SUBSTITUTION OF MONEY AND NEAR MONEY
EVIDENCE FROM SRI LANKA

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This study investigates the substitutability of money and near money in the Sri-Lankan economy for the period of 1959-77. The introduction discusses briefly the important issue of money and its substitutes and in Section Two the hypothesis to be tested and the methodology are analyzed. The empirical results of the study are discussed in Section Three and the last Section presents concluding remarks.

I. Introduction

ɪAbout three decades, ago, Gurley and Show's Study (12, 1956) recalled the the theoretical validity of money substitutability in developed money economies Since then many scholars especially in the 1960s and 1970s have written about the substitutability of money, but the subject has not been exhausted and studies continue (17, Johnson 1962), (19, Laidler 1969), (7, Fisher 1976) and (6, Feige 1976). Due to marked changes in the monetary sectors in most countries (24, Meyer 1976), (25, Simpson 1979), (31,Wrightsman 1971) and (21, Lauma 1978) while the spread and degree of changes are not the same everywhere, the distinction between narrowly defined money (M_1) and broad money (M_2) has been blurred. This study considered the problem of a better definition of money or, put another way, the substitutability of narrowly defined money with savings deposits. This subject had been investigated and analyzed by using different combinations of definitions of money and functional forms. Most earlier studies have tested this issue using data for developed countries in seeking whether money is substitutable for other liquid assets, and if so to what extent (6, Feige 1977), (23, Lee 1966), (14, Hamberger 1969), (2, Chetty 1969) (to rame a few).

Basically, the interest rate has been considered the main determining variable in these studies, generally an arbitrary choice, subject to the economy in question. One way of considering substitutability is the cross-elasticity of various asset yields with money. Another approach is to find the elasticity of substitution between money and other financial assets. In this Study, which investigates a small developing economy, the treasury bill yield (as the opportunity cost of money) and the rate of interest on savings deposits (as the price of savings) are considered. Nonbank savings deposits, credit union share drafts, etc. have not been included (*See* 12, Goldsmith 1966, pp. 23-26).

The elasticity of substitution and the cross elasticity both have been investigated in this study. The elasticity of substitution is obtained by estimating the parameters of the relevant utility function (2, Chetty 1969). The cross elasticity is estimated by using regression coefficients of demand for money and savings function (4, Christ 1963) (6, Feige 1977) (23, Lee 1966) (to name a few).

The successfulness of the monetary activities of Sri Lanka's Central Bank or the ability of the Central Bank to predict the response of the economy to monetary policyt, partly depends upon the accuracy of demand for money function.

"To be sure, the monetary aggregates are by no means the only guides to policy. Developments in the credit markets, in the foreign exchange markets, in business conditions, and in prices all play an important role in policy making... as the financial system evolves, allowing the public to find new forms in which to hold its financial wealth, relationships among money, interest rates, income and prices are altered as well. Without stability in these relationships the conduct of monetary policy is greatly complicated."

Regardless of the development level in the economy in question, the identification of asset categories which indicates the accurate behavior of the the private sector is an important task in building the demand for money function. Thus the importance of finding the substitutability of money and near money should not be underestimated.

Although facts indicate that the theoretical framework of the monetary systems in non-Communist LDCs (Less Developed Countries) is similar to that of DCs (Developed Countries), in a developing economy's monetary sector, innovations in financial instruments are clearly slower than in DCs.*

This slow growth then raises the question of whether LDSs should stay on narrowly defined M_1. The answer is strongly suggested by a look at the overall changes in the monetary sector with respect to the "commonly accepted" assets such as, M_1 and savings deposits (21, Laumes, 1978). Several changes in the monetary sector in the Sri-Lankan economy can be seen in the past few years (32, 1968, 1977).

As many of the investigations about the sbustitutability of money and near money have taken place in DCs rather than in LDCs the task of reviewing earlier literature on LDCs has been limited. However as the main

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* Wenninger, John and Sivesind, M. Charles. "Defining Money for a Changing Financial System, Federal Reserve Bank of New York. Spring, 1979, p. 1

emphasis of this paper is to study the better definition of money in Sri Lankan economy which directly involves the substitutability concept, the literature about DCs is briefly considered.

