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Financial Liberalization and Money Demand in ASEAN Countries: Implications for Monetary Policy

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Abstract

This paper examines the impact of financial market development and liberalization on money demand behavior in Indonesia, Malaysia, Singapore, and Thailand since the early 1980s. The empirical results indicate continuing instability in the interaction of money growth, economic activity, and inflation. Rapid growth and ongoing changes in financial markets suggest that policy needs to be guided by a wider set of monetary and real sector indicators of inflationary pressures. The feasibility of alternative policy frameworks--including nominal exchange rate targets, and inflation targets--is discussed in the context of the substantial and sustained increase in foreign capital inflows.

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Contents

Summary

Monetary developments in Indonesia, Malaysia, Singapore, and Thailand since the early 1980s have to be assessed in the context of substantial changes in their financial markets. The rapid growth and deepening of financial markets reflect not only sustained increases in per capita incomes, but also financial market reforms that have increased competition and foreign capital inflows. This paper examines the extent to which financial market development and liberalization in these countries since the 1980s have affected money demand and seeks to draw implications for the operation of moentary policy.

An important prerequisite for operating a policy framework centered around monetary targets is a stable and predictable demand for money. However, the empirical results suggest continuing instability in the interaction of money growth, economic activity, and inflation—especially in the ASEAN countries that have undergone extensive financial market reforms. These results indicate that money growth rates may, at times, be poor predictors of future inflation and output trends.

This finding suggests that policy decisions will need to be based on a wider set of monetary and real sector indicators of inflationary pressures.

The feasibility of alternative policy frameworks, including nominal exchange rate targets and inflation targts, is discussed in the context of the increasing integration of financial markets and the substantial increase in foreign capital inflows. The benefits of a pegged exchange rate in terms of stability must be weighed against other considerations, including the challenges of managing capital inflows and other real shocks. The paper concludes with some observations on the merits of inflation targets. Experience with the operation of inflation targets in other countries suggests that policy credibility is aided by the transparency of decision making.

I. INTRODUCTION

Monetary developments in Indonesia, Malaysia, Singapore, and Thailand—the ASEAN-4—since the early 1980s have to be assessed in the context of remarkably successful economic performance that has contributed to the rapid development of domestic financial markets. The extent of financial liberalization—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. In many industrial countries that went through substantial episodes of financial deregulation and financial innovation during the early and mid-1980s, there were significant shifts in the orientation of monetary policies. Several countries found it difficult to retain intermediate targets and moved more toward explicit targets for final objectives, typically inflation.

This paper examines the extent that the financial market changes in the ASEAN-4 countries has affected money demand behavior and seeks to draw the implications for monetary policy. The core of the paper assesses whether money demand equations are relatively stable and predictable—an important prerequisite for operating a policy framework centered around monetary targets. The results of this exercise caution against excessive reliance on monetary aggregates to gauge monetary conditions. Similar to the experience of many industrial countries, ongoing changes in financial markets suggest that policy actions need to be based on a wider set of monetary and real sector indicators. Although not directly stemming from the empirical work here, the paper also discusses—in the context of increasing integration of financial markets and substantial foreign capital inflows—the feasibility of alternative policy frameworks, including nominal exchange rate targets and inflation targets.

The paper is organized as follows. Section II outlines some of the major changes in financial markets and briefly discusses how monetary policy frameworks have evolved away from a strict adherence to monetary targets. Section III present the estimates of money demand equations for each of the ASEAN-4 countries, while Section IV discusses both the direct policy implications of our findings and offers some concluding remarks on the main alternative policy frameworks.

II. FINANCIAL LIBERALIZATION AND MONETARY POLICY

A. The Impact of Financial Liberalization on Money Demand

Measures to promote competition among financial institutions will generally tend to lower transactions costs, and technological advances such as the introduction of automatic teller machines and credit cards may cause money demand to respond more rapidly to interest rate changes thereby increasing the interest elasticity of money demand. More generally, measures that promote financial market development could result in the introduction and deepening of markets for new and more attractive assets such as money market paper, stocks

and bonds, and may cause gradual portfolio shifts away from monetary assets, possibly reducing the predictability of money demand. In practice, a failure to allow for changes in money demand following financial reform could result in monetary policy that is tighter or looser than planned before the reforms are implemented.

The conventional money demand equation 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 interest on an alternative asset *(i)*:

$$\frac{M}{P}=a+bY+ci+\epsilon \qquad (1)$$

where ϵ is an error term representing money demand shocks. Instability of this error term will weaken the relationship between money holdings and, income and interest rates. The potential instability in money demand will affect the coefficients, mainly b, and c, but also the intercept term a.

In the ASEAN-4, financial liberalization since the mid-1970s has included the deregulation of deposit rates, and the introduction or deepening of alternative monetary instruments, 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 U.S. 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 preceded the development of money and bond markets, although the money markets 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, comprising mostly repos, started to develop in 1979, a full decade before the liberalization of deposit interest rates.

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 "leading" 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 1989-1990, 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 licenses.	Deregulation since 1989 has removed barriers between different types of financial institutions, and allowed finance companies to participate in the interbank market and merchant banks to issue nonnegotiable CDs; Labuan offshore center introduced in 1990, new entry of banks in domestic market remains restricted.	Since late 1960s, free entry, subject to 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 assets, 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 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 to 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 with introduction of rating bureau and Bond Dealers Club. Stock market boomed after establishment of Securities and Exchange Commission in 1992.

Table 1. The ASEAN-4: Financial Liberalization

	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 1989, the Banking and Financial Institutions Act placed all banking institutions under BNM supervision, and strengthened prudential regulation based on the Basle capital framework.	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 late-1960s.	Restrictions on capital inflows are limited (although restrictions on short-term inflows were temporarily introduced in 1994). Capital outflows above certain maxima are subject to approval by BNM.	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 center, was established in 1993, providing foreign currency loans to domestic and foreign businesses.

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 agency in 1990. The Singapore bond market is the largest in the region, but is dominated by foreign bonds—about 98 percent 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.[2]

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 a hundred years, and the market capitalization relative to GDP is the highest among the ASEAN-4. The stock exchange 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.

The financial market reforms and financial developments described above may change the velocity of broad money—in principle, in either direction.[3] Reforms that increase the number of banks, and spur institutional and technological advances such as credit cards, and electronic transfers of deposits or cash machines, can raise the velocity of broad and narrow money, as these developments make it easier to convert money into money substitutes. However, as noted by Bordo and Jonung (1990), in many developing countries, the velocity of broad money may decline over time because of the increasing monetization of the economy or financial deepening. Furthermore, there can be shifts between the various categories of money. As interest rates are liberalized on time deposits, private agents may shift their assets from currency and demand deposits to time deposits, raising the velocity of narrow money, but lowering the velocity of broad money.

