Financial Liberalization and Money Demand in the ASEAN Countries

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We estimate long-run money demand equations for the ASEAN-4 countries (Indonesia, Malaysia, Singapore, and Thailand) and evaluate whether the equations are cointegrated. Despite the substantial financial liberalization that has taken place in these countries, we find that the money demand equations are cointegrated. In sum, our results show that provided that the monetary authorities know the shape of these money demand equations, a policy framework aimed around monetary targets can be implemented. Copyright © 1999 John Wiley & Sons, Ltd.

KEY WORDS: financial liberalization; money demand; ASEAN

SUMMARY

Monetary targeting to control inflation depends on the stability and predictability of money demand. Only if money demand is stable can monetary authorities have a reasonable degree of confidence that if actual money growth is above target, there is likely to be upward pressure on prices and that consequently some policy actions are needed to tighten monetary conditions.

In this paper, we find that real money demand for the ASEAN-4 countries—Indonesia, Malaysia, Singapore, and Thailand—are stable, despite the substantial financial liberalization that has taken place. The financial liberalization can be proxied by simple linear time trends and time dummy variables, to capture secular and more sudden changes in the financial systems, respectively. Provided that the monetary authorities are aware of the trends and dummy variables, they can use the estimated money demand functions to target money.

INTRODUCTION

This paper examines the extent that the financial market changes in Indonesia, Malaysia, Singapore, and Thailand—the ASEAN-4—since the early 1980s has affected money demand behavior in these countries. We focus on the period until 1995, that is before the Asia-wide crisis that started in July 1997.[1] The extent of financial liberalization in the ASEAN-4—interest rate deregulation and greater competition in banking markets, as well as the liberalization of restrictions on cross-border capital flows—has been considerably greater than in many other developing countries. *A priori*, it would be surprising if these structural changes in financial markets and the associated rapid growth did not affect the relation between money, economic activity, and inflation.

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In this paper, we estimate long-run money demand equations for the ASEAN-4 and evaluate whether the equations are cointegrated. If a money demand equation is cointegrated, it means that real money and its determinants (interest rates, real income, proxies for financial liberalization) move together in the long-run. Cointegration is a necessary condition for a money demand equation to be stable in the long-run (Melnick, 1995; Ericsson and Sharma, 1996).

Surprisingly, we find that real money demand functions in the ASEAN-4 are cointegrated. Two reasons may account for this result. First, we may be adequately capturing the impact of financial innovation in these countries by simple linear time trends and time dummy variables, and the inclusion of these variables along with the conventional determinants of money demand may be sufficient to achieve cointegration. Second, our success in finding cointegration may be related to our use of systemwide methods. That is, jointly with the money demand equation, we impose and estimate a purchasing power parity equation. This systemwide estimation may have resulted in more precise estimates. In sum, our results show that provided the monetary authorities know the existence of these time trends and dummy variables, real money demand equations are stable and predictable, and a policy framework aimed around monetary targets can be implemented.

This paper is organized as follows. In the next section, we describe the financial reforms that have taken place since about the mid-1970s in the ASEAN-4. In the 'Financial Liberalization and Money Demand' section, we describe how the theoretical literature treats the relationship between financial liberalization and real money demand. In the 'Estimation' section, we describe the estimation procedure, and the estimates are depicted in the 'Results' section. The final section concludes.

SUMMARY OF FINANCIAL LIBERALIZATION IN THE ASEAN-4

In the ASEAN-4, financial liberalization since the 1980s has included the deregulation of deposit rates, and the introduction and deepening of the markets in money alternatives such as short-term paper (money), bonds, and equities (Table 1). The liberalization of interest rates has been the most important feature of financial reform in the ASEAN-4 countries. With the exception of Singapore, real interest rates were sometimes negative before the reform, as in other previously financially 'repressed' economies. In Indonesia, after the 1983 reform, time deposit rates more than doubled and real interest rates remained positive, even during subsequent high inflation years. In Malaysia, deposit rates increased following the 1978 liberalization, ending the era of financial repression. Nominal and real rates increased markedly between 1988 and 1993, raising the money market–LIBOR differential, and inducing the inflows of foreign capital. In Singapore, the liberalization of interest rates was complete by 1975, and the extremely open nature of the economy made it difficult for the government to pursue an independent monetary policy. The relatively low levels of both the nominal and real rates in Singapore during most of the 1980s were reflective of US interest rate trends. In Thailand, despite financial repression until the mid-1980s, real rates moved to positive levels from the early-1980s onward as inflation subsided. Until the 1989 liberalization measures, however, time deposit rates in Thailand moved in discrete steps as deposit rates were controlled by the authorities.

