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MONEY Demand

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ABSTRACT

Money facilitates numerous transactions which would not have taken place in a barter economy. As a consequence, money represents generalized purchasing power over goods and services. Since every transaction involves money, economists have endeavoured to link the quantity of money with the value of economic transactions in the economy by developing theories explaining why people wish to hold money. The development of the various theories on the money demand function has resulted in voluminous empirical studies. Generally, the results of these empirical studies suggest a stable relationship between monetary aggregates and income. This is important because a stable and predictable money demand function will enable monetary authorities to forecast and to control inflation effectively.

Nevertheless, the effect of financial liberalization and financial innovations in the 1980s convinced monetary authorities in both the developed and developing countries to de-emphasize the use of monetary aggregates in the transmission of monetary policy and to use interest rates instead as the policy indicator for their monetary policy purposes. Ever since then economists have tried to find ways to restore monetary aggregates to its 'rightful place' as the main monetary policy indicator. The continuing quest for a stable money demand function has been considered on both theoretical and empirical grounds. In explaining the underlying determinants of desired money holdings, researchers have incorporated the effects of technological changes such as improvements in electronic payments systems, employing 'refined' econometric techniques in particular the use of the cointegration approach, and new financial assets into multi-asset portfolio models. However, as Duca and Vanhoose (2004: p.266) state "it remains to be seen, however,

whether the empirical advances in money demand literature will both adequately keep pace with financial progress and have a practical impact on the conduct of monetary policy". In other words, given the availability of data and methods, searching for a stable money demand function so as to support an effective monetary policy action is an empirical question.

WHAT IS MONEY?

Money has been defined as anything that is generally acceptable as payment for goods and services or for the discharge of debt. Generally money serves: as a medium of exchange; as a standard of value; as a store of value (wealth); and as a standard of deferred payments. As a medium of exchange, money is used as a means of payment in exchange for goods and services, in turn reducing transaction costs (time and effort spent) devoted to exchange, thus expanding the scope of specialization and division of labour and raising living standards.

Money acts as a standard of value since prices are generally quoted in terms of monetary units (i.e. in terms of ringgit and sen in Malaysia). Thus, money fulfills the role of a measuring rod or yardstick in assessing the value of goods and services. Money also act as a convenient store of value since money does not lose its value over time when stored. Thus, one way of storing purchasing power is by holding money. By combining the two roles of money as a standard of value, and as a store of value, money is able to serve as a standard of deferred value. Thus, future financial obligations can be settled in terms of money.

Thus, what constitutes money? How do we measure money? What is the empirical (practical) definition of money? Most people, when using the term 'money' refer to notes and coins (currencies) issued by the central bank. However, according to the conceptual definition, demand deposits, debit card and traveler's cheques could also be considered money. All are used to affect transactions. The components of money can also be expanded to a broader measurement by including savings deposits or fixed deposits since these financial assets can also act as store of value function. These assets can be quickly turned into cash and be used for transactions. However, these assets have varying degrees of 'moneyness'[1]. The question of an appropriate empirical definition of money has been one of the most debatable and unsettled issues in economics. Given these considerations, the central bank adopts several alternative definitions to measure the total quantity of money circulating amongst the public. Each definition incorporates assets with different degrees of moneyness. Proponents of the medium of exchange function of money prefer the narrow concept of money which only includes currency and demand deposits. On the other hand, the proponents of the store of value of money favour a broader concept of money, which incorporates not only currency and demand deposits but also other interest-bearing financial assets in the financial system. In fact, monetary authorities all over the world have used alternative measures of money with respect to both approaches to defining money - the medium of exchange and store of value approaches. A survey by Kumah (1989) indicated that in general, the measurement of money used by monetary authorities in over 150 countries is limited to M1, M2 and M3, depending on the level of development or monetization of the financial system. Gurley and Shaw (1960) argued that as the financial sector develops, new financial intermediaries emerge; offering varieties of interest-bearing financial assets with various maturity dates, and these financial assets should be added as components of money, giving a broader concept of monetary aggregates. Kumah (1989) observed that this has been the trend for the countries surveyed where broader measures of money are emphasized.

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[1]For empirical evidence on varying degree of moneyness of financial assets in Malaysia, see Habibullah (1988a, 1991).

Muzafar Shah Habibullah

THE ECONOMIC IMPORTANCE OF MONEY

In a barter economy, when no money was involved, each and every transaction required an exchange of goods and/or services between two or more parties. Without the use of money, each transaction requires 'double coincidence of wants' which will limit exchanges or trade and ultimately retard economic growth and lower living standards. However, in a monetary economy, the use of money eliminates the requirement of 'double coincidence of wants', thus greatly increasing trade, income, specialization and division of labour and raising living standards. Money thus facilitates numerous transactions which would not have taken place in a barter economy. As a consequence, money represents generalized purchasing power over goods and services.

According to Pierson (1972), the use of money as a medium of exchange produces two effects. The first effect is the gain in efficiency in all market transactions: in exchanges of goods, both current for current and current for future goods, and in the hiring of labour and payment for other factors of production. The more efficient exchange system "frees labour from distribution to be used in production" and increases consumer leisure time and consumer satisfaction. Pierson (1972) further argues that money should appear in the production function[2] and in the consumption function. The second effect is the credit creation function of money. Since money is a *form* of holding purchasing power (in the form of savings), with accumulated savings as a *source* of purchasing power independent of current and expected future resources, the monetary authorities can lend this purchasing power at will, thus permitting the recipients

[2]Evidence of money as the third input in the production function for Malaysia, see Habibullah (1988b, 1992a).

to either purchase the excess output or bid up the prices of resources and generate forced savings.

In an exchange, with each transaction that involves buyers and sellers, the nominal value of total spending must equal the nominal value of output of goods and services produced in the economy. By holding money, individuals and firms can demand for goods and services in the economy. Thus, individuals and firms choose to hold money because its use greatly facilitates a wide range of economic transactions. Since every transaction involves money, economists have endeavoured to link the quantity of money with the value of economic transactions in the economy or with economic activity.

The relationship between money and economic activity has attracted wide attention, with economists providing and developing theories explaining why people wish to hold money[3]. The development of the various theories of the 'money demand function' has resulted in voluminous empirical studies. Generally, the results of the empirical studies suggest that a stable relationship between monetary aggregates and income (or the level of prices), is essential for a central bank to potentially exploit this relationship in the process of monetary policy formulation[4]. A stable and predictable money demand function will enable monetary authorities to forecast and to control inflation effectively.

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[3]Studies on Malaysia, see Habibullah (1989a, 1998a, 1998g), Habibullah and Baharumshah (1993, 1995, 1996a, 1996b, 1998a, 1999,), Habibullah, Baharumshah and Tan (1998), Azali, Habibullah and Baharumshah (1999), Habibullah, Azali, Azman-Saini and Baharumshah (2000), Habibullah, Azali, Puah and Baharumshah (2002), Puah and Habibullah (2004), and Puah, Habibullah and Lim (2006).

[4]On the relationship between money, income and prices in Malaysia and other developing countries, see Habibullah (1997a, 1997b, 1997c, 1998b, 1998c, 1998d, 1998e, 1998f, 1999a, 1999b, 1999c, 1999d, 2006, 2007), Habibullah and Smith (1997a, 1998a), Habibullah, Azali and Baharumshah (2001), Habibullah, Puah and Azali (2001, 2002), Habibullah and Azali (2002), and Puah, Habibullah and Mansor (2008).

The simplest theory linking money supply with the price level (or other economic activity) is the 'quantity theory of money'. The theory specifies the following equation of exchange

$$MV = PT \tag{1}$$

In this identity, M is money supply, P is the price level, T is the volume of transactions in the economy, and V (by definition equals PT / M) is the transaction velocity of money, that is, the number of times a given money stock is used in the purchase of goods and services in a year. Note that the R.H.S. of Equation (1), PT is simply the total value of annual transactions (the average price per transaction times the number of transactions). The L.H.S. of Equation (1), MV also expresses the value of annual transactions but does so in terms of money stock and the transactions velocity of money. Thus, Equation (1) simply states that annual expenditures (MV) equal annual expenditures (PT).

In an empirical work, T is often proxied by real output, y (i.e. real GDP) and CPI (consumer price index) is used to measure price level, P. Thus, Py represents nominal GDP or nominal income as an alternative for PT. To turn Equation (1) into a theory, velocity is assumed constant. In this case the quantity of money will move in proportion to the nominal GDP in the economy. Equivalently, the real quantity of money (M/P) will move proportionally to real output (y). However, in the real world, velocity is not constant and it is closely related to the motives for holding money (average money holding as a proportion of nominal income will equal to the reciprocal of velocity). For example, an increase in market interest rate will tend to induce people to hold less money, (therefore increasing velocity) since holding money yields no returns, the opportunity cost of holding money increases, and as a result people shift their allocation of financial wealth by holding higher yielding assets. The amount of money people desire to hold is also known as the demand for money. Changes in transaction technology, market interest rates, financial innovation, the introduction of credit cards, ATM machines among others will affect money demand.

MONEY AND ECONOMIC DEVELOPMENT

Money plays an important role in economic development. Money in the form of savings and/or investment is crucial for development because capital goods depreciate over time. A significant flow of savings must be generated and transferred into productive investment just to maintain a nation's capital stock and preserve existing living standards. For living standards to rise, a healthy flow of savings and investment must be sustained. As a general proposition, the greater the proportion of current output saved and invested, the more rapid the rate of economic growth. In a modern society, as a result of specialization and division of labor, the process of investment is separated from the savings process. Thus, it is the function of the financial institutions to provide the mechanism to channel funds from the savers to the investors. By reducing the asymmetry of information for borrowers and lenders, the allocation of funds to the most productive sectors can be made, therefore increasing economic efficiency and social welfare.

The World Bank (1989: 30) reports that, "faster growth, more investment and greater financial depth all come partly from higher savings. In its own right, however, greater financial depth also contributes to growth by improving the productivity of investment. Investment productivity is significantly higher in the faster growing countries, which also have deeper financial systems. This suggests a link between financial development and growth". However, according to Patrick (1966) there are two possible relationships between financial development and economic growth. Firstly, as the economy grows, it generates demand for financial services which he calls a 'demand-following' phenomenon. According to this view, the lack of financial institutions in developing countries is an indication of lack of demand for their services. Secondly, the establishment and the widespread expansion of financial institutions in an economy may actively promote development, which Patrick called the 'supply-leading' phenomenon. This latter view which has been dubbed the 'financial-led' growth hypothesis has been popular among governments in several developing countries as a means of promoting development. The recent study by Habibullah and Eng (2006) support the contention made by Calderon and Liu (2003), Fase and Abma (2003), and Christopoulos and Tsionas (2004) that financial development promotes growth, thus, supporting the old Schumpeterian hypothesis[5] and Patrick's supply-leading hypothesis. In other words, the supply-leading growth hypothesis has been the main engine of growth in thirteen developing Asian nations for the period 1990-1998[6]. It implies that the policy of liberalization and financial reforms adapted by these Asian countries has been shown to improve economic growth[7].