For the ASEAN-4 countries, with the exception of Singapore, there has been a marked secular decline in the velocity of broad money (Chart 1). In Singapore, broad money velocity

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[2]For a more detailed discussion of the factors that contributed to the development of bond markets in Thailand, see Callen and Reynolds (1996).

[3]The velocity of money is defined as nominal income divided by the quantity of nominal money.

has declined since 1985, which is somewhat surprising, given the fall in both nominal and real time deposit rates, and the boom in the Singapore Stock Exchange. The velocity of narrow money has been considerably more volatile, particularly in Indonesia and Thailand, although, except in Malaysia, there has not been a trend decline in the velocity of narrow money.

B. The Evolving Monetary Policy Framework

Financial liberalization can affect the choice of targets of monetary policy and the variables that are monitored by central banks to gauge monetary conditions. In an underdeveloped financial market, interest rates tend to be set by administrative controls, and the central bank usually targets quantity variables such as broad money. Following financial liberalization, the stability of monetary aggregates may be reduced. Central banks presiding over relatively advanced financial markets often resort to monitoring price variables such as exchange and interest rates. In many industrial countries, broad money targets are effectively seen as monitoring ranges, with very few central banks attempting to strictly adhere to monetary targets, or base policy actions on deviations of actual money growth from projected growth.

In each of the ASEAN-4 countries, the role of monetary targets in the conduct of monetary policy has been reduced in recent years. This process took place earliest in the case of Singapore, which since the early 1980s has focused primarily on managing the exchange rate as its principal monetary instrument (previously it monitored a variety of intermediate targets, including the monetary base, interest rates and loan growth, as well as exchange rates).[4] However, in recent years it has also been apparent in the other ASEAN-4 countries. In Malaysia, the emphasis of monetary policy shifted during the 1980s from M1 to M2 and then to M3; in recent years, policies have focused more on short-term interest rates although money and credit aggregates are still monitored (Table 2). Similarly, the Bank of Thailand has shifted its policy emphasis from M2 towards commercial bank credit to the private sector and domestic interest rates;[5] and Indonesia, while continuing to set money and credit targets and conduct a reserve money programming exercise, has in practice given increased weight to interest rates.

The shift away from formal monetary targeting has been due to several factors. In the case of Singapore—and increasingly a number of other countries as well—it has reflected the growing difficulties in simultaneously seeking to target the exchange rate and monetary

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[4]The shift in policies in Singapore reflected also recognition of the significant role of the exchange rate in a small and open economy (see MAS (1996)).

[5]Tivakul (1995).

Chart 1. Velocity of Monetary Aggregates

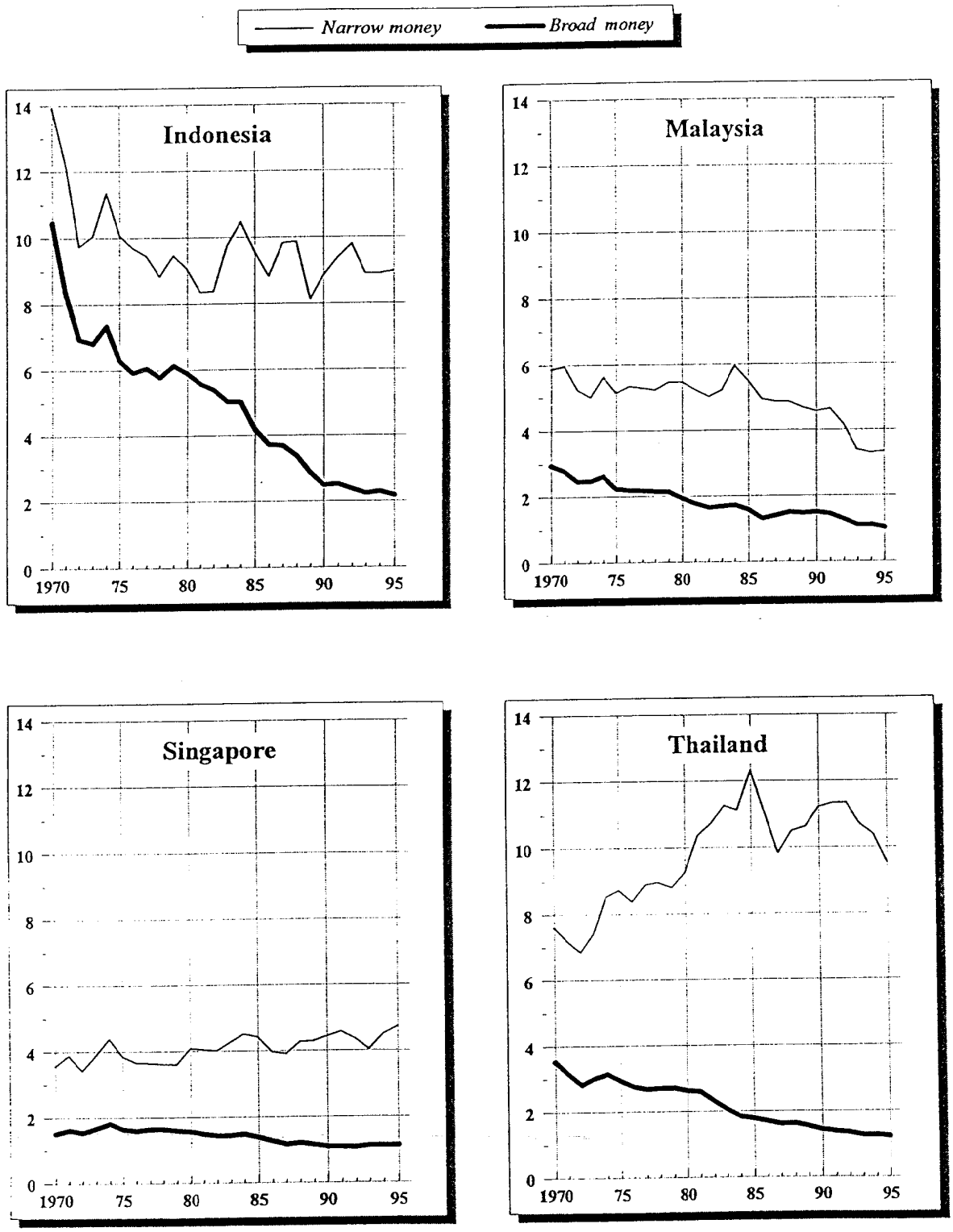

Table 2. The ASEAN-4: Monetary Policy in the 1990s

	Indonesia	Malaysia	Singapore	Thailand
Decision Making Process	The authorities monitor broad money, credit aggregates, as well as reserve money. In addition, the authorities monitor the real value of the rupiah against a basket of currencies.	The short-term operating target is the one month interbank rate, while monitoring money and credit growth and the exchange rate.	The nominal exchange rate is managed to maintain low inflation. There are no money, credit, or interest rate targets.	The baht is pegged to an undisclosed basket of currencies. The short-term operating target is the interbank rate; an overall target for private credit is set in the credit plan.
Main Instruments	Open Market Operations involving Bank Indonesia paper (SBIs) and commercial bank paper (SBPUs). Reserve Requirements. Foreign Exchange Operations.	Reserve requirements. Direct lending and borrowing from the interbank market. Sales of Bank Negara bills. Shift of government and Provident fund deposits to Bank Negara.	Foreign exchange operations.	Repurchase operations. Sales of Bank of Thailand bonds. The credit plan.
Recent Reforms in Monetary Instruments	No major changes since introduction of SBIs in February 1984 and SBPUs in February 1985.	Introduction in 1993 of Bank Negara bills.	No major changes in recent years.	Reintroduction in 1995 of Bank of Thailand bonds.

aggregates in increasingly open economies.[6] But it has also reflected concerns that the demand for money may have become more unstable as financial liberalization has accelerated, and thus a less reliable guide to policy formulation.