Generally, in the ASEAN-4, the liberalization of interest rates has preceded the development of money and bond markets, although the money markets have developed much faster than the bond markets. With the exception of Thailand, short-term money markets in the ASEAN-4 developed rapidly soon after the liberalization of interest rates. In Thailand, the money market, comprised mostly of repos, started to develop in 1979, a full decade before the liberalization of deposit interest rates.

The development of the ASEAN-4 bond markets has been hampered by strong government fiscal positions in Malaysia, Singapore, and Thailand, the 'balanced-budget' rule in Indonesia, and until recently restrictions on corporate bond issues, and the absence of bond rating agencies. In Indonesia, bond market development has also been hindered by the paucity of institutional investors. While still small, the Malaysian corporate bond market has grown since the establishment of a credit rating

Table 1. The ASEAN-4: financial liberalization

	Indonesia	Malaysia	Singapore	Thailand
Interest rate liberalization	Controls on deposit and lending interest rates lifted in 1983.	In 1978, deposit and lending rates liberalized. In the mid-1980s, lending rates of all banks pegged to the lending rates of the two 'lending' banks. In 1991, lending rates again liberalized.	Domestic interest rate cartel abolished, and, deposit and lending rates liberalized in 1975.	Ceilings on all time deposit rates removed in 1990, and those on lending rates removed in 1992.
Bank deregulation and competition	In 1988, relaxation of entry requirements of domestic and joint venture banks. Total number of banks rose from 111 in 1989 to about 240 in 1994, when authorities curtailed granting of new licences.	Generally, deregulation since 1989 has removed barriers between different types of financial institutions. Deregulation has allowed finance companies to participate in the interbank market and merchant banks to issue nonnegotiable CDs.	Since late 1960s, free entry, subject standards set by MAS. Today, highly competitive market with close to 150 domestic commercial banks and close to 40 foreign banks with full domestic privileges.	Since late 1980s, liberalization of permissible activities and asset holding requirements of commercial banks. Now, commercial banks allowed to hold a greater variety of assts, and permitted to engage in activities such as trading securities and underwriting debt instruments. Entry of foreign banks through BIBF liberalized in 1993.
Financial market development	Deepening money markets since the mid-1980s introduction of SBIs and SBPUs. Growing CP market since the early 1990s. Small corporate bond market, and no government bond market. Rapid recent growth in the stock market, owing to improvement in market infrastructure and better supervision by Bappepam and the Jakarta Stock Exchange.	Since 1979, growing markets in CDs, and bankers acceptances. Government bond market, although large, declining relative to GDP since 1988. Since the 1990 establishment of a credit rating agency, the corporate bond market has grown. The stock market capitalization relative to GDP highest among the ASEAN-4; the market has history dating back over 100 years.	Rapid growth in the money markets since 1975, as duties abolished on CDs, bills of exchange, and promissory notes. Large bond market dominated by Asian Dollar bonds (98% of bond market capitalization); small domestic government bond issues mainly to absorb Central Provident Fund and Post Office Deposits. Stock market has rapidly grown, since the 1973 delinking from the Malaysian Stock Exchange.	Between 1979 and 1990, the market comprised mainly of repos; since 1990, growth in CDs, commercial bills, and promissory notes. Traditionally, small outright trading in government bonds; corporate bond issuance severely restricted until 1992, but has since grown as standarized dealing and settlement procedures developed through Bond Dealers Club. Stock market boomed after establishment of Securities and Exchange Commission in 1992.