There are two differing views on how the financial system can

[5]Schumpeter (1934) argues that financial sector leads economic growth by acting as a provider of funds for productive investments and therefore could lead to accelerating economic growth.

[6]The thirteen Asian developing countries include: Bangladesh, India, Indonesia, South Korea, Lao PDR, Malaysia, Myanmar, Nepal, Pakistan, Philippine, Singapore, Sri Lanka and Thailand.

[7]See also Habibullah (1999e), Azman-Saini, Habibullah and Azali (2000), Habibullah and Hidthiir (2004), and Law and Habibullah (2006).

be manipulated to enhance economic growth. The Structuralist School recommends an expansion in the structure of the financial system, such as an increase in the number of financial institutions. This school also encourages an increase in the array of financial instruments made available to the public (Goldsmith, 1969; Patrick, 1966). Neo-liberals on the other hand, advocate the liberalization of the financial system, by which they mean the relaxation of controls imposed on the financial systems by the monetary authorities (McKinnon, 1973; Shaw, 1973). Neo-liberals believe that administratively determined (as opposed to market-determined) low rates of interest may not encourage savings. Without savings there cannot really be any investment. Thus, according to this school, the freeing of interest rates is the key to capital formation and growth. Goldsmith (1969), McKinnon (1973), Shaw (1973), Fry (1988) and King and Levine (1993a, 1993b) are among those who have provided evidence that financial development is a prerequisite for economic growth.

Habibullah and Smith (1997b) have shown that in Asia, South Korea, Taiwan and the countries of the ASEAN[8] region have benefited greatly from the financial liberalization exercises. The

[8]The Association of South East Asian Nations (ASEAN) was founded in 1967 with the signing of the ASEAN Declaration. At present, the ASEAN member countries include Brunei, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand and Vietnam.

[9]Shaw (1973) defines financial deepening as the phenomenon in which the financial sector grows at a rate faster than the real sector of an economy. On the other hand, the process of monetization refers to the size as well as the composition of the stock of money (money supply) in an economy. Chandavarkar (1977) notes that the difference between monetization and financial intermediation is that, the latter refers to the process of mediation through institutions and instruments between primary savers and lenders and ultimate borrowers and is measured by the financial interrelations ratio. Thus, it connotes financial deepening rather than widening (enlargement of the money exchange economy), which is the phenomenon expressed in the term 'monetization'.

development of monetization and financial deepening[9] in selected Asian countries has been substantial. The degree of monetization in Asian countries has been significant over the 1956-94 period. The use of money (M1), relative to GNP (gross national product), has stabilized in most of the Asian countries, but declined in Myanmar, Singapore, Sri Lanka and Thailand. However, increasing use of broad money (M2) is evident in all the Asian countries, as shown by the consistent rise in their M2/M1 and M2/GNP ratios during the periods, reflecting the movement towards a higher level of monetized economy. During the deregulation period of 1986-94, Thailand registered the highest M2/M1 ratio of 7.46, followed by Korea (4.00), Singapore (3.75), Malaysia (3.61), Philippines (3.38) and Indonesia (3.34). Other Asian countries showed a ratio of less than 3.00. During the same period, other indicators of monetization, such as the holdings of money per capita and total bank deposits per capita, suggest that Singapore and Taiwan had significantly higher levels of monetization relative to those in the remaining eight Asian countries.

Habibullah and Smith (1997b) also presents the relationship between total assets of the financial system and national income, which measures the stage of financial intermediation in a country. More interestingly, the dominance of the banking system (comprising only the Central Bank and commercial banks) in all the Asian financial systems was particularly overwhelming, ranging from 0.54 for Nepal to 2.50 for Singapore. The income elasticity of assets of financial institutions to national income is just as revealing. The income elasticity of financial assets during the deregulation era was way above unity for all the Asian countries. The income elasticity of financial assets in Malaysia which was 1.53 during the period 1971-94, is one of the highest among the Asian countries.

MONEY, MONETARY POLICY AND FINANCIAL LIBERALIZATION

In the 1980s, the financial systems of a majority of the Asian countries underwent a radical transformation from the relatively simple structure of the early 1960s, comprising the Central Bank and small financial intermediaries into a more sophisticated financial system characterized by the presence of finance companies, merchant banks, commercial banks, discount houses, development finance institutions, capital market institutions, commodity market institutions and new thrift and trust institutions among others. In addition, the evidence of financial innovations and deregulation in the form of interest rates liberalization, relaxation of exchange controls, and foreign exchange dealings by financial institutions, computerized cheque clearing system, electronic banking, and new financial instruments has been a common feature in these Asian nations.

More importantly, these structural changes and financial innovations have significant implications for public portfolio behaviour and consequently, for the conduct of monetary policy. According to Laumas and Porter-Hudak (1986), the success of monetary policy depends on the extent to which the demand for money function can be estimated, and on the stability of the money demand function. Judd and Scadding (1982) further point out that the stability of the money demand function depends on the financial and monetary developments which include financial innovations in the financial markets. These innovations will alter public behaviour in the holding of real money balances. With financial and monetary development, the role of the non-bank financial intermediaries becomes apparent, offering a spectrum of interest-bearing financial instruments of various maturity dates. A shift out of money (currency and demand deposits) to these interest-bearing financial assets will subsequently affect the stability of the money demand function.

The aftermath of financial liberalization has created new problems for the monetary authorities of developing countries. The relationship between monetary aggregates, in particular, that of the narrow money M1 and national income has been questioned. There is evidence that there had been a breakdown in the link between M1 and income in developing countries. This has led monetary authorities to focus on broader monetary aggregates as monetary indicators for policy action. Tseng and Corker (1993) concluded from their study on nine Asian countries[10] that, as a consequence of the changing financial systems, the relationships between money, income and interest rates in those countries have been altered. Tseng and Corker (1993) point out that financial liberalization leads to one time or more gradual shifts in the level of money holdings, as well as to changes in the measured income and interest elasticity of money demand[11]. As a matter of fact, earlier, Gurley and Shaw (1960) had contended that the increased availability of interest-bearing financial assets as a result of an expanding financial sector can raise the sensitivity of money holdings to changes in interest rates. The implications of the growth of these money substitutes are important to monetary policy since with a high interest elasticity of money demand, monetary policy becomes less effective.

The effect of financial liberalization and financial innovations is not only limited to developing countries. In fact, the central banks

[10]The nine Asian countries include Indonesia, Malaysia, Myanmar, Nepal, Philippines, Singapore, South Korea, Sri Lanka and Thailand.

[11]In another aspeet, finaneial liberalization will result in the reduction of liquidity constraints which will affect the role of monetary aggregates as policy indicators. See for example studies by Habibullah (1999f), Habibullah and Smith (1999, 2001, 2009), and Habibullah, Smith and Azman-Saini (2006).

of developed economies have de-emphasized the importance of monetary aggregates in the transmission of monetary policy and used interest rates instead as the policy indicator for monetary policy purposes. As a matter of fact, in the last two decades, the role of monetary aggregates has been undermined. According to Duca and Vanhoose (2004), under the interest-rate-based policy procedures implemented by most central banks, monetary aggregates are residuals and not variables of interest to policy makers seeking to stabilize output and inflation. Duca and Vanhoose (2004) further point out that in most modern macroeconomic models, monetary aggregates are regarded as irrelevant to the policy process and this is reflected in the increasingly frequent use of the "Taylor rules" in macro-monetary models. On the other hand, the proponents of monetary aggregates indicate that monetary aggregates may be useful to policymakers as a proxy for the various portfolio substitution effects induced by monetary policy actions, which, in turn, affect aggregate demand (Nelson, 2003a, 2003b). McCallum and Nelson (1999) and Nelson (2002) show that changes in real monetary base have influenced real output in the US and UK independent of the short-term interest rates. According to Nelson (2003a, 2003b) and Kajanoja (2003), the quantity of money stands out as a potential indicator for monetary policy that is independent of short-term interest rates established by central bank policies. Thornton (2008) argues that the essential feature of money is that it guarantees "final payment" and is essential for price determination. Thornton (2008) further suggests that the ability of the central banks to control interest rates may be greatly exaggerated. Thus, at present, the potential role of monetary aggregates in the transmission process remains unresolved or implicitly ignored, which suggests that developments in money demand theory are likely to remain somewhat diffused and confused (Duca and Vanhoose, 2004).

MONEY DEMAND FUNCTION

Estimating a money demand function is of crucial significance to monetary policy. The ability to forecast and to control inflation effectively requires a stable and predictable money demand function. Without a stable relationship between money demand and its determinants, the potential absence of causality in the evolution of time series makes forecasting inflation appear more uncertain. Given the importance of the money demand function, economists have conducted voluminous money demand studies for both the developed and developing countries. The general formulation for the money demand function estimated in many of the empirical studies employed follows the conventional money demand function with variations in its determinants as follows

$$m_t = f(y_t, r_t, Z_t) \qquad (2)$$

In Equation (2), the dependent variable m stands for real money balances, that is, the amount of money balances people collectively choose to hold. The independent variables include real income level, y, the level of interest rate, r, and the third variable, Z, which represents other economic and institutional factors that could have an effect on money demand. These factors, among others include financial technology, financial innovations, wealth, own-rate of money, expected inflation, volatility measures, equity, foreign interest rate, exchange rate, political instability, and financial development indicators (see for example: Payne, 1995; Caruso, 1996; Friedman, 1984; Serletis, 1990; Bordo and Jonung, 1990; Siklos, 1993; Raj, 1995; Hoggarth and Pill, 1992; Hall, Hendry and Wilcox, 1990; Melvin and Shiau, 1990; Ghaffar and Habibullah, 1987a, 1987b; Habibullah, 1989b, 1995; Habibullah and Ghaffar, 1991; Azali, Baharumshah and Habibullah, 2000; Sriram, 2001).

Money Demand

In the empirical estimations of the money demand function, it has been the "tradition" to specify and estimate a short-run money demand that incorporates both the lagged dependent and lagged independent variables in the estimated equations. The partial adjustment model, the adaptive expectation and permanent income hypotheses and the autoregressive distributed lag (ARDL) models make this possible and have become popular when specifying short run money demand equations.

Variants of money demand equations have been estimated by specifying the following models in logarithm:

Money demand: $m_t^* = \alpha_0 + \alpha_1 y_t^p + \alpha_2 r_t + \mu_t \quad \alpha_1 > 0, \alpha_2 < 0$ (3)

Partial adjustment: $m_t - m_{t-1} = \theta(m_t^* - m_{t-1}) \quad 0 \le \theta \le 1$ (4)

Adaptive expectation: $y_t^p - y_{t-1}^p = \gamma(y_t - y_{t-1}^p) \quad 0 \le \gamma \le 1$ (5)

Equation (3) states that desired real money holdings m_t^*, depend on real permanent income, y_t^p and interest rate r_t. Since desired real money balances and real permanent income are not observable, Equation (4) and Equation (5) were used to transform them into the final estimating models. Assuming y_t in Equation (3) and using Equation (4) to adjust desired to actual real money holdings we have the real partial adjustment model (RPAM) as follows

$$m_t = a_0 + a_1 y_t + a_2 r_t + a_3 m_{t-1} + \omega_t \tag{6}$$

where $a_0 = \theta\alpha_0$, $a_1 = \theta\alpha_1$, $a_2 = \theta\alpha_2$, $a_3 = (1-\theta)$ and $\omega_t = \theta\mu_t$. The a values represent short run or impact coefficients or elasticities. Using these short run elasticities we can also derive the long run elasticities. The parameter a_3 measures the speed of adjustment.

