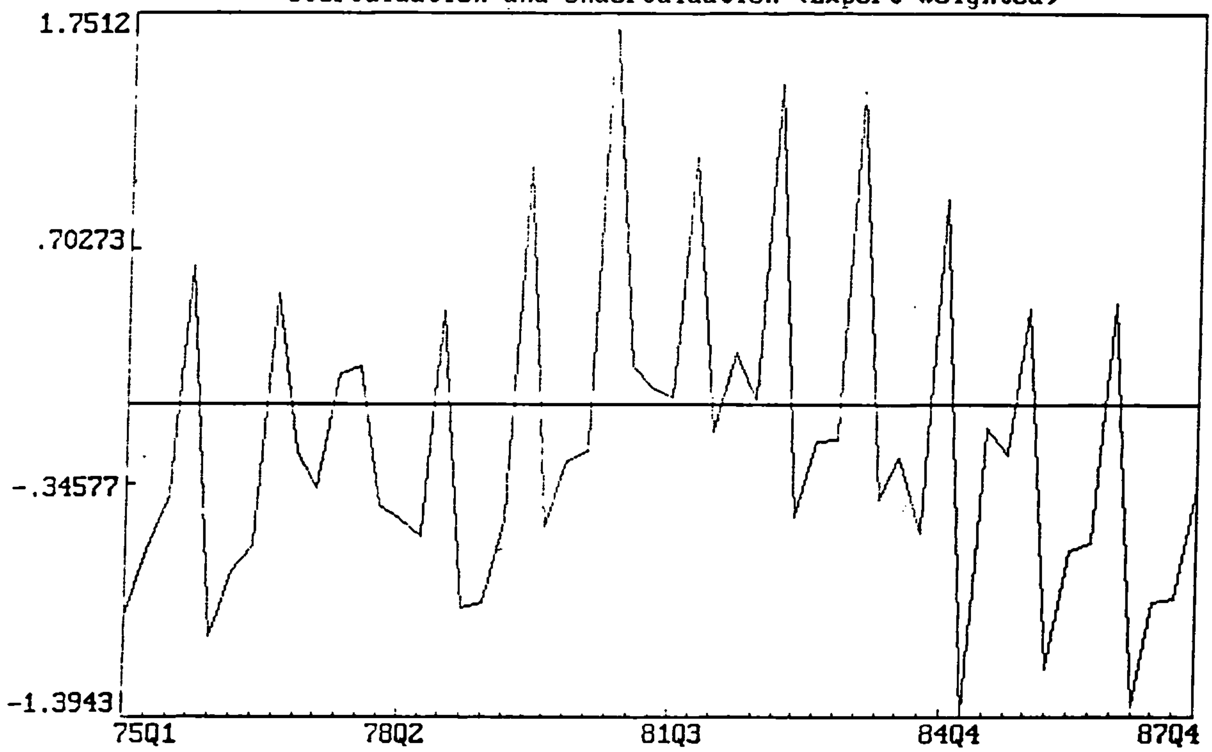


Figure 5P.1
Log of Federal Government Expenditure relative to Nominal GDP (LFGTEY)

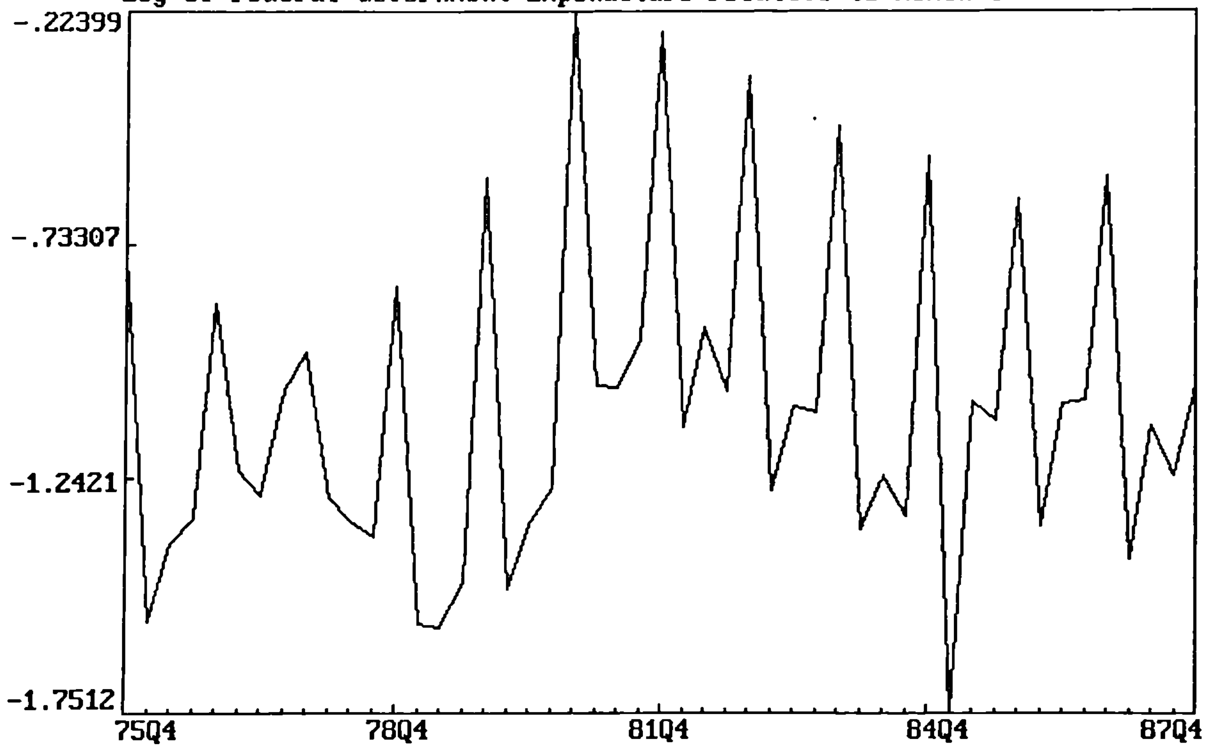


Figure 5P.2

De-seasonalised Residuals of the Cointegrating Vector (Trade-Weighted)

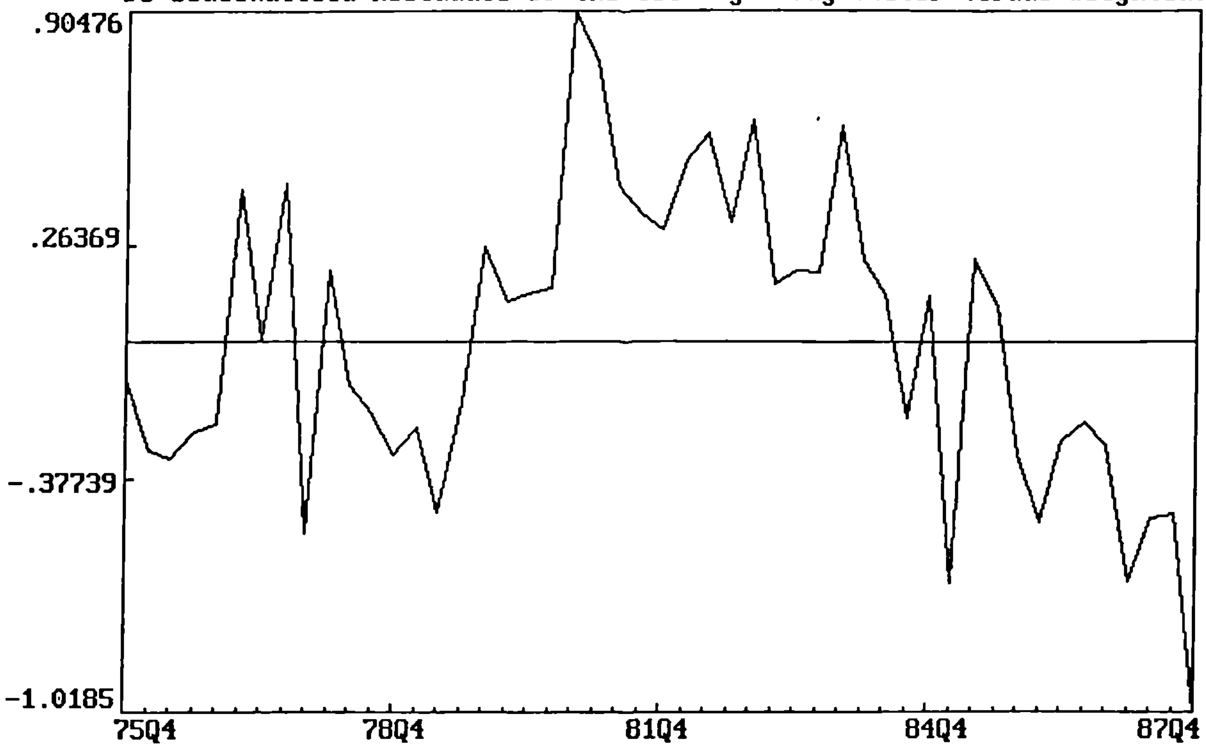
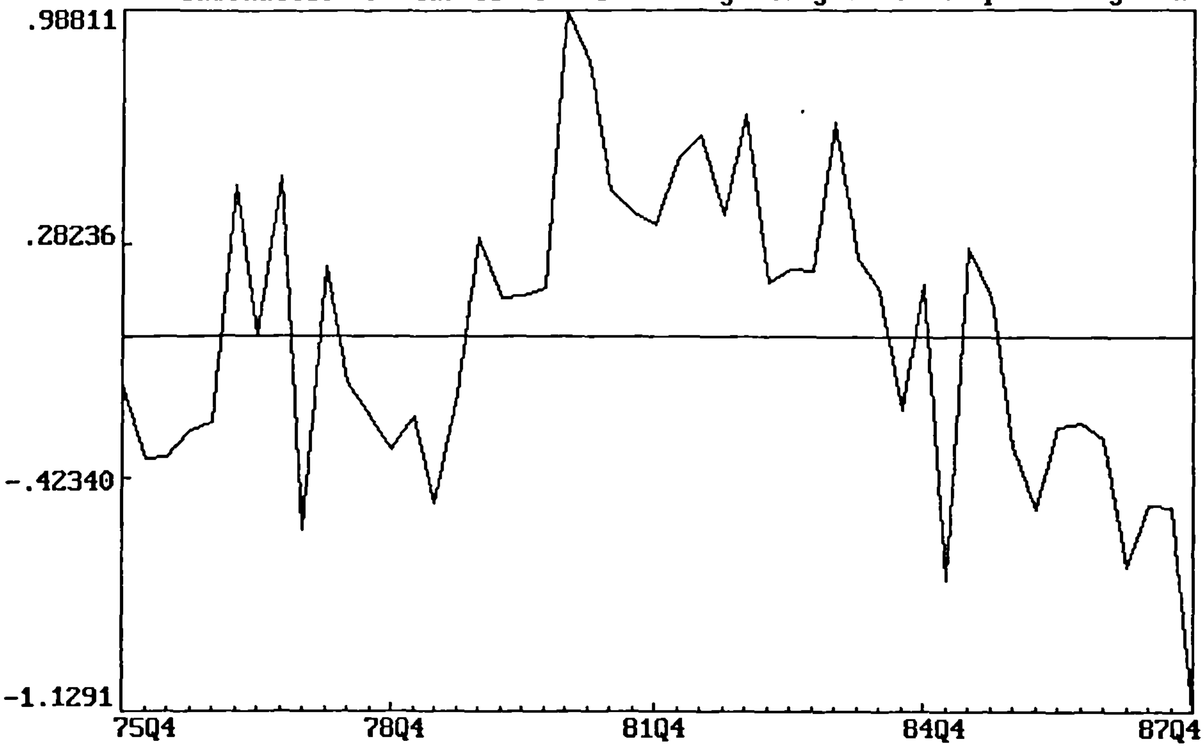