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Table 1. (continued)

	Indonesia	Malaysia	Singapore	Thailand
Management and supervision	In early 1990s, imposition of new rules on capital adequacy and restrictions on commercial bank involvement in the equity and CP markets. In 1995, lending limits imposed on problem banks and non-bank financial institutions, and regulations issued empowering BI to take over management of problem banks.	In 1989, The Banking and Financial Institutions Act passed and high minimum reserve, liquidity, and capital requirements imposed on commercial banks, finance companies, and merchant banks. Guidelines to curtail loans to the real estate and consumer sectors imposed on banks in the early 1990s.	MAS sets minimal capital and licensing standards for banks. In early 1990s, following BIS guidelines, single customer lending limits set to 25% of a bank's capital and a minimum Tier-I capital adequacy ratio of 12% imposed.	In early 1990s, BOT applied BIS guidelines on asset quality and capital adequacy to both commercial banks and finance companies. BOT introduced measures to improve the quality of securities and finance companies by encouraging the merger of those companies that are not sufficiently competitive.
Capital account and openness	Open capital account since 1960s.	Open capital account until 1994, when major restrictions on short-term capital inflows adopted for about 1 year.	Highly open capital account since 1978, when all foreign exchange controls abolished.	In 1991, most restrictions on capital outflows eliminated. The Bangkok International Banking Facilities (BIBFs), an offshore banking centre, was established in 1993, providing foreign currency loans to domestic and foreign businesses.

agency in 1990. The Singapore bond market is the largest in the region, but is dominated by foreign bonds—about 98% of the capitalization are Asian dollar bonds. In Thailand, corporate bond issuance was severely restricted until 1992, but has since grown with the establishment of a credit rating agency and the Bond Dealers Club.

The development of the equity markets in the ASEAN-4 has been rapid, and has closely tracked their impressive overall economic performance. The stock market in Malaysia has a long history, dating back over 100 years, and the market capitalization relative to GDP is the highest among the ASEAN-4. The stock exchanges of Singapore was established in 1973, when it was formally delinked from the exchange in Malaysia, and has grown rapidly since that time and is now comparable in size to the major stock markets in the world. The Thai stock exchange—established in 1974—experienced only modest growth initially but grew rapidly in the mid-1980s. In Indonesia, since the early 1990s, the improvement in market infrastructure and the greater supervision and regulation by Bappepam and the Jakarta Stock Exchange have aided the growth of the equity market, with market capitalization increasing from $81 million in 1986 to $67 billion at the end of 1995.

FINANCIAL LIBERALIZATION AND MONEY DEMAND

The conventional money demand equation (Goldfeld, 1992) expresses the demand for real money balances (M/P) as a function of a scale variable, usually the level of real income (Y), and an opportunity cost variable, usually the rate of (nominal) interest on an alternative asset (i):

$$\frac{M_t}{P_t} = L(Y_t, i_t).$$

In their survey, McCallum and Goodfriend (1992) maximize an intertemporal utility function subject to the usual intertemporal budget constraint and a 'shopping-time' constraint,

$$s = \varphi(c_t, m_t),$$

to obtain

$$\frac{M_t}{P_t} = J(c_t, i_t).$$

The 'shopping-time' constraint is the amount of time required to carry out purchases and is increasing in total transactions, c, but decreasing in the quantity of real money balances. McCallum and Goodfriend (1992) add that in empirical applications, since economic actors other than households—such as firms—also demand money, it may be preferable to use Y as a transactions variable, instead of c, as in (1).

Financial liberalization affects the demand for money by changing the shape of the shopping-time function,

$$\frac{dm_t}{dc_t} = -\frac{\varphi_1}{\varphi_2}.$$

The financial market reforms described above may change dm/dc in either direction. Reforms that increase the number of banks, and spur institutional and technological advances such as credit cards, and electronic transfers and cash machines can lower dm/dc as these developments make it easier to convert money substitutes into money. However, as noted by Bordo and Jonung (1987), Fry (1988), and Melnick (1995), in many developing countries dm/dc may rise over time because of increasing monetization (departure from barter trade) of the economy or financial deepening. It is straightforward to show from the equations in McCallum and Goodfriend (1992) that holding i constant, a fall (rise) in dm/dc results in a rise (fall) in the velocity of money, PY/M.[2]

For the ASEAN-4 countries, with the exception of Singapore, there has been a marked secular decline in the velocity of broad money (Figure 1).[3] In Singapore, broad money velocity has declined since 1995, which is somewhat surprising given the boom in the Singapore Stock Exchange. These trends suggest that movements in broad money velocity are dominated by the effects of increased monetization. We show below that these monetization effects can be adequately captured by time trends. Changes in the velocity of narrow money have been considerably more volatile, particularly in Indonesia and Thailand, although except for Malaysia there has not been a trend decline in the velocity of narrow money.