On the other hand, assuming m_t in Equation (3) and using Equation (5) to incorporate permanent income in the money demand model, we have the following adaptive expectation money demand model

$$m_t = b_0 + b_1 y_t + b_2 r_t + b_3 r_{t-1} + b_4 m_{t-1} + \varpi_t \tag{7}$$

where $b_0 = \gamma\alpha_0$, $b_1 = \gamma\alpha_1$, $b_2 = \alpha_2$, $b_3 = -(1-\gamma)\alpha_2$, $b_4 = (1-\gamma)$ and $\omega_t = \mu_t - (1-\gamma)\mu_{t-1}$. Next, assuming m_t^* and y_t^p in Equation (3) and using Equations (4) and (5) we arrive at the following real partial adjustment adaptive expectation money demand model as follows:

$$m_t = c_0 + c_1 y_t + c_2 r_t + c_3 r_{t-1} + c_4 m_{t-1} + c_5 m_{t-2} + \eta_t \tag{8}$$

where $c_0 = \theta\gamma\alpha_0$, $c_2 = \theta\alpha_2$, $c_3 = -\theta(1-\gamma)\alpha_2$, $c_4 = (2-\theta-\gamma)$, $c_5 = -(1-\gamma)(1-\theta)$ and $\eta_t = \theta[\mu_t - (1-\gamma)\mu_{t-1}]$.

A more general model is the autoregressive distributed lag (ARDL) model of the following form:

$$m_t = \beta_0 + \sum_{i=0}^{q} \beta_{1i} y_{t-i} + \sum_{i=0}^{n} \beta_{2i} r_{t-i} + \sum_{i=1}^{k} \beta_{3i} m_{t-i} + v_t \tag{9}$$

where q, n and k represent the number of lagged terms to be considered for each variable. It is possible to used the 'general to specific' approaches and reparameterisation of Equation (9) by including 'differenced' terms as well as the original 'levels' variables to arrive at an error correction model. Any short run demand for money equations can be reparameterised to incorporate an error correction mechanism. According to Engle and Granger (1987) the concept of cointegration can be linked to the error correction mechanism. Consider the following simple ARDL short run equation for real money balances

$$m_t = d_0 + d_1 y_t + d_2 y_{t-1} + d_3 r_t + d_4 r_{t-1} + d_5 m_{t-1} + v_t \qquad (10)$$

When m, y and r are cointegrated it implies the use of an error correction model. The error correction model stipulates that m, y and r follow a long run relationship

$$m = \delta_0 + \delta_1 y + \delta_2 r + \varepsilon \qquad (11)$$

In the long run, as $t \longrightarrow \infty$, Equation (10) becomes

$$m = \frac{d_0}{1-d_5} + \frac{d_1 + d_2}{1-d_5} y + \frac{d_3 + d_4}{1-d_5} r + \varepsilon \qquad (12)$$

Since m, y and r follow the long run relationship, we know that $d_0/(1-d_5) = \delta_0$, and $(d_3 + d_4)/(1-d_5) = \delta_2$. Solving d_5, d_2 and d_4 in terms of $d_0, d_1, d_3, \delta_0, \delta_1$ and δ_2 and substituting them in Equation (10) yields

$$m_t = d_0 + d_1 y_t + \left(\delta_1 \frac{d_0}{\delta_0} - d_1 \right) y_{t-1} + d_3 r_t$$
$$+ \left(\delta_2 \frac{d_0}{\delta_0} - d_3 \right) r_{t-1} + \left(1 - \frac{d_0}{\delta_0} \right) m_{t-1} + v_t \qquad (13)$$

Rearranging and grouping the terms, we have the following error correction model for the short-run money demand equation

$$\Delta m_t = \varphi_0 + \varphi_1 \Delta y_t + \varphi_2 \Delta r_t - \lambda (m_{t-1} - \delta_1 y_{t-1} - \delta_2 r_{t-1}) + \tau_t \qquad (14)$$

where $\varphi_0 = d_0, \varphi_1 = d_1, \varphi_2 = d_3, \lambda = -d_0 / \delta_0$ and $\tau_t = \mu_t$.

Thus, using variants of money demand equations of the forms (6), (7), (8) and (14), hundreds of money demand studies were carried out to ascertain the most appropriate and stable money demand functions and to address the 'missing money' episode and the impact of financial innovations on the long run relationship between money and income or price that is useful for monetary policy purposes[12]. A large number of money demand studies were compiled by Fase (1993), Sriram (2001) and Knell and Stix (2003). A survey paper by Fase (1993) contains money demand estimations from 100 papers that were written from 1972 to 1992. Sriram (2001) includes estimations from 39 papers published from 1990 to 1999. On the other hand, Knell and Stix (2003) surveyed money demand

[12] See Sriram (1999) for other variants of money demand equations estimated in the literature.

studies from 68 papers from 1995 to 2002[13]. Despite all these studies and their findings, central banks all over the world have been emphasizing interest rates as their monetary policy tools. In their survey, Duca and Vanhoose (2004: p.266) point out that the continuing doubts about the role of monetary aggregates in the transmission of monetary policy leaves the empirical – as well as theoretical-literature in a somewhat unsettled state. At present, the potential role of monetary aggregates in the transmission process remains unresolved or implicitly ignored, which suggests that developments in money demand theory are likely to remain somewhat diffuse and unfocused".

MICROFOUNDATIONS AND THE DEMAND FOR MONEY

A. Aggregating Monetary Aggregates

In most of the monetary and macroeconomics studies, money is the key variable. Researchers try to estimate the money demand function, and the relationship between money and other macroeconomic variables in the view that money plays an important role in affecting economic activity. The measures of money traditionally used by both policy makers and economists are the official simple sum aggregates. Unfortunately, the empirical validity of these simple sum aggregates have been questioned due to their theoretical inconsistency with microeconomic and index number theories. Implicitly, the simple sum method of aggregation assumes

[13]For Malaysia, see for example studies by Habibullah (1987, 1990a, 1990b, 1992b), Ghaffar and Habibullah (1987c), Habibullah and Ghaffar (1988), and Azali, Habibullah and Jalal (2001).

that the component assets are regarded perfect substitutes. This assumption is obviously invalid in the sense that each of the component assets is different in terms of their 'moneyness', and therefore have different opportunity costs and should not be treated as perfect substitutes. As a result, the traditional way of measuring money is considered flawed and makes money no longer a viable policy tool.

On the other hand, the weighted monetary aggregates have gained much attention and have always been suggested as an alternative measure of the monetary policy tool. Barnett (1980) proposes a viable alternative to the simple sum aggregates. He assigns each component asset a weight that depends jointly on the quantities and user costs of every asset in the aggregate. The resulting weighted monetary aggregates thus become a more valid measure of the monetary services in the economy. Since the early research work by Barnett, there have been numerous theoretical as well as empirical studies on weighted monetary aggregations. Different theoretic aggregation methods that are based on microeconomic and statistical index number foundations have been proposed to construct monetary aggregates. This line of research particularly emphasizes on the relative performance of Barnett's (1980) Divisia index and Rotemberg, Driscoll and Poterba's (1995) Currency Equivalent (CE) index over the simple sum index.

For example, Chrystal and MacDonald (1994) investigated the role of the Divisia aggregate for the United States, United Kingdom, Australia, Germany, Switzerland, Canada and Japan and found support for the Divisia aggregate as opposed to the Simple sum aggregate in these developed countries. They pointed out that in the United States; the credibility of the Simple sum aggregate has been greatly undermined compared to the Divisia aggregate even during the period in which financial innovation was the greatest.

Chrystal and MacDonald's (1994) main conclusions are very clear. Chrystal and MacDonald (1994: p.74-76) noted that, "There has been a major measurement error in virtually all of the previous literature on money. Instability in empirical relationships has been primarily due to the fact that Simple sum measures of money are not admissible aggregates on index-theoretic grounds. Hence, this suggests that the problems with tests of money in the economy in recent years may be more due to bad measurement theory rather than to instability in the link between true money and the economy. Rather than a problem associated with the Lucas Critique, it could instead be a problem stemming from the "Barnett Critique"." In supporting the use of Divisia measures of money, Belongia (1996b) asserts that many of the monetary puzzles of the 1980s would have been resolved if Divisia monetary aggregates had been used. Belongia (1996b: p.1082) argues that, "the results show that basic inferences about the direction, magnitude and significance of money growth on economic activity can depend crucially on the chosen measure. Because simple-sum indexes violate basic theoretical principles, the sensitivity of empirical results illustrated here offers practical evidence against further use of the reported simple-sum monetary aggregates".

Simple Sum Aggregation

For decades, simple sum monetary aggregates have been the most commonly used measures of money. The simple sum aggregation is derived from the classical quantity theory of money where money was narrowly defined and it served the function of medium of exchange. As such, only highly liquid monetary assets that can facilitate transactions, such as currency and demand deposits were included in the aggregation. Monetary assets that could not be used directly to facilitate transactions were excluded.

These aggregates are constructed by the simple summation of the dollar amounts of each monetary component. For a given set of n monetary assets ($m_1, \ldots, m_n$), the nominal stock of the simple sum aggregate (SS) is given by the following index:

$$SS = \sum_{i-1}^{n} m_i \tag{15}$$

With such a summation procedure, a weight of unity is implicitly assigned to each monetary asset. In other words, different monetary components are regarded perfect substitutes (infinite elasticities of substitution) and with the same opportunity cost. Nevertheless, different monetary assets have different degrees of liquidity and thus their opportunity costs should not be viewed as identical. Thus, the simple sum aggregation method does not capture the true dynamics of the asset demand theory. Due to this reason, it has been criticized as an improper index number.

The prior strong assumption about the elasticities of substitution in simple sum aggregation is invalid especially where a broader monetary aggregate is concerned. At the narrowest level of aggregation (M1), the simple sum aggregate has its empirical validity since currency and demand deposits are nearly homogenous. Thus, we can consider them perfect substitutes. As the heterogeneity of the monetary assets increases at the broader levels of aggregation (for example, M2 and M3), however, the simple sum method is clearly inappropriate. This is because when the definition of aggregation becomes broader, the monetary assets would be more heterogeneous, and thus have different degrees of substitutability. As such, the perfect substitutability condition is more seriously violated. Consequently, simple sum aggregates become increasingly distorted at broad levels of aggregation[14].

