THE LIBERALISATION AND INTEGRATION OF DOMESTIC FINANCIAL MARKETS IN WESTERN PACIFIC ECONOMIES

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ABSTRACT

This paper addresses the integration of *domestic* financial markets in Western Pacific economies – an unexamined issue in the literature of international financial integration – by exploring the relationship between money market interest rates and deposit and loan interest rates. Rules for setting interest rates on deposits and loans are derived, and these are shown to be consistent with commercial banking practice and to capture recent key developments in the banking sectors of the region. An error-correction model is used to show that the integration of domestic institutional financial markets has increased substantially over the past decade, due to pervasive liberalisation and, more recently, growing competitiveness. The adjustment of domestic institutional rates to changes in money market rates has increased, often significantly, and by the first half of the 1990s the speed and pattern of adjustment of institutional rates in most of the developing/newly developed economies of East Asia had become similar to that in economies with developed financial systems. There is also a difference between the adjustment of deposit and loan rates, with the former adjusting more rapidly. This may be explained by differences in the maturity, substitutability and transactions costs associated with loans and deposits. The riskiness of private borrowers and the poor health of the banking system were shown to have a significant, deleterious effect on the level of loan rates in the region. Country differences are analysed and implications for monetary policy, competition policy and supervision policy are noted.

TABLE OF CONTENTS

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1. INTRODUCTION

It is hardly surprising that economists who are interested in analysing international financial integration focus primarily on the relationship between interest rates on internationally traded financial instruments such as money market instruments and government and corporate bonds. This is a major part of international financial integration but it is not the whole story. The macroeconomic impact of international financial integration also depends on the extent of *domestic* financial integration - that is, the integration of domestic institutional interest rates such as deposit and loan interest rates with domestic money market rates – which itself turns on the regulatory and competitive structure of domestic financial markets. This is particularly important in assessing the international financial integration of Western Pacific economies since domestic financial markets in these countries are in very different states of development.

Accordingly, this paper focuses on the changing relationship between the money market interest rate and deposit and lending interest rates in the Western Pacific economies of Australia, Hong Kong, Indonesia, Korea, Japan, Malaysia, the Philippines, Singapore, Taiwan and Thailand.[1] The analysis centres on the integration of retail with wholesale markets, or, alternatively stated, with the relationship of non-traded with traded financial instruments.

Section 1 motivates the analysis of domestic integration by examining the relative depth of money markets and institutional markets in each country. Section 2 provides a brief summary of institutional arrangements and changes in each country, and notes that substantial liberalisation, greater competitiveness and occasional deterioration in asset quality are three characteristics of banking systems in the region. Section 3 derives a set of simple pricing rules for deposits and loans in a regulated market and in a free market to provide an analytical framework to assess the interactions between

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[1] New Zealand and Papua New Guinea are part of this region but are not considered since data of sufficient length were not available.

money market and institutional interest rates. The rules highlight the importance of competition, financial liberalisation and the permanency of money market interest rate shocks in analysing the changing relationship between money market and institutional interest rates, and so capture the salient features of banking systems in the region. Term structure effects are also shown to be relevant since the effect of a change in the money market rate on institutional rates depends on the permanence of changes to the money market rate. Section 4 presents correlation coefficients and an error-correction model for money and institutional interest rates, and reveals how the relationship between them has changed over time.[2] A discussion of the results and country developments are given in Section 5. The paper is summarised and three policy implications are stated in the conclusion.

[2] A version of this paper which contains discussion of econometric issues and tables reporting full results of unit root tests and error-correction tests is available on request from the author.

2. THE MONEY MARKET AND INSTITUTIONAL MARKETS

Markets in traded wholesale financial assets in the Western Pacific region are generally well integrated with world markets in the sense that arbitrage trade can be, and is, conducted between them, and that foreign interest rate shocks have a direct and often substantial effect on domestic money market rates (Chinn and Frankel 1994a, 1994b; Glick and Moreno 1994; de Brouwer 1995). In short, money market centres in the region are integrated internationally.

These tests, however, are narrow since they only apply to a quite limited range of assets, namely traded wholesale assets. While interest rates on traded assets affect the macroeconomy directly via the exchange rate, their broader effect on consumer and producer choice and hence national income depends on how they affect intermediated interest rates. As shown in Table 1, domestic deposit and bank loan markets are often considerably larger than domestic money markets[3] in Western Pacific economies. At least until the 1990s, most economies in the region could generally be characterised as heavily reliant on bank deposits for the domestic mobilisation of funds and on bank credit for external finance. Furthermore, access to private capital through the stock market or corporate bond issuance has generally been restricted, though again, this constraint has eased somewhat in the 1990s.