The instruments of monetary policy have depended on the maturity and depth of financial and capital markets, and the flexibility of interest rates. There has been greater reliance on open-market operations to affect short-term interest rates as financial markets have developed, and, in general, a move away from achieving broad money targets by limiting bank lending through moral suasion, or through changes in reserve requirements.

Since the 1980s, Indonesia, Malaysia, and Thailand have tried to introduce or to intensify the use of open-market operations (Table 2). The absence in the early 1980s of government debt instruments in these countries meant that the shift to open market operations was accompanied by the issuance of the central banks' own debt instruments. To date, however, only Indonesia has a short-term paper market of sufficient depth to conduct traditional open market-type operations. Normally, when tightening monetary conditions, Bank Negara Malaysia raises reserve requirements or borrows directly from the interbank market, and the Bank of Thailand sells repos or Bank of Thailand paper.

Singapore's monetary policy, in contrast, is implemented through foreign exchange operations, with the Monetary Authority of Singapore (MAS) selling foreign exchange for Singapore dollars to achieve a steady appreciation of the nominal exchange rate. Although treasury bills are auctioned and yields are competitively determined, the MAS does not carry out traditional open market operations. Official exchange rate intervention is able to exert a stronger influence on the nominal exchange rate because various regulations, such as limits on bank lending in Singapore dollars, have prevented the Singapore dollar from being widely held by foreigners.

III. Empirical Estimates of Money Demand Equations

The estimation of money demand has a long history, but it is only recently that cointegration techniques have been applied. In conventional money demand equations, such as (1), if M/P, Y, and i, are cointegrated, then in the long-run movements in these variables will be closely related. If some shock drives the long-run relationship between money, real income, and the opportunity cost of money out of equilibrium, there will be a tendency for real money balances to adjust, and for these variables to move together again. Thus the existence of a cointegrating relation means that in the long-run, the economy will return to some stable relationship between money, income, and the opportunity cost of money. Without a proper understanding of the structural parameters of the long-run money demand equation, it is

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[6]Indonesia widened its exchange rate band to 8 percent in September 1996, thereby increasing monetary autonomy.

possible that policymakers react to an adverse shock to real income, for example, by an excessive easing of monetary conditions, leading to inflation that is higher than targeted.

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 that there is a cointegrating vector containing money, income, and interest rates. The test for this 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 no cointegration. In principle, there may, of course, be more than one cointegrating vector between these variables. In such cases, given the issue that is of immediate interest, we focus only on the vector that has money on the left hand side (normalized on M/P), although in practice, in all the countries considered here, this problem did not arise. Details of the estimation procedure are provided in Appendix I, and variable definitions and data sources are provided in Appendix II.

A. Results

The estimation results, presented in Table 3, by and large, do not provide strong evidence of stable relationships.[7] We find stable demand equations with reasonable coefficients for real narrow and broad money only in Malaysia (and even here, coefficients on key variables are statistically insignificant). Overall, these results suggest that it is difficult to obtain stable real money demand functions using only the conventional determinants—real income, and interest rates. Alternative specifications have not been explored because the focus here is on the relatively narrow question of whether there is a stable relation between money, income and interest rates that could provide the basis for a particular monetary policy framework.[8]

1. Summary of Nominal Money Demand Results

Prior to estimating real money demand, we estimated nominal money demand equations of the form $M=\alpha+bY+ci+dP+\epsilon$ to test if the coefficient 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. The results are shown in Appendix I. We reject the assumption that d is equal to one for nominal narrow money in Singapore, and nominal broad money in Malaysia, Singapore, and Thailand. However, to estimate real money demand, we impose the restriction that d is one

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[7]All money demand equations in this paper are estimated on annual data.

[8]There may, of course, be a stable relationship between money and some components of consumer price indices.

Table 3--ASEAN-4: Estimates of Real Money Demand Elasticities

	Indonesia		Malaysia		Singapore		Thailand	
	Narrow	Broad	Narrow	Broad	Narrow	Broad	Narrow	Broad
GDP	1.51	1.39	1.18	1.56	0.88	1.20	1.0	1.26
	(4.98)	(7.68*)	(4.93*)	(4.52*)	(17.35*)	(17.35*)	(8.62*)	(0.78)
Time Deposit Rate 1/	0.01	...	-0.076	...	...	...	-0.079	
	(0.32)		(16.53*)				(15.89*)	
Call Money-Broad Money Return 1/	...	-0.017	...	-0.068	...	...	...	-1.0
		(4.34)		(3.74)				(7.2*)
Broad Money Return 1/	...	...	...	...	...	0.028	...	...
						(6.21*)		
Foreign Return 1/	...	...	...	...	-0.0033	-0.021	...	...
					(0.75)	(0.75)		
Dummy 1983	0.38	0.38	...	...	...	...	...	...
	(2.39)	(18.96*)						
Dummy 1988	-0.09	0.52	...	...	...	...	...	...
	(0.12)	(21.88*)						
Sample Period	1974-1995		1976-1995		1975-1995		1978-1995	
Maximal Eigenvalue Statistic 2/ 3/	18.1	31.2	21.4*	17.6	18.9	23.2	19.5	13.0
Trace Eigenvalue Statistic 2/ 3/	33.1	46	25.6	32.6*	22.6	35.7	26.4	20.1
Stable?	No	No	Yes	Yes	No	No	No	No

Note: Estimated by Johansen's (1988) method, with one lag.
All variables except for interest rates are in logarithms.
chi-squared tests for statistical significance in parentheses
* denotes significant at 5% level
1/ Semi-elasticity.
2/ Eigenvalue tests for the null hypothesis that there are no cointegrating vectors.
The eigenvalue statistics are adjusted for degrees of freedom (Reimers, 1992).
3/ Critical values for Indonesia, which are inclusive of two dummy variables, are simulated. For the other countries, critical values are from Osterwald-Lenum (1992).

since the rejection could be a result of sample specific factors.[9] 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.