Past studies used variety of data sources. Some studies used time series data (2 Chetty 1979; 14, Hambager 1969) while others used cross sectional data (23, Lee 1966; 5, Edwards 1972). Some used micro data such as data from metropolitan areas (5, 1972) and others used aggregate data (6, Feige 1977). Interest rate differentials are used in some studies (23 Lee 1966) and absolute yields in others (2 chetty 1969) Unfortunately the necessity of using such divergent sources made it difficult to find a commonly-held view on the problem of substitutability

On this subject, Carl Crist (4, 1963), using annual data over the period 1934 - 1959 from U.S.A. and adopting the OLS (Ordinary Least Square) estimation technique and linear and nonadditive functional forms,[2] found a complementary relationship between demand deposits and savings and loan shares.

Hamberger (14, 1969) used annual data from 1951-1965 for U.S.A. and adopted OLS estimation technique and loglinear functional forms. He also used real per capita currency plus demand deposits as a dependable variable. Hamberger found low elasticities of interest rate and concluded that there is little evidence to prove the substitutability between money and other assets such as savings and loan shares.

Although some studies rejected the substitutability of other assets, such as savings and loan shares, to narrowly-defined money, many investigations have easily accepted the other assets, considered as substitutes for narrowly-defined money.

Among these studies, Tong H. Lee (23, 1966) using the OLS (Ordinary Least Squares) estimation technique, log linear functional form and adopting annual data for the U.S.A., found non-bank intermediary liabilities are close substitutes for money. In another Study Lee (1967) found similar results. He concluded that the demand for money is highly sensitive to changes in the the yield on savings and loan shares, and therefore the later are closer substitutes for money.

Galper (10, 1969) using 1956-1966 quarterly data and adopting OLS as an estimation technique and log linear functional form, found a - 55 cross elasticity for savings and loan rates, while the cross elasticity for the time

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2. Linear nonadditive functional form allows both dollar shifts and elasticities to vary over time.

deposits was-. 03. Gurley and Show (13, 1956) had indicated that the interest elasticity of the demand for money had risen due to the growth of financial intermediaries.

Chetty (2, 1969) investigated the elasticity of substitution, using the CES (Constant Elasticity of Substitution) utility function. His results stressed the elasticity of substitution between M_1 and time deposits, savings and loan shares, and mutual savings deposits, and he concluded that these three assets are close substitutes for money. Although Chetty was criticized by Larry Steinhauer and John Chenge (26, 1972) and Edwards (5, 1972), his model has explored and alternative way of proving the substitutability of money and near monies (for further information *see* (17, Johnson 1962) (6, Feige 1977) (20, Lailder 1969) and (7, Fisher 1966).

Another approach used to define money or substitutability is to examine which definition is most closely related to nominal income. Kaufman (19, 1969) Lauma (22, 19) and Timberlake (28, 1967) had used this approach. (For criticisms of this approach *see* Edwards (5, 1972).

Wrightsman (21, 1971) in his text, says[3]

The savings account type of liabilities of financial intermediatrics are not perfect substitutes for demand deposits and currency, but neither are they completely unrelated. This imperfect substitutability has made some monetary economists uncomfortable with any definition of money which either includes them, or excludes them, *inthier entirety*.

As can be clearly seen there is no uniform view of substitutability of money and near money. There is no such agreement on how large must be the cross elasticity or the elasticity of substitutions in order to define money as broad money. In this regard, Feige & Pearce say

"...it is unrealistic to expect that such powerful quantitative statements are possible given the present state of art..."[4]

All of these investigations have taken place under somewhat similar methodology: all observe the consistency of empirical data with propositions.

Basically two approaches can be seen as alternative methods in the field (which also can be seen in the field of Finance, *see* 30 Weston 1966). One formulates assumptions and related definitions and then develops and tests the propositions by empirical studies. The data in the empirical study is shown to be consistent with the propositions derived from the assumptions.

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3. Wrightsman (31, 1971? p. 31.
4. Feige & Pearce [6, 1976? p. 463.