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[3] The money market is defined as the market for traded financial instruments with a maturity of less than one year. The particular instruments which are included varies by country and this paper follows the definitions outlined by Emery (1991) where relevant. The Australian money market includes bank placements with authorised money market dealers, bank bills (BBs), Treasury notes (TNs), negotiable certificates of deposit (NCDs) and promissory notes (PNs). The Hong Kong market includes interbank loans, commercial paper (CPs) and floating rate notes (FRNs), NCDs, bankers' acceptances (BAs) and bills of exchange (BEs). The Indonesian market includes interbank loans, NCDs, CPs, repurchase agreements (RAs), SBIs (sertifikat bank Indonesia or Bank Indonesia certificates) and SBPUs (surat berharga pasar uang or money market securities). The Japanese market includes call loans and bills, NCDs, CPs, gensaki or bond repurchases (BRs), financial bills (FBs) and treasury bills (TBs). The Korean market includes monetary stabilisation bonds (MSBs), CPs, RAs, NCDs, and TBs (interbank data not available). The Malaysian market includes NCDs, TBs, interbank loans, BAs, and discounts (RPs not available). The Philippine market includes interbank loans, TBs, PNs, CPs and RAs. The Singaporean market includes interbank loans, commercial bills (CBs), TBs and NCDs. The Taiwan market includes TBs, NCDs, CPs and BAs (interbank data not available). The Thai market includes interbank loans, TBs and BRs (CBs, CPs and BEs data not available). The Canadian market includes TBs, BAs, CPs and sales finance and consumer loan company paper (interbank data not available). The US market includes interbank loans, TBs, CDs, mutual fund shares, money market fund shares and security repurchase agreements.

Moreover, when covered and uncovered interest parity tests were being developed, they were regarded as relevant to policy precisely because the money market rates used were regarded as being closely linked to other rates in the financial system, such that the tests could be used to draw general conclusions about financial integration. Prachowny (1970), for example, tested covered interest parity by using deposit and loan rates. More recently, when Marston (1993) tested parity relationships for the G7 countries, he first used prime rates and then used euro rates to demonstrate the effect of capital controls. The interest parity tests can still be applied to the Western Pacific economies, of course, but the additional step must be taken to assess whether the integration of money markets does indeed signal broader, more fundamental financial integration.

Table 1: Deposit, Loan and Money Markets in the Western Pacific Region

Country	Deposits/GDP	Loans/GDP	Money Market/GDP
Australia	0.56	0.69	0.27
Indonesia	0.37	0.44	-
Hong Kong	1.05	1.20	0.71
Japan	1.02	1.19	0.22
Korea	0.38	0.58	0.19
Malaysia	0.77	0.75	0.30#
Philippines	0.36	0.27	0.98#
Singapore	0.82	0.89	0.40#
Taiwan	0.90	0.83	0.15#
Thailand	0.69	0.73	0.02#
Unweighted average	0.69	0.76	0.36
Canada	0.57	0.60	0.10
US	0.49	0.61	0.59

Notes: as at 1993 except # which signifies 1989 data. Deposits include demand, savings and time deposits placed with banks (IMF code 24 and 25) (including thrifts in the case of the US). Loans are bank credit to the private sector (IMF code 22).

Source: IMF *IFS* bank statistical bulletins, Emery (1991).

3. RECENT DEVELOPMENTS IN BANK DEPOSIT AND LOAN MARKETS

The institutional arrangements and history of markets in the region vary widely by country, but the common thread in the past decade has been a clear shift in lifting

controls on deposit and lending interest rates, on increasing the competitiveness of the domestic banking sector, and on improving supervision of the banking sector, largely in response to serious deteriorations in asset quality. Appendix 1 provides a chronology of relevant major banking reforms in each country for the past two decades. The account provided here is very brief, and the reader is referred to Fischer (1993), Fischer and Reisen (1993), Haggard, Lee and Maxfield (1993), Andersen (1993) and central bank annual reports for more detail and information.

As shown in Appendix 1, all countries in the sample have now instituted major liberalisation of deposit and lending rates, though the speed of reform has varied substantially by country. Singapore instituted reform in 1975, Australia in the early 1980s, Indonesia in 1983, Japan in 1985 to 1994, Malaysia in 1987 (deposits) and 1991 (loans), Taiwan in 1989, Korea in 1991 to 1994, Thailand in 1992 and Hong Kong in 1994 and 1995.

The formal liberalisation of rates, however, does not necessarily mean that monetary authorities have surrendered other, non-market based forms of control over institutional rates. The authorities at times use moral suasion (to attempt) to influence the setting of rates by banks, especially when they consider competition in the domestic banking system to be imperfect (as in Thailand, Indonesia, Japan and, to a lesser extent, Australia) or when they provide direct liquidity to banks (as in Indonesia and Japan). Moreover, the shift to a market-based system for the determination of interest rates has not necessarily meant that direct credit rationing and preferential financing have been discontinued (consider Indonesia, Korea, the Philippines and, to a lesser extent, Japan). Historically, public ownership of banks has also been important in Indonesia and, particularly, Taiwan in allowing the authorities to influence the rate outcome.