2. Real Narrow Money

In Indonesia, Thailand, and Singapore we are unable to find a stable relationship between real narrow money[10] and its conventional determinants, real GDP, and an opportunity cost variable—typically the time-deposit rate. This is perhaps not surprising for Indonesia and Thailand, which have experienced substantial financial reform from the 1980s to the present. (In Indonesia, the inclusion of dummy variables to capture the effects of the 1983 and 1988 financial liberalization episodes, does not help in achieving stability.) For Singapore, the freeing of interest rates and other major reforms were almost completed by the beginning of our sample, 1975.[11] Thus, the instability of narrow money demand is probably related more to the financial innovations that were common to all international financial centers in the 1980s—the greater use of credit cards, electronic transfers, and the introduction of mutual funds with checking accounts, enabling Singaporeans to economize on narrow money holdings. The difficulty in finding stable money demand functions in a number of industrial countries, such as the United Kingdom, the United States, and Australia over the 1980s and early 1990s is often attributed to similar, albeit more widespread institutional and technological innovations. It is noteworthy that Malaysia, where reforms have been less extensive than in Indonesia and Thailand, and where financial markets are less developed than in Singapore, is the only country among the ASEAN-4 with a stable narrow money demand function.

Previous research on the stability of narrow money demand in the ASEAN-4 is limited, but, in general, has had more success in finding stability. The differences between the earlier work and the results reported here can be attributed partly to different sample periods and to differences in specification and estimation techniques but, as explained in more detail in Appendix I, some previous studies have not corrected the test statistics for the small sample

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[9]There are several reasons why the statistical tests may reject unit price homogeneity over our sample period. First, as an 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.

[10]Real narrow money is defined as currency plus demand deposits divided by the CPI.

[11]In Singapore, where domestic residents have substantial scope for investing in dollar-denominated assets, instead of the time-deposit rate as the opportunity cost variable, we include a variable that represents the rate of return that domestic residents can earn on dollar assets. Dollar asset returns are approximated as LIBOR minus the expected depreciation of the U.S. dollar against the Singapore dollar.

size, and may therefore have erroneously rejected the null hypothesis of no cointegration. Using data only up to 1989, Tseng and Corker (1991) found that real narrow money demands were stable for Indonesia, Malaysia, and Singapore, but unstable for Thailand. Using a very different specification, Hataiseree (1994) estimated that real narrow money, real income, and nominal interest rates were cointegrated for Thailand.[12] Price and Insukundro (1994) and Arize (1994) found stability for narrow money in Indonesia and Singapore, using somewhat different estimation methods than that adopted here.[13]

3. Real Broad Money

The estimated real broad money equations are unstable for the ASEAN-4, except for Malaysia (Table 3).[14] For Malaysia, the elasticity of real broad money with respect to real income is higher than that for real narrow money, but the opportunity cost semi-elasticity, although reasonable, is statistically insignificant.[15] 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.[16] 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 all reasonable, we fail to achieve cointegration for Indonesia, Singapore, and Thailand.

It is somewhat surprising that the results for real broad money are not better than those for real narrow money. The freeing of time-deposit rates should mainly cause a shift from one component of broad money to another, from narrow to quasi-money. These instabilities in real broad money demands may, therefore, reflect the growth of money alternatives such as stocks and money market instruments. Equity markets grew very rapidly in the 1980s in Indonesia and Thailand, and firms and individuals in these countries, as a

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[12]Hataiseree appended a goods market equation (the investment-saving relation) to the money demand equation.

[13]Both studies used the error-correction specification. We would have pursued a similar procedure had we been more successful in finding stable long-run relationships.

[14]Real broad money is defined as nominal broad money (narrow money plus quasi-money, time and saving deposits) divided by the CPI.

[15]The demand for broad money depends on the desire to hold money as an asset, in addition to holding money for transactions purposes. Since wealthier agents accumulate more assets, we would expect the elasticity for broad money to be higher than that for narrow money.

[16]The return on broad money is equal to the time-deposit rate times the share of quasi-money in broad money.

result, may have changed their money holding behavior. In contrast, in Malaysia, the equity market was well entrenched by the beginning of our sample.

Previous research on the stability of real broad money demand in the ASEAN-4 is again limited. However, consistent with our results, the earlier work has had greater difficulty in finding stability for real broad money than for real narrow money. Among the ASEAN-4, using the period up to 1989, Tseng and Corker (1991) found broad money stability only for Indonesia. Hataiseree (1994) and Arize (1994) using specifications and estimation methods different from ours and Tseng and Corker's, found stability for Thailand and Singapore.

IV. 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. If money demand behavior is not predictable, however, monetary authorities face the difficulty of not knowing whether "excess" money growth reflects an underlying shift in the private sector's desire to hold money balances, or whether the actual money holding is temporarily above what private agents would wish to hold over the long term.

During the 1980s, many industrial countries such as Canada, the United Kingdom, the United States, and a number of countries in continental Europe faced similar policy dilemmas. Following deregulation of financial markets in the late 1970s and early 1980s, a number of these countries experienced rapid growth of financial markets, which was also spurred by continuing advances in underlying transaction technologies. Money demand instability effectively implied that money growth rates were poor predictors of future inflation and output trends.[17] The dilemma for policymakers is to decide on how much policy actions should be constrained by pre-announced targets. If money growth rates are not good leading indicators of future inflation, then it may be preferable to abandon them as intermediate targets, or as many industrial countries did, downgrade them as one of a set of variables that policymakers regularly monitor.[18]

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[17]For an extensive survey of financial innovation and the implications for monetary policy in industrial countries, see Goodhart (1989).

[18]Some central banks in industrial countries--for example the U.K. and the U.S.—have periodically published and monitored weighted monetary aggregates, such as the Divisia index where monetary assets are assigned weights that reflect differences in the transactions services provided by different components of monetary aggregates. The Bank of England currently

(continued...)

For some of the ASEAN countries that are currently faced with similar uncertainty regarding money growth, there is the potentially difficult judgment to be made about how much emphasis to place on intermediate targets. If money targets are announced, but policy actions are not seen to be based on money growth because specific episodes of "excess" money growth are judged not to indicate inflation pressures, there is a risk that credibility of policies could be undermined. Against this concern, policymakers also have to weigh the reduced effectiveness of policies if money growth and inflation are not closely related. Indeed, as discussed in Section II, a number of countries have reduced the emphasis on strictly adhering to monetary targets.

But moving away from a monetary targets framework raises the question of whether there is an alternative yardstick by which monetary conditions can be assessed. If there is no single variable that can be used as an intermediate target, either because of an unstable relationship with economic activity, or because those that are closely related to the state of the economy cannot be directly influenced by central bank actions, then the assessment of monetary conditions and policy actions will necessarily be based on monitoring a range of indicators. In practice, of course, all central banks monitor a wide set of variables, including some real sector variables that can only be influenced indirectly. The challenge for policymakers is to ensure that, in the absence of an explicit intermediate target, credibility of the central bank's resolve to maintain low inflation is sustained. When the assessment of monetary conditions is based on a range of indicators, there is always a risk that policy inaction could be seen as a weakening in the anti-inflation stance. While policies must demonstrate consistency, transparency of the monetary policy decision making process is also important to provide more information to market participants about the rationale for policy actions.

