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THE BUFFER-STOCK MONEY MODEL

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*The purpose of this paper is to investigate empirically the importance of the **unanticipated** and **anticipated money supply** variable in the demand for money function for the Malaysian economy over the period 1965-1984. The specifications of the demand for money function were based on the Carr-Darby's model. The evidence indicates that the **unanticipated money supply** significantly affects the demand for real balances, while the **anticipated money supply** turns out to be insignificant.*

BUFFER-STOCK MONEY MODEL

The buffer-stock money (BSM) recognizes that individuals' desired money holdings may comprise of an ***anticipated (planned)*** component and an ***unanticipated (transitory)*** component. The ***anticipated*** component is governed by expected level of transactions and rate of returns, while the ***unanticipated*** are temporary holdings of money and are caused by unexpected 'shocks' such as unexpected receipts or disbursements.

Carr-Darby (1981) argued that cash balances act as a ***shock absorber***, which temporarily hold excess or deficit amounts depending on whether the ***unanticipated*** shock is positive or negative. Carr-Darby made two assumptions;

1) Fully ***anticipated*** changes in the money supply will be reflected in price level expectations and therefore in nominal money demand. Hence, fully ***anticipated*** changes in the money supply will have no effect upon real money demand.

2). ***Unanticipated*** changes in the money supply will temporarily be stored in banks accounts. Moreover, the price level and interest rates will not adjust quickly enough for money demand to equal money supply. Thus, these ***unanticipated*** changes in money supply will affect real money holdings, with a positive coefficient.

Carr-Darby estimatek real demand for money functions with a modification to include *unanticipated* nominal money using the following equation;

$$M^d_t - P_t = \beta^T X_t + \mu_t \qquad (1)$$

Equation (1) in logarithmic form, is a conventional short-run demand for money equation where the vector X_t typically contains interest rates, real income variables, and, in ***partial adjustment model***, a lagged dependent variable, β is a vector of coefficients to be estimated and μ_t is a random error term, which reflects the impact of all the factors not included in X_t, M^d_t denotes the logarithm of the demand for nominal money in period t, and P_t denotes the logarithm of the price level in period t, Carr-Darby hypothesized that real money holding $(M^d_t - P_t)$ is related to real money demand by the equation;

$$M_t - P_t = (M^d - P_t) + \alpha(M^s_t - \hat{M}^s_t) \qquad (2)$$

where M^s_t denotes the logarithm of the money supply, and $\hat{M}^s_t$ denotes the anticipated value of M^s_t. Since $M^d_t \cong M^s_t$, it must follow that $M_t = M^s_t$. Using this fact, and substituting equation (1) in (2), we obtain Carr-Darby equation;

where $0, < \alpha < 1 \qquad M_t - P_t = \beta^T X_t + \alpha (M_t - \hat{M}_t) + \mu_t \qquad (3)$

M_t now denotes M^s_t, and $(M_t - M_t)$ denotes the ***unanticipated money supply.*** It is assumed that agents in the economy know that the economic structure which determines the money supply. Carr-Darby forecast it using the relation;

$$M_T = \gamma^T Z_t + V_t \qquad (4)$$

where Z_t contains all the variables which are observable by agents at the time they form their money supply expectations and which plays a systematic role in determination of the money supply, γ is a vector of coefficients to be estimated. It follows from equation (1,3) that $M_t = \gamma^T Z_t$ so that the additional regressor introduced into equation (1,2) is $v_t = (M_t - \hat{M}_t)$ The actual specification of equation (4) that is used by Carr-Darby is not revealed in their paper, expect that it is a univeriate ***ARIMA*** model, so that Z_t includes only lagged values of M_t.

Carr-Darby estimated the equation (3) and (4) over the period *1957(I)* – 1976(IV)for narrow money (M1) for eight industrial countries. They use an autoregressive predictor for the ***anticipated money supply*** and obtain encouraging results for a number of countries. In particular, the coefficient of $(M_t - M_t)$ is less than unity and usually significant.

BSM approach takes the view that it may be incorrect to equate the desired short-run demand for money (M^d_t) with the actual money supply in circulation (M^s_t), BSM therefore assumes that;

$$M^s_t = M^d_t + M^T_t \qquad (5)$$

where (M^T_t) are transitory or buffer-stock holdings of money. If the money supply is endogenous and positively responds to changes demand, then it may be correct to equate desired money holdings in the aggregate to the actual money supply as in the conventional approach (i.e., the partial adjustment model). When there is an unexpected shift in the demand for money, then, either the money market may not clear in the current period and disequilibrium prevails, or individuals may experience an unexpected change in their income and buffer-stock holding of money ensue. Buffer-stock monetarism, therefore, recognizes that the supply of money is not always determined. It sees supply shocks as resulting in buffer money that are willingly held (desired) in the short-run. Conversely, a desired change in money holdings by a group of individuals, say by an increase in holding of buffer by other agents. Even with an unchanged money supply, aggregate money balances are still willingly held in the short-run. An autonomous change in the desired short-run demand for money need not required a change in the money supply, or price, income and interest rate, for the aggregate money market to remain in equlibrium in the short-run. As buffer-money is perceived as a permanent addition to money balances, individuals attempt to run down these balances produce conventional real balance effect on prices, output and interest rates.