Figure 5P.3
De-seasonalised Residuals of the Cointegrating Vector(Export-Weighted)



appreciating impact on the real exchange rates in the long run with their estimated coefficients exceeding unity. The ratio of total imports of investment goods to nominal GDP which is supposedly a proxy for technological progress and rate of capital accumulation also bears an appreciating influence on the real exchange rates though its estimated long run coefficient is approximately 0.5. It is noteworthy that though the coefficient of the terms of trade seems large, exceeding unity, subsequent short run estimates reveal that terms of trade has only a negligible influence on the real effective exchange rate (export-weighted) contemporaneously. The large long run terms of trade coefficient could imply a preponderance of the income over the substitution effect on the consumption of nontradables if a terms of trade improvement is engendered by a decline in import prices. If the improvement is due to a surge in export prices, then both income and substitution effects on the consumption of nontradables would be mutually reinforcing to induce an appreciation of the real effective exchange rate.

Conditional upon the correct specification of these long run relationships, there is no evidence of sustained overvaluation or undervaluation of the Malaysian ringgit over the entire sample period as years of overvaluation and undervaluation could both be found as indicated by the residuals of the cointegrating vectors (Figures 5O and 5P). The sharp seasonality in the residuals in these figures is probably explicable by the seasonal pattern of the federal government expenditure relative to nominal GDP (LFGTEY). A plot of LFGTEY is given in Figure 5P.1. In order to get a clearer picture of the periods of undervaluation and overvaluation, we have de-seasonalised the residuals of cointegrating vectors for LRETWI and LREXWI respectively and the de-seasonalised residuals are plotted in Figures 5P.2 and 5P.3 respectively. The plots reveal a period of overvaluation followed by a period of undervaluation and then a return to an overvalued position. Hence, all this may constitute an indication that Malaysia has not made any systematic attempt to undervalue its currency throughout the period under review to arrive at its current stage of economic development.

In modelling the short run real exchange rate dynamics, the general-to-specific approach has been followed. In order to capture the influence of macroeconomic policies on the real exchange rate causing it to deviate from its long run equilibrium level, both EXCRE (excess credit) and EXM1O (excess M1) have been used interchangeably as a monetary policy variable and the change in the total debt of the federal government as a proportion of nominal GDP (DLFDBTY) as an indicator of the fiscal policy stance of the federal government.[8] Two alternative courses of action have been followed in moving from the most general to the most specific equation viz by incorporating the error correction term derived from the above reported equations with a lag of one and then with a lag of three. With respect to the trade-weighted index, the initial specification of its short run equation involves 20 variables. The variables include two lags of change in the trade-weighted exchange rate index and present and two lags of changes in terms of trade, federal government total expenditure, ratio of total import duties collected to retained imports and the ratio of total imports of investment goods to nominal GDP, current excess credit (excess supply of M1) and the change in the ratio of the total debt of the federal government to nominal GDP, the error correction term and the seasonal dummies. The same applies to the export-weighted index understandably with lagged changes in trade-weighted index being replaced by changes in export-weighted index. In terms of the ability to explain deviations of the real exchange rate from its long run equilibrium however, only those equations estimated based upon EXCRE instead of EXM1O display statistical significance of the monetary policy variable. Under no occasion has EXM1O appeared statistically significant. Hence estimates based upon EXM1O are not reported. It can be discerned from Tables 5.VIIA and 5.VIIB that the equations finally arrived at exhibit some superiority over their preliminary specifications in terms of standard error of the regression and the explanatory power.

Table 5.VIIA

General-to-Specific Reductions of Overly-Parameterized ADL (Based upon Immediate Lag of the Error Correction Term)

	LRETWI	LREXWI
Initial Specification		
Number of Parameters	20	20
Equation Standard Error	0.015541	0.015674
$\bar{R}^2$	0.50284	0.48694
Final Model		
Number of Parameters	7	7
Equation Standard Error	0.015449	0.015056
$\bar{R}^2$	0.50870	0.52657

[8] This yardstick for fiscal policy stance has been mobilised because total debt is bound to rise if the government turns on its fiscal tap while the converse is also always true.

Table 5.VIIB

General-to-specific Reductions of Overly-Parameterized ADL (Based on the Third Lag of the Error Correction Term)

	LRETWI	LREXWI
Initial Specification		
Number of parameters	20	20
Equation Standard Error	0.015541	0.015674
$\bar{R}^2$	0.50284	0.48694
Final Model		
Number of parameters	8	8
Equation Standard Error	0.015337	0.015467
R^2	0.51579	0.50039

These estimates could pass all the diagnostic tests for serial correlation, normality, heteroscedasticity and functional form misspecifications (see Appendices 5.1 through 5.4). The most preferred estimates of all are reproduced below:

$$\Delta LRETWI_t = -0.02\Delta LFGTEY_t + 0.12EXCRE_t - 0.03EC_{t-3} -$$
$$0.03\Delta LFGTEY_{t-2} - 0.09\Delta LMTAXRM_{t-1} - 0.09\Delta LINVGDP_{t-1} + 0.34\Delta LRETWI_{t-1} - 0.02S1$$

$$\Delta LREXWI_t = -0.09\Delta LTOT_t - 0.04\Delta LFGTEY_t + 0.11EXCRE_t -$$
$$0.05EC_{t-1} + 0.06\Delta LFGTEY_{t-1} + 0.04\Delta LFGTEY_{t-2} - 0.02S1$$

Based upon the equations above, changes in the extent of government fiscal involvment in the economy (FGTEY) do have an appreciating impact albeit nominally in the short run on the real exchange rate, be it trade or export-weighted. What is however more interesting to note from these equations is that an expansionary monetary policy effected by an expansion in domestic credit would lead to a real exchange rate depreciation rather than an appreciation as being popularly conceived. This is somehow consistent with the monetary approach to exchange rate determination which states that excess supply of money caused presumably by an expansionary monetary policy could lead to an exchange rate depreciation. In a situation of price stickiness, nominal depreciations will be translated into real depreciations. The estimated excess credit elasticity is approximately 0.1. Though terms of trade does seem to yield contemporaneously an appreciating influence on the export-weighted real effective rates, albeit nominally (-0.09), such influence is absent in the case of trade-weighted index. The estimated coefficient of the error correction term of about 0.03-0.05 also suggests that there would only be a very gradual adjustment towards the long run equilibrium in the event of any deviation.

5.4.2 Bilateral Rates (M$/US$)

The best estimate of the long run equilibrium exchange rate equation is given by the cointegrating vector as detailed in Table 5.VIII. The estimation period spans from 1975Q3 through 1987Q4 with a provision for two lags. No serious serial correlation and normality problems arise either with the use of this number of lags. Based upon the trace and maximal eigenvalue statistics, the null hypothesis that one cointegrating vector exists can be upheld. A weak exogeneity test conducted on the independent variables also suggests that the null hypothesis of weak exogeneity is also valid at the 5% significance level. The estimated cointegrating vector is reproduced below:

$$LRMUSI_t = -0.03LTOT_t + 0.09LFGTEY_t - 0.22LMTAXRM_t + 0.05LINVGDP_t - 0.34$$

Table 5.VIII

The Johansen Procedure (Non-trended case)
LRMUSI
VAR with 2 lags and seasonal dummies included
Sample Period: 1975Q3 - 1987Q4 (50 observations)

I EIGENVALUES: 0.5871 0.4134

Test statistics for the number of cointegrating vectors

Ho:	r = 0	r ≤ 1
Trace	88.8437	44.6117
	(76.0690)	(53.1160)
λ max	44.2320	26.6700
	(34.4000)	(28.1380)

II ESTIMATED COINTEGRATING VECTOR

LRMUSI	-1.0000
LTOT	-0.0288
LFGTEY	0.0926
LMTAXRM	-0.2172
LINVGDP	0.0509
Intercept	-0.3396

III ESTIMATED ADJUSTMENT MATRIX

LRMUSI	-0.4947
LTOT	-0.3994
LFGTEY	+1.1212
LMTAXRM	-0.1804
LINVGDP	+0.1516

IV EXOGENEITY TESTS

Ho: $\alpha_2 = \alpha_3 = \alpha_4 = \alpha_5 = 0$	5.7009
	(9.49)

V TESTS FOR APPROPRIATE LAG LENGTH (2)