It is sometimes argued that if countries cannot pursue money-based disinflation strategies, the operation of monetary policy could be simplified by adopting an exchange rate target. In terms of the decision making process, an exchange target is perhaps the most simple to operate; central banks are only required to maintain a fixed rate either with respect to a basket of trading partner currencies, or vis-à-vis a single major foreign currency. However, the benefits of fixed exchange rates are stongest for countries that lack credibility and have a history of relatively high inflation. In the ASEAN-4, which have maintained macroeconomic stability and relatively low inflation rates, the benefits of a pegged exchange rate in terms of stability must be weighed against other considerations, including the greater difficulties of

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[18](...continued)
publishes a Divisia broad money aggregate. For details of how this index is constructed and how it compares with conventional simple-sum aggregates, see Fisher et al (1993). See also, Pill and Pradhan (1994) for a discussion of why, despite their strong theoretical foundation, especially in periods of rapid financial changes, such indices have failed to gain widespread acceptance among policymakers.

managing capital inflows and other real shocks. In particular, reduced monetary autonomy weakens the ability to control inflation.

An alternative approach, when there is no suitable intermediate target variable that can be predictably influenced by policy and has a close relationship with inflation, is to target inflation directly. The instruments available to the monetary authorities and the objectives of monetary policy—maintaining low inflation—are exactly similar under both approaches. Indeed when comparing the operation of monetary policy in countries that have explicit inflation targets with those that frame policy decisions around intermediate targets, the difference may be more semantic than economic. Policy objectives are in most cases specified in terms of price stability.

If inflation targeting is not very different from targeting intermediate variables, what then are the benefits of moving toward explicit inflation targets, and with respect to the ASEAN countries, what would be the requirements to pursue this approach? The empirical analysis of money demand behavior in Section III, establishes only that strict adherence to intermediate targets on monetary aggregates may not be desirable in the ASEAN-4 countries, but it does not provide sufficient evidence to determine whether inflation targets would be beneficial and also whether they would be feasible in these countries. To address these issues requires further research on the underlying determinants of inflation and on the variability of inflation. Nevertheless, it is helpful to consider the benefits of inflation targeting in a general context and the key ingredients of this approach.

In countries that have adopted inflation targets, the formulation of explicit medium-term price objectives has helped to fill an important gap following the abandonment of monetary targets, and in some cases exchange rate targets. When monetary policy assessments are based on a range of indicators, or when policy is framed around intermediate targets, there may be a tendency for the policy framework to lack an explicit forward-looking element. Moreover, private agents may find it difficult to gauge the policy stance when actions of the authorities are based on a complex feedback rule. This is essentially a presentational problem that can undermine credibility. Inflation targets help get round this presentational problem by forcing the authorities to base policy actions on their forward-looking assessment of inflation. Furthermore, because central banks find it easier to justify policy actions by making public their assessment of future inflation, this also helps to enhance the credibility of polices.

The adoption of inflation targets is not, however, costless. By definition, forward-looking assessments are subject to wide margins of uncertainty. Forecasting errors in inflation projections typically tend to be relatively large.[19] This in effect gives rise to a trade-off between flexibility and credibility. To ensure that targets are met, central banks may define a relatively large inflation target band, but this will not enhance credibility of policies. Thus,

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[19]Debelle and Stevens (1995) find that in Australia, 95 percent confidence intervals around one year ahead inflation projections are about 5 percentage points.

with respect to the ASEAN-4 countries, an important prerequisite is to model the inflation process and to examine both the magnitude and the source of forecast errors. If, for example, an economy is subject to frequent supply or structural shocks, actual inflation may deviate significantly from the target range. In such circumstances, it may well be appropriate for monetary authorities not to tighten conditions, but this could result in some loss of credibility. Although the economic structure of the ASEAN-4 countries is diverse, sector specific shocks may still have strong economy-wide effects, and these issues need to be investigated in greater detail to establish the desirability of an explicit inflation targeting approach.

Money Demand Estimation for ASEAN-4

The estimates reported in Table 3 in the text are derived from the Johansen maximum likelihood tests for cointegration between money, prices, real income, and interest rates. To ascertain the order of integration of these variables (i.e., whether the levels are stationary or whether their first differences are stationary), Table A1 presents Augmented Dickey-Fuller (Dickey and Fuller (1981)) statistics for unit root tests on log-levels of money, prices and income, and on the level of interest rates. These test statistics suggest that most of these 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—it is difficult to accept in an economic sense that these variables would be I(2) in the long run. 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).[20]

A. Cointegration

Tables A2a-A2d report the estimates and the associated test statistics for cointegration between money, prices, real income, and the opportunity cost variables for each of 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 maximum eigenvalue statistics are from Osterwald-Lenum (1992), except for Indonesia (see below). Miyao (1996) shows, on the basis of simulations of U.S. money demand equations, that there are substantial size distortions in the Johansen (1988) procedure. Using conventional critical values, the Johansen test tends to reject the null hypothesis of no cointegration too rarely (Reimers, 1992)). To partly address this size problem, we apply a simple small sample correction to the eigenvalues by multiplying both eigenvalue statistics by T-n*m, instead of T, where T is the sample size, n is the number of endogenous variables, and m is the number of lags (m=1 in all the estimates reported in Tables A2a-A2d).

For Indonesia, two 0,1 dummy variables are included to capture the effects of the major financial reforms in 1983 and in 1988. The corresponding critical values are simulated since published critical values are not available for the Johansen procedure when the

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[20]A number of other authors also use this assumption when faced with ambiguities about time series properties of variables. See, for example, Ericsson and Sharma (1996).

estimation includes dummy variables.[21] These critical values are simulated by the following sequence. First, 22 random observations—equal to the sample size—are simulated, corresponding to each of our endogenous variables. These variables are regressed on a constant and two dummy variables, and the residuals from this regression are used to form the sample moments that asymptotically converge to the standard Wiener processes involved in the expressions for the Johansen procedure. Using these expressions, we form the approximate limiting distributions of the maximum and trace eigenvalue statistics; 10,000 replications are generated to approximate the limiting distribution from which we can find the 5 percent critical values.

With the above small sample eigenvalue corrections and critical values, it is more difficult to reject the null of no cointegration. The estimates of the long-run cointegrating vector are reported in Table A2a-A2d, including in cases where we cannot find cointegration. It should be noted, however, that a number of other studies using the Johansen procedure with limited samples do not correct the critical values for the sample size, and this may lead to rejecting the null hypothesis (no cointegrating vectors) too often. If, as in earlier studies, we use conventional asymptotic critical values, the null of no cointegration can be rejected far more often in the present estimates as well. However, this procedure is clearly not valid, and we therefore conclude that in most cases conventional money demand equations do not cointegrate.