ESTIMATION

Following Melnick (1995), we estimate the following long-run log money demand equation,

$$\ln\frac{M}{P_t} = a + b\ln Y_t + ci_t + dsf_t + \varepsilon_{2t}, \qquad (1)$$

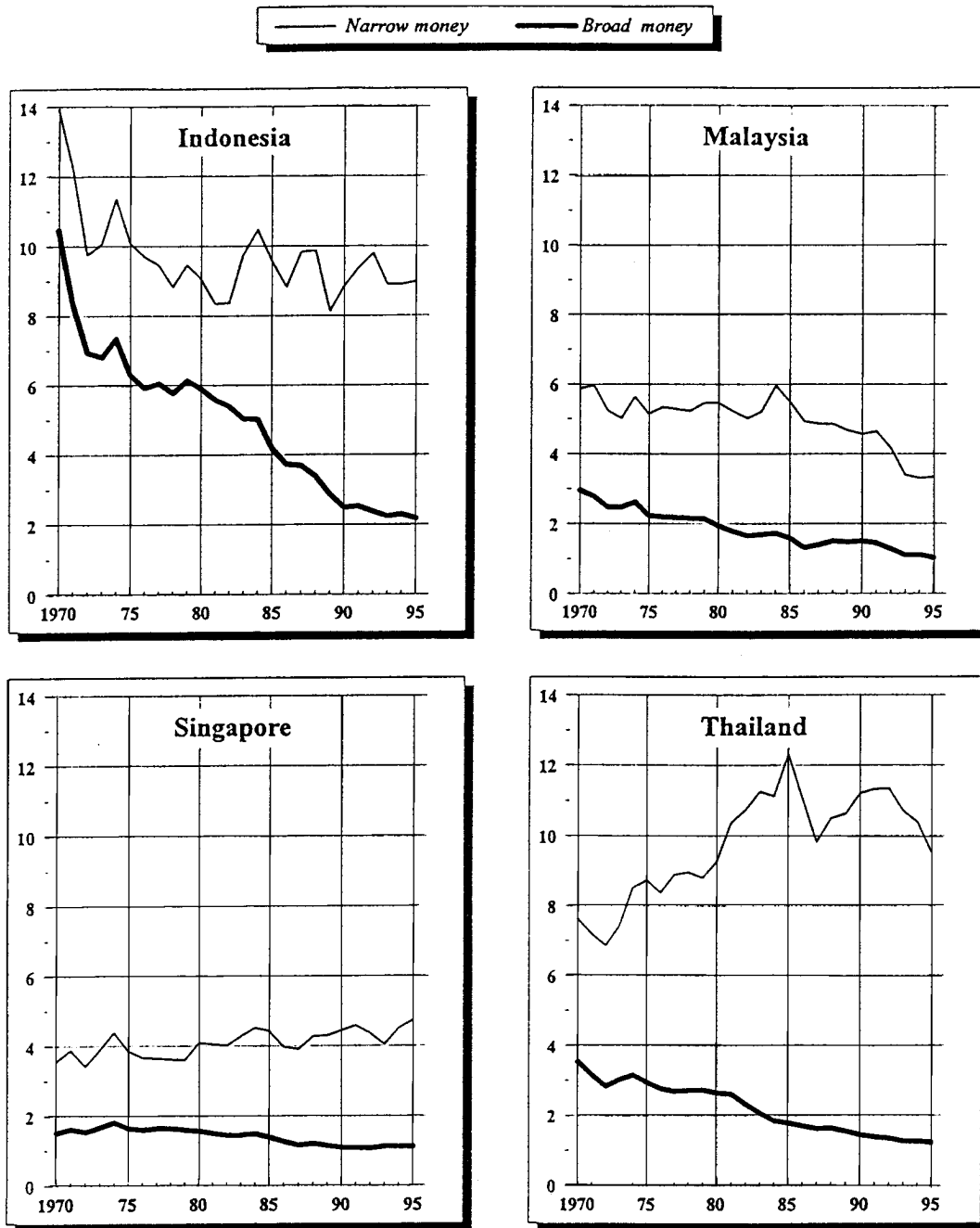where M is nominal money, P is the domestic price level, Y is real output, i is the nominal rate of