	Serial Correlation $\chi^2(4)$	Serial Correlation F(4,33)	Normality $\chi^2(2)$
ΔLRMUSI	1.0476 [0.903]	0.1766 [0.949]	0.1959 [0.907]
ΔLTOT	3.3457 [0.502]	0.5916 [0.671]	9.8374 [0.007]
ΔLFGTEY	3.5909 [0.464]	0.6383 [0.639]	0.7285 [0.695]
ΔLMTAXRM	2.8626 [0.581]	0.5010 [0.735]	1.1135 [0.573]
ΔLINVGDP	10.8754 [0.028]	2.2932 [0.080]	7.6913 [0.021]

Notes:

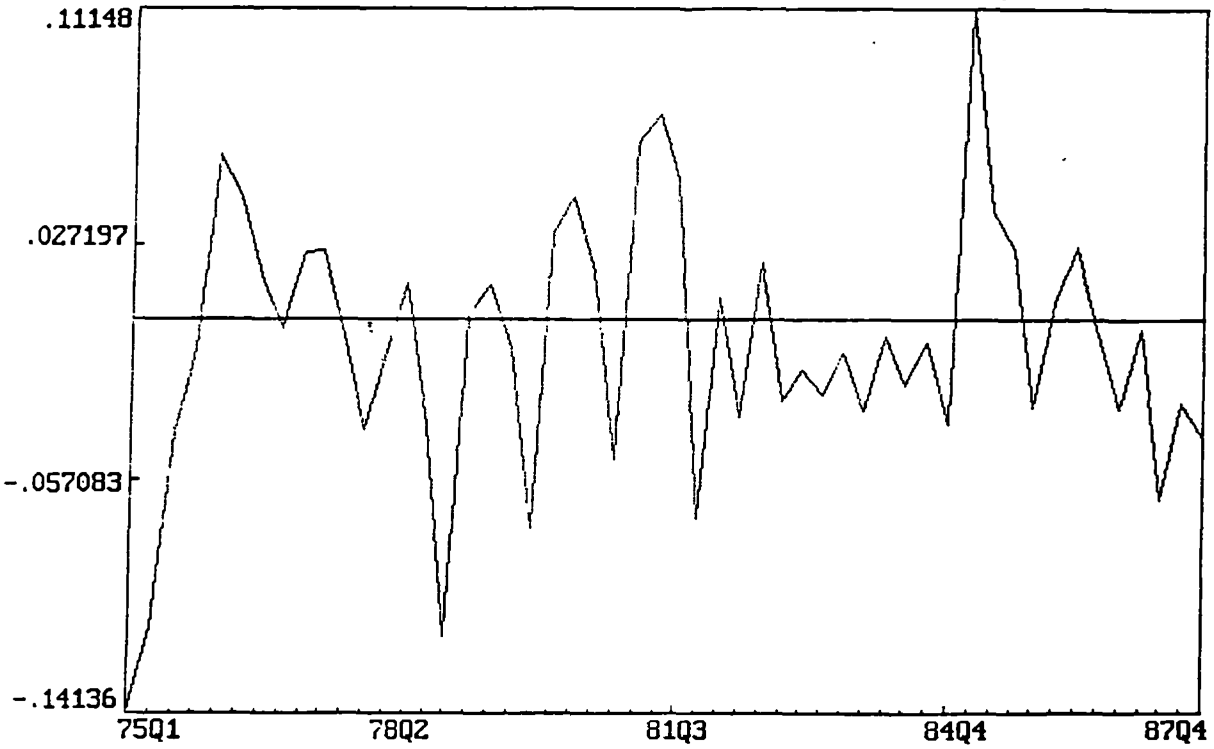
(I) Figures in normal parentheses ( ) below test statistics refer to 95% critical values.

(II) Figures in square parentheses [ ] refer to marginal significance levels.

The long run estimates above appear to be very distinct from the results based upon effective rates. While terms of trade (TOT) improvement and trade restrictions (MTAXRM) seem to have an appreciating effect on the real bilateral exchange rate, the extent of government's fiscal involvment in the economy (FGTEY) and the relative magnitude of imports of investment goods (INVGDP) seem to yield a depreciating impact on the bilateral rate. This may be due to a massive involvment of US$ in such transactions. Plots of the residuals of the cointegrating vector are given in Figure 5Q and not unlike the case of effective rates, overvaluations and undervaluations have been frequently experienced by the Malaysian RER.

In order to model the short run dynamics, the general-to-specific approach has also been followed with excess domestic credit (EXCRE) and excess money supply (EXM1O) and the change in the total debt of the federal government relative to nominal GDP (DLFDBTY) being taken into consideration. In the process of discovering the parsimonious equation, the error

Figure 5Q
Overvaluation and Undervaluation (Bilateral)



correction term has initially been incorporated with a lag of one and then with a lag of two. The most general specification of the short run dynamics involves 15 variables namely one lag of change in the bilateral exchange rate index, present and one lag of change in the terms of trade (TOT), federal government total expenditure as a proportion of nominal GDP (FGTEY), import tariff incidence (MTAXRM), and total imports of investment goods relative to nominal GDP (INVGDP), current excess domestic credit or money supply (EXCRE or EXM1O), and change in the ratio of the total federal government debt to nominal GDP (DLFDBTY), the error correction term and 3 seasonal dummies. In terms of standard error and goodness of fit, final specifications appear superior to the most general specification (Tables 5.IXA & 5.IXB).

Table 5.IXA

General-to-specific Reductions of Overly-Parameterized ADL based on EXCRE included as an I(0) variable

	LRMUSI (Immediate Lag)	**LRMUSI (Second Lag)**
Initial Specification		
Number of parameters	15	15
Equation Standard Error	0.018892	0.018892
$\bar{R}^2$	0.51116	0.51116
Final Model		
Number of parameters	6	6
Equation Standard Error	0.018020	0.017757
$\bar{R}^2$	0.55526	0.56816

Table 5.IXB

General-to-specific Reductions of Overly-Parameterized ADL based on EXMIO included as an I(0) variable

	LRMUSI (Immediate Lag)	LRMUSI (Second Lag)
Initial Specification		
Number of parameters	15	15
Equation Standard Error	0.018767	0.018767
$\bar{R}^2$	0.51764	0.51764
Final Model		
Number of parameters	6	6
Equation Standard Error	0.018020	0.017757
$\bar{R}^2$	0.55526	0.56816

Nonetheless, the monetary policy variable be it EXCRE or EXM1O does not seem to influence the bilateral rate even in the short run as attested to by the parsimonious equations detailed out in Appendices 5.5 and 5.6. Both processes of identifying the parsimonious short run equations involving alternate uses of EXCRE or EXM1O yield the same final set of equations. The most preferred equation is reproduced below:

$$\Delta LRMUSI_t = 0.03\Delta LFGTEY_t - 0.48EC_{t-2} + 0.07\Delta LFGTEY_{t-1} - 0.11\Delta LTOT_{t-1}$$
$$-0.09\Delta \ln MTAXRM_{t-1} + 0.06S2C$$

Only the extent of government spending relative to the economy seems to yield a contemporaneous influence on the bilateral exchange rate causing the rate to depreciate though the magnitude of influence is rather small estimated at about 0.03.

5.5 RER Misalignment? Then Its Measurement

Though there is no evidence of any real exchange rate misalignment particularly when misalignment is defined as sustained departures of the actual real exchange rate from its equilibrium level, as a matter of interest we have also attempted to compute indices of misalignment based upon trade and export weights and on a bilateral basis. By doing so, we are treating a real exchange rate overvaluation or undervaluation at every period as a misalignment phenomenon. Following Ghura & Grennes (1993), the index of RER misalignment (RERMIS) is computed as follows:

$$RERMIS_t = (ERER_t \quad RER_t) - 1$$

where ERER = equilibrium real exchange rate

RER= actual real exchange rate

Three pairs of such indices have been computed namely (MTWIA, MTWH), (MEWA, MEWH) and (MMUSA, MMUSH) based upon the relevant estimated cointegrating vectors. MTWIA, MEWA and MMUSA are trade-, export-weighted and bilateral (vis-a-vis US$) indices of misalignment respectively and are based upon actual values of the fundamental determinants observed. In these cases then the actual values are regarded as sustainable values. The others namely MTWH, MEWH and MMUSH are also trade-, export-weighted and bilateral indices but have been computed based upon measured "sustainable" values of the fundamentals. The measured values of two fundamentals namely MTAXRM (incidence of import tariffs) and FGTEY (federal government consumption) are their four lowest values observed over the sample period, 1975Q3-1987Q4 while the actual values of the other fundamentals namely TOT (terms of trade) and INVGDP (a proxy for technological progress and capital accumulation) are deemed their sustainable values. Hence this latter set of indices involves an element of arbitrariness and as contended earlier, the former set of indices (MTWIA, MEWA and MMUSA) should be granted more credulity. Plots of these indices are given in figures 5R, 5S and 5T.

As can be seen from these figures, if the strict definition of a real exchange rate misalignment were to be adopted and actual values of the fundamentals are being treated as their sustainable values, the question of Malaysian real exchange rate misalignment does not arise be it measured on a trade-, export-weighted or bilateral basis. Periods of overvaluation and undervaluation have been commonly experienced by Malaysia over the entire sample period as indicated by MTWIA, MEWA and MMUSA. In other words, there has been no long run overvaluation or undervaluation. However if we go by indices computed based upon measured sustainable values namely MTWH, MEWH and MMUSH, Malaysia would appear to have had suffered from a real exchange rate misalignment. Based upon MTWH and MEWH, there has been a sustained RER overvaluation throughout the sample period though MMUSH indicates that this only occured over the period 1975Q3-1980Q4. Nevertheless, we shall not attach any significance to the scenarios painted by MTWH, MEWH and MMUSH given their greater limitations as pointed out earlier.