Another way of approaching to monetary problems is to test the existing theory with empirical data for consistency. Although a theory is not proved by a set of data (facts), confidence in the theory can be increased if it can be shown consistent with a particular set of data. This latter approach has been often used in the monetary field, and this study also uses it.

SECTION II

This study tests the hypothesis whether savings deposits in Sri Lanka are a close substitute for money which is defined as currency plus demand deposits.

The study assumes that savings deposits are the more commonly accepted financial asset than other financial assets and people make the best use of these assets by combining money and savings deposits with budget constraints. Two models are discussed here. The first one is used to estimate the elasticity of substitution, using Chetty's Model (2, 1969) and the second model based on demand functions for savings is used to estimate the cross elasticity between savings and money.

Model 1

The maximum utility of any combination of two liquid assets, money and savings deposits, can be obtained by equating the slope of the indifference curve of money (M) and savings deposits (S) to the slope of the budget line.

In this case the constant elasticity of substitution (CES) utility function is used (2, 1969).

The utility function is given by

$$U = (\beta_1 M^{-\rho} + \beta_2 S^{-\rho})^{-1/\rho} \qquad -(1)$$

Where

M = money (currency plus demand deposits.)

S = Savings deposits

Assumption 1: $\beta_1 = 1$.

Suppose the individual has total cash balances equal to M_0 and wants to allocate it between money and savings deposits. If S_1 stands for the cash value of savings deposits in the next period, and if Rs stands for the rate of interest on savings deposits, then the budget constraint will be:

$$M_o = M + \frac{S_1}{1 + R_s} \qquad\text{———— (2)}$$

The slope of the budget line is $- (1 + R_s)$.

In utility maximization subject to the budget constraint (2) we obtain

$$\frac{\partial \mu}{\partial M} = UU^\rho\, B_1\, M^{-\rho-1} \qquad\text{———————— (3)}$$

$$-\frac{\partial \mu}{\partial S} = UU^\rho\, \beta_2\, S^{-\rho-1} \qquad\text{———————— (4)}$$

using equation (2)
we obtain

$$\frac{\beta_1}{\beta_2} \left(\frac{M}{S}\right)^{-(1+\rho)} = 1 + R_s$$

Rearranging and taking logarithms and adding an error term, we get

$$\log \frac{M}{S} = \frac{-1}{1+\rho}\, \log \frac{\beta_2}{\beta_1} - \frac{1}{1+\rho}\, \log(1 + R_s) + e \quad\text{———(5)}$$

where M and S stands for the same as above and

e = the disturbance form.

Using the OLS estimation technique we obtain the intercept and the slope of the regression line of (5) using $1+\rho$ to the intercept we obtain an estimate $\left(\frac{\beta_2}{\beta_1}\right)$ and under assumption (1)

($\beta = 1$) we may find an estimate of β_2. The elasticity of substitution between money and savings is obtained by $\sigma = \dfrac{1}{1+\rho}$.

Using the estimates ρ and β_2 from equation (5) we then may calculate the adjusted money (Ma) i.e., the monetary services rendered by money and savings deposits (26 Sienhawer 1972).

$$\text{i.e. Ma} = \left(\frac{S^{-\rho}}{(M^{-\rho} + \beta_2}\right)^{.1/\rho} \underline{\hspace{3cm}} \quad (6)$$

If M and S are perfect substitutes β_2 is equal to one and $\rho = -1$. Then the adjusted money equation can be written as

$$\text{Ma} = (M + S).$$

As Chetty (2, 1969) mentioned, the elasticity of substitution is not directly comparable to cross elasticities. But the relationship between elasticity of substitution and the own elasticity of money as well as the corss elasticity of savings can be derived with respect to the rate of interest of treasury bills (6, Fiege 1977).

i.e.

$$\sigma = \frac{1 + Rm}{Rm} \quad (\eta sRm \quad -\eta mRm) \quad \underline{\hspace{2cm}} \quad (7)$$

where Rm $=$ the rate of interest of treasury bills

      $\eta sRm =$ the elasticity of savings with respect to the price of money (rate of interest of treasury bills).

$\eta mRm =$ the own elasticity of money.