Figure 1. Velocity of monetary aggregates.

Table 2. ADF statistics for testing for a unit root

	LGDP	TIME	RET	CMR	FOR	LRNM	LRBM	LNM	LBM	LCPI
Indonesia										
Null order										
I(1)	−1.40	−2.48	−1.45	−2.79	−1.27	−2.75	−1.86	−2.41	−3.32	−4.03*
I(2)	−4.49*	−3.84*	−3.06[a]	−4.32*	−3.13*	−4.02*	−3.78*	−2.96[a]	−4.04*	−3.11*
Malaysia										
Null order										
I(1)	−1.79	−2.24	−1.91	−3.81*	−1.76	−0.97	−1.62	−1.90	−0.76	−2.61
I(2)	−4.37*	−4.00*	−4.41*	−4.62*	−3.78*	−4.00*	−3.82*	−3.77*	−3.63[b]	−4.28*
Singapore										
Null order										
I(1)	−2.31	–	−1.83	–	−3.07	−2.17	−2.65	−2.56	−2.96	−2.38
I(2)	−3.67*	–	−3.27[c]	–	−4.05*	−5.35*	−4.18*	−5.48*	−4.44*	−4.51*
Thailand										
Null order										
I(1)	−2.28	−2.92	−2.64	−2.69	−1.72	−2.46	−1.83	−2.08	−3.26	−2.42
I(2)	−2.98[d]	−2.85*[e]	−4.26*	−3.42[e]	−2.58[f]	−3.41[a]	−3.35[b]	−3.63[b]	−4.50*	−3.72*

* Denotes rejection at the 5% level.
[a] Critical value is −3.63.
[b] Critical value is −3.69.
[c] Critical value is −3.79.
[d] Critical value is −3.66.
[e] Critical value is −3.83.
[f] Critical value is −3.29.
LGDP, Log of real GDP; TIME, time deposit rate; RET, broad money return; CMR, call money or other money market return; FOR, foreign interest rate (LIBOR plus expected currency appreciation); LRNM, log real narrow money; LRBM, log real broad money; LNM, log nominal narrow money; LBM, log nominal broad money; LCPI, log consumer price index.
The stationarity tests included a constant, a trend term and up to four lags.
For any variable x and a null order of $I(1)$, the ADF statistic tests the null hypothesis of a unit root in x against the alternative of a stationary root. For a null order of $I(2)$, the ADF statistic tests for a unit root in the first difference of x.

return on an alternative asset, and sf is the index of financial innovation.[4] Since, as mentioned above, financial innovation can in principle change the demand (velocity) for money in either direction, d can have either a positive or negative sign.

We approximate sf by linear time trends and step dummy variables, to capture the secular developments and structural changes in the financial system, respectively. In capturing the impact of financial innovation on money demand, many authors have included as proxies for sf variables such as ratios of population to bank offices, and non-bank financial assets to total financial assets (Laidler, 1985; Bordo and Jonung, 1987). However, in the ASEAN-4, where financial reform has been most dramatic and has often proceeded in discrete steps, it is difficult to find one or two variables that adequately proxy for financial change. In particular, in Indonesia and Malaysia, in addition to long-run monetization trends, there were distinct

financial liberalization episodes in 1983 and 1988 (Indonesia) and in 1989 (Malaysia). The reforms enacted during these episodes were all encompassing, and included domestic and capital account liberalization, and changes in prudential controls. Below, we show that our strategy of using time trends (to capture secular movements) and step dummies (to capture discrete liberalization episodes) can help achieve cointegrating real money demand equations in all four countries.