Figure 5R
Exchange Rate Misalignment Indices (Trade-Weighted)

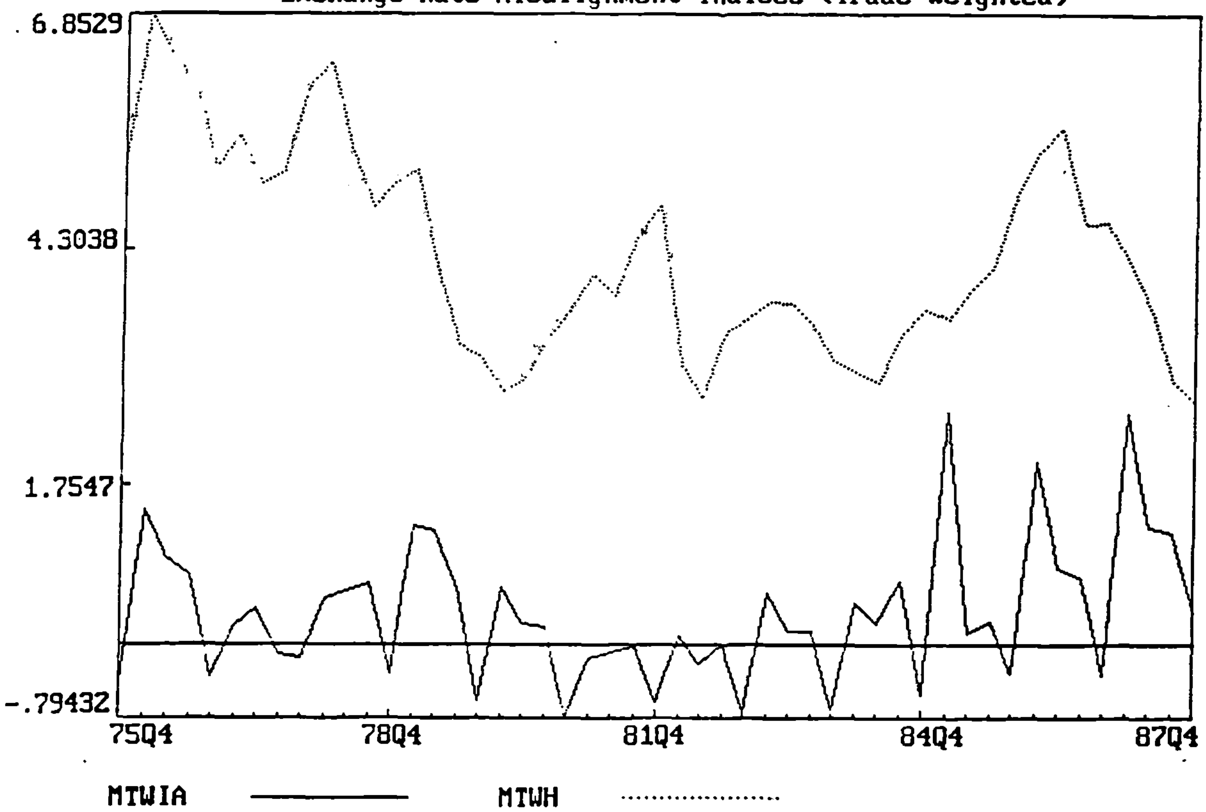


Figure 5S
Exchange Rate Mislignment Indices (Export-Weighted)

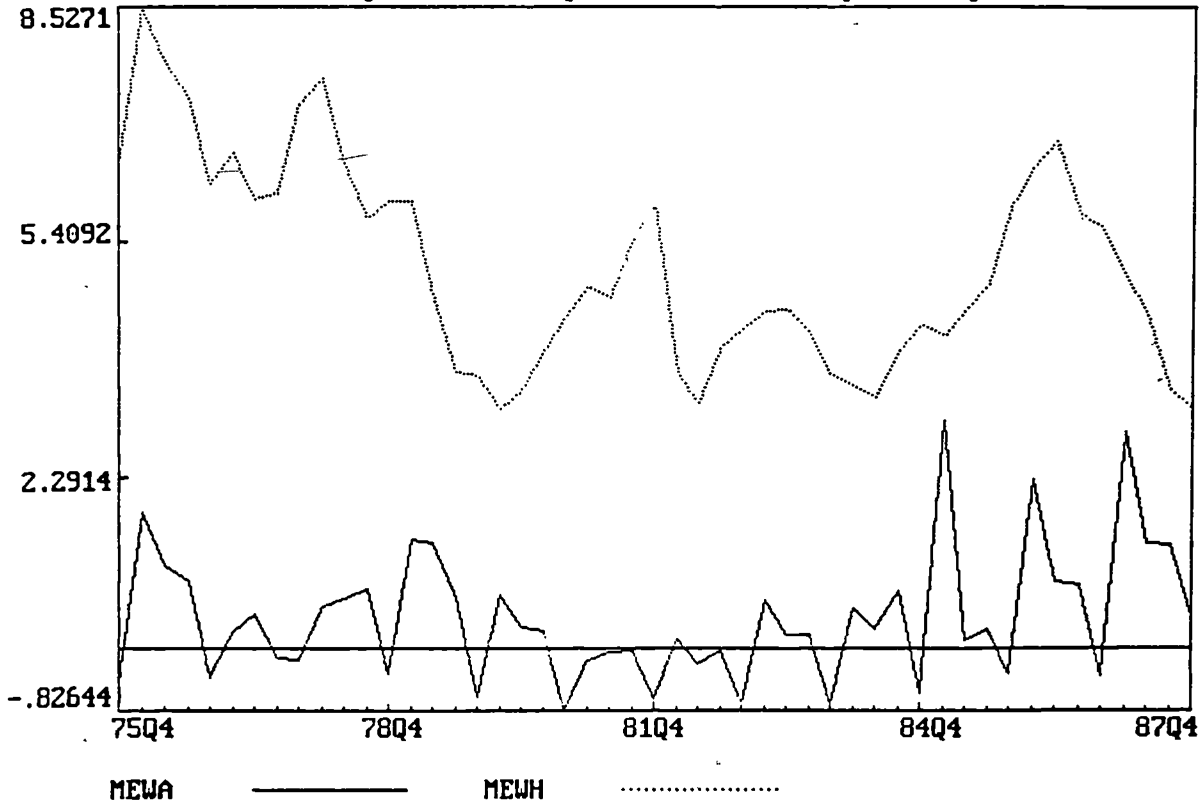
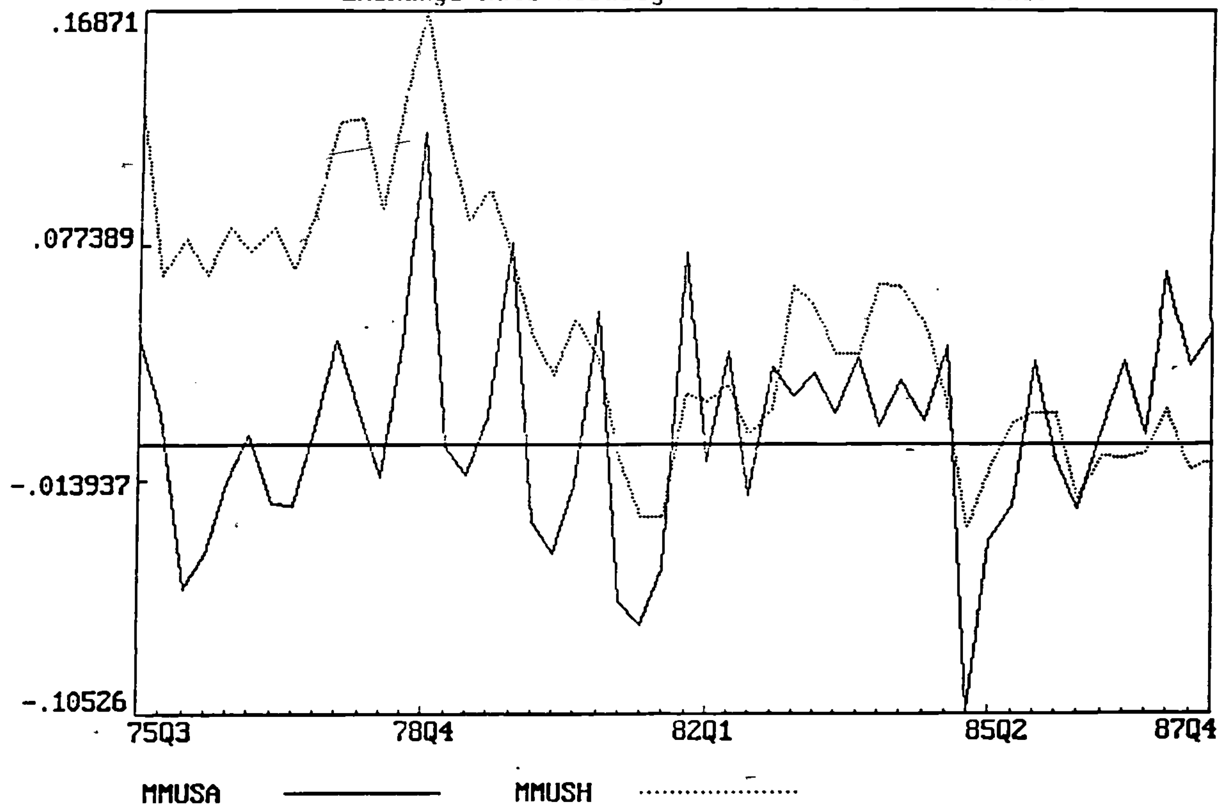


Figure 5T
Exchange Rate Misalignment Indices (Bilateral)



5.6 Exchange Rate Movements Versus Macroeconomic Performance

In this section we shall discuss the results of our empirical endeavors to link economic performance specifically real gross domestic product to effective and bilateral exchange rate indices using Sim's VAR technique via real exports. The ordering of the VAR is as follows: LRETWI (LREXWI or LRMUSI), LREXPOT and LRGDP. The following hypotheses are then tested based upon a multivariate generalisation of Granger causality test:

H1: LREXPOT and LRGDP do not Granger cause LRETWI (LREXWI or LRMUSI)

H2: LRETWI (LREXWI or LRMUSI) and LREXPOT do not Granger cause LRGDP

It is suggested by Tables 5XA and 5XB that the use of 5 vis-a-vis 6 lags is appropriate to estimate such a system involving LRETWI or LREXWI based upon Ljung-Box and Likelihood Ratio statistics.