Model 2

The cross elasticity of savings with respect to the treasury bills rate is calculated using OLS estimation technique and log linear functional form. The savings function in logrithmic form is given by

$$\log\left(\frac{S}{P}\right)_t = \text{constant} + a \log (Y)_t + b\log (RM) + c\log (R_s) \underline{\hspace{1cm}} (8)$$

where S $=$ savings

       y $=$ real income

       Rm$=$ rate of return on Treasury bills (price of money)

       Rs $=$ interest rate on savings (price of savings)

       p $=$ GNP price deflator

  (a). $=$ income elasticity

   (b) $=$ interest elasticity of money $(\eta_s R_m)$

   (c) $=$ interest elasticity of savings $(\eta_s R_s)$

(If the cross elasticity is positive, it indicates the substitutability between two goods. See wrigthsman (30, 1971 pp 26 - 30)

In an earlier Study I have estimated the own elasticity of money using the OLS estimation technique and log linear functional form. The estimates of demand for money function was of the following form.   (see 16, hettihewa S. 1979)

$$\log (M/PN)_t = \text{constant} + a \log (y/N)_t + b \log (R_m)_t$$

where   M = money

      p = GNP price deflator

      y = Real income

      Rm = Rate of return of treasury bills

      N = population

      a = income elasticity

      b = interest elasticity

The estimated elasticity between money and its price (b) was found to be -0.029.

SECTION III

Empirical Results

These models were used to investigate the substitutability of money and savings deposits, using time series data for the Sri Lankan economy and for the period of 1959-1977.

Shown below are the empirical results of equation (5), with the t-ratios recorded in parentheses below the coefficients :

$$\log \left(\frac{M}{S}\right) = 1.0938 + 12.95 \log (1+R_s)$$
$$(16.097) \quad (7.207)$$

$R^2 = .753$

$D.W. = .914$

$\beta_2 = \exp (-1.0938/12.95) = .9191$

based on the coefficient estimates, the adjusted stock of money can be written by:

$$Ma = (M^{.923} + .9191 \; S^{.923}) \; 1.0836$$

The coefficient of log $(1/1+R_s)$ of equation 5 is 12.95, the elasticity of substitution is 12.95; which indicates that M and S are close substitutes. Table 1 shows that M + S and adjusted money (Ma) have a close relationship. The velocity* based on various definitions of money are given in Column 5 and 6 in the Table 1. The velocity based on Ma is more constant than the other two (*see* Table 1).

The empirical results of equation (7) can be written as,

$$\log \left(\frac{S}{P}\right)_t = -7.3395 + .9\,67 \log Y_t + .178 \log (Rm)_t + .1107 \log (Rs)_t$$

$$(-3.0536) \qquad (3.7566) \qquad (1.0069) \quad (0.4821)$$

TABLE 1*

MONEY STOCKS AND VELOCITIES

Time	M_1	$M_1 + S$	Ma	Y/M_1N_1 V_1	$Y/M_1 + S$ V_2	Y/Ma V_3
1959	1177.7	1693.1	1735.46	10.21	3.77	3.68
1960	12.089	1756.7	18.0036	10.50	3.77	3.68
1961	1288.6	1846.4	1892.71	10.02	3.69	3.60
1962	1342.6	1921.2	1969.43	9.85	3.69	3.60
1963	1506.10	2124.0	2177.75	9.00	3.50	3.42
1964	1621.8	2299.2	2357.27	8.87	3.54	3.46
1965	1715.7	2453.3	2515.01	8.60	3.41	3.32
1966	1658.9	2432.20	2492.41	9.35	3.61	3.54
1967	1807.60	2623.4	2688.84	9.09	3.63	3.54
1968	1913.2	2806.2	2876.12	8.97	3.75	3.66
1969	1883.1	2851.2	2920.02	9.86	4.28	4.18
1970	1966.60	3208.60	3279.73	10.09	4.31	4.21
1971	2149.1	3596.3	3673.21	9.16	3.92	3.84
1972	2481.1	4004.7	4094.91	8.14	3.83	3.75
1973	2777.7	4570.5	4670.89	7.69	3.90	3.89
1974	2945.6	5047.1	5151.30	8.02	4.39	4.30
1975	3088.2	5449.3	5556.16	7.79	4.41	4.34
1976	4165.6	7060.6	7209.37	6.06	3.62	3.59
1977	5365.9	8619.9	8816.38	4.78	3.06	29.3

where M^1 — currency plus demand deposit
$M_1 + S$ — M_1 plus savings
Ma — adjusted money
V_1 — the velocity based on M
V_2 — velocity based on $M_1 + S$
V_3 — velocity based on adjusted money

Source : M_1 and S are taken from the *Annual Report*. Central Bank of Ceylon. 1968 and 1977.