Generally speaking, monetary authorities have also tried to improve competition within the domestic sector, mainly through easing controls on bank branching (as in Indonesia and, more recently, the Philippines) and on foreign bank entry (as in Australia, Indonesia, the Philippines, Taiwan and Thailand), and through encouraging competition from smaller banks (as in Australia and, more recently, Indonesia) and non-bank financial intermediaries (NBFIs) (as in Korea and Thailand). These policies are not always successful. In Thailand, for example, NBFIs did not compete with banks since they were themselves largely controlled by the banks, and capital divestiture, initiated in the 1980s, proceeded only slowly and, while it did dilute shareholdings, it failed to break the control of the 16 Chinese families over the

domestic banking system (Chaiyasoot 1993). While concentration ratios are generally a flawed measure of competition, since they do not take account of the contestability of markets, such ratios can be informative when branching and foreign bank entry are restricted. In most countries, a small number of large banks have typically dominated the banking sector, for example, Australia, Indonesia, Japan and Thailand. While the number of banks is larger in the Philippines, Hutchcroft (1993) reports that both national and private banks have engaged in express collusive behaviour. Privatisation has been touted as a key policy reform in some countries (Korea and Taiwan), though the process has sometimes been painstakingly slow (as in Taiwan) or only relatively superficial (as in Korea where the banks were privatised in the early 1980s but their presidents and directors continued to be appointed by government).

At times, however, the monetary authorities have been ambivalent in pursuing competition. While banks are free to set institutional interest rates in Singapore, the authorities largely exclude foreign institutions from the domestic banking market and continue to enforce tight controls on bank branching and automation (APEG 1995). Hong Kong, on the other hand, encourages foreign institutions but sanctioned a cartel to reduce competitive pressure in domestic bank markets until 1994. In Japan, the Ministry of Finance unsuccessfully attempted to use administrative guidance in early 1995 to prevent regional credit banks from offering competitive deposit rates (in the form of interest lotteries). Bank Indonesia initially opposed the 1983 financial reform package (Macintyre 1993), but adopted a pro-competition stance in the late 1980s which has resulted in a substantial expansion of private banking and increase in competition. The Indonesian, Malaysian and Philippine authorities have also used measures to reduce ‘undue’ or destabilising competition at times.

As in various European countries, problems with banks' asset quality have also been a recurring phenomenon in Western Pacific economies. In the 1990s, banks in Australia, Indonesia and Japan experienced serious difficulties with non-performing loans and bad debts, which led to major reform of banking supervision. Thailand suffered a series of financial failures from 1983 to 1986 due to poor supervision and management practices (mainly lending to executives and associates), which led to major, successful reform (Doner and Unger 1993). The Philippines has experienced four major crises of confidence in its financial institutions since the 1960s, reportedly due to weak supervision and corruption. The central bank was substantially restructured in June 1993, partly in response to this. Bad debts have also caused periodic major problems in banking in Korea, where the government has bailed out institutions (Choi 1993). Taiwan's banking sector, on the other hand, has largely been

free of bad debt problems due to the high risk aversion of its commercial bankers (bankers face civil liabilities if they make loans which fail) (Cheng 1993).

4. DEPOSIT AND LOAN PRICING RULES UNDER FIAT AND MARKET REGIMES

In order to identify how the relationship between the money market interest rate and institutional interest rates may have changed over time, it is necessary to have a benchmark model of the determination of institutional interest rates. This section outlines simple pricing rules for deposit rates and loan rates under both a fiat regime and a market regime, and so provides a perspective on the conditions under which changes in money market rates lead to changes in institutional rates. There is an extensive literature on banks and the pricing of their assets and liabilities – see, for example, Klein (1971), Monti (1972), Baltensperger (1980), Takeda (1985), Cottarelli and Kourelis (1994) and Borio and Fritz (1995). The model outlined in this paper, however, is constructed in a way which reflects to the main characteristics of banking in the region and focuses on both deposit and loan markets.

4.1 Fiat Deposits and Loan Rate Rules

When the deposit market is determined by the authorities, the deposit interest rate, *d*, is given by fiat:

Rule (1a) $$d_t = \bar{d}\,.$$

When the loan market is determined by the authorities, the loan rate, *l*, is given by fiat:

Rule (1b) $$l_t = \bar{l}\,.$$

The particular rule used by the authorities to set rates is not specified, since it will vary by country and by time, and it may or may not conform to the market rule outlined below.

4.2 Market Deposit and Loan Rate Rules

In this subsection, a model of institutional rate determination is constructed, the retail interest rate rules are stated, predictions of the rules for regression analysis outlined, and, finally, the model and rules are critically assessed. The deposit and loan rates are assumed to be determined by a profit maximising bank with a simplified balance sheet comprising reserves (*R*) and loans (*L*) on the asset side, and money market borrowings (*M*), deposits (*D*) and equity (*E*) on the liabilities side. It is assumed initially that these instruments are of the same maturity, *n*. Reserves are proportional to deposits, $R = rD$, where r is the reserves ratio, and it is assumed that reserves do not pay interest. Accordingly, the balance sheet constraint for the bank is:

$$L_t = E_t + M_t + (1 - r)D_t \tag{1}$$

Expected total profit is expected total revenue (*TR*) less expected total cost (*TC*) which are respectively,

$$TR_t = l_{n,t} p_t L_t \tag{2}$$

$$TC_t = (q_t + c)L_t + e_{n,t} E_t + m_{n,t} M_t + (d_{n,t} + r + z)D_t \tag{3}$$

where $l_{n,t}$, $e_{n,t}$, $m_{n,t}$ and $d_{n,t}$ are the rates of return at time t on the n-period instruments L, E, M and D respectively, p is the probability of payment of loan interest, q is the probability of default on the loan principal, c is the administrative cost of loans, and z is the administrative cost of deposits. It is assumed that the administrative costs on loans and deposits are constant and those on equity and money market borrowings are zero (equivalently, deposits are costlier to administer than equity and money market borrowings). Following Lowe (1995), the probabilities of interest payment and loan default are included since banks face asset risk in the sense that they must pay out deposits and deposit interest at par but are not guaranteed receiving loan principal and loan interest payments at par.