Table 5.XA

Ljung-Box and Likelihood Ratio Statistics of the VAR system: LRETWI, LREXPOT and LRGDP

Period (lags) Eqn	1974Q1 - 1991Q4 (6)	1974Q1 - 1991Q4 (5)	1974Q1 - 1991Q4 (4)	1974Q1 - 1991Q4 (3)
LRETWI	Q(24) = 11.4915 [0.9851]	Q(24) = 17.6991 [0.8174]	Q(24) = 16.4066 [0.8728]	Q(24) = 23.2412 [0.5056]
LREXPOT	Q(24) = 16.0783 [0.8852]	Q(24) = 22.5073 [0.5490]	Q(24) = 24.4391 [0.4367]	Q(24) = 79.1982 [0.0000]
LRGDP	Q(24) = 38.7227 [0.0292]	Q(24) = 31.2695 [0.1462]	Q(24) = 23.9661 [0.4635]	Q(24) = 176.821 [0.0000]

Likelihood Ratio Statistics

3 vs 4 lags:	$\chi^2(9)$	=	44.99453 [0.0000009]
4 vs 5 lags:	$\chi^2(9)$	=	23.76131 [0.00469506]
5 vs 6 lags:	$\chi^2(9)$	=	12.76552 [0.1735064]

Notes:

I) Figures in square parentheses below test statistics refer to the marginal significance level.
II) Q is the Ljung-Box test statistic for serial correlation with 24 degrees of freedom.

Table 5.XB

Ljung-Box and Likelihood Ratio Statistics of the VAR system: LREXWI, LREXPOT and LRGDP

Period (lags) / Eqn	1974Q1 - 1991Q4 (6)	1974Q1 - 1991Q4 (5)	1974Q1 - 1991Q4 (4)	1974Q1 - 1991Q4 (3)
LREXWI	Q(24) = 10.9464 [0.9894]	Q(24) = 16.7930 [0.8574]	Q(24) = 15.6157 [0.9015]	Q(24) = 22.1812 [0.5685]
LREXPOT	Q(24) = 15.7094 [0.8983]	Q(24) = 21.8532 [0.5880]	Q(24) = 24.3106 [0.4439]	Q(24) = 80.0897 [0.0000]
LRGDP	Q(24) = 38.9326 [0.0278]	Q(24) = 31.3900 [0.1429]	Q(24) = 24.3853 [0.4398]	Q(24) = 177.180 [0.0000]

Likelihood Ratio Statistics

3 vs 4 lags:	$\chi^2(9)$	=	44.6270 [0.0000]
4 vs 5 lags:	$\chi^2(9)$	=	24.2448 [0.0039]
5 vs 6 lags:	$\chi^2(9)$	=	12.8444 [0.1698]

Notes:

I) Figures in square parentheses below test statistics refer to the marginal significance level.
II) Q is the Ljung-Box test statistic for serial correlation with 24 degrees of freedom.

Tables 5.XIA and 5.XIB indicate that while H1 can be accepted marginally, H2 can be rejected though it is also a marginal case.

Table 5.XIA

Multivariate Generalization of Granger Causality Tests
VAR System: LRETWI, LREXPOT and LRGDP

H1	-	$\chi^2(10) = 17.7635$ [0.0591]
H2	-	$\chi^2(10) = 18.8022$ [0.0429]

Notes:

1) H1: LREXPOT and LRGDP do not Granger cause LRETWI
H2: LRETWI and LREXPOT do not Granger cause LRGDP

2) Figures in square parentheses refer to the marginal significance level.

Table 5.XIB

Multivariate Generalization of Granger Causality Tests
VAR System: LREXWI, LREXPOT and LRGDP

H1	-	$\chi^2(10) = 17.2930$ [0.0681]
H2	-	$\chi^2(10) = 18.6770$ [0.0446]

Notes:

1) H1: LREXPOT and LRGDP do not Granger cause LREXWI
H2: LREXWI and LREXPOT do not Granger cause LRGDP

2) Figures in square parentheses refer to the marginal significance level.

Proceeding on the assumption that real exchange rate movements do influence real exports and real GDP, a variance decomposition analysis is effected and the impulse response functions derived. The variance decompostion analysis suggests that real effective exchange rates (trade-weighted) movements have a very negligible impact on the volume of real exports as innovations in LRETWI explain only about 0.52% of the variation in LREXPOT at a one-quarter horizon and 1.25% at an 8-quarter horizon (Table 5.XIIA). With regard to real GDP (LRGDP), innovations in LRETWI merely account for 6.76% of the forecast error variance of LRGDP at a one-quarter horizon and 10.55% at an 8-quarter horizon. The impulse response function also somehow reflects this negligble response (Table 5.XIIB). On the basis of export-weighted index, broadly similar conclusions can be drawn (Tables 5.XIIIA and 5.XIIIB).

With respect to the system comprising LRMUSI, LREXPOT and LRGDP, the Ljung-Box and Likelihood Ratio statistics suggest that the use of 5 lags is appropriate in the estimation process without any problem of serial correlation (Table 5.XIV). Nevertheless there does not appear to be any causal relationship existing between real exports and real gross domestic product on one hand and real bilateral exchange rates on the other as the null hypothesis (H1) cannot be rejected (Table 5.XV). The same applies to the case of H2.

To verify further that no significant relationship actually exists between RER movements on one hand and external trade performance and economic activity on the other, Granger causality tests are conducted on a bivariate basis. Results of the tests suggest that the RER (be it effective or bilateral) has no causal relationship at all with the real balance of trade (RBOT) (Tables 5.XVIA, 5.XVIB and 5.XVIC), real gross domestic product (Tables 5.XVIIA, 5.XVIIB and 5.XVIIC) and real exports (Tables 5.XVIIIA, 5.XVIIIB & 5.XVIIIC).

Table 5.XIIA

Variance Decomposition of Variables
VAR System: LRETWI, LREXPOT and LRGDP

Variables Explained	Forecast Horizons (Quarters Ahead)	Due to Innovations in LRETWI	LREXPOT	LRGDP
LRETWI	1	100.00	-	-
	2	97.68	0.31	2.01
	3	90.81	2.17	7.02
	4	84.83	2.62	12.55
	5	80.81	3.01	16.18
	6	75.62	5.24	19.14
	7	67.12	11.27	21.61
	8	57.64	18.27	24.09
	12	31.52	44.45	24.03
	16	24.43	55.60	19.97
	20	23.2	59.94	16.86
	24	23.12	61.33	15.55
LREXPOT	1	0.52	99.48	-
	2	0.25	99.12	0.63
	3	0.20	95.91	3.89
	4	1.18	92.24	6.58
	5	0.98	92.96	6.06
	6	0.99	93.22	5.79
	7	1.21	92.79	6.00
	8	1.25	92.39	6.36
	12	1.61	93.21	5.18
	16	1.80	93.85	4.35
	20	1.77	94.39	3.84
	24	1.64	94.82	3.54
LRGDP	1	6.76	11.04	82.20
	2	8.09	19.14	72.77
	3	7.94	21.04	71.02
	4	8.27	21.76	69 97
	5	6.36	29.06	64.58
	6	6.60	34.49	58.91
	7	7.86	36.36	55.78
	8	10.55	36.01	53.44
	12	13.86	43.97	42.17
	16	13.49	54.83	31.68
	20	10.51	66.00	23.49
	24	7.62	74.58	17.80

Table 5.XIIB

Responses to one-standard deviation shock in LRETWI

Quarters	Impulse Response Functions of		
	LRETWI	LREXPOT	LRGDP
1	0.0179	-0.0041	0.0069
2	0.0216	0.00006	0.0053
3	0.0137	0.0023	0.0014
4	0.0110	0.0119	0.0023
5	0.0111	0.0009	0.0041
6	0.0084	-0.0049	0.0046
7	0.0039	-0.0083	0.0056
8	0.0016	-0.0055	0.0078
9	0.0006	-0.0086	0.0063
10	-0.0012	-0.0091	0.0061
11	-0.0035	-0.0081	0.0069
12	-0.0051	-0.0054	0.0085
13	-0.0062	-0.0073	0.0063
14	-0.0073	-0.0083	0.0056
15	-0.0084	-0.0077	0.0061
16	-0.0087	-0.0054	0.0069
17	-0.0087	-0.0059	0.0045
18	-0.0086	-0.0059	0.0034
19	-0.0085	-0.0045	0.0035
20	-0.0080	-0.0022	0.0040
21	-0.0073	-0.0023	0.0018
22	-0.0066	-0.0023	0.0006
23	-0.0059	-0.0011	0.0008
24	-0.0050	0.0007	0.0012

Table 5.XIIIA

Variance Decomposition of Variables
VAR System: LREXWI, LREXPOT and LRGDP

Variables Explained	Forecast Horizons (Quarters Ahead)	Due to Innovations in		
		LREXWI	LREXPOT	LRGDP
LREXWI	1	100.00	-	-
	2	97.90	0.31	1.79
	3	91.30	2.13	6.57
	4	85.42	2.60	11.98
	5	81.41	3.00	15.59
	6	76.19	5.28	18.53
	7	67.57	11.31	21.12
	8	57.98	18.28	23.74
	12	31.91	44.06	24.03
	16	25.25	54.80	19.95
	20	24.38	58.83	16.79
	24	24.49	60.03	15.48
LREXPOT	1	0.61	99.39	-
	2	0.29	99.06	0.65
	3	0.19	95.90	3.91
	4	0.99	92.39	6.62
	5	0.82	93.12	6.06
	6	0.96	93.28	5.76
	7	1.34	92.73	5.93
	8	1.47	92.27	6.26
	12	2.06	92.88	5.06
	16	2.39	93.39	4.22
	20	2.39	93.89	3.72
	24	2.23	94.33	3.44
LRGDP	1	7.18	11.44	81.38
	2	8.12	19.83	72.05
	3	7.91	21.83	70.26
	4	8.09	22.67	69.24
	5	6.14	30.09	63.77
	6	6.24	35.74	58.02
	7	7.26	37.82	54.92
	8	9.60	37.68	52.72
	12	12.27	46.16	41.57
	16	11.72	57.11	31.17
	20	8.95	67.97	23.08
	24	6.44	76.10	17.46