Since the traditional monetary aggregates are 'accounting' measures, they are not suitable to measure 'money is what money does', that is providing services to the holder. Friedman and Schwartz (1970: p.151-152) observed that, "This (simple summation) procedure is a very special case of the more general approach discussed earlier. In brief, the general approach consists of regarding each asset as a joint product having different degrees of 'moneyness,' and defining the quantity of money as the weighted sum of the aggregate value of all assets, and the weights for individual assets varying from zero to unity with a weight of unity assigned to that asset or assets regarded as having the largest quantity of 'moneyness' per dollar of aggregate value. The procedure we have followed implies that all weights are either zero or unity. The more general approach has been suggested frequently but experimented with only occasionally. We conjecture that this approach deserves and will get much more attention than it has so far received."

Earlier, Fisher (1922: p.29) pointed out that, "the simple arithmetic average produces one of the very worst of index numbers, and if this book has no effect than to lead to total abandonment of the simple arithmetic type of index number, it will have served a useful purpose." Fisher further strongly advises that this index should not be used under any circumstances because it possesses two undesirable properties, that is, 'bias and freakishness.'

Thus, by treating all component assets as perfect substitutes, the simple sum aggregation methods lose their validity and do not adhere to both microeconomic and index number theories. For that

[14]According to Chrystal and MacDonald (1994), there is an overwhelming body of evidence showing that monetary assets are not perfect substitutes and that there is a low degree of substitutability between some of these assets.

reason, economists try to use new variables and/or transformations of the old variables to solve the deficiency in the traditional measure of money. Subsequently, weighted monetary aggregation methods emerge as an important issue. These methods utilize the microeconomics theory and statistical index number theory to construct monetary aggregates. Two such methods are the Divisia and Currency-Equivalent indexes.

Theoretical Framework of Monetary Aggregation

The construction of monetary aggregates is based on the aggregation and statistical index number theory that required a set of assumptions. Anderson, Jones and Nesmith (1997: p.7) show that the general assumptions necessary for the aggregation of any group of economic decision variables include: (i) an aggregator function that can be factored out of the economic agent's decision; (ii) efficient allocation of resources over the group of economic variables; (iii) no quantity rationing within the group variables; and (iv) the existence of a representative agent if the underlying data being aggregated have been previously aggregated across agents.

However, these conditions are insufficient to apply the microeconomic theory in the study of the aggregates. Additional assumptions about the structure of the model from which the aggregator functions are derived should be added to examine the behavior of the aggregates. Following Anderson et al. (1997), we use a general neoclassical model of consumer demand to discuss the linkages between microeconomic and aggregation theory. The required assumptions for aggregating across current period monetary assets are: (i) the weak separability assumption that indicates the existence of a theoretical aggregator function defined over current period monetary assets; (ii) the utility maximization assumption that leads to the efficient allocation of resources over the weakly separable monetary assets; and (iii) the absence of quantity rationing.

Anderson et al. (1997: p.7-8) pointed out that with the above assumptions, "a price taking representative consumer is assumed to maximize an intertemporal utility function in which current period monetary assets are weakly separable from other goods and leisure, subject to a set of multiperiod budget constraints". The assumption that consumers are price takers is sufficient to allow statistical index numbers to be constructed from the observable user costs (prices) and asset stocks of the monetary assets[15].

Consumer's Choice Problem

At the micro level, economic agents have different utility functions, which they attempt to maximize by choosing the quantities of all goods consumed, so that the marginal utilities of the goods are proportional to the prices of the goods. Aggregation models commonly apply the concept of a 'representative agent' to the economic theory of household behavior and consumer demand, and then use the representative agent to solve for optimal maximization. This is done by maximizing the household's utility function subject to a budget constraint and obtaining first-order conditions to reach the equilibrium level of price and quantity.

Monetary assets can be treated as durable goods in the household's utility function. The treatment of monetary assets as durable goods in a household's utility function dates from Walras (1954)[16]. The reason for including money in the utility function is

[15]In some cases, relaxing the price taking assumption may require the use of marginal or shadow prices, as suggested in Diewert (1980). One additional problem is that the existence of a representative firm in Debreu's (1959) proof depends on the assumption of perfectly competitive markets.

[16]However, it was not until year 1978 that the appropriate user cost of monetary assets was derived by Barnett (1978).

because it served as the medium of exchange. As a result, money appeared to have positive market value in the general equilibrium model. Arrow and Hahn (1971) pointed out that a derived utility function contained money information if money has positive value in general equilibrium. There is no loss or gain by including money in the utility function because any model that does not include money in the utility function, but produces a motive for holding money in equilibrium, is functionally equivalent to a model that does include money in a derived form. So the starting point for monetary aggregation has been a representative agent maximizing utility.

Barnett (1980) assumes that, in each period, the representative consumer maximizes an intertemporal utility function over a finite planning horizon of T periods. The consumer's intertemporal utility function in any period, t, is:

$$u_t(m_t, m_{t+1}, \ldots, m_{t+T}; q_t, q_{t+1}, \ldots, q_{t+T}; l_t, \ldots, l_{t+T}; A_{t+T}) \tag{16}$$

where for all periods $\{t, t+1, \ldots, t+T\}$, $m_s = (m_{1s}, \ldots, m_{ns})$ is a vector of real stock of n monetary assets, $q_s = (q_{1s}, \ldots, q_{ms})$ is a vector of quantities of m non-monetary goods and services, l_s is the desired number of hours of leisure, and A_{t+T} is the real stock of a benchmark financial asset, held in the final period of the planning horizon at date $t+T$.

The representative agent is assumed to reoptimize in each period t, choosing values $(m_t, \ldots, m_{t+T}; q_t, \ldots, q_{t+T}; l_t, \ldots, l_{t+T}; A_t, \ldots, A_{t+T})$ that maximize the intertemporal utility function subject to a set of $T+1$ multiperiod budget constraints. This set of multiperiod budget constraints, indexed by $s \in \{t, t+1, \ldots, t+T\}$ is given as

$$\sum_{i=1}^{m} p_{is}q_{is} = w_s L_s + \sum_{i=1}^{n}[(1+r_{i,s-1})p_{s-1}^{*}m_{i,s-1} - p_s^{*}m_{i,s}] \\ +[(1+R_{s-1})p_{s-1}^{*}A_{s-1} - p_s^{*}A_s] \tag{17}$$

where p_s^{*} is a true cost of living index, $p_s = (p_{1s},\ldots, p_{ms})$ is a vector of prices for the m non-monetary goods and services, $r_s = (r_{1s},\ldots, r_{ns})$ is a vector of nominal holding period yields on the n monetary assets, R_s is the nominal holding period yield on the benchmark asset, w_s is the wage rate, A_s is the real quantity of a benchmark asset which appears in the utility function only in the final period $t+T$, and L_s is the number of hours of labor supplied, for all $s \in \{t, t+1,\ldots, t+T\}$.

Assuming H is the total number of hours in a period, l_s, the leisure time of the household during each period is given by $H - Ls$. Equation (18) shows that the real value of assets carried over from the previous planning period is :

$$\sum_{i=1}^{n}(1+r_{i,t-1})m_{i,t-1} + (1+R_{t-1})A_{t-1} \tag{18}$$

and the real value of the consumer's provisions for the following planning periods is

$$\sum_{i=1}^{n}(1+r_{i,t+T})m_{i,t+T} + (1+R_{t+T})A_{t+T} \tag{19}$$

Anderson et al. (1997) pointed out that the above representation implicitly assumes that: (i) a true cost of living index, p_s^{*}, exists as in Barnett (1987), and the non-monetary goods and services are blockwise weakly separable in the current period from other decision variables in the model; (ii) except for the intertemporal transfer of wealth, all of the services provided by monetary assets have been incorporated into the household's utility function; and (iii) the benchmark asset, A_s, which appears only in the final period does not provide any monetary services to the household except in the final period of the planning horizon. Household uses the benchmark asset only for transferring wealth from one period to another.

Before we proceed to the consumer's choice problem, it is possible to simplify the notation. Let $m_t = (m_{1t},...,m_{nt})$ be a vector that consists of all current period monetary assets, and $x_t = (m_{t+1},...,m_{t+T}; q_t,...,q_{t+T}; l_t,...,l_{t+T}; A_{t+T})$ represents a vector that includes all other decision variables in the model. Also, assume that the vectors $m_t^* = (m_{1t}^*,...,m_{nt}^*)$ and $x_t^* = (m_{t+1}^*,...,m_{t+T}^*; q_t^*,...,q_{t+T}^*; l_t^*,...,l_{t+T}^*; A_{t+T}^*)$ indicate the solutions to the household's maximization problem. With the above simplified notation, the utility function in Equation (16) can be written as $U(m_t, x_t)$. The first-order conditions of this model, evaluated at the optimum level, give the marginal rate of substitution between current period monetary assets i and j as follows

$$\frac{\dfrac{\partial U(m_t,x_t)}{\partial m_{it}}\Big|_{\substack{x_t=x_t^* \\ m_t=m_t^*}}}{\dfrac{\partial U(m_t,x_t)}{\partial m_{jt}}\Big|_{\substack{x_t=x_t^* \\ m_t=m_t^*}}} = \frac{p_t^* \dfrac{R_t - r_{it}}{1+R_t}}{p_t^* \dfrac{R_t - rj}{1+R_t}} \tag{20}$$

The optimum marginal rate of substitution between the current period monetary asset i and the current period non-monetary good k can also be obtained by solving the first-order conditions of this model as follows

$$\frac{\dfrac{\partial U(m_t, x_t)}{\partial m_{it}} \Big|_{\substack{x_t = x_t^* \\ m_t = m_t^*}}}{\dfrac{\partial U(m_t, x_t)}{\partial q_{kt}} \Big|_{\substack{x_t = x_t^* \\ m_t = m_t^*}}} = \frac{p_t^* \dfrac{R_t - r_{it}}{1 + R_t}}{p_{kt}} \tag{21}$$

The derivations in Equations (20) and (21) show that the marginal rates of substitution between assets (either among the monetary assets or monetary asset with non-monetary asset) are proportionate to the relative prices of those assets. Barnett (1978) states that the 'price' or opportunity cost of the current period monetary asset *i*, m_{it}, is equal to $\pi_{it} = p_t^* \dfrac{R_t - r_{it}}{1 + R_t}$. He further refers to π_{it} as the 'user cost' of a monetary asset. The user cost in the current period can be interpreted as the present value of the interest forgone by holding the monetary assets rather than holding the benchmark asset. $\dfrac{1}{1 + R_t}$ is the discount factor that is used to account for the interest paid at the end of the holding period.

Monetary Aggregator Functions and Two-Stage Budgeting

As mentioned in the pervious section, the weak separability condition of the utility function is required by meaningful microeconomic aggregation theory. Barnett (1980: p.13) contends that "without the appropriate [weak] separability conditions, any aggregate is inherently arbitrary and spurious and does not define an economic variable"[17]. Therefore, it is important to hold the weak separability assumption in the discussion of monetary aggregates. Assume that the intertemporal utility function is weakly separable in the current period's consumption of monetary and non-monetary assets, so the utility function in Equation (16) can be expressed as follows:

$$U[u(m_t), m_{t+1}, \ldots, m_{t+T}; q_t, q_{t+1}, \ldots, q_{t+T}; l_t, \ldots, l_{t+T}; A_{t+T}] \qquad (22)$$

Equation (22) can then be written as $U(u(m_t), x_t)$, where $m_t = (m_{1t}, \ldots, m_{nt})$ and $x_t = (m_{t+1}, \ldots, m_{t+T}; q_t, \ldots, q_{t+T}; l_t, \ldots, l_{t+T}; A_{t+T})$. The factorable sub-function, $u(m_t)$, that consists of all current period of monetary assets is called the "category subutility function". It is also referred to as the "monetary services aggregator function", which measures the amount of current monetary services provided by the monetary assets. Note that only current period monetary assets are included in the subutility function $u(m_t)$. Goldman and Uzawa (1964) demonstrate that the marginal rates of substitution among a group of separable monetary assets are independent of the quantity of the decision variables outside the group[18]. As such, the weak separability of m_t implies that the marginal rates of substitution between current period monetary assets are equal to

[17]Most of the studies in monetary aggregation assume that the monetary assets are weakly separable in the representative agent's utility function (see for example, Belongia, 1996a; Ford and Mullineux, 1996; Gaoitti, 1996; Wesche, 1997).

[18]In the absenee of weak separability, although changes in the relative prices of other assets do not alter the overall aggregate price index, it will lead to different levels of demand for the aggregate as a whole. Obviously, the resulting demand function is therefore unstable. Thus, weak separability is a necessary condition for any group of assets to be considered as a monetary aggregate.

$$\frac{\partial u(m_t)/\partial m_{it}}{\partial u(m_t)/\partial m_{jt}} \tag{23}$$

and the optimum first order condition will give

$$\frac{\partial u(m_t)/\partial m_{it}\ \big|_{m_t=m_t^*}}{\partial u(m_t)/\partial m_{jt}\ \big|_{m_t=m_t^*}} = \frac{\pi_{it}}{\pi_{jt}} \tag{24}$$

With this derivation result, Barnett (1980, 1987) indicates that the vector of the optimal holdings of current period monetary assets, $m_t^* = (m_{1t}^*, \ldots, m_{nt}^*)$, which represent the solution to the representative agent's maximization problem, is exactly the same vector that would have been chosen if the agent had solved the simpler problem involving only current period variables. Therefore,

$$\underset{m}{Max}\, u(m) \text{ subject to } \sum_{i=1}^{n} m_{it}\pi_{it} = y_t\,, \tag{25}$$

where $y_t = \sum_{i=1}^{n} m_{it}^*\pi_{it}$ is the total optimal expenditure on monetary services implied by the solution to the agent's original intertemporal decision problem.

The weak separability of the utility function allows formulation of the agent's maximization problem as a two-stage budgeting problem. The agent first allocates optimal expenditure share on the weakly separable group of current period monetary assets, y_t, and other decision variables outside the group of current period monetary assets. In the second stage, the chosen expenditure on monetary assets is optimally allocated among the individual current period monetary assets based on the individual opportunity costs in order to maximize the subutility function, u, subject to the expenditure constraints in the first stage[19].

Anderson et al. (1997) show that if u is homogeneous of degree one (linearly homogeneous)[20], it can be regarded a monetary quantity aggregator function. Then, the optimal holdings of current monetary assets, $u(m_t^*)$, will provide the current period 'monetary services' to the representative agent. In view of this, the first stage decision can be reinterpreted as the simultaneous choice of optimal quantities of current period monetary services and all other decision variables, subject to both prices of the goods and the agent's budget constraint[21]. With that, the derived monetary aggregates have their micro-foundation and are considered to be theoretically valid.

Divisia Index

In order to construct the monetary aggregates, the subutility function and monetary aggregate aggregator function need to be specified. However, estimation of these aggregator functions would require imposing specific assumptions on the functional forms of the expenditure and utility functions. To solve this problem, Diewert (1976) and Barnett (1980) show that an unknown aggregator function evaluated at the optimal condition may be approximated by a superlative chained index number[22]. Such statistical index is

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[19]See Green (1964) for a discussion of two-stage budgeting where he viewed the weak separability as 'functional separability'.

[20]The linear homogeneity implies that both the aggregate and its component assets will change at the same rate. Fisher, Hudson and Pradhan (1993) claim that it is an important property in the derivation of the Divisia index from the transaction services function.

[21]The details of first stage decision are discussed in Anderson et al. (1997).

specification and estimation free, and utilizes observed data on both prices (user costs) and quantities. In other words, only quantities and user costs of the monetary assets are required in its calculation in this index.

Hulten (1973) points out that in continuous time, the Divisia quantity index (see Divisia, 1925) is exact for the unknown monetary services (quantity) aggregate[23]. In particular, the continuous time Divisia index, M_t^D, is given by the differential equation

$$\frac{d\log(M_t^D)}{dt} = \sum_{i=1}^{n} s_{it} \frac{d\log(m_{it}^*)}{dt} \tag{26}$$

where the expenditure share for the i^{th} monetary asset is defined as

$$s_{it} = \frac{m_{it}^* \pi_{it}}{\sum_{i=1}^{n} m_{it}^* \pi_{it}} \tag{27}$$

It is clearly shown in the continuous time Divisia quantity index, that the growth rate of is M_t^D equal to the share-weighted average of the growth rates of the monetary component quantities. Unlike the simple sum index, which simply assumes that all component monetary assets are perfect substitutes, the Divisia quantity index

[22]A chained index exists when the prices and quantities of adjacent periods are used in the index number formula. When an index number is chained, the center of the second order approximation moves such that the remainder term is relative to the changes between successive periods, rather than from the current period back to the fixed base period.

[23]A statistical index number is said to be exact if it exactly equal to an unknown aggregator function evaluated at optimum.

assigns weights to each of its components according to the degree that they provide monetary services. Since the Divisia quantity index is exact for the quantity aggregate and can precisely track the unknown aggregator in the utility function, it is an implication of the economic theory, not an approximation.

In discrete time, however, there is no statistical index that is exact for an arbitrary aggregator function. Therefore, we must rely on an approximation in constructing monetary aggregates. Diewert (1976) demonstrates that there exists a class of superlative statistical index numbers, which are exact for second-order approximations to unknown economic aggregators in the linearly homogeneous function in discrete time. One of the most important superlative index numbers is the Tornqvist-Theil discrete time approximation to Divisia continuous time quantity index[24]. For monetary aggregation, the Tornqvist-Theil monetary quantity index (henceforth is referred to as the Divisia index) is defined as follows:

$$M_t^{TT} = M_{t-1}^{TT} \prod_{i=1}^{n} \left(\frac{m_{it}^*}{m_{i,t-1}^*} \right)^{\frac{1}{2}(s_{it}+s_{i,t-1})} \tag{28}$$

Diewert (1976) shows that the Divisia index is exact for the translog flexible functional form, and it provides a second-order approximation to the unknown subutility function obtained from the microeconomic optimization. Barnett (1980) advocates the use of the Divisia index due to its straightforward interpretation, which can be seen by taking the logarithms of Equation (28):

[24]The discrete time Tornqvist-Theil quantity index is one of the valid index numbers. Diewert (1976) points out that other valid index numbers include the Fisher Ideal, Laspeyres, and Paasche indexes.

$$\Delta\log(M_t^{TT}) = \sum_{i=1}^{n} \bar{s}_{it}\Delta(\log m_{it}^{*}) \tag{29}$$

or

$$\log M_t^{TT} - \log M_{t-1}^{TT} = \sum_{i=1}^{n} \bar{s}_{it}(\log m_{it}^{*} - \log m_{i,t-1}^{*}) \tag{30}$$

where $\bar{s}_{it} = \frac{1}{2}(s_{it} + s_{i,t-1})$ is the average expenditure share for all i. Equation (28) clearly indicates that the growth rate of the Divisia index is simply a weighted average of the growth rates of component monetary assets. Barnett (1980) further shows that the user cost index which is dual to the Divisia index, Π_t^{Dual}, can be expressed as:

$$D_t^{Dual} = \Pi_{t-1}^{Dual}\left(\frac{\sum_{i=1}^{n}\pi_{it}m_{it}^{*} \Big/ \sum_{i=1}^{n}\pi_{i,t-1}m_{i,t-1}^{*}}{M_t^{TT} \big/ M_{t-1}^{TT}}\right) \tag{31}$$

The Divisia index and its dual user cost (price) index are in line with the microeconomic theory. They are regarded as high quality statistical approximations of the true, but unknown aggregates in the utility function. Therefore, it is clear that the Divisia index is, at least theoretically, superior to the simple sum index. The relative performance of these two indexes in empirical applications, however, is actually an empirical issue[25].

[25] For empirical applications and estimations of the Divisia monetary aggregates for developing countries, see Habibullah and Baharumshah (1997), Habibullah (1998h, 1998i, 1999f, 2000), Habibullah and Smith (1998b, 2002), Habibullah, Azali and Baharumshah (2000), and Puah, Habibullah, Lau and Mansor (2006).

Nevertheless, use of the Divisia index for 'monetary services' has been criticized on several grounds. Curthbertson (1997) argues that the Divisia index does not allow for adjustment costs to equilibrium and that the strong restriction of linear homogeneity of the aggregator function linking the set of monetary asset stocks to the level of 'monetary services' provided by these assets is inappropriate. Furthermore, Divisia ignores the precautionary motive and the speculative motive for holding monetary assets, and the choice of the benchmark asset is extremely arbitrary. Finally, the claim that Divisia deals effectively with financial innovation via new assets seems misplaced since the Divisia index has a discontinuity.

However, according to Cuthbertson (1997), despite the above weaknesses, Divisia money is more useful than the simple sum aggregates in the sense that: (i) it provides a stable long-run and short run money demand function that is consistent with economic theory; and (ii) it is a stable leading indicator for money with incremental power. As for policy purposes, some adjustment need to made since the weights in the Divisia index change as relative interest rates change.

Currency-Equivalent Index

When prices of monetary assets change, there are substitution and income effects, which will affect the demand and supply for other decision variables purchased by the representative agent. Apart from that, the changes in the prices of monetary assets might have wealth effects that can influence the stock of monetary services. As discussed in the pervious section, the Divisia index is used to measure the flow of the monetary service. In order to measure the stock of monetary wealth, we need to utilize other superlative indexes. Anderson et al. (1997) explicitly derived an expression for the stock of monetary wealth as the discounted present value of expenditure on monetary service flow, and provide a possible quantitative measure of the concept. Their illustration started by using Barnett's (1978, 1987) result where the multi-period budget constraints for the intertemporal decision, indexed by $s \in [t, t+1, \ldots, t+T)$,

$$\sum_{i=1}^{m} p_{is} q_{is} = w_s L_s + \sum_{i=1}^{n} [(1+r_{i,s-1}) p_{s-1}^{*} m_{i,s-1} - p_s^{*} m_{i,s}] + [(1+R_{s-1}) p_{s-1}^{*} A_{s-1} - p_s^{*} A_s]$$

could be simplified to a single budget constraint where monetary assets enter this single budget constraint through the term:

$$V_t = \sum_{s=1}^{\infty} \sum_{i=1}^{n} \left[\frac{p_s^{*}}{p_s} - \frac{p_s^{*}(1+r_{is})}{p_{s+1}} \right] m_{is} = \sum_{s=1}^{\infty} \sum_{i=1}^{n} \pi_{is} m_{is} \qquad (32)$$

and $\rho_s = \begin{cases} 1 & s = t \\ \prod_{u=1}^{s-1} (1+Ru) & t+1 \leq s \leq t+T \end{cases}$, with ρ_s and π_{is} representing the discount factor and the discounted nominal user cost, respectively. Evaluating V_t at the optimum when T goes to infinity gives:

$$V_t = \sum_{s=1}^{\infty} \sum_{i=1}^{n} \pi_{is} m_{is}^{*} = \sum_{s=1}^{\infty} y_s \qquad (33)$$

where, y_s, is the discounted expected total expenditure on monetary assets in period s. Therefore, V_t can be regarded the discounted present value of all current and future expenditure on monetary services. In other words, it is the stock of monetary wealth.

However, we are unable to directly compute the value of V_t since it appears as an infinite forward sum of discounted expenditures. Barnett (1991) shows that V_t can be used to measure the stock of monetary wealth under the assumption of static expectations. With static assumptions, the agent expects all future interest rates including the benchmark rate to equal current interest rates, and that the expected optimal holdings of all monetary assets in all future periods equal current holdings. Under this assumption, Barnett (1991) has shown that the stock of monetary wealth is equal to the Rotemberg et al. (1995) Currency Equivalent (CE) index:

$$CE_t = p_t^* \sum_{i=1}^{n} \frac{R_t - r_{it}}{R_t} m_{it}^* \tag{34}$$

In this case, the CE index is a measure of the stock of monetary wealth and can be used to study the wealth effects of money.

In its simplest sense, the CE index is the total stock of currency required to provide the same amount of transaction services that is provided by all monetary assets. In other worlds, CE index is a time-varying weighted average of the stocks of all monetary assets, where the weights are the ratio of each asset's user cost to a benchmark 'zero liquidity' asset.

B. Consumer Demand Theory Approach to Money Demand

The consumer demand theory approach analyses money like any other goods where they are held because an individual derives utility from them. In economic analysis, consumer behaviour is conveniently summarized by means of a utility function where the utility function is a way to describe preferences. A rational consumer will always choose the most preferred bundle from the set of affordable alternatives. Given income and prices, the consumer demand theory approach basically answers the question: how much money would a given consumer need at the price, say P, to be as well off as he could be by consuming the bundle of goods, say X? (Barnett, Fisher and Serletis, 1992).

The consumer demand theory approach provides a consistent framework for analyzing portfolio choice and offers greater insights into results from aggregate studies of demand for money than the motives approach. This is achieved by incorporating restrictions of demand theory in such a manner as to assure consistency with the optimizing behaviour of economic agents. This allows for a tractable approach and provides for testing of the key axioms of the choice theory, and hence a better interpretation of the role of nominal interest rates, inflation and wealth in the demand for money function (Barnett et al., 1992: p. 2088; Feige and Pearce, 1977: p. 441).

Since the 1980s, this approach has been popular because of the growing interest in developing firmer microeconomic foundations for macroeconomics, by determining the desired money holdings by simultaneously solving the decisions of the household and firm production and consumption decisions, rather than analyzing individual desired holdings of money as a separate problem (Duca and Vanhoose, 2004). One of the more popular approaches of integrating money into general equilibrium is the shopping-time models[26]. The shopping-time models date back to Saving (1971) and were popularized by McCallum and Goodfriend (1987) who

[26]The other models include the overlapping-generations models and the cash-in-advance models.

advocate money directly in the utility function. It is assumed that consumption purchases take time to be carried out such that the amount of leisure available for the household is reduced. The use of money permits individuals to reduce the amount of time allocated to consumption, thereby freeing up time available for labour and leisure activities. The fundamental implication of the shopping-time approach is that, the demand for money function includes interest rate, and consumption rather than income as a scale variable. Studies by Mankiw and Summers (1986), Arestis, Hadjimatheou and Zis (1992), and Howells and Hussein (1997) found that consumption outperforms other proxies for the scale variables in the money demand function. Some application of the shopping-time models to money demand study include Chadha, Haldane and Janssen (1998), Hueng (1999), Nijsse and Sterken (1996), and Tlelima and Turner (2004).

Search Costs and Advertising

Saving (1971: p. 407) once said that "the lack of consideration of transaction cost and its effect on consumer behaviour has led to rather strained explanations of why individuals use or hold money. Such explanations sometimes involve arbitrary payment schedules, balanced portfolios or perhaps simply a throwing up of the hands and saying that the utility function contains money holdings as an argument." The same analogy can be applied to the role of advertising in reducing consumer search costs and increasing market demand. An increase in market demand implies an increase in transactions and thereby increases money holdings.

According to Janssen and Non (2008) search costs consist of two components: the cost of visiting a shop knowing that the shop carries the product the consumer wants to buy and the cost of finding or searching for a shop that carries the product. Janssen and Non (2008) assume that the former cost is negligibly small and since a firm's advertisement not only informs a consumer of the price the firm charges, it also informs the consumer that the firm carries the product, thus, advertisements eliminate the costs of finding a shop that sells a product and at what price. Their study found that advertising and search are substitutes, in the sense that when firms advertise a lot consumers save on search costs. This finding is in agreement with the earlier observation made by Stigler (1961) that advertising is a substitute for consumer search.[27]

Ehrlich and Fisher (1982) and Laband (1986) have pointed out that the implicit demand for cost-saving information by households generates a derived demand for advertising by firms. Mixon (1995) points out that households demand advertising as a means of reducing the full transaction cost of exchange.[28] Households will search for goods and services up to the point where their marginal benefits from search equal the marginal costs of search. The central element in the household's marginal search costs is the opportunity of time. Studies by Ekelund et al. (1994), and Laband (1986, 1991) have shown that household mobility (as a proxy for the opportunity cost of time) is an important determinant of the level of information in *Yellow Pages* advertisements because firms have profit-based incentives to help households "economize" on search time. This contention is further supported by the more recent studies by Mixon (1995, 1998) who concludes that firms respond to search costs by

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[27]In their study, Narula, Lentnek and Harwitz (1987: p. 415) state the search policy the household should follow: "Given the known prices of the advertised specials and other information, the household determines the trip circuit that minimizes the sum of transportation and expected purchase costs to acquire the basket of goods."

[28]Full cost includes money plus information plus time costs for exchange.

producing information about products in a manner that minimizes the total cost of voluntary exchange.

Advertising and Money Demand

It has been recognized that shopping time technology is proving popular as a means of rationalizing agents' money holdings as an alternative to a cash-in-advance constraint or placing money directly in the utility function. The important role of holding real money balances is to reduce the number of trips to the bank for each transaction, thus it enhances leisure time. We put forward two types of costs involved when a household makes a transaction for the consumption of a good. First, is the number of trips to the bank to withdraw money for each transaction. If the household goes to the bank too often, this will increase transaction costs. Thus, holding money balances will reduce transaction costs. Second, is the number of trips to the shop to search for the 'right' goods to consume. As for the latter, the role of advertising is to provide information on the 'characteristics' of a given good and where to acquire the goods. The positive side of advertising is that it informs households of the goods available and tells them about market conditions so that they know where to go for the lowest price or the brand best suited to their needs (Spencer, 1967). The time saved on search efforts increases leisure time.

To incorporate advertising expenditure in the money demand function, consider an economy consisting of a large number of identical and infinitely lived households. The behaviour of a representative household is to maximize total discounted utility over an infinite planning horizon with each period's consumption and leisure appearing as arguments of his utility function given by:

$$Max\,U = \sum_{i=0}^{\infty} \beta^t u(c_t, \ell_t) \tag{35}$$

where c_t and ℓ_t are the individual's real consumption of good x and leisure during period t, and $\beta = 1/(1+\delta)$, with $0 < \delta < 1$ representing the household's rate of time preference. Both c_t and ℓ_t are considered as normal goods, U is strictly quasi-concave and, as non-satiation is supposedly continuously increasing in both c_t and ℓ_t, that is, $u_1 > 0$ and $u_2 > 0$.

Purchase of the consumption good x requires shopping time, n_t. The household is assumed to have access to a production function that is homogeneous of degree one in physical capital and labour. Assuming that labour is supplied inelastically, the production function can be written as $y_t = f(k_{t-1})$, where y_t is production during period t and k_{t-1} is the stock of capital held at the end of period $t-1$. The production function is well-behaved and is assumed to satisfy the conditions $f' > 0$, and $f'' < 0$. Capital is non-consumed output, so its price is the same as that of the consumption good and its rate of return between t and $t+1$ is $f'(k_t)$. The household is assumed to sell its specialized output and buy other goods it does not produce at a constant relative price. Normalizing the time the household does not work to one, leisure time $\ell = 1 - n_t$.

In a monetary economy, the amount of shopping time required for a given amount of consumption will depend negatively upon the quantity of real money balances held by the household. Following McCallum and Goodfriend (1987), this introduces money into the utility function by assuming that money balances are leisure-enhancing because they save on shopping time, so we specify the following leisure function as

$$\ell_t = \phi(c_t, m_t) \tag{36}$$

where the function $\phi(.)$ defines transaction technology, that is, saved shopping time – in the model. Further, $\phi_1 < 0$, higher consumption (c_t) implies more shopping time and hence less leisure time; and $\phi_2 > 0$, higher real money balances (m_t) help reduce shopping time and thereby free-up more time for leisure.

In view of the important role of advertising as information provider to reduce search costs thus implies enhancing leisure time, we modify transaction technology Equation (36) to include advertising as an argument as follows

$$\ell_t = \varphi(c_t, m_t, a_t) \tag{37}$$

where a_t is advertising expenditures. The function $\varphi(.)$ defines transaction technology, that is, saved shopping time due to the holding of money balances reducing cost on the number of trips to the bank, and due to advertising reducing search costs on the number of trips to the shop for the suited goods. Thus, the first-order partial derivatives are: $\varphi_1 < 0$, $\varphi_2 > 0$, $\varphi_3 > 0$.

In addition to money, it is assumed that household purchases bonds B_t at time t at a money price of $1/(1+R_t)$ and redeems them for one unit of money at time $t+1$. The household's budget constraint can be written as

$$P_t y_t + M_{t-1} + B_{t-1}(1+R_{t-1}) = P_t c_t + M_t + B_t \tag{38}$$

where P_t is the price level at time and R_t is the nominal rate of return (nominal interest rate) on bonds. The left side of Equation (38) describes the sources of funds available to the household from the commodity market, $P_t y_t$, the principal received on last period's bonds, B_{t-1}, the interest receipts from these bonds, $R_t B_{t-1}$, and the stock of money held over from the previous period, M_{t-1}. The right side of Equation (38) describes uses of funds (household's total expenditures) in consumption expenditures, $P_t c_t$, holdings of bonds, B_t, and holdings of money balances, M_t. Defining the inflation rate from period t to period $t+1$ as $\pi_t = (P_t - P_{t-1}) / P_{t-1}$, the household's budget constraint in real terms is derived as

$$y_t + \frac{M_{t-1}}{P_t} + \frac{B_{t-1}(1+R_{t-1})}{P_t} = c_t + m_t + b_t \tag{39}$$

Multiply the second and third terms of L.H.S. of Equation (39) with P_{t-1} / P_{t-1} and we have

$$y_t + \frac{M_{t-1}}{P_{t-1}} \frac{P_{t-1}}{P_t} + \frac{B_{t-1}}{P_{t-1}} \frac{P_{t-1}}{P_t}(1+R_{t-1}) = c_t + m_t + b_t \tag{40}$$

Rearranging Equation (40), we have

$$y_t + \frac{m_{t-1}}{1+\pi_t} + b_{t-1} \frac{1+R_{t-1}}{1+\pi_t} = c_t + m_t + b_t \tag{41}$$

The Lagrangian associated with this problem can be written as

$$L=\sum_{t=0}^{\infty}\beta^t u\left[c_t,\varphi(c_t,m_t,a_t)\right]$$
$$+\lambda_t\left[y_t+(1+\pi)^{-1}m_{t-1}+(1+\pi)^{-1}b_{t-1}(1+R_{t-1})-c_t-m_t-b_t\right] \quad (42)$$

where $\varphi(c_t,m_t,a_t)$ is substituted for ℓ_t, and λ_t is the Lagrange multiplier associated with the household's period *t* budget constraint. We maximize *L*, with respect to c_t, m_t, b_t and λ_t. The first-order conditions are

$$\frac{\partial L}{\partial c_t}=u_1(c_t,\varphi(.))+u_2(c_t,\varphi(.))\varphi_1(c_t,m_t,a_t)-\lambda_t=0 \quad (43)$$

$$\frac{\partial L}{\partial m_t}=u_2(c_t,\varphi(.))\varphi_2(c_t,m_t,a_t)-\lambda_t+\lambda_{t+1}(1+\pi_{t+1})^{-1}=0 \quad (44)$$

$$\frac{\partial L}{\partial b_t}=\lambda_t-\lambda_{t+1}\left(\frac{1+R_t}{1+\pi_{t+1}}\right)=0 \quad (45)$$

$$\frac{\partial L}{\partial \lambda_t}=b_{t-1}-\sum_{i=1}^{\infty}\prod_{j=0}^{i}\left(\frac{1+\pi_{t+j}}{1+R_{t-1+j}}\right)\left[c_{t-1+i}-y_{t-1+i}+\left(m_{t-1+i}-\frac{m_{t-2+i}}{1+\pi_{t-1+i}}\right)\right]=0 \quad (46)$$

Combining Equations (43), (44) and (45), we have

$$u_2(c_t,\varphi(.))\varphi_2(c_t,m_t,a_t)=$$

$$\left[u_1(c_t,\varphi(.))+u_2(c_t,\varphi(.))\varphi_1(c_t,m_t,a_t)\right]\left(1-\frac{1}{1+R_t}\right) \tag{47}$$

where the term on the L.H.S. of Equation (47) denotes the marginal utility of additional units of money and the terms on the R.H.S. denote the net marginal utility of additional units of consumption. Rearranging Equation (47) we have the following:

$$\frac{u_2(c_t,\varphi(.))\varphi_2(c_t,m_t,a_t)}{u_1(c_t,\varphi(.))+u_2(c_t,\varphi(.))\varphi_1(c_t,m_t,a_t)}=1-\frac{1}{1+R_t} \tag{48}$$

Equation (48) states that the marginal rate of substitution between real money balances and consumption equals the opportunity cost of holding money. It can also be shown that according to the assumptions on the utility function and the shopping time function, m_t has a positive partial derivative with respect to c_t , and negative partial with respect to R_t :

$$\frac{\partial m_t}{\partial c_t}=\frac{\left(1-\frac{1}{1+R_t}\right)\left[u_{11}+(u_{12}+u_{21})\varphi_1+u_{22}\varphi_{11}\right]-u_{21}\varphi_2-u_{22}\varphi_{21}}{u_{22}\varphi_{22}-\left(1-\frac{1}{1+R_t}\right)\left[u_{12}\varphi_2+u_{22}\varphi_{12}\right]}>0 \tag{49}$$

$$\frac{\partial m_t}{\partial R_t} = \frac{u_1 + u_2\varphi_1}{(1+R_t)^2[u_{22}\varphi_{22}] - R_t[u_{12}\varphi_2 + u_{22}\varphi_{12}]} < 0 \qquad (50)$$

However, whether m_t has a positive or negative partial derivative with respect to a_t depends on the cross derivative between m_t and a_t, that is φ_{23}, as shown in Equation (51).

$$\frac{\partial m_t}{\partial a_t} = \frac{\left(1 - \frac{1}{1+R_t}\right)\left[u_{12}\varphi_3 + u_{22}\varphi_{13}\right] - u_{22}\varphi_{23}}{u_{22}\varphi_{22} - \left(1 - \frac{1}{1+R_t}\right)\left[u_{12}\varphi_2 + u_{22}\varphi_{12}\right]} \qquad (51)$$

On one hand, advertising that reduces household's search cost may in turn undermine the need to hold real balances. In other words, m_t and a_t are competing instruments in reducing shopping time, implying that m_t has a negative partial derivative with respect to a_t. On the other hand, reduction in search costs, thanks to advertising, *ceteris paribus*, could spawn larger volume of consumption, which indirectly bolsters the demand for real balances, whereby we shall witness a positive partial derivative of m_t with respect to a_t.

For example, the positive link between advertising and money balances is given by Narula et al. (1987: p. 408) where they state that, "the household has to deal with two kinds of price fluctuations when making purchases. First, is the knowledge of advertised specials which always represents an opportunity to buy goods more cheaply than originally expected. Second, are the in-store price changes which can be observed or known only by going to the stores. The advertised specials are used to modify the original trip circuits just prior to the journey-to-shop. The household must also allow for the effect of the second kind of fluctuation by searching for advantageous prices on a given day, if that search appears worthwhile. Thus, given these two sources of fluctuations, the purchase plan differs from a deterministic plan in that allowance is made for an estimated increase in total purchasing power due to the value of advertised specials and successful price searches."

Further, Equation (48) can be interpreted as an implicit money demand function. For example, if we take a simple Cobb-Douglas form of utility function as $u = c^{1-\alpha}\varphi^{\alpha}$, where $0<\alpha<1$ and define the leisure-enhancing transaction technology functional form as

$$\varphi = c_t^{-\gamma}\left(\left[a_t^{1-\eta} + m_t^{1-\eta}\right]^{\frac{1}{1-\eta}}\right)^{\gamma} \tag{52}$$

where a_t and m_t as instruments that reduce shopping time takes CES form[29] and $0 < \gamma < 1$. The parameter η takes the value smaller than one if both a_t and m_t are substitutable, but greater than one if they are complementary. The first order conditions are given as follows

$$\frac{\partial L}{\partial c_t} = (1-\alpha-\alpha\gamma)c_t^{-\alpha-\alpha\gamma}\left(a_t^{1-\eta} + m_t^{1-\eta}\right)^{\frac{\alpha\gamma}{1-\eta}} = \lambda_t \tag{53}$$

[29]For the Cobb-Douglas form for the transaction technology function, see the Appendix.

$$\frac{\partial L}{\partial m_t} = \alpha\gamma\left(a_t^{1-\eta} + m_t^{1-\eta}\right)^{\frac{\alpha\gamma}{1-\eta}-1} m_t^{-\eta} c_t^{1-\alpha-\alpha\gamma} = \lambda_t\left[1 - \frac{1}{1+R_t}\right] \tag{54}$$

The money demand function can thus be obtained in the form

$$\left[\frac{\alpha\gamma}{1-\alpha-\alpha\gamma}\right]\left[\frac{1+R_t}{R_t}\right]c_t = m_t\left[1+\left(\frac{a_t}{m_t}\right)^{1-\eta}\right] \tag{55}$$

Taking log on both sides, and given the fact that $\log(1+R_t^{-1}) \approx -R_t$ and $\log\left(1+(a_t/m_t)^{1-\eta}\right) \approx (1-\eta)\log\left(a_t/m_t\right)$, we get

$$\log m_t = \theta_0 + \log c_t - R_t - (1-\eta)\log(a_t/m_t) \tag{56}$$

Equation (56) indicates that real money balances are determined by real consumption, interest rate and the advertising velocity, (a_t/m_t). The above money demand model implies that unitary elasticities for consumption are positively related to real money holdings and interest rate are negatively related to real money holdings. On the other hand, advertising velocity will suggest complementarity between advertising and money holdings when $(1-\eta)$ is positive, that is, when $\eta > 1$. Substitution between advertising and money holdings or the reducing effect of advertising on money holdings is when $(1-\eta)$ is negative, that is, when $\eta < 1$.

However, we see no need to impose these restrictions for our analysis. Thus, the money demand model as specified in Equation (56) will serve as the basis for empirical investigations on the role of advertising in money demand. Of course a more general macroeconomic model of money demand can be specified as follows

$$m_t = f\left(c_t, R_t, av_t, er_t, \pi_t, fdev_t\right) \tag{57}$$

where m is real money balances; c is real private consumption; R is short-term interest rate; av is advertising velocity; er is exchange rate; π is inflation rate, and $fdev$ is financial development. As a priori we would expect:

$\partial m/\partial c > 0$, $\partial m/\partial R < 0$, $\partial m/\partial av > 0$ *or* $\partial m/\partial av < 0$, $\partial m/\partial er < 0$, $\partial m/\partial \pi < 0$, and $\partial m/\partial fdev > 0$.

CONCLUSIONS

Estimating a money demand function is important for the conduct of monetary policy for a nation. The ability to forecast and to control inflation effectively requires a stable and predictable money demand function. Without a stable relationship between money demand and its determinants, the potential absence of causality in the evolution of time series makes forecasting inflation more uncertain. Given the importance of the money demand function, economists have conducted numerous money demand studies for both developed and developing countries.

For the past many years hundreds of money demand studies were carried out to ascertain the most appropriate and stable money demand function, to address the 'missing money' episode and the impact of financial innovations on the long run relationship between money and income or price that is useful for monetary policy purposes. Despite all these studies and their findings, central banks all over the world have been emphasizing interest rates as their monetary policy tools. Until today the role of monetary aggregates has been marginalized and the effort to put money in its 'rightful place' as the main monetary policy indicator has been a continuing quest and research effort of economists.

For the last twenty years, the search for microfoundations for the demand of money has been the principal item on the research agenda of monetarist economists in order to explain the 'missing money' episode. For instance, Barnett has pioneered the monetary aggregation theory and provides the user cost of monetary services and proposed the Divisia monetary aggregates as the appropriate measurement of monetary services of a country. Barnett and his associates in several of their theoretical and empirical studies on money demand have put forward a strong case for the Divisia aggregates, and stressed that the culprit for instability and errors in forecasting is the use of simple sum aggregation in analysis. Barnett (1997: p.1180) explains "the root source of the failure of so many demand for money models is the payment of interest on monetary assets. Demand for money functions that ignore the theoretical implications of that fact have performed increasingly poorly as more and more deregulated, interest-bearing assets have been entered into monetary aggregates".

On another level, monetary economists have re-emphasized the individual's overall production/consumption optimization problem to model the money demand function. Such models are the overlapping-generations models, shopping-time models, and cash-in-advance models approach to money demand. Despite all these developments, Duca and Vanhoose (2004: p.266) caution that "better econometric methods for identifying the various factors influencing the desired holdings of alternative monetary assets help provide policymakers with a more concrete understanding of liquid asset allocations within household and firm portfolios. It remains to be seen, however, whether the empirical advances in money demand literature will both adequately keep pace with financial progress and have a practical impact on the conduct of monetary policy." In other words, given the availability of data and methods, searching for a stable money demand function so as to support an effective monetary policy action is an empirical question.

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APPENDIX

If we take the simple utility function $u(c_t, \ell_t) = c_t^{1-\alpha} \ell_t^{\alpha}$, where $0 < \alpha < 1$ and $\varphi(c_t, m_t, a_t) = c_t^{-\gamma}(a_t m_t)^{\gamma}$, where $0 < \gamma < 1$, then Equation (48) implies a money demand function of the form

$$m_t = \frac{\alpha\gamma}{1-\alpha-\alpha\gamma}\left(\frac{c_t}{a_t}\right)\left(1+\frac{1}{R_t}\right) \tag{A.1}$$

Taking logs on both sides of Equation (A.1) yields a linear money demand function

$$\log m_t = \theta_0 + \log c_t - \log a_t - R_t \tag{A.2}$$

where θ_0 is a constant. This model implies unitary consumption, advertising and interest rate elasticities. Thus the above money demand model, by the nature of the simple utility function produces very strong restrictions on the consumption, advertising expenditures and interest rate elasticities.

BIOGRAPHY

Muzafar Shah Habibullah was born in Kampung Padang Changkat, Bukit Chandan, Kuala Kangsar, Perak, on 1st September 1958. He is the first child in a family with nine children – seven boys and two girls. He is married to Juwana Sulaiman and they have four children (all boys) – Khairul Anam Shah (1988), Khairul Ridhwan (1989), Khairul Anwar (1992) and Khairul Amirul (1994). He received his primary education at Sekolah Rendah Jenis Kebangsaan Clifford, Kuala Kangsar, Perak (1965-1970), and his secondary education at Sekolah Menengah Kota Bahru, Kelantan (1971-1972) and Sekolah Menengah Jenis Kebangsaan Clifford, Kuala Kangsar, Perak (1973-1975). After passing his Malaysia Certificate of Education (MCE) examination in 1975, Muzafar Shah went on to pursue his undergraduate studies at Universiti Pertanian Malaysia (UPM); enrolling for the one year Diploma in Agriculture program before being promoted the following year to pursue a Bachelor of Science in Agribusiness degree course and being awarded the Malayan Banking Berhad Scholarship. He subsequently graduated in 1981 following which he worked at Malayan Banking Berhad (the largest commercial bank in Malaysia) as a credit officer for two years, subsequently, returning to UPM to pursue his Master degree at the Faculty of Resource Economics and Agribusiness in 1983. He graduated with a Master of Science degree in 1985 and joined the faculty as a lecturer the same year.

Since joining UPM, Muzafar Shah has been actively involved in research in the areas of macroeconomics, monetary and financial economics, and banking. He was promoted to Associate Professor in January 1993. In October 1995, Muzafar Shah went on to pursue a doctorate in Economics at the University of Southampton, United

Kingdom. He worked on a thesis entitled, "Financial Liberalization, Monetary Aggregates and Monetary Policy in the SEACEN Countries: An Empirical Investigation". He completed the thesis in February 1998 and was awarded a doctoral degree in the same year. To his credit, he has produced two important academic publications from his Ph.D. research. First, a paper presented at the Tun Abdul Razak Conference in Ohio, Athens, United States which was published in the special issue of the *Journal of Asian Business* (published by University of Michigan); and the second, where several chapters from his Ph.D. thesis was published by Ashgate Publishing Company (United Kingdom) as a book entitled, *"Divisia Monetary Aggregates and Economic Activities in Asian Developing Economies"*. The book explores the potential role of the Divisia monetary aggregates as useful intermediate indicators for monetary policy purposes in ten "deregulated" Asian developing economies.

Currently, he has more than 200 publications to his credit. He has published articles in more than 70 different journals such as *Physica A; Journal of Asian Economics; Journal of Emerging Markets Finance; International Journal of Business Research; Japan and the World Economy; International Journal of Economics and Management; International Applied Economics and Management Letters; International Journal of Economic Policy in Emerging Economies; Journal of Applied Sciences; Journal of Asian Business; Asian Social Science; Journal of Politics and Law; International Journal of Economics and Finance; Modern Applied Science; Journal of Sustainable Development; Journal of International Business and Economics; The Journal of Global Business Management; Applied Economics; Applied Economics Letters; Review of Applied Economics; International Economic Journal;*

International Journal of Social Economics; Journal of the Asia Pacific Economy; European Journal of Economics, Finance and Administrative Sciences; South African Journal of Economics; Journal of Money, Investment and Banking; Frontiers in Finance and Economics; International Research Journal of Economics and Finance; International Review of Economics and Business; Savings and Development; Journal of Social and Economic Policy; The Nigerian Journal of Economics and Social Studies; Agro Ekonomi; ASEAN Economic Bulletin; Asian Economies; Asian-African Journal of Economics and Econometrics; Economic Affairs; Economic Journal of Nepal; Finance India; Indian Journal of Applied Economics; Journal of Agricultural Economics; Journal of Rural Development; Jurnal Ekonomi dan Keuangan Indonesia; Pakistan Journal of Applied Economics; The Asian Economic Review; The Bangladesh Journal of Agricultural Economics; The ICFAI Journal of Applied Economics; The ICFAI Journal of Applied Finance; The ICFAI Journal of Financial Economics; Journal of International Economic Review; The ICFAI Journal of Bank Management; The ICFAI Journal of Industrial Economics; The ICFAI Journal of Mergers & Acquisitions; The ICFAI Journal of Monetary Economics; The ICFAI Journal of Agricultural Economics; The ICFAI Journal of Public Finance; The Indian Economic Journal; The Indian Economic Review; The Indian Journal of Agricultural Economics; The Indian Journal of Economics; The Philippine Review of Economics; The Philippine Review of Economics & Business; The Singapore Economic Review; Banker's Journal Malaysia; Borneo Review; Capital Market Review; International Journal of Business and Society; International Journal of Management Studies; Journal of Natural Rubber Research; Jurnal Analisis; Jurnal AZAM;

Jurnal Ekonomi Malaysia; Jurnal Pengurusan; Kajian Ekonomi Malaysia; Labuan Bulletin of International Business & Finance; Malaysian Journal of Agricultural Economics; Malaysian Journal of Economic Studies; Malaysian Journal of Small and Medium Enterprises; Malaysian Management Journal; Malaysian Management Review; Pertanika; Pertanika Journal of Social Sciences & Humanities; and The Chartered Secretary Malaysia.

Apart from research activities, Muzafar Shah has taught and supervised numerous students at various levels: Ph.D., M.Sc., Master of Economics and Bachelor of Economics. His current research interests include topics on the economics of crime, war and conflict, natural disasters, and climate change. At the moment he is the Deputy Dean (Research and Innovation) at the Faculty of Economics and Management. He was previously the Head, Department of Economics from 2005-2007.

Due to his many contributions, Muzafar Shah has received several awards. He is the first recipient of the prestigious ***Putra Excellent Literary Award 2002*** **(Anugerah Karyawan Putra Cemerlang 2002)** from the university. The award was conferred by the Sultan of Selangor in November 2002. In 2007, he was awarded the ***Vice Chancellor Fellowship 2007*** for his excellence in research at UPM and in 2008 he was awarded the ***EUREKA Medal,*** Award of Excellence in Research, during the Invention & Research Innovation Exhibition 2008 organized by the Research Management Centre (RMC), Universiti Putra Malaysia. Since the exhibition was initiated four years ago, Muzafar Shah has collected several GOLD, SILVER and BRONZE medals for his achievements in research work at UPM.

Muzafar Shah is also involved in organizational activities. Currently he serves as the Editor-in-Chief of the *Journal of*

International Economic Review (published by Serial Publications) and *International Applied Economics and Management Letters* (published by UPM Press); Editorial Board Member of the *Pertanika Journal of Social Science & Humanities* and *International Journal of Business and Society*. He is a life member of the Malaysian Economic Association (PEM), Malaysian Social Science Association (MSSA) and Malaysian Association of Agricultural Economics (PETA), and ordinary member of the Association of Comparative Economic Studies (based in US). Muzafar Shah has been invited to speak on "Research and Publications" at the International Islamic University of Malaysia (IIUM), Universiti Malaysia Sabah, UiTM Sarawak and the Labuan School of International Finance and Faculty Seminar 2006. He has also conducted workshops on "*Applied Quantitative Techniques in Business and Economics*" at Universiti Pendidikan Sultan Idris (UPSI), UiTM Sarawak and "*Application of EViews in Applied Economics*" for the staff of the Economic Planning Unit (EPU), Prime Minister's Department. On several occasion he has been invited to appear on RTM1 – *Selamat Pagi Malaysia* to speak/ discuss on economic issues.

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I have always been fascinated with the study on 'money demand' ever since I took a course on Money and Banking taught by Professor Dr. Mohammed Bin Yusoff in the late 1970s. I am forever indebted to him, my mentor, my teacher and my supervisor (for both 1st degree and master degree). He showered me with dedication and determination. I am what I am today as a result of that dedication and determination and I would very much like to thank him for that. Not forgetting my other mentor Dr. Peter Smith, my Ph.D. supervisor who also plays an important role in nurturing and moulding me into what I am today.

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My humble and heartfelt dedication to my beautiful wife, Juwana Sulaiman, and my four sons – Anamshah, Ridhwan, Anwar and Amirul, for their sacrifice, utmost understanding, and love, providing me the energy, determination and courage to fulfill my dream. To my hardworking late father Habibullah Hj Husin and my ever loving mother Dasima Sabdin, I thank them for their undivided love and support.

To my former staffs during my tenure as the Head of Department of Economics, thank you for making the experience a joyous one. To my current staffs in the Deputy Dean (Research & Innovation), thank you for your kind cooperation, support and dedication.

I would also like to thank the Faculty of Economics and Management, Universiti Putra Malaysia, MOSTI and Kementerian Pengajian Tinggi Malaysia for providing research grants and other support for my research. I will always be indebted to the staffs of this faculty both academic and non-academic, for their undivided support during the course of my tenure in UPM in teaching, research and other activities, not forgetting the committee members of this Inaugural Lecture, who work hard in enabling and make this public lecture a success. Some names might have been inadvertently omitted, but it is by no means to undermine their contribution; any inconveniences are regretted.

I am grateful and thankful to the God Almighty to make all these possible and providing me with a marvelous life, beautiful wife, fantastic kids and great friends.

Thank you.

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