Banks may enjoy monopsony power in the determination of deposit interest rates, implying $d=d(D)$ and $d'(D)>0$ since banks must increase the deposit rate to attract depositors, or monopoly power in the determination of loan rates, implying $l=l(L)$ and $l'(L)<0$ since banks must reduce the loan rate to attract borrowers. Following the literature (Baltensperger 1980), it is assumed that banks are price-takers in the money market.

The deposit rate is determined through profit-maximising liabilities management by the bank. The Lagrangean may be written as:

$$\ell = \left(l_{n,t}\, p_t - q_t - c\right)L_t - e_{n,t}E_t - m_{n,t}\,M_t - \left(d_{n,t}\left(D_t\right) + r + z\right)D_t + l\left[L_t - E_t - M_t - (1-r)D_t\right] \quad (4)$$

Banks hold a proportion of their loans as equity for prudential purposes, and this is assumed to be a requirement imposed on them. Accordingly, banks maximise the Lagrangean with respect to *M* and *D*. The first order conditions imply:

$$d_{n,t} = (1-r)m_{n,t} - r - z - d'(D_t)D_t \quad (5)$$

Since banks only have price-fixing power in the deposit market, they take the money market rate as given. From equation (5), the deposit rate rises as the money market rate rises but falls as the reserve ratio, administrative costs and monopsony power of banks increase.

This specification assumes that money market instruments and deposits are of the same maturity but in practice this need not be so. The term structure is assumed to be defined in discrete time by the unbiased expectations hypothesis (Hicks 1946) and so the interest rate on the *n*–period money market instrument at time *t*, $m_{n,t}$, is:

$$1 + m_{n,t} = \left(\prod_{i=0}^{n-1}\left(1 + m_{1,t+i}\right)\right)^{\frac{1}{n}} \quad (6)$$

where m_1 is the interest rate on a *1*-period money market instrument. Adding 1 to both sides of equation (5) and substituting equation (6) for m_n, equation (5) may be rewritten as:

$$\left(1+d_{n,t}\right)=(1-r)\left(\prod_{i=0}^{n-1}\left(1+m_{1,t+i}\right)\right)^{\frac{1}{n}}-z-d'(D)D_t \tag{7}$$

Given that *d'(D)>0*, this may be rewritten as:

$$\left(1+d_{n,t}\right)\leq(1-r)\left(\prod_{i=0}^{n-1}\left(1+m_{1,t+i}\right)\right)^{\frac{1}{n}}-z \tag{8}$$

If banks do not enjoy monopsony power in the deposit market then equation (8) holds as an equality.

This derivation assumes that depositors do not enjoy the same access to the money market as they do to the retail deposit market, for if they did and deposit rates were less than money market rates, they would place all their funds in the money market. The rejection of this arbitrage mechanism (and the consequent equalisation of money market and retail deposit rates) is made on the ground that most deposits fall below the minimum amount required for transacting in the wholesale market, thereby excluding depositors from the wholesale market and restricting them to the retail market. To the extent that arbitrage occurs (perhaps through non-bank financial intermediaries), the deposit rate will tend to equal the money market rate and the cost of reserves will be passed into the loan rate directly.

Now consider the loan rate. The loan rate is determined by profit maximisation, that is marginal revenue equal to marginal cost. Taking the total differential of equations (2) and (3), letting *DL* and *L* equal one, and setting the change in *E*, *M* and *D* equal to their share in *L*, $a_1=E/L$ (which is determined exogenously to banks), $a_2=M/L$ and $a_3=(1-r)D/L$, then:

$$DTR_t = pl_{n,t} + pl'\left(L_t\right) \tag{9}$$

$$\Delta TC_t = q + c + a_1 e_{n,t} + a_2 m_{n,t} + a_3(d_{n,t} + r + z) \tag{10}$$

Equating these and solving for the loan rate, yields:

$$l_{n,t} = \frac{1}{p}\left[q + c + a_1 e_{n,t} + a_2 m_{n,t} + a_3 (d_{n,t} + r + z) - pl'(L_t)\right] \tag{11}$$

Substituting equation (6) for the money market rate and equation (7) for the deposit rate (and assuming that the deposit market is competitive), the loan rate is given as:

$$l_{n,t} = \frac{1}{p}\left[q + c + a_1 e_{n,t} - a_2 + \left(a_2 + (1-r)a_3\right)\left(\prod_{i=0}^{n-1}\left(1 + m_{1,t+1}\right)\right)^{\frac{1}{n}} - a_3(1-r) - pl'\left(L_t\right)\right] \tag{12}$$

where $l_{n,t}$ is increasing in the probability of loan default, loan administration costs, the cost of equity, the cost of money market funds, the reserve ratio and market power, and is decreasing in the probability of payment of loan interest. This may be rewritten as:

$$l_{n,t} \geq \frac{1}{p}\left[q + c + a_1 e_{n,t} - a_2 + \left(a_2 + (1-r)a_3\right)\left(\prod_{i=0}^{n-1}\left(1 + m_{1,t+i}\right)\right)^{\frac{1}{n}} - a_3(1-r)\right] \tag{13}$$

which holds as an equality when banks do not have monopoly power in the loan market.