Table 5.XIIIB

Responses to one-standard deviation shock in LREXWI

Quarters	Impulse Response Functions of		
	LREXWI	LREXPOT	LRGDP
1	0.0179	-0.0045	0.0071
2	0.0212	-0.0003	0.0050
3	0.0134	0.0011	0.0012
4	0.0107	0.0108	0.0019
5	0.0109	-0.0009	0.0039
6	0.0082	-0.0067	0.0043
7	0.0037	-0.0102	0.0052
8	0.0014	-0.0073	0.0073
9	0.0003	-0.0102	0.0059
10	-0.0015	-0.0106	0.0056
11	-0.0039	-0.0097	0.0064
12	-0.0056	-0.0070	0.0080
13	-0.0067	-0.0089	0.0059
14	-0.0079	-0.0099	0.0051
15	-0.0089	-0.0093	0.0055
16	-0.0093	-0.0069	0.0063
17	-0.0093	-0.0072	0.0040
18	-0.0092	-0.0071	0.0028
19	-0.0091	-0.0057	0.0028
20	-0.0085	-0.0033	0.0033
21	-0.0078	-0.0033	0.0012
22	-0.0070	-0.0032	-0.00004
23	-0.0063	-0.0021	0.00004
24	-0.0053	-0.0002	0.0004

Table 5.XIV
Ljung-Box and Likelihood Ratio Statistics of the VAR system: LRMUSI, LREXPOT and LRGDP

Period (lags) EQN	1974Q1 - 1991Q4 (6)	1974Q1 - 1991Q4 (5)	1974Q1 - 1991Q4 (4)	1974Q1 - 1991Q4 (3)
LRMUSI	Q(24) = 27.0255 [0.3033]	Q(24) = 21.9659 [0.5813]	Q(24) = 22.6872 [0.5383]	Q(24) = 23.7894 [0.4737]
LREXPOT	Q(24) = 22.5094 [0.5489]	Q(24) = 29.3575 [0.2070]	Q(24) = 27.6273 [0.2761]	Q(24) = 85.2844 [0.0000]
LRGDP	Q(24) = 30.3242 [0.1742]	Q(24) = 25.9667 [0.3549]	Q(24) = 28.1025 [0.2557]	Q(24) = 198.689 [0.0000]

Likelihood Ratio Statistics

3 vs 4 lags: $\chi^2(9)$ = 33.2905 [0.0001]

4 vs 5 lags: $\chi^2(9)$ = 18.7928 [0.0270]

5 vs 6 lags: $\chi^2(9)$ = 15.0184 [0.0904]

Notes:

I) Figures in square parentheses refer to the marginal significance level
II) Q is the Ljung-Box test statistic for serial correlation with 24 degrees of freedom

Table 5.XV

Multivariate Generalization of Granger Causality Tests
VAR System: LRMUSI, LREXPOT and LRGDP

H1	-	$\chi^2(10) = 6.5407$ [0.7680]
H2	-	$\chi^2(10) = 10.5215$ [0.3960]

Notes:
1) H1: LREXPOT and LRGDP do not Granger cause LRMUSI
H2: LRMUSI and LREXPOT do not Granger cause LRGDP

2) Figures in square parentheses refer to the marginal significance level.

Table 5.XVIA
Individual Equation F-tests*

Bilateral VAR System: RERTWI and RBOT (1974Q1 - 1987Q4)

Target / Causal	RERTWI	RBOT
RERTWI	28.8250 [0.0000]	0.3937 [0.9302]
RBOT	2.4570 [0.0269]	28.4551 [0.0000]

* Based upon a provision of 9 lags for each variable.

Note: Figures in parentheses refer to marginal significance levels.

Table 5.XVIB
Individual Equation F-tests*

Bilateral VAR System: RERXWI and RBOT (1974Q1 - 1987Q4)

Target / Causal	RERXWI	RBOT
RERXWI	28.8084 [0.0000]	0.4142 [0.9191]
RBOT	2.5224 [0.0235]	28.9509 [0.0000]

* Based upon a provision of 9 lags for each variable.

Note: Figures in parentheses refer to marginal significance levels.

Table 5.XVIC
Individual Equation F-tests*

Bilateral VAR System: RMUSI and RBOT (1974Q1 - 1987Q4)

Target / Causal	RMUSI	RBOT
RMUSI	261.8531 [0.0000]	1.0350 [0.3136]
RBOT	0.0405 [0.8414]	239.5155 [0.4034]

* Based upon a provision of 1 lag for each variable.

Note: Figures in parentheses refer to marginal significance levels.

Table 5.XVIIA
Individual Equation F-tests*

Bilateral VAR System: LRETWI and LRGDP (1974Q1 - 1993Q3)

Target / Causal	LRETWI	LRGDP
LRETWI	162.9018 [0.0000]	1.7025 [0.1471]
LRGDP	0.7475 [0.5909]	741.3623 [0.0000]

* Based upon a provision of 5 lags for each variable.

Note: Figures in parentheses refer to marginal significance levels.

Table 5.XVIIB
Individual Equation F-tests*

Bilateral VAR System: LREXWI and LRGDP (1974Q1 - 1993Q3)

Target / Causal	LREXWI	LRGDP
LREXWI	161.3357 [0.0000]	1.6359 [0.1636]
LRGDP	0.6819 [0.6388]	779.7041 [0.0000]

* Based upon a provision of 5 lags for each variable.

Note: Figures in parentheses refer to marginal significance levels.

Table 5.XVIIC
Individual Equation F-tests*

Bilateral VAR System: LRMUSI and LRGDP (1974Q1 - 1993Q3)

Target / Causal	LRMUSI	LRGDP
LRMUSI	55.8126 [0.0000]	0.9446 [0.4581]
LRGDP	0.2289 [0.9487]	380.8759 [0.0000]

* Based upon a provision of 5 lags for each variable.

Note: Figures in parentheses refer to marginal significance levels.

Table 5.XVIIIA
Individual Equation F-tests*

Bilateral VAR System: LRETWI and LREXPOT (1974Q1 - 1992Q1)

Target / Causal	LRETWI	LREXPOT
LRETWI	82.1178 [0.0000]	0.9794 [0.4482]
LREXPOT	1.0484 [0.4049]	214.8288 [0.0000]

* Based upon a provision of 6 lags for each variable.

Note: Figures in parentheses refer to marginal significance levels.

Table 5.XVIIIB
Individual Equation F-tests*

Bilateral VAR System: LREXWI and LREXPOT (1974Q1 - 1992Q1)

Target / Causal	LREXWI	LREXPOT
LREXWI	83.4919 [0.0000]	1.0403 [0.4098]
LREXPOT	0.9789 [0.4486]	230.7030 [0.0000]

* Based upon a provision of 6 lags for each variable.

Note: Figures in parentheses refer to marginal significance levels.

Table 5.XVIIIC
Individual Equation F-tests*

Bilateral VAR System: LRMUSI and LREXPOT (1974Q1 - 1992Q1)

Target / Causal	LRMUSI	LREXPOT
LRMUSI	24.9997 [0.0000]	1.0042 [0.4312]
LREXPOT	1.3593 [0.2458]	94.2036 [0.0000]

* Based upon a provision of 6 lags for each variable.

Note: Figures in parentheses refer to marginal significance levels.

5.7 Concluding Remarks

This chapter of the thesis deals mainly with a number of selected issues on exchange rates namely:

1) the implications for exchange rate, price and income (output) movements given the presence of equilibrium credit rationing in the domestic banking system. The Dornbusch's (1976) model has been utilised for the purpose;

2) an empirical establishment of the fundamental determinants of real exchange rates in the spirit of Edwards (1989). Both bilateral (M$/US$) and effective exchange rate indices (trade-weighted, export-weighted and import-weighted) have been explored. Long run equilibrium exchange rate equations have been identified on the basis of cointegrating vectors estimated using the cointegration technique of Johansen with residuals of cointegrating vectors being construed as short run departures from the long run equilibrium. The behavior of these residuals has also been regarded as indicative of the extent of any misalignment of the Malaysian exchange rate; and

3) an empirical establishment of the links between real exchange rate movements and economic activity by applying the Sim's VAR technique. The direction of causality between them is also being stressed upon in the empirical endeavors.

An examination of the historical time series of real effective and bilateral exchange rate indices has revealed the following:

1) The Malaysian nominal effective and bilateral exchange rates have not exhibited any appreciable long run depreciating or appreciating trend since 1976 though the nominal effective exchange rates do exhibit an increasing variability. The bilateral rate vis-a-vis US$ however has not displayed an increasing variability in the 1980s. This is presumably due to some exchange rate policy of the Central Bank of pegging the ringgit more to the US$;

2) Similarly no distinct long run appreciating or depreciating trend can be observed with respect to real effective and bilateral rates. An increasing variability has also been observed for all the real effective indices. This may speak of a growing difficulty of attempting to manage the external competitiveness of the country at least in the short run by managing the exchange

rate especially if one is inclined to associate exchange rate developments with external competitiveness;

3) Real effective exchange rate movements have been largely dictated by nominal rate movements since the mid 1980s though this scenario has already been observed since the 1970s in the case of bilateral exchange rates. At least from a theoretical perspective, managing the real exchange rate is then synonymous with managing the nominal exchange rate if real exchange rate movements indeed determine the external competitiveness of the country; and

4) Notwithstanding (1) and (2) above, the Malaysian ringgit has been on a depreciating trend since 1984Q3 in real and nominal effective terms though there has been some rebound since 1990Q3 in real terms. Though there is also a corresponding steep rise in exports, by no means can it be solely attributed to exchange rate developments. The abrupt rise in exports might have been a major consequence of the government's move in the mid 1980s to step up its export promotion efforts which had already been initiated in the early 1970s. Even if it cannot be denied that the depreciation has been catalytic to export growth, merchandise imports have also increased considerably both in nominal and in real terms. Hence real exchange rate movements may not be a sufficient condition for economic growth though it may be a necessary one. Perhaps as a policy lesson for developing countries, economic growth could only be aided by a real exchange rate depreciation if the industrial complex of a country is already well in place. It is imperative to maintain some industrial or structural development policy as well. Having said this, Malaysia's economic growth and development performance cannot so far be attributed to real exchange rate management. As has been seen in our empirical section, periods of undervaluation and overvaluation have been quite commonly witnessed in the nation's past let alone the empirical reality that no strong relationships have actually existed amongst real exchange rates, exports and income.