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* The velocity is the nominal income measured by nominal money i.e. Y/M — V.

$$R^2 = .978$$

$$D.W = 1.592.$$

Based on these results and our previous estimates of the interest elasticity of money (-0.0293) the elasticity of substitution can be computed;

$$\sigma = \frac{1+.04}{.04} \quad .151 \; -(-.02) = 4.46.$$

As we discussed in Section II (see equation (2) these results again indicate that money and savings are substitutes. This elasticity of substitution is lower than the one computed with Chetty's method. But the main conclusion is that both models support the substitutability hypothesis.

SECTION IV

Summary

In this Study, the hypothesis of substitutability between money and savings deposits is tested using elasticity of substitution utility analysis and cross elasticity demand analysis. In the first case a CES utility function is used, adopting Chetty's (2, 1969) model. In the second case the log linear savings function is used. In both models the parameteres are estimated by using the OLS technique, and in both cases savings are proved statistically to be substitute for money.

Implications

These findings may be used to construct a better money supply policy. Knowing the correct weight of savings deposits the total amount of monetary services available in the economy can be measured more precisely. For example, using Chetty's model, if a large proportion of the outstanding savings deposits is added to the narrowly defined money supply, it can give the adjusted money supply (Ma) which clearly shows the monetray services of savings deposits as well as Money.

In predicting the level of national income, these more accurate measures of the total amount of monetary services is of considerable importance.

Following Chetty's study, the non-monetary services from savings are not considered.

The scope of this Study is limited to savings deposits as a test for money substitutability, because other financial assets, such as government security bills, savings and loan shares in the non-bank institutions are not widely available to the mass population. Furthermore they are not necessary to appropriate for the validity of this study, though in character such phenomenal assets are somewhat close to money.

Conclusion

Under some limitation the elasticity of substitution can be used as useful tool in monetary policy implication. The basic question that arises when applying model previously used in a developed economy to a developing economy is whether the model is suitable for the less organized monetary market of the latter. A model which is suitable for an industrially advanced country with a free economy may not be suitable for a mainly agricultural developing economy. It does not follow that a model which is used in an already developed country is always entirely inconsistent for a developing country.

The usefulness of the model partly depends upon how close it is to reality. The conclusion of this empirical study is that the models used are well supported by the data and that the findings seem to indicate savings deposits in Sri Lankan economy are close substitutes for money. Therefore, the implications for monetary policy that manages monetary aggregates are far reaching.

BIBLIOGRAPHY

(1) ADEKUNLE, JOSEPH O. "The Demand for Money, Evidence from Developed and Less Developed Economies." *International Monetary Fund*, StaM Papers (1968) pp. 22-265.

(2) CHETTY, V. K. "On Measuring the Nearnes of Near-Moneys" AER June 1969, 59(3), pp. 2710-8

(3) CHETTY, V. K. "On Measuring the Nearnes of Near Moneys: Reply." AER, March 1972, 62(1). pp. 226-29

(4) CHRIST, CARا F. "Interest Rates and Portfolio Selection' Among Liquid Assets in the U. S.," in *Measurement in Economics: Studies in Mathematical Economics and Econometrics in Memory of Yehuda Grunfeld*, Stamford: Stamford University Press, 1963, pp. 201-18.

(5) EDWARDS, FRANKLIN R. "More on Substitutability between Money and Near Money." *Journal of Money*, Credit Banking, August 1972, (4(3), pp. 551-71.

(6) FEIGE, EDGAR, L. and PEARCE, DOUGLAS K. "The Substitutability of Money and Near Money: A Survey of the Time Series Evidence." *Journal of Economic Literature*, June 1977, Vol. XV, Number 2, pp. 439-469.