The deposit and loan rate rules may now be stated. Under the assumption of perfect foresight, the profit maximising bank sets the deposit rate in relation to its other, exogenously determined funding costs, specifically the cost of money market funds, according to the deposit pricing rule,

Rule (2a) $$\left(1 + d_{n,t}\right) \leq (1-r)\left(\prod_{i=0}^{n-1}\left(1 + m_{1,t+1}\right)\right)^{\frac{1}{n}} - z$$

which is equation (8). The rule predicts that the deposit rate is less than or (at most) equal to the money market rate, and that the deposit rate is increasing in the money market rates expected to prevail over the deposit period and decreasing in both reserve requirements and net deposit administration costs. If the market for deposits is perfectly competitive, then Rule (2a) holds as an equality; otherwise banks can suppress deposit rates below the implied term structure equivalent rate.

When loans are priced in the market, the profit maximising bank sets the loan rate in relation to its funding and administration costs, the riskiness of its assets, and its market power according to the pricing rule:

Rule (2b) $$l_{n,t} \geq \frac{1}{p}\left[q + c + a_1 e_{n,t} - a_2 + \left(a_2 + (1-r)a_3\right)\left(\prod_{j=0}^{n-1} \left(1 + m_{1,t+i}\right) \right)^{\frac{1}{n}} - a_3(1-r) \right],$$

which is equation (13). The rule predicts that the loan rate is greater than or (at least) equal to the money market rate, and that the loan rate increases when the cost of equity or money market borrowing increases, when the probability of loan default increases or the probability of interest payment falls, and when deposit reserve ratios increase. If markets are perfectly competitive, then Rule (2b) holds as an equality; otherwise banks can use market power to extract a higher loan rate than implied by funding and administration costs.

The rules indicate that institutional rates are functions of several variables, most of which are not observable or available, at least not on a monthly or even quarterly basis and usually not for a reasonable length of time.[4] Accordingly, like Cottarelli and Kourelis (1994) and Borio and Fritz (1995), the analysis is restricted to regressing the institutional rate on the money market rate with the other factors appearing in the constant or error term.[5] The rules are useful, however, in that they yield a number of predictions about the constant and slope coefficients.

Consider the constant term. When the deposit rate is the dependent variable, the constant term is expected to be weakly negative since, by Rule (2a), it is the negative of deposit administration costs. When the loan rate is the dependent variable, the

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[4] One possible alternative is to use proxies for the missing variables. For example, the effect of the risk of default on loan rates may be identified if economic growth is included (since risk of default is expected to be inverse to economic growth). This was tried without success for the Australian loan equation for all sub-samples by using the deviation from linear trend of the Melbourne Institute's index of manufacturing production. One problem with using these sorts of variables is that monthly observations of real variables tend to be highly volatile. Another is that a deterioration in economic conditions will reduce the demand for loans at any given interest rate, which may offset the putative rise in the loan rate due to a higher risk premium.

[5] If this approach is to yield consistent estimates, then the money rates must be uncorrelated with the unmodelled variables that appear in the error term. This may not be the case, if, for example, the risk of default is positively correlated with the money market rate. However, tests showed that the error term is not correlated with either the level or change in the money market rate.

model predicts that the constant will be weakly positive since it comprises loan administration costs, probabilities of default on loan principal and interest, and the cost of equity (or, more strictly speaking, the incremental cost of equity relative to borrowing in the money market). As these factors change, so will the constant term. Given that some banking systems in the region have at times experienced serious problems with non-performing or bad loans, one would anticipate that the constant term in the loan rate equation will vary over time.

The slope coefficient, on the other hand, is principally affected by regulation (that is, whether there is a regime shift from Rule (1) to Rule (2)), by the degree of competition in the banking sector, and by the nature of shocks to the term structure. As regulation, competition and the permanency of term structure shocks change, so will the slope coefficient. Given that banking systems in the region have been increasingly deregulated and competition has improved over time, one would anticipate that the slope coefficient will increase over time. The inclusion of the term structure implies a smoothing process according to which the effect of shocks to money market rates on deposit and loan rates will depend on their expected permanency. A rise in the slope coefficient may, therefore, merely reflect changes in the permanency and timing of shocks to money market interest rates, perhaps due to improvements in monetary management techniques or cyclical effects. To minimise this, the maturity of money, deposit and loan rates across countries should be as similar as possible and a sufficiently long sample selected.