A number of interesting implications for exchange rate, price and output movements can be drawn based upon Dornbusch's (1976) model for an economy plagued with asymmetric information problems in its banking system. The presence of equilibrium credit rationing is perceived as a factor that keeps the domestic interest rate low vis-a-vis the foreign one. It appears that any measure taken to alleviate information asymmetries would lead to a depreciation in the long run equilibrium exchange rate and an increase in the long run equilibrium price level. The higher is the interest elasticity of money demand, the greater would be the depreciation and the increase in the equilibrium price level. On impact, a weaker domestic currency and a higher output level can be expected. Again this depends on the interest elasticity of money demand with the weakness of the domestic currency and the rise in the output level varying directly with the elasticity.

In the spirit of Edwards (1988a, 1988b & 1989), our empirical endeavors reveal that terms of trade, total federal government expenditure relative to the GDP, import tariff incidence and the ratio of total imports of investment goods to nominal GDP (which is supposedly a proxy for technological progress and rate of capital accumulation) have a strong appreciating influence on real effective exchange rates in the long run. Assuming that these long run relationships indeed hold, evidence is not found of any sustained overvaluation or undervaluation of the effective exchange rates (trade- and export- weighted) over the period 1974 through 1987. Moreover the fact that cointegrations exist would also suggest that there has been no serious exchange rate misalignment in the case of Malaysia. Perhaps we could then conclude that it has not been a deliberate policy of Malaysia to maintain an 'undervalued' position for its currency in order to boost its national development.

In assessing the influence of short run macropolicies namely monetary and fiscal policies on real effective exchange rates, the general-to-specific approach has been employed. Both excess domestic credit and excess M1 supply have been used interchangeably as a monetary policy variable while change in the total debt of the federal government relative to nominal GDP has been relied upon as an indicator of fiscal policy stance. However excess M1 supply has never emerged as a significant short run determinant of real effective exchange rate movements in our research experiments. An interesting insight gained from these experiments is that excess domestic credit leads to a depreciation of effective exchange rates rather than an appreciation, contrary to the popular belief of Edwards and others. This is somehow more consistent with the view of proponents of the monetary approach to exchange rate determination. The change in the fiscal policy stance of the government has no bearing at all on the short run movement of these rates.

With respect to bilateral exchange rate (M$/US$) movements, the fundamental determinants seem to differ in terms of the direction of influence on the rate in the long run from the case of effective rates. Though terms of trade improvement and trade restrictions appear to have an appreciating influence, total federal government expenditure and imports of investment goods both relative to nominal GDP seem to have a depreciating influence. Presumably this is due to an intense involvment of US dollars in such transactions. In the short run however only the extent of government involvment in the economy is significant in determining contemporaneously the bilateral exchange rate. Neither the monetary policy nor the fiscal policy stance variable has any influence at all unlike the case of effective exchange rates.

Finally based upon our empirical attempt to link real bilateral and effective exchange rate movements to economic performance via real exports, it is also interesting to note the absence of any strong relationship between them. In fact there is a total absence of causal relationships between real exchange rate movements on one hand and external trade balance, exports and income on the other, each taken in isolation. This may speak of the exchange rate policy insignificance to national economic development at least in macro terms. In other words, exchange rate movements need not be a particularly crucial factor in national economic development planning. Hence even though large swings in the exchange rate or its overvaluation could be generated by a financial liberalisation programme, this should not be taken as a worrisome phenomenon since exchange rate movements have no significant bearing on the economy in the light of these findings. Furthermore despite the fact that Malaysia has been maintaining a liberal exchange control regime, there has not been any sustained overvaluation of the Malaysian real exchange rate at all unlike the experience of Southern Cone countries in the late 1970s when they implemented a capital account liberalisation policy.

APPENDIX 5.1

$$\Delta LRETWI_t = -0.0263\ \Delta LFGTEY_t + 0.1077\ EXCRE_t$$
$$\qquad\qquad (-3.2722) \qquad\qquad (2.2874)$$

$$- \ 0.0417\ EC_{t-1} + 0.0537\ \Delta LFGTEY_{t-1}$$
$$\qquad (-5.1817) \qquad (4.7469)$$

$$+ \ 0.0314\ \Delta LFGTEY_{t-2} + 0.2142\ \Delta LRETWI_{t-1}$$
$$\qquad (4.2845) \qquad\qquad (1.8668)$$

$$- \ 0.0215S1$$
$$(-2.3364)$$

$\bar{R}^2 = 0.5087$

Autocorr: $\chi^2(1) = 0.0308$ [0.861]

$\chi^2(2) = 0.6697$[0.715]

$\chi^2(3) = 1.3299$ [0.722]

$\chi^2(4) = 1.4320$ [0.839]

$F(6,42) = 9.2835$ [0.000]

S.E. of Regression = 0.0155

Normality: $\chi^2(2) = 2.0083$ [0.366]

Heteroscedasticity: $\chi^2(1) = 0.0633$ [0.801]

ARCH: $\chi^2(1) = 0.7111$ [0.399]
$\chi^2(2) = 1.1311$ [0.568]
$\chi^2(3) = 2.0229$ [0.568]
$\chi^2(4) = 2.3153$ [0.678]

Functional Form: $\chi^2(1) = 1.8540$ [0.173]

Notes:

(I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

(II) Figures in square parentheses [ ] refer to marginal significance levels

APPENDIX 5.2

$$\Delta LRETWI_t = -0.0218\,\Delta LFGTEY_t + 0.1195\,EXCRE_t$$
$$\qquad (-2.9186) \qquad (2.4959)$$

$$-\ 0.0324\,EC_{t-3} - 0.0304\,\Delta LFGTEY_{t-2}$$
$$\qquad (-4.7994) \qquad (-3.6364)$$

$$-\ 0.0884\,\Delta LMTAXRM_{t-1} - 0.0939\,\Delta LINVGDP_{t-1}$$
$$\qquad (-2.4195) \qquad (-3.7470)$$

$$+\ 0.3436\,\Delta LRETWI_{t-1} - 0.0233S1$$
$$\qquad (3.2902) \qquad (-2.6210)$$

$\bar{R}^2 = 0.5158$

$F(7,41) = 8.3044$ [0.000]

S.E. of Regression = 0.0153

Normality: $\chi^2(2) = 1.1910$ [0.551]

Heteroscedasticity: $\chi^2(1) = 1.9705$ [0.160]

ARCH: $\chi^2(1) = 1.1078$ [0.293]
$\chi^2(2) = 1.7031$ [0.427]
$\chi^2(3) = 1.4926$ [0.684]
$\chi^2(4) = 3.3095$ [0.507]

Functional Form: $\chi^2(1) = 1.7956$ [0.180]

Autocorr: $\chi^2(1) = 0.0979$ [0.754]
$\chi^2(2) = 0.5701$ [0.752]
$\chi^2(3) = 1.2142$ [0.750]
$\chi^2(4) = 1.2746$ [0.866]

Notes:

(I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

(II) Figures in square parentheses [ ] refer to marginal significance levels

APPENDIX 5.3

$$
\begin{aligned}
\Delta LREXWI_t \quad = \quad & -0.0857\,\Delta LTOT_t - 0.0362\,\Delta LFGTEY_t \\
& \quad (-2.4447) \qquad\qquad (-4.5876) \\
+ \quad & 0.1066\,EXCRE_t - 0.0496\,EC_{t-1} \\
& \quad (2.3223) \qquad\qquad (-7.6977) \\
+ \quad & 0.0632\,\Delta LFGTEY_{t-1} + 0.0363\,\Delta LFGTEY_{t-2} \\
& \quad (5.9036) \qquad\qquad (5.1741) \\
- \quad & 0.0226S1 \\
& \quad (-2.5228)
\end{aligned}
$$

$\bar{R}^2 = 0.5266$

$F(6,42) = 9.8978$ [0.000]

S.E. of Regression = 0.0151

Normality: $\chi^2(2) = 0.2975$ [0.862]

Heteroscedasticity: $\chi^2(1) = 0.0066$ [0.935]

ARCH: $\chi^2(1) = 0.0149$ [0.903]
$\chi^2(2) = 1.8639$ [0.394]
$\chi^2(3) = 3.0757$ [0.380]
$\chi^2(4) = 4.0677$ [0.397]

Functional Form: $\chi^2(1) = 1.3007$ [0.254]

Autocorr: $\chi^2(1) = 0.0159$ [0.900]
$\chi^2(2) = 0.5963$ [0.742]
$\chi^2(3) = 2.3072$ [0.511]
$\chi^2(4) = 2.3513$ [0.671]

Notes:

(I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

(II) Figures in square parentheses [ ] refer to marginal significance levels

APPENDIX 5.4

$$\Delta LREXWI_t = \underset{(-2.8751)}{-0.0216\,\Delta LFGTEY_t} + \underset{(2.3611)}{0.1141\,EXCRE_t}$$

$$- \underset{(-4.6249)}{0.0286\,EC_{t-3}} - \underset{(-2.3998)}{0.0883\,\Delta LMTAXRM_{t-1}}$$

$$- \underset{(-3.6304)}{0.0916\,\Delta LINVGDP_{t-1}} - \underset{(-3.5307)}{0.0300\,\Delta LFGTEY_{t-2}}$$

$$+ \underset{(3.3277)}{0.3532\,\Delta LREXWI_{t-1}} - \underset{(-2.5549)}{0.0229S1}$$

$\bar{R}^2 = 0.5004$

$F(7,41) = 7.8679$ [0.000]

S.E. of Regression = 0.0155

Normality: $\chi^2(2) = 1.5288$ [0.466]

Heteroscedasticity: $\chi^2(1) = 2.0240$ [0.155]

ARCH: $\chi^2(1) = 1.1140$ [0.291]
$\chi^2(2) = 1.7629$ [0.414]
$\chi^2(3) = 1.3364$ [0.721]
$\chi^2(4) = 2.9979$ [0.558]

Functional Form: $\chi^2(1) = 1.5708$ [0.210]

Autocorr: $\chi^2(1) = 0.2375$ [0.626]
$\chi^2(2) = 0.6558$ [0.720]
$\chi^2(3) = 1.2132$ [0.750]
$\chi^2(4) = 1.2654$ [0.867]