To increase the efficiency of estimates, we estimate (1) along with the long-run price equation,

$$\ln P_t = v + f \ln P_t^* + g \ln e_t + \varepsilon_{2t}, \qquad (2)$$

where P^* is the foreign price level, and e is the nominal exchange rate.[5] We will assume that in the long-run, purchasing-power parity (PPP) holds, so we impose the restrictions, $f = 1$, $g = 1$, except for Singapore.[6]

For Singapore, the imposition of these PPP restrictions led to 'wrong' signs on some of the variables. More than other ASEAN countries, the Singapore government has actively managed exchange rates to achieve aggregate demand targets, and in our limited sample PPP may not hold. Therefore, we allow f and g to be freely determined.

Table 2 presents augmented Dickey–Fuller statistics for unit root tests. These test statistics suggest that most of the variables are integrated of order one ($I(1)$), although for some variables—such as narrow money and interest returns on broad money in Indonesia, real GDP and the foreign rate of return in Thailand—the ADF statistics indicate that their first differences are not stationary. However, some of these time series properties are likely to reflect the relatively small sample period. Moreover, univariate tests of this kind are typically of low power compared to stationary alternatives. The analysis in this paper, therefore, treats all variables as $I(1)$.

Because of its importance in affecting real economic activity and prices, below we focus on estimating the demand for broad money, rather than the demand for narrow money. This is also convenient because, as shown in Figure 1, compared to the behavior of narrow money velocity, the behavior of broad money velocity seems to be better captured by a simple linear time trend, the index of financial innovation that we adopt here.

To estimate long-run real money demand relationships, we use the Johansen (1988) Full-Information Maximum-Likelihood procedure. A necessary condition for the existence of a stable long-run relationship is the existence of cointegrating vectors, in our case, two: (1) that relating real money, income, and interest rates (money demand); and (2) that relating domestic and foreign prices with the nominal exchange rate (PPP). The test for these relationships is whether the 'maximal-eigenvalue' or 'trace-eigenvalue' statistics from the Johansen procedure are above the relevant critical values, in which case we can reject the hypothesis of less than two cointegrating vectors. Restrictions—such as our PPP restriction—can be imposed on the long-run matrix, and these restrictions can be tested (Doornik and Hendry, 1994, pp. 223–9). Details of the estimation procedure, and variable definitions and data sources are provided in Appendix A.

RESULTS

The estimation results, presented in Table 3, by and large provide evidence of stable relationships when proxies for financial innovation—time trends and time dummy variables—are included.[7] We find cointegrating real money demand equa-tions with reasonable coefficients for all ASEAN-4 countries (based on at least one eigenvalue criteria; however,

Table 3. ASEAN-4: estimates of real broad money demand elasticities (estimated jointly with the PPP equation)

	Indonesia	Malaysia	Singapore[a]	Thailand
GDP	0.92 (4.9)	1.29 (23.4*)	1.01 (27.5*)	1.69 (5.9)
Call money–broad money return[b]	−0.014 (8.92)	−0.024 (25.2*)	–	−0.0037 (28.7*)
Foreign return–broad money return[b]	–	–	−0.0025 (24.1*)	–
Trend	0.074 (26.2*)	−0.026 (6.1)	0.16 (8.2)	0.014 (26.1*)
Dummy 1983	0.34 (3.1)	–	–	–
Dummy 1988	0.57 (2.5)	–	–	–
Dummy 1989	0.57 (2.5)	0.42 (8.1)	–	–
Sample period	1974–1995	1975–1995	1975–1995	1978–1995
Maximal eigenvalue statistic[c]	35.1	38.7*	51.5*	32.6
Trace eigenvalue statistic[c]	91.4*	67.8	128.0*	97.6*
PPP restriction	8.2	9.5	23.8*	6.5

* Denotes significance or rejection of null hypothesis at 5% level.
Estimated by the Johansen (1988) method, with one lag.
All variables except for interest rates are in logarithms.
Chi-squared tests against the null hypothesis that the variable equals zero are in parentheses.
[a] For Singapore, the restriction of PPP not imposed on the pricing equation.
[b] Semi-elasticity.
[c] Eigenvalue test for the null hypothesis that there are less than two cointegrating vectors.

some of the coefficients on key variables are statistically insignificant). Overall these results suggest that stable real money demand functions exist using only the conventional determinants: real income and interest rates.