(7) FISHER, STANLEY; BARROW, J. ROBERT "Recent Developments in Monetary Theory," *Journal of Monetary Economics*, 1976 (2), pp. 133-167.

(8) FRIEDMAN, MILTON   "The Demand for Money: Some Theoretical and Empirical Results" *The Journal of Political Economy*, Vol. LXVII No. 4, Aug. 1959.

(9) FRIEDMAN, MILTON and SCHWARTZ, Ann *A Monetary History of the United States 1867-1960.* Princeton University Press, Princeton, 1963.

(10) GULPER, HARVEY "Alternative Interest Rates and the Demand for Money." *AER*, 1969, 59 (3), pp. 401-407.

(11) GOLDFELD, STEPHEN M.   "The Demand for Money Revisited." *Brookings Papers*, Econ. Act 1973 (3), pp. 577-638.

(12) GOLDSMITH, RAYMOND W. *The Determinants of Financial Structure.* Development Centre of the Organisation for Economic Co-operation and Development, Paris 1966.

(13) GURLEY, JOHN and SHAW, S. EDWARD "Financial Intermediaries and the Saving-Investment Proc" *The Journal of Finance*, May 1956, pp. 257-76.

(14) HAMBERGER, M. J. "Alternative Interest Rates and the Demand for Money" Coment," June 1969, 59 (3), pp. 407-412.

(15) HAFER, R. W. and HEIN, SCOTT, E. "Evidence on the Temporal Stability of the Demand Money Relationship in the United States" *Federal Reserve Bank*, St. Louis.   Dec, 1979, pp. 3.

(16) HETTIHEWA SAMANTHALA "The Demand for Money In Sri Lanka" unpublished paper 1979

(17) JOHNSON, HARRY G. "Monetary Theory and Policy"   *AER*, June 1962, 52 (3), pp 335-384.

(18) KAUFMAN, GEORGE G. *Money: the Financial System and the Economy*

(19) KAUFMAN, GEORGE G. "More on the Empirical Definition of Money" *AER*, March 1969, pp. 78

(20) LAIDLER, DAVID E. W. *The Demand for Money Theories and Evidence.* Scranton: International Text Book, 1959.

(21) LAUMAS, S. PREM. "Monetization, Economic Development and the Demand for Money." *The Review of Economics and Statistics.*   1978, pp.

(22) LAUMAS, S. PREM. "The Role of Savings Deposits As Money, A Comment." *Money, Credit and Banking pp* 789-195

(23) LEE, TONG HUN. "Substitutability of Non-Bank Intermediary Liabilities for Money. The Empirical Evidence." *Journal of Finance,* Sept. 1966, 21, pp. 441-457.

(24) MEYER, LAURENCE H. "Alternative Definition of the Money Stock and the Demand for Money." *Monthly Review.* Oct. 1976, pp. 266-274.

(25) SIMPSON, D. THOMAS "A Proposal for Redefining the Monetary Aggregates" *Federal Reserve Bulletin,* Jan. 1979, pp. 13-12.

(26) STEINLHAUER, LARRY and CHANG, JOHN. "On Measuring the   Nearness of Near Moneys: Coment," *AER,* March 1972, 62 (1), pp. 221-25.

(27) THORN, RICHARD S. (ed.) *Monetary Theory and Policy.* Praeger Publishers........N.Y. 1976

(28) TIMBERLAKE, RICHARD H. and FORTSON, JAMES. "Time Deposits in the Definition of Money *AER,* Vol. 57 (March 1967), pp. 190-194.

(29) WENNINGER, JOHN and SIRESIND, M. CHARLES. "Defining Money for a Changing Financial System" *Federal Reserve Bank of New York,* Spring, 1979. pp. 1-8.

(30) WESTON, FRED J. *The Methodology of the Finance* 1966

(31) WRIGHTSMAN, DWAYNE. The Free Press. A Division of Macmilan Publishing Co., Inc. New York, 1971. *An Introduction to Monetary Theory and Policy"*
     Data Source

(32) *Annual Reports.* Central Bank of Ceylon.