With the exception of Malaysia, our results imply that the null hypothesis of no cointegration cannot be rejected. Although some nominal money demand equations do cointegrate, equations with real money on the left hand side do not, and moreover, a number of coefficients have the wrong sign suggesting that these behavioral relations are poorly determined. As a result, for most countries, it would not be valid to proceed further either with testing for exogeneity of right hand side variables or with modeling the short-run adjustment processes.

In **Indonesia**, the null of no cointegration cannot be rejected for any of the money demand specifications including when the differential between the foreign return and the domestic return on broad money (FOR-RET) is used as the opportunity cost variable.

In **Malaysia**, we can reject the null hypothesis of no cointegration for real narrow money, nominal broad money, and real broad money. For real narrow money, the coefficients on LGDP and TIME are significant and of reasonable magnitude—a 1 percent increase in GDP raises the demand for real narrow money by 1.18 percent. For nominal broad money, surprisingly, the constraint of unit price homogeneity is rejected and also the coefficient on LGDP is well below unity. In the real broad money equation, although the coefficients are reasonable, none are statistically significant. When the foreign interest rate is substituted for the money market rate it has the predicted negative effect, but the own rate does not exert the

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[21]We are very grateful to John McDermott for simulating these small sample critical values.

predicted positive effect. Moreover, in both the narrow money and broad money equations, income and interest rate variables are not weakly exogenous, suggesting that the relationship between these variables may not be uni-directional—in a statistical sense, movements in income, for example, may lead movements in monetary aggregates.

In **Singapore**, only the equations for nominal narrow and broad money cointegrate. For nominal narrow money, the coefficient on the foreign interest rate appears reasonable, while the coefficient on real GDP is rather small. The hypothesis that the coefficient on LCPI is unity can be rejected at a very high level of significance. For nominal broad money, the coefficients are not plausible—both the domestic and foreign returns have the wrong signs.

In **Thailand**, only the equation for nominal narrow money cointegrates with plausible coefficient signs and magnitudes, and the test for unit elasticity on LCPI cannot be rejected.

Data Construction and Sources

Interest rates

The opportunity cost of holding narrow money is proxied by the rate of return on time deposits, while the opportunity cost of holding broad money is proxied by the money market rate less the time deposit rate weighted 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 narrow and broad money is proxied by the three–month dollar LIBOR (the London Interbank Offer Rate) minus (plus) 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 five-year moving average of actual exchange rate changes. For consistency, similar foreign interest rate variables are included in the empirical money demand equations for the other ASEAN countries.

Source: *International Financial Statistics (IFS)*, lines 60b and 60l.

Monetary Aggregates

All data on narrow money and on broad money (quasi-money), with the exception of Indonesia since 1988, are taken from IFS--lines 34 and 35. For Indonesia, post-1988 data on monetary aggregates are from Bank Indonesia.

Output and Prices

Data on nominal and real GDP, and consumer price indices for all countries are from IFS—lines 99b, 99b.p, and 64, respectively.

Table A1
ADF Statistics for Testing for a Unit Root

Indonesia	LGDP	TIME	RET	CMR	FOR	LRNM	LRBM	LNM	LBM	LCPI
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 1/	-4.32*	-3.13 *	-4.02 *	-3.78 *	-2.96 1/	-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 2/	-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 3/	...	-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 4/	-2.85* 5/	-4.26*	-3.42 5/	-2.58 6/	-3.41 1/	-3.35 2/	-3.63 2/	-4.50*	-3.72*

* denotes rejection at the 5% level.
1/ Critical Value is -3.63.
2/ Critical Value is -3.69.
3/ Critical Value is -3.79.
4/ Critical Value is -3.66.
5/ Critical Value is -3.83.
6/ Critical Value is -3.29.

Notes: 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.

Table A2a
Cointegration Analysis of Money Demand in Indonesia

I. Nominal Narrow Money
(1974-1995)

Hypotheses	r=0	r<=1	r<=2	r<=3
L(max)	25.0	17.7	11.3	3.6
95% cr. val.	57.2	36.9	18.3	7.1
L(trace)	57.7	32.6	14.9	3.6
95% cr. val.	99.5	55.3	23.0	7.1

Coefficients

LGDP	TIME	LCPI	1983D	1988D
13.4	0.2	11.6	2.1	-2.3

Weak Exogeneity Test Statistic

	LGDP	TIME	LCPI
Chi-sq.(1)	0.7	1.2	10.7*

Statistics for testing the significance of a given variable

	LGDP	TIME	LCPI	1983D	1988D
Chi-sq.(1)	1.1	3.8	2.01	0.76	0.08

Statistic for testing whether coefficient on LCPI = 1

Chi-sq.(1)	0.25

II. Real Narrow Money
(1974-1995)

Hypotheses	r=0	r<=1	r<=2
L(max)	18.1	10.6	4.9
95% cr. val.	36.9	18.3	7.1
L(trace)	33.1	15.0	4.5
95% cr. val.	55.3	23.0	7.1

Coefficients

LGDP	TIME	1983D	1988D
1.51	0.011	0.38	-0.09

Weak exogeneity test statistics

	LGDP	TIME
Chi-sq.(3)	0.08*	3.73*

Statistics for testing the significance of a given variable

	LGDP	TIME	1983D	1988D
Chi-sq.(3)	4.98	0.32	2.39	0.12

Cointegration Analysis of Money Demand in Indonesia (Continued)

III. Nominal Broad Money
(1974-1995)

Hypotheses	r=0	r<=1	r<=2	r<=3
L(max)	35.6	21.3	9.5	7.9
95% cr. val.	57.2	36.9	18.3	7.1
L(trace)	74.3	38.7	17.5	7.9
95% cr. val.	99.5	55.3	23.0	7.1

Coefficients

LGDP	CMR-RET	LCPI	1983D	1988D
0.76	0.036	0.79	0.83	1.01

Weak exogeneity test statistics

	LGDP	CMR-RET	LCPI
Chi-sq.(1)	2.40	1.67	10.51

Statistics for testing the significance of a given variable

	LGDP	CMR-RET	LCPI	1983D	1988D
Chi-sq.(1)	7.17*	6.08	12.48*	19.10*	20.27*

Statistic for testing whether coefficient on LCPI = 1

Chi-sq.(1)	0.83

IV. Real Broad Money
(1974-1995)

Hypotheses	r=0	r<=1	r<=2
L(max)	31.2	8.9	2.9
95% cr. val.	36.9	18.3	7.1
L(trace)	46.0	14.9	2.9
95% cr. val.	55.3	23.0	7.1