The attraction of the rules is not just their simplicity but also their realism. In the first place, anecdotal evidence supports the claim that banks in fact use these sorts of rules in setting retail rates. Banks tend to set deposit rates with direct reference to money market rates, and they set loan rates on the basis of funding and administration costs and the riskiness of borrowers. In Japan, for example, banks price term deposit rates and the short-term prime rate off the CD rate (Bank of Japan 1994). In general, banks make as much use as possible of their market power in retail markets. Moreover, the rules capture key recent developments in deposit and loan markets in the Western Pacific region, namely regulatory regime shifts, increased competitiveness in the banking sector and occasional but significant changes in asset quality.

On the other hand, the model has some obvious short-comings. First, it assumes that financial institutions are price takers in the money market, but there are instances where this is violated. In Japan, for example, institutions which rely on call loans to fill a funds shortage sometimes borrow funds at above-market prices to allow

institutions with a funds surplus to obtain extra profit.[6] Even in the negotiable certificate of deposit (NCD) market, banks will sometimes limit issuance in order to push up rates to strengthen their bargaining position with borrowers (since the short-term prime rate is priced off the NCD interest rate).[7] Similarly, in Thailand the number of players in the market is relatively small and prices at times have been subject to manipulation. While there are such examples of price-making in markets at various times, the approximation of perfect competition is not unreasonable. In Japan, for example, interbank rates generally closely follow open market developments, and CD rates very closely follow euroyen rates which are less subject to price-fixing (de Brouwer 1995). That is, banks have occasional but not systematic price-setting power in money markets, and this is certainly considerably less than the power they may have in institutional markets.

Second, the model assumes profit maximisation but this is not always the case in practice. For example, at various times banks in Australia, Indonesia and Japan, among other countries, have sought to maximise the size of their balance sheets rather than profits, and this is more likely to occur when central bank credit depends on the size of a bank's operations (Takeda 1985). Banks are also less likely to be profit maximisers when they are publicly owned (Cottarelli and Kourelis 1994). All else given, greater focus on balance sheet size implies higher deposit rates (Monti 1972) and lower loan rates, while less focus on profit maximisation implies slower adjustment of institutional rates (Cottarelli and Kourelis 1994). The effect on the price-setting rules depends on the extent to which the bank can ignore profit maximisation, but it is arguable that a policy of focussing on balance sheet size *at the expense* of profits is not sustainable over time, particularly in world markets which are increasingly integrated over time.

Third, the model is perhaps too simple. For instance, the intertemporal dimension is modelled in the term structure but not in the profit maximisation of the bank. If the bank is an intertemporal optimiser and possesses market power, then its strategic price rules may be considerably more complex and interesting. Another simplification is the modelling of the probability of default. If the probability of default is a function of the level or variance of the money market rate or the loan rate, of regime shifts, or of learning, then changes in asset quality may not appear just in the constant term but also in the slope coefficient. The model also does not take account of equilibrium

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[6] Based on interview in Tokyo, 27 February 1995.

[7] Based on interview in Tokyo, 20 February 1995.

risk-sharing or implicit contracting between the bank and its customer (Fried and Howitt 1980) according to which banks may price institutional rates such that they are less variable than they would be in spot markets in return for a higher average loan rate or lower average deposit rate. One way to do this in the model is to include utility functions of depositors and borrowers which are concave in income and costs respectively. Slope coefficients would also be a function of risk preference, and the results may indicate whether people had a preference for smoothing interest income over borrowing costs. Further modifications could include modelling the informal or curb loan market, modelling the different riskiness of borrowers in formal and informal markets, and modelling information asymmetries (as in Ahn (1994)). While these modifications would enrich the theoretical model and are worthy of pursuit, they are second order considerations in terms of the issues in this paper.

5. CORRELATIONS, ERROR-CORRECTION AND THE ADJUSTMENT OF INSTITUTIONAL INTEREST RATES

This section presents correlation coefficients and an error correction model (ECM) of monthly domestic deposit and loan rates for Australia, Hong Kong, Indonesia, Japan, Korea, Malaysia, the Philippines, Singapore, Taiwan and Thailand for the four 5-year periods from 1975 to 1994.[8] Results for Canada and the US are included as comparison with well-developed and liberalised financial markets. The deposit, loan and money market interest rates for each country are defined, sourced and graphed in Appendix 2. The results are interpreted in Section 6.

The empirical analysis focuses on the evolution of the relationship between interest rates on traded and non-traded instruments, and this is shown by conducting the tests over four sub-periods, 75M1-79M12, 80M1-84M12, 85M1-89M12 and 90M1-94M12. These sub-samples are arbitrary but are of sufficient length (60 observations) to provide reasonable power and show how systems have evolved over different periods of time. Moreover, they are generally of sufficient length to capture all or most of an economic cycle, and so cyclical effects on the adjustment coefficients are minimised. When a major structural change occurs at around the start or end of a sub-period, the sample length is modified. When a change occurs around the middle of a sub-period, the results for alternative sub-samples are reported in

[8] In some cases, data were not available for the full period, and so actual sub-periods may contain fewer observations.

footnotes. Accordingly, the change in the relationship between rates both over periods of time and over regimes is identified.