Prior to estimating real money demand, we estimated nominal money demand equations of the form $M = \alpha + bY + ci + dP$ to test if the co-efficient on the log price level (d) is equal to one. If d is unity (price homogeneity)—a doubling of the price level will double nominal money demand—this would then allow us to estimate the real demand for money. We reject the assumption that d is equal to one for nominal broad money in Malaysia, Singapore, and Thailand. However, to estimate real money demand, we impose the restriction that d is one since the rejection could be a result of sample specific factors.[8] Over the long-run, it would be unlikely that price illusion exists—rather the rejection most likely reflects ongoing changes in financial markets and money-holding behavior among private sector agents.

The PPP restriction on Equation (2) could not be rejected (by Chi-squared tests), except for Singapore (Table 3).[9] Therefore, except for Singapore, we estimate (1) and (2) imposing the PPP restriction on the matrix of long-run responses. The coefficients on real money demand shown in Table 3 are the restricted estimates for all countries, except Singapore.

The estimated real broad money equations are stable (cointegrated) for the ASEAN-4. None of the money demand equations are stable (cointegrated) without a time trend; Indonesia and Malaysia did not cointegrate when dummy variables were excluded. For Indonesia, Malaysia, and Thailand, we use the difference between the call money rate and the return on broad money as the opportunity cost of broad money.[10] In Singapore, given the openness of its capital market, we include the foreign return along with the return on broad money. Although the coefficient estimates are reasonable (Bordo and Jonung, 1987; Goldfeld, 1992), there are many insignificant coefficients. The time trends are significant only for Indonesia and Thailand; the dummy variables were insignificant even for these two countries.

Previous research on the stability of real broad money demand in the ASEAN-4 is limited. Using a less powerful econometric methodology and estimating money demand alone (not jointly with PPP), Tseng and Corker (1991) found broad money stability only for Indonesia. Arise (1994) and Hataiseree (1994) using specifications and estimation methods different from ours found stability for Thailand and Singapore.[11]

POLICY IMPLICATIONS AND CONCLUSIONS

The empirical results of the previous section, although preliminary, have an important bearing on the feasibility of framing monetary policy around targets for monetary aggregates. Monetary targeting to control inflation depends on the stability and predictability of money demand. Only then can monetary authorities have a reasonable degree of confidence that if actual money growth is above target, there is likely to be upward pressure on prices and consequently some policy actions needed to tighten monetary conditions.

In this paper, we find that real money demand functions for the ASEAN-4 are stable, despite the substantial financial liberalization that has taken place. The financial liberalization can be proxied by simple linear time trends and time dummy variables, to capture secular and more sudden changes in the financial systems, respectively. Provided that the monetary authorities are aware of the trends and dummy variables, they can use the estimated money demand functions to target money.

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APPENDIX A: DETAILS OF THE ESTIMATION PROCEDURE, AND VARIABLE DEFINITIONS AND DATA SOURCES

Estimation Procedure

Table 3 in the text reports the estimates and the associated test statistics for cointegration between real money, real income, and the opportunity cost variable for the ASEAN-4 countries.

The number of cointegrating vectors (r) is determined by two likelihood ratio tests. In the first test, based on the maximal eigenvalue, the null hypothesis is that there are at most r cointegrating vectors against the alternative of $r + 1$ cointegrating vectors. The second test is based on the trace of the stochastic matrix where the null hypothesis is that there are at most r cointegrating vectors against the alternative hypothesis that there are r or more cointegrating vectors. The critical values for the trace and maximal eigenvalue statistics are from Osterwald-Lenum (1992). For Indonesia, two (0, 1) dummy variables are included to capture the effects of the major financial reforms in 1983 and 1988. For Malaysia, one (0, 1) dummy variable is included the capture the effects of reforms in 1989.

Data Construction and Sources

All data are from the *International Financial Statistics (IFS)*.