Coefficients

LGDP	CMR-RET	1983D	1988D
1.39	-0.017	0.38	0.52

Weak exogeneity test statistics

	LGDP	CMR-RET
Chi-sq.(1)	0.09	3.45

Statistics for testing the significance of a given variable

	LGDP	CMR-RET	1983D	1988D
Chi-sq.(1)	7.68*	4.34	18.96*	21.88*

Cointegration Analysis of Money Demand in Indonesia (Continued)

V. Real Broad Money (Foreign Interest Rate)
(1974-1995)

Hypotheses	r=0	r<=1	r<=2
L(max)	25.0	11.2	2.6
95% cr. val.	36.9	18.3	7.1
L(trace)	38.9	13.8	2.6
95% cr. val.	55.3	23.0	7.1

Coefficients

LGDP	FOR-RET	1983D	1988D
1.16	-0.19	0.80	0.32

Weak exogeneity test statistics

	LGDP	FOR-RET
Chi-sq.(1)	12.27*	0.0004

Statistics for testing the significance of a given variable

	LGDP	FOR-RET	FOR	1983D	1988D
Chi-sq.(1)	7.98*	10.35*	21.43*	20.81*	6.27

Notes:

1. The vector autoregression includes one lag on each variable.
2. The statistics L(max) and L(trace) are Johansen's maximal eigenvalue and trace eigenvalue statistics for testing cointegration.
3. The weak exogeneity and significance test statistics are evaluated under the assumption that rank=n and are therefore, asymptotically distributed as Chi-sq.(n).
4. Critical Values are simulated, since standard tables do not exist in the presence of step dummy variables. We thank John McDermott for these simulations.
   * denotes significance at the 5% level.
5. All monetary aggregates are expressed in logs.
6. 1983D and 1988D are dummy variables which take on values of unity after 1983 and 1988.

Table A2b
Cointegration Analysis of Money Demand in Malaysia

I. Nominal Narrow Money
(1976-1995)

Hypotheses	r=0	r<=1	r<=2	r<=3
L(max)	20.4	16.6	5.5	1.4
95% cr. val.	27.1	21.0	14.1	3.8
L(trace)	44.0	23.6	7.0	1.4
95% cr. val.	47.2	29.7	15.4	3.8

Coefficients

LGDP	TIME	LCPI
1.66	-0.10	0.45

Weak exogeneity test statistics

	LGDP	TIME	LCPI
Chi-sq.(1)	4.79*	2.46	0.0004

Statistics for testing the significance of a given variable

	LGDP	TIME	LCPI
Chi-sq.(1)	1.1	4.62*	0.03

Statistic for testing whether coefficient on LCPI = 1

Chi-sq.(1)	0.25

II. Real Narrow Money
(1976-1995)

Hypotheses	r=0	r<=1	r<=2
L(max)	21.4*	2.4	1.7
95% cr. val.	21.0	14.1	3.8
L(trace)	25.6	4.1	1.7
95% cr. val.	29.7	15.4	3.8

Coefficients

LGDP	TIME
1.18	-0.076

Weak exogeneity test statistics

	LGDP	TIME
Chi-sq.(1)	20.71*	6.8*

Statistics for testing the significance of a given variable

	LGDP	TIME
Chi-sq.(1)	4.93*	16.53*

Cointegration Analysis of Money Demand in Malaysia (Continued)

III. Nominal Broad Money
(1976-1995)

Hypotheses	r=0	r<=1	r<=2	r<=3
L(max)	29.7*	15.3	5.7	0.03
95% cr. val.	27.1	21.0	14.1	3.8
L(trace)	50.8*	21.1	5.8	0.03
95% cr. val.	47.2	29.7	15.4	3.8

Coefficients

LGDP	CMR-RET	LCPI
0.35	-0.07	3.29

Weak exogeneity test statistics

	LGDP	CMR-RET	LCPI
Chi-sq.(1)	2.4	3.1	2.72

Statistics for testing the significance of a given variable

	LGDP	CMR-RET	LCPI
Chi-sq.(1)	1.4	16.05*	11.91*

Statistic for testing whether coefficient on LCPI = 1

Chi-sq.(1)	11.4*

IV. Real Broad Money
(1976-1995)

Hypotheses	r=0	r<=1	r<=2
L(max)	17.6	12.2	2.8
95% cr. val.	21.0	14.1	3.8
L(trace)	32.6*	15.0	2.8
95% cr. val.	29.7	15.4	3.8

Coefficients

LGDP	CMR-RET
1.56	-0.068

Weak exogeneity test statistics

	LGDP	CMR-RET
Chi-sq.(1)	4.52*	3.32

Statistics for testing the significance of a given variable

	LGDP	CMR-RET
Chi-sq.(1)	1.69	3.74

Cointegration Analysis of Money Demand in Malaysia (Continued)

V. Real Broad Money (Foreign Interest Rate)
(1976-1995)

Hypotheses	r=0	r<=1	r<=2	r<=3
L(max)	22.2	13.2	11.3	0.3
95% cr. val.	27.1	21.0	14.1	29.7
L(trace)	47.1	24.5	11.6	0.3
95% cr. val.	47.2	29.7	15.4	3.8

Coefficients

LGDP	RET	FOR
1.55	-0.0044	-0.0092

Weak exogeneity test statistics

	LGDP	RET	FOR
Chi-sq.(1)	2.44	1.45	0.05

Statistics for testing the significance of a given variable

	LGDP	RET	FOR
Chi-sq.(1)	9.38*	0.07	2.25

Notes

1. The vector autoregression includes one lag on each variable.
2. The statistics L(max) and L(trace) are Johansen's maximal eigenvalue and trace eigenvalue statistics for testing cointegration, adjusted for degrees of freedom, (Reimers, 1992).
3. The weak exogeneity and significance test statistics are evaluated under the assumption that rank=n and are therefore, asymptotically distributed as Chi-sq.(n).
4. Critical Values are from Osterwald-Lenum (1992).
   * denotes significance at the 5% level.
5. All monetary aggregates are expressed in logs.