Given the observations made above about possible term structure effects, money, deposit and loan rates were selected with as common a maturity length as possible, and this information is summarised in the second to fourth columns of Table 2. Maturity-matching is more difficult with loan rates, and they are generally defined as short-term prime rates (variable rates on a loan of less than 1-year to a bank's best customers). The remainder of Table 2 sets out the correlation coefficients of the first-difference of *domestic* deposit and loan rates against *domestic* money market rates.

Table 2: Correlation Coefficients of Deposit and Lending Rates with Money Market Rate

Country	Money	Deposi Maturity	Loan	Deposit rates				Loan rates			
				75-79	80-84	85-89	90-94	75-79	80-84	85-89	90-94
Australia	3m	3m	prime	n/a	0.62*	0.12	0.70*	n/a	0.14	0.70*	0.40*
Indonesia	avg	3-6m	prime	n/a	-0.03	-0.13	0.18	n/a	n/a	0.15	0.05
Hong Kong	3m	3m	prime	n/a	n/a	0.53*	0.65*	n/a	n/a	0.51*	0.65*
Japan	o'night	3m	prime	0.48*	0.58*	0.49*	0.55*	0.33*	0.70*	0.44*	0.64*
Korea	avg	3m	<1 yr	-0.11	-0.34*	0.00	0.14	n/a	-0.23	-0.03	0.13
Malaysia	o'night	3m	prime	-0.18	0.15	0.37*	0.67*	-0.12	0.23	0.13	0.27*
Philippines	3m	2-3m	avg	-0.06	0.67*	0.38*	0.39*	0.29*	0.33*	0.23	0.60*
Singapore	3m	3m	min	0.24	0.65*	0.35*	0.30*	0.44*	0.64*	0.26*	0.27*
Taiwan	3m	3m	avg	n/a	0.21	0.46*	0.35*	n/a	0.25	0.70*	0.12
Thailand	avg	3-6m	max	0.00	0.17	0.17	0.03	0.00	0.13	0.08	-0.01
Average	-	-	-	0.06	0.36	0.27	0.40	0.19	0.28	0.27	0.31
Canada	o'night	3m	prime	0.62*	0.36*	0.31*	0.30*	0.37*	0.43*	0.62*	0.45*
US	o'night	3m	prime	n/a	0.82*	0.73*	0.75*	0.65*	0.80*	0.50*	0.79*

Note: 'n/a' signifies not available, '*' signifies statistical significance at the 5 per cent level.

The correlation coefficients provide an insight into the instantaneous or impact effect of changes in money rates on institutional markets, but they do not consider dynamics and how long it takes changes in wholesale rates to be reflected in institutional rates. One way to view this would be to examine sub-samples of the cross-correlation function or the distributed lag structure between money market rates and institutional

rates, with the length of the lag structure indicating the speed at which changes in one set of rates affect the other set, as in Cottarelli and Kourelis (1994). On the other hand, if there is an underlying equilibrium relationship between money market and institutional interest rates, then it is natural to estimate adjustment in that context.[9] The possibility of such a relationship is suggested by the result that nominal interest rates appear to be integrated of order one, according to the augmented Dickey-Fuller test, since the null hypothesis of a unit root is accepted for the variables in levels but not for the variables in first-differences.[10,11]

The equilibrium relationship is conducted using a general-to-specific modelling procedure embedded in an ECM (Banerjee, Dolado, Galbraith and Hendry 1993). The analysis is bivariate, since the focus is the adjustment of an institutional rate (i) to a money market interest rate (m). The series, m and i, are integrated of order 1 and are assumed to be n-order autoregressive distributed lag processes. This paper focuses on the response of the rate on a non-traded financial instrument to changes in that of the traded financial instrument, and the analysis is restricted to single equation estimation with the retail interest rate as the dependent variable.

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[9] Cottarelli and Kourelis (1994) state that an ECM performs poorly, but this is because they impose the condition that in equilibrium the loan rate equals the money market rate.

[10] Money market rates generally possess one unit root over the full sample period and the four sub-samples, based on critical values drawn from MacKinnon (1991). Depending on the country and regulatory regime, however, deposit and lending rates are sometimes I(0) processes, as for example in Indonesia and Thailand in the 1980s, or I(2) processes, as for example in Australia, Singapore and Taiwan from 1990 to 1994. Details of the methodology used and the test statistics are available on request from the author.

[11] An ECM is a reparameterisation of a regression between variables measured in levels and can be applied regardless of the order of integration. This is potentially an issue here, despite the finding that the series are I(1). Firstly, the tests used to determine the order of integration have low power, and so the time series may in fact be stationary but strongly autoregressive. Moreover, the variables examined in this paper are interest rates, and it is not clear that they behave like other I(1) series. For example, while interest rates are not bounded from above and do attain extreme positive values at times, they are bounded from below at zero and there is a tendency for shocks to die out and for rates to revert to *around* their previous level, which is not typical of integrated series. Finally, the full sample period is 20 years and the 4 sub-sample periods are 5 years each, but one would not necessarily expect a data series to possess the same time series properties over these two very different period lengths or between any two of the sub-sample periods. In fact, the series do tend to exhibit similar behaviour across periods, but even when this is not the case, the ECM is still valid, although the interpretation is different.