Interest Rates

The opportunity cost of holding broad money is proxied by the money market rate less the time deposit rate weighed by the share of quasi-money in broad money. For Singapore, where domestic residents have access to a large eurodollar market, the opportunity cost of broad money is proxied by the 3-month dollar LIBOR minus the expected depreciation of the Singapore dollar *vis-à-vis* the U.S. dollar. The expected rate of exchange rate depreciation is proxied by the 5-year moving average of actual exchange rate changes.

Monetary Aggregates, Output, Exchange Rates, and Prices

Data on broad money, nominal and real GDP, US and domestic consumer price indices, and nominal exchange rates are from the IFS.

NOTES

1. We focus on the pre-crisis period because we wish to isolate the effects of financial liberalization on money demand, and not have the effects confounded by crisis and financial panic.
2. Using Y as a transactions variable instead of c.
3. Narrow and broad monies are defined in Appendix A.
4. As Laidler (1985) (pp. 81–97) mentions, these explanatory variables are standard in conventional money demand equations.
5. Efficiency is increased if ε_{1t} and ε_{2t} are correlated.
6. Using a different sample period and single equation methods, Chinn (1998) finds that the assumption of PPP is violated in some Asian countries. Below, using systemwide methods, we find somewhat more support for PPP.
7. All money demand equations in this paper are estimated with annual data.
8. There are several reasons why the statistical tests may reject unit price homogeneity over our sample period. First, as the economy grows, the basket of goods in the CPI may become less relevant for firms and households that are increasing their broad money holdings, and second, technological progress may have changed the relationship between nominal money and prices.
9. For Singapore, f and g were estimated as -0.13 and 0.36.
10. The return on broad money is equal to the time deposit rate times the share of quasi-money in broad money.
11. Hataiseree (1994) appended a goods market equation (the investment–saving relation) to the money demand equation.

REFERENCES

Arise, A.C., 'A Re-examination of the Demand for Money in Small Developing Economies', *Applied Economics*, **26** (1994), 217–28.

Bordo, M. and Jonung, L., *The Long-Run Behavior of the Velocity of Money: The International Evidence*, Cambridge: Cambridge University Press, 1987.

Chinn, M., 'On the Won and Other East Asian Currencies', NBER Working Paper, 6671, 1998.

Doornik, J. and Hendry, D., *PcFiml: Interactive Econometric Modelling of Dynamic Systems*, London: Thomson International, 1994.

Ericsson, N. and Sharma, S., 'Broad Money Demand and Financial Liberalization in Greece', IMF Working Paper 96/62, Washington: International Monetary Fund, 1996.

Fry, M., *Money, Interest, and Banking in Economic Development*, Baltimore: Johns Hopkins Press, 1988.

Goldfeld, S., 'Demand for Money: Empirical Studies', in P. Newman, M. Milgate, J. Eatwell (Eds), *New Palgrave Dictionary of Money and Finance*, London: Macmillan, 1992.

Hataiseree, R., 'The Relationship Between Monetary Aggregates and Economic Activities: Some Thai Evidence Using a Cointegration Approach', Papers on Policy Assessment No. 2537, Bangkok: Bank of Thailand, 1994.

Johansen, S., 'Statistical Analysis of Cointegrating Vectors', *Journal of Economic Dynamics and Control*, **12** (1988), 231–54.

Laidler, D., *The Demand for Money*, New York: Harper and Row, 1985.

McCallum, B. and Goodfriend, M., 'Demand for Money: Theoretical Studies', in P. Newman, M. Milgate, J. Eatwell (Eds), *New Palgrave Dictionary of Money and Finance*, London: Macmillan, 1992.

Melnick, R., 'Financial Services, Cointegration, and the Demand for Money in Israel', *Journal of Money, Credit, and Banking*, **27** (1995), 321–50.

Osterwald-Lenum, M., 'A Note with Quantiles of the Asymptotic Distribution of the Maximum Likelihood Cointegration Rank Statistics', *Oxford Bulletin of Economics and Statistics*, **54** (1992), 461–72.

Tseng, W. and Corker, R., 'Financial Liberalization, Money Demand, and Monetary Policy in Asian Countries', IMF Occasional Paper No. 84, Washington: International Monetary Fund, 1991.