Table A2c

Cointegration Analysis of Money Demand in Singapore

I. Nominal Narrow Money

(1975-1995)

Hypotheses	r=0	r<=1	r<=2	r<=3
L(max)	30.8*	10.7	4.7	0.0028
95% cr. val.	27.1	21.0	14.1	3.8
L(trace)	46.3	15.5	4.8	0.0028
95% cr. val.	47.2	29.7	15.4	3.8

Coefficients

LGDP	FOR	LCPI
0.62	-0.017	1.62

Weak exogeneity test statistics

	LGDP	FOR	LCPI
Chi-sq.(1)	3.95*	0.088	7.56*

Statistics for testing the significance of a given variable

	LGDP	FOR	LCPI
Chi-sq.(1)	7.90*	11.34*	22.63*

Statistic for testing whether coefficient on LCPI = 1

Chi-sq.(1)	15.06*

II. Real Narrow Money

(1975-1995)

Hypotheses	r=0	r<=1	r<=2
L(max)	18.9	3.6	0.0055
95% cr. val.	21.0	14.1	3.8
L(trace)	22.6	3.7	0.0055
95% cr. val.	29.7	15.4	3.8

Coefficients

LGDP	FOR
0.88	-0.0033

Weak exogeneity test statistics

	LGDP	FOR
Chi-sq.(1)	5.17*	0.85

Statistics for testing the significance of a given variable

	LGDP	FOR
Chi-sq.(1)	17.35*	0.75

Cointegration Analysis of Money Demand in Singapore (Continued)

III. Nominal Broad Money
(1975-1995)

Hypotheses	r=0	r<=1	r<=2	r<=3	r<=4
L(max)	37.9*	23.9	9.9	8.1	0.10
95% cr. val.	33.5	27.1	21.0	14.1	3.8
L(trace)	79.9*	42.0	18.1	8.2	0.10
95% cr. val.	68.5	47.2	29.7	15.4	3.8

Coefficients

LGDP	RET	FOR	LCPI
5.42	-0.52	0.13	-9.50

Weak exogeneity test statistics

	LGDP	FOR	RET	LCPI
Chi-sq.(1)	0.68	7.62*	0.42	26.8*

Statistics for testing the significance of a given variable

	LGDP	FOR	RET	LCPI
Chi-sq.(1)	0.67	31.7*	10.9*	7.56*

Statistic for testing whether coefficient on LCPI = 1

Chi-sq.(1)	26.75*

IV. Real Broad Money
(1975-1995)

Hypotheses	r=0	r<=1	r<=2	r<=3
L(max)	23.2	7.9	4.3	0.10
95% cr. val.	27.1	21.0	14.1	3.8
L(trace)	35.7	12.4	4.5	0.10
95% cr. val.	47.2	29.7	15.4	3.8

Coefficients

LGDP	RET	FOR
1.2	0.028	-0.021

Weak exogeneity test statistics

	LGDP	RET	FOR
Chi-sq.(1)	5.17*	1.20	0.85

Statistics for testing the significance of a given variable

	LGDP	RET	FOR
Chi-sq.(1)	17.35*	6.21*	0.75

Notes

1. The vector autoregression includes one lag on each variable.
2. The statistics L(max) and L(trace) are Johansen's maximal eigenvalue and trace eigenvalue statistics for testing cointegration, adjusted for degrees of freedom, Reimers (1992).
3. The weak exogeneity and significance test statistics are evaluated under the assumption that rank=n and are therefore, asymptotically distributed as Chi-sq. (n).
4. Critical Values are from Osterwald-Lenum (1992).
   * denotes significance at the 5% level.
5. All monetary aggregates are expressed in logs.

Table A2d
Cointegration Analysis of Money Demand in Thailand

I. Nominal Narrow Money
(1978-1995)

Hypotheses	r=0	r<=1	r<=2	r<=3
L(max)	22.3	18.2	6.1	0.74
95% cr. val.	27.1	21.0	14.1	3.8
L(trace)	47.4*	25.1	6.9	0.74
95% cr. val.	47.2	29.7	15.4	3.8

Coefficients

LGDP	TIME	LCPI
1.13	-0.0093	0.67

Weak exogeneity test statistics

	LGDP	TIME	LCPI
Chi-sq.(1)	5.28*	2.62	0.026

Statistics for testing the significance of a given variable

	LGDP	TIME	LCPI
Chi-sq.(1)	4.26*	0.24	3.98*

Statistic for testing whether coefficient on LCPI = 1

Chi-sq.(1)	1.63

II. Real Narrow Money
(1978-1995)

Hypotheses	r=0	r<=1	r<=2
L(max)	19.5	6.0	0.86
95% cr. val.	21.0	14.1	3.8
L(trace)	26.4	6.9	0.86
95% cr. val.	29.7	15.4	3.8

Coefficients

LGDP	TIME
1.00	-0.079

Weak exogeneity test statistics

	LGDP	TIME
Chi-sq.(1)	5.78*	0.88

Statistics for testing the significance of a given variable

	LGDP	TIME
Chi-sq.(1)	8.62*	15.89*

Cointegration Analysis of Money Demand in Thailand (Continued)

III. Nominal Broad Money
(1978-1995)

Hypotheses	r=0	r<=1	r<=2	r<=3
L(max)	25.3	13.0	10.0	0.22
95% cr. val.	27.1	21.0	14.1	3.8
L(trace)	18.5	23.3	10.3	0.22
95% cr. val.	47.2	29.7	15.4	3.8

Coefficients

LGDP	CMR-RET	LCPI
1.56	0.36	1.06

Weak exogeneity test statistics

	LGDP	CMR-RET	LCPI
Chi-sq.(1)	4.6	8.12*	8.65*

Statistics for testing the significance of a given variable

	LGDP	CMR-RET	LCPI
Chi-sq.(1)	6.55*	6.31*	7.37*

Statistic for testing whether coefficient on LCPI = 1

Chi-sq.(1)	3.49

IV. Real Broad Money
(1978-1995)

Hypotheses	r=0	r<=1	r<=2
L(max)	13.0	6.8	0.40
95% cr. val.	21.0	14.1	3.8
L(trace)	20.1	7.1	0.40
95% cr. val.	29.7	15.4	3.8

Coefficients

LGDP	CMR-RET
1.26	-1.00

Weak exogeneity test statistics

	LGDP	CMR-RET
Chi-sq.(1)	7.46*	1.00

Statistics for testing the significance of a given variable

	LGDP	CMR-RET
Chi-sq.(1)	0.78	7.2*

Cointegration Analysis of Money Demand in Thailand (Continued)

V. Real Broad Money (Foreign Interest Rate)
(1978-1995)

Hypotheses	r=0	r<=1	r<=2	r<=3
L(max)	19.0	12.3	9.5	0.24
95% cr. val.	27.1	21.0	14.1	3.8
L(trace)	41.1	22.1	9.8	0.24
95% cr. val.	47.2	29.7	15.4	3.8

Coefficients

LGDP	RET	FOR
1.09	0.23	-0.035

Weak exogeneity test statistics

	LGDP	RET	FOR
Chi-sq.(1)	2.01	3.61	0.05

Statistics for testing the significance of a given variable

	LGDP	RET	FOR
Chi-sq.(1)	0.31	6.10*	0.63

Notes

1. The vector autoregression includes one lag on each variable.
2. The statistics L(max) and L(trace) are Johansen's maximal eigenvalue and trace eigenvalue statistics for testing cointegration, adjusted for degrees of freedom, (Reimers, 1992).
3. The weak exogeneity and significance test statistics are evaluated under the assumption that rank=n and are therefore, asymptotically distributed as Chi-sq.(n).
4. Critical Values are from Osterwald-Lenum (1992).
   * denotes significance at the 5% level.
5. All monetary aggregates are expressed in logs.

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