An additional issue is whether both the deposit and lending rate should enter the estimating equation for each institutional interest rate – that is, whether the equation should include three rather than two variables. If banks set deposit and lending rates according to Rules (2a) and (2b) respectively, then the deposit-loan rate spread is superfluous: the loan rate does not enter the deposit rate equation and, while the deposit rate enters the loan rate equation, it is substituted out of the equation and replaced by the money market rate. In short, when institutional rates are market-determined, there is not an independent relationship between deposit and loan rates. On the other hand, when deposit and loan rates are determined by fiat, the authorities *may* use a rule by which they set these rates in relation to each other, and so both institutional rates *may* be relevant. Since the issue being examined is the changing relationship between money and institutional rates, and not the particular rule used to set institutional interest rates, the deposit-loan spread is not generally included in the estimating equation. This issue, however, is revisited in more detail in the discussion in Section 6 since declining statistical significance of the spread may be an indication of a regime shift.

Accordingly, the adjustment process is estimated in the single conditional error correction equation,

$$\Delta i_t = m - b_1 i_{t-1} + b_2 m_{t-1} + \sum_{j=1}^{n-1} p_j \Delta i_{t-j} + \sum_{j=0}^{n-1} q_j \Delta m_{t-j} \text{ for } i = d, l \qquad (14)$$

The adjustment coefficient of the institutional rate to itself is β_1 and to the money market rate is β_2. If they are statistically significant, then there exists a long-run relationship between *i* and *m* of the form $i = {}^{m}\!/_{b_1} + {}^{b_2}\!/_{b_1}\, m$ where ${}^{m}\!/_{b_1}$ is the long-run constant and is positive (negative) if μ is positive (negative). The pricing rules suggest that the constant is weakly negative for the deposit rate and weakly positive for the loan rate.

The cointegrating vector normalised on the money market interest rate is calculated from the ECM as $\left(-1, {}^{b_2}\!/_{b_1}\right)$. The pricing rules suggest that ${}^{b_2}\!/_{b_1} \leq 1$ for both the deposit rate and the loan rate, and that it is strictly equal to one only if rates are fully market-determined, markets are perfectly competitive, shocks to money market rates are permanent and occur at the start of the maturity period and there is no reserves requirement. These are stringent conditions and one would generally expect the

coefficient to be less than one. Greater liberalisation, competition and the permanency of shocks to money market rates tend to increase the coefficient. The value of the coefficient is an empirical issue and so the cointegrating vector is unrestricted. The result will also depend on whether the money and institutional rates are of the same maturity. It is easier to match the maturities of money market rates (typically 3-month interbank rates) with deposit rates (typically 3-month fixed deposit rates) than with lending rates (typically short-term prime rates), and so one may expect the coefficient to be closer to one in the case of deposit rates since the term structure effects are more precisely netted out.

The ECM in equation (14) is estimated for deposit and loan rates relative to money market rates for the countries listed in Table 2 using monthly data for the full 20 year period (where possible) and the four 5-year sub-periods. Equation (14) may contain nuisance parameters in the form of insignificant dynamics terms, and these can be eliminated by sequential reduction using the standard general-to-specific methodology. Six lags were included in the auto-regressive distributed lag model.

The estimations over the full sample period are generally poorly specified, but specifications over sub-samples are better and goodness of fit improves over time. Given that institutional rates over much of the period were inflexible and subject to sharp discrete movements in most countries, the errors are usually non-normally distributed and heteroscedastic. Sharp discrete movements in institutional rates are a characteristic of controlled rate systems (and give rise to non-normality), and as markets are liberalised, these movements become smoother (which gives rise to non-constancy in the variance of the equation). There also tends to be less volatility in money market rates, which may be due to improvements in domestic monetary management techniques (for example, the changes in operating procedures in Hong Kong in 1988 and in Australia in 1989) or less weight put on bilateral exchange rate targetting. Whatever the case, an examination of the residuals indicates that reduced money rate volatility is a relatively minor source of non-normality. Broadly speaking, not only changes in the adjustment mechanism but also the improvement in the diagnostic performance of the estimations indicate increased domestic integration.

The specifications generally reduce to a simple model whereby the change in the institutional rate is a function of the disequilibrium between institutional and market rates and the current change in the money market rate. The dynamic lag specification, however, tends to be more complex for loan rates than for deposit rates, which implies relatively greater price sluggishness in the loan market (discussed below). It

is unusual in these estimations for lags of the dependent variable to be significant: lagged dependent variables are only significant for Indonesian deposit rates and Taiwanese loan rates, which suggests that in this case the autoregressive behaviour dominates the error-correction process.[12] As anticipated, in general, the slope coefficient is less than one, and the constant term is weakly negative in deposit rate equations and weakly positive in loan rate equations.

Tables 3 and 4 present a summary of relevant results on the speed of adjustment for deposit and lending rates respectively. The structure of the table is identical in both cases. The rows list the results for each country. The first column nominates the respective country, while columns two to five list the adjustment coefficient of the institutional rate to itself (β_1) in the top row and to the money market rate (β_2) in the bottom row for each of the four sub-periods (1975-79, 1980-84, 1985-89, 1990-94). The cointegrating vector is β_2/