Notes:

(I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

(II) Figures in square parentheses [ ] refer to marginal significance levels

APPENDIX 5.5

$$
\begin{aligned}
\Delta LRMUSI_t = \; & 0.0294\, \Delta LFGTEY_t - 0.4929\, EC_{t-1} \\
& (3.4047) \qquad\qquad (-6.7526) \\
+ \; & 0.0307\, \Delta LFGTEY_{t-1} - 0.0999\, \Delta LTOT_{t-1} \\
& (1.9509) \qquad\qquad (-2.4500) \\
+ \; & 0.4388\, \Delta LRMUSI_{t-1} + 0.0570S2 \\
& (4.5086) \qquad\qquad (3.6220)
\end{aligned}
$$

$\bar{R}^2 = 0.5553$

$F(5,44) = 13.2354$ [0.000]

S.E. of Regression = 0.0180

Normality: $\chi^2(2) = 0.1923$ [0.908]

Heteroscedasticity: $\chi^2(1) = 0.0456$ [0.831]

ARCH: $\chi^2(1) = 0.0230$ [0.879]
$\chi^2(2) = 1.7562$ [0.416]
$\chi^2(3) = 3.5157$ [0.319]
$\chi^2(4) = 4.5581$ [0.336]

Functional Form: $\chi^2(1) = 1.5683$ [0.210]

Autocorr: $\chi^2(1) = 0.4210$ [0.516]
$\chi^2(2) = 0.9702$ [0.616]
$\chi^2(3) = 0.9726$ [0.808]
$\chi^2(4) = 1.4502$ [0.835]

Notes:

(I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

(II) Figures in square parentheses [ ] refer to marginal significance levels

APPENDIX 5.6

$$\Delta LRMUSI_t = 0.0294\ \Delta LFGTEY_t - 0.4808\ EC_{t-2}$$
$$\qquad (3.4646) \qquad (-7.6286)$$

$$+\ 0.0744\ \Delta LFGTEY_{t-1} - 0.1065\ \Delta LTOT_{t-1}$$
$$\qquad (4.5834) \qquad (-2.6398)$$

$$-\ 0.0846\ \Delta LMTAXRM_{t-1} + 0.0553S2$$
$$\qquad (-2.0201) \qquad (3.5972)$$

$R^2 = 0.5682$

$F(5,44) = 13.8938$ [0.000]

S.E. of Regression = 0.0178

Normality: $\chi^2(2) = 0.1754$ [0.916]

Heteroscedasticity: $\chi^2(1) = 0.0723$ [0.788]

ARCH: $\chi^2(1) = 0.0345$ [0.853]
$\chi^2(2) = 2.1901$ [0.335]
$\chi^2(3) = 3.0368$ [0.386]
$\chi^2(4) = 3.6662$ [0.453]

Functional Form: $\chi^2(1) = 1.0902$ [0.296]

Autocorr: $\chi^2(1) = 0.2716$ [0.602]
$\chi^2(2) = 1.3469$ [0.510]
$\chi^2(3) = 1.3480$ [0.718]
$\chi^2(4) = 1.9270$ [0.749]

Notes:

(I) Figures in normal parentheses ( ) below estimated parameters refer to t-statistics

(II) Figures in square parentheses [ ] refer to marginal significance levels

Chapter 6

OVERALL CONCLUSIONS

To recapitulate, this is principally a three-part thesis pertaining to money demand, credit and exchange rates with specific reference to the Malaysian economy. The econometric techniques employed herein are mainly Johansen's maximum likelihood approach to cointegration, the error correction approach and vector autoregression (VAR) as advocated by Sims.

With respect to money demand, long and short run real money demand functions with money variously defined as M0, M1 and M2 have been estimated against the backdrop of financial liberalisation and innovation processes in Malaysia. The application of Johansen cointegration technique to the study of Malaysian money demand functions has been unprecedented. Previous Malaysian money demand studies have neglected the possible influence of expected exchange rate movements on money demand. Indeed it has been found that an expected exchange rate depreciation could yield a negative impact on real M1 demand with a contemporaneous exchange rate elasticity of -0.23. Hence the effectiveness of an expansionary monetary policy aimed at boosting economic activity may be compromised to some extent if it is executed when confidence in the domestic currrency is lacking.

Cointegrations have been found to exist between real money demand as variously defined on one hand and real gross domestic product, interest rates and expected exchange rate movements on the other. This suggests the presence of a stable long run relationship amongst them in spite of financial liberalisation and innovation. However a possibly interesting insight gained from this study is that while long run relationships exist amid the liberalisation and innovation processes, stable short run money demand functions do not over the entire sample period under review. Hence it may not be appropriate for one to conclude that the monetary policy effectiveness has been unaffected by the liberalisation and innovation processes on the basis of the presence of cointegrating vectors. This is especially so as monetary policy is essentially a short run stabilisation policy aimed at ironing out undue macroeconomic fluctuations. This prompted us to reestimate short run money demand functions over more recent periods in order to boost the policy relevance of the estimated parameters.

The part of the thesis relating to the study of bank credit in Malaysia stresses the possibility of equilibrium credit rationing (a la Stiglitz & Weiss, 1981 & 1983) being practised by commercial banks and the significance of bank credit relative to other monetary variables in influencing economic activity. The significance of the study is underscored by the fact that the ratio of commercial bank loans to GDP has been rising steadily.

One of the major implications of equilibrium credit rationing is the virtual insensitivity of lending rates to movements in the determinants of loan demand and supply. Our empirical analysis has shown that the lending rate would only respond negligibly to loan supply factors though not to a single loan demand factor. Another major implication is the presence of a 'ceiling' on the lending rate chargeable by banks. The presence of the ceiling could spell a doom to any financial liberalisation strategy aimed at harnessing more savings for the purpose of channelling them to productive uses. The ceiling acts as a constraint on the ability of banks to attract deposits by offering attractive rates of return. Nevertheless, the effect of equilibrium credit rationing on the volume of deposits and hence loanable funds secured by banks and the interest rate payable on them may depend on the interest elasticity of their flows.Our empirical analysis has suggested that deposits with banks have a virtually zero elasticity. Hence banks in Malaysia could always adjust their deposit rates downward when the market for loans deteriorates without undermining their deposit flows. Coupled with the fact that Malaysian banks have limited alternative investment opportunities, this could imply a prevalence of relatively smaller excess demand for loans in Malaysia in the event of equilibrium credit rationing.

In a separate consideration however, the larger is the interest elasticity of deposits, the greater will be the volume of deposits secured besides the possibility of a higher interest rate payable on them. This has been demonstrated with a simple profit-maximising model of a bank.

Perhaps we could then conclude that the negative impact of equilibrium credit rationing on the amount of deposits mobilised and the deposit rate will be more limited the higher is the interest elasticity of deposits. However there may be a more severe credit crunch in the event of an adverse twist in the optimal lending rate precipitated by an economic recession when deposits are interest elastic as this could involve a greater loss of loanable funds. Hence equilibrium credit rationing coupled with a high interest elastic condition could have a procyclical effect on the economy with the amplitude of the economy being accentuated.

In our exploration of the significance of bank credit to the Malaysian economy relative to other monetary variables, commercial bank credit has been found to exert a larger influence on the economy compared with M1, M2 and the lending rate. Hence in the conduct of monetary policy, perhaps more attention should be devoted to credit rather than monetary aggregates or lending rates.

The third part of the thesis on exchange rates has considered the following:

I) The implications for exchange rate, price and output (income) movements amid the presence of equilibrium credit rationing in the domestic banking system via an adaptation of the Dornbusch's (1976) model;

II) The fundamental determinants of equilibrium real bilateral and effective exchange rates a la Edwards (1988a, 1988b & 1989) that has also permitted us to establish whether Malaysian real exchange rates have been misaligned in particular a deliberate undervaluation. The pertinency of this study can be found in the high regard that some other developing countries have for Malaysia in economic development especially in the light of the tendency amongst developing countries to maintain a real exchange rate overvaluation; and

III) The causal relationships between real exchange rate movements on one hand and exports and economic growths on the other in Malaysia.

Prior to examining these issues, an examination of the historical time series of bilateral and effective exchange rate indices (in nominal and real terms) has revealed the absence of any distinct long run depreciating or appreciating trend. However both nominal and real effective indices did display a growing variability. In fact the real effective exchange rate movements have been largely caused by nominal exchange rate movements with no offsetting influence from relative price movements since the mid 1980s. This may imply that exchange rate management for the sake of maintaining the external competitiveness of the country has become a formidable task especially if one has a strong conviction that exchange rate developments have a bearing on exports and economic growths.

In our application of the Dornbusch's model, equilibrium credit rationing in the domestic banking system is perceived as a factor that keeps the domestic interest rate low relative to the foreign one. Our analysis has suggested that any measure taken to curb information asymmetries could result in a depreciation in the long run equilibrium exchange rate and a surge in the long run equilibrium price level. On impact, a weaker domestic currency and a higher output level are likely. However the strength of the long run effect and the impact effect would vary positively with the interest elasticity of money demand.

One of the salient results derived from our analysis of the fundamental determinants of equilibrium real exchange rates is the absence of any sustained overvaluation or undervaluation of the Malaysian rates. Thus the question of a real exchange rate misalignment does not arise. In the light of these findings, Malaysia's achievements in economic development so far cannot be attributed to any deliberate policy of real exchange rate undervaluation. Moreover our analysis of causal links has revealed no strong relationships existing between real exchange rate movements on one hand and exports and income on the other. All this may allude to an exchange rate policy insignificance to national economic growths or development at least from a macroeconomic perspective. Another interesting revelation of our analysis is that a depreciation rather than an appreciation of real effective exchange rates can be expected from an excessive domestic credit expansion. This is in fact inconsistent with conventional wisdom.

Finally, it is also noteworthy from our review of the Malaysian financial system that the present state of development of the Malaysian financial system (which is only second to Singapore in the South-East Asian region) cannot be attributed to a preservation of positive real interest rates on bank deposits. In spite of the October 1978 interest rate liberalisation measures, negative real yields could still be observed in recent years.

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