In summary, buffer-stock monetarists argued that much effort (theoretical and empirical) has been expanded in the modelling desired short-run money balances but little attention has been paid to that ***unanticipated money holdings*** , BSM rather neatly copes with shocks to both the demand and supply of money and hence is more general than the partial adjustment model in conventional demand for money function which requires an endogenous money supply and the inversion of the demand function when we assume an exogenous supply of money.

Based on the buffer-stock approach, the following equation equation were estimated for the Malaysian demand for money function over the period 1965 – 1984;[1] –

$$M_t - P_t = \beta^T X_t + \alpha(\Delta M_t - \Delta \hat{M}_t) + \phi \Delta \hat{M}_t + \mu_t \qquad (6)$$

$$M_t - P_t = \beta^T X_t + \alpha(\Delta M_t - \Delta \hat{M}_t) + \mu_t \qquad (7)$$

$$M_t - P_t = \beta^T X_t + \phi \Delta \hat{M}_t + \mu_t \qquad (8)$$

$$\Delta M_t = \alpha^T \Delta Z_t + V_t \qquad (9)$$

where all variables are in logarithmic form with;-

M = nominal money supply (M1);

P = price level;

X= vector of traditional variables, i.e., interest rate, income and laggeed dependent variable.

$\Delta\hat{M}_t$ = anticipated money growth. In this study, the rate of change of money (supply ΔM_t is used instead of M_t as in the Carr-Darby model.)

Equations (6), (7) and (8) are the demand for real balances which depends on traditional variables (X_t), unanticipated money growth $(\Delta M_t - \Delta\hat{M}_t)$ and anticipated money growth $(\Delta\hat{M}_t)$. According to Carr-Darby hypothese, α should be positive and ϕ should be zero. That is to say, the ***unanticipated money growth*** affects real money holdings, and that ***anticipated money growth*** does not. Equation (9) is the money growth equation where ΔZ_t includes the lagged values of money growth, lagged values of total domestic credit[2], lagged values of growth of net foreign assests[3] and lagged values of exchange rate. (But, in Carr-Darby model, Z_t contains only lagged values of M_t).

We first estimate equation (9), the money growth forecasting equation, to obtain estimate of γ and thus form ΔM_t. Then equations (6), (7) and (8) were estimated using ordinary Least Squares and Maximum Likehood Iterative Techniques adjusted for first order serial correlation.

Table 1 shows our estimates of (6), (7) and (8). In equation (6), the ***unanticipated*** and ***anticipated money growth*** significantly affects the demand for real balances. The coefficient of ***unanticipated money growth*** is positive, i.e., $0<\alpha<1$, thus this is consistent with Carr-Darby hypotheses where ***unanticipated money supply*** matters. In equation (8), when ***unanticipated money growth*** is excluded from the equation, the coefficient of ***anticipated money growth*** turns out to be zero. Thus, this is also consistent with Carr-Darby hypotheses where the coefficient of $\phi=0$. That is to say that ***anticipated money growth*** does not affect the demand for real balances. The traditional variables, i.e, the real income, interest rate, and lagged dependent variable theoretically have theoretically have the correct sign and significantly affects the demand for real balances.

TABLE 1: *REGRESSION ESTIMATE FOR MALAYSIAN DEMAND FOR MONEY FUNCTION BASED ON CARR-DARBY MODEL*

Equation	(1.5)	(1.6)	(1.7)
Constant	−0.114	−0.069	−0.229
	(1.806)	(1.131)	(1.919)
(y/P)t	0.201	0.180	0.337
	(4.055)+	(3.629)+	(3.920)+
Rt	−0.026	−0.044	−0.056
	(1.595)	(3.247)+	(1.994)+
(M/P)t − 1	0.822	0.848	0.677
	(19.634)+	(20.152)+	(8.212)+
$(\Delta Mt - \Delta \hat{M}t)$	0.701	0.686	excluded from
	(9.511)+	(9.120)+	the equation
$\Delta \hat{M}t$	0.065	excluded from	0.000
	(2.076)+	the equation	(0.001)
DVI	−0.042	−0.042	−0.035
	(7.213)+	(7.048)+	(4.688)+
DV2	−0.025	−0.025	−0.024
	(4.055)+	(4.488)+	(3.277)+
DV3	−0.030	−0.030	−0.030
	(5.443)+	(5.303)+	(4.504)+
SSR	0.017	0.018	0.038
SE	0.016	0.017	0.024
$\bar{R}^2$	0.999	0.999	0.999
Theil's	0.00001	0.00002	0.0003
Durbin's h	1.094	1.099	−0.432

The 't' values are given in parentheses and + indicates that the coefficient are statistically significant.

'NOTES'

[1]Quarterly data were used; from the first quarter of 1965 to the fourth quarter of 1984.

[2]Total domestic credit-Claims on Government (holdings of Government debts less Government deposits plus credit to the private sector)

[3]Net foreign assests-Net foreign assets of the commercial banks plus net international reserves of the Central Bank.

In conclusion, the buffer-stock model based on Carr-Darby model showed that the ***unanctcipated money supply*** significantly affects the demand for real balances with a positive sign, while ***anticipated money supply*** turns out to be insignificant.In addition, the real income, interest rate and lagged dependent variable also significantly affects the demand for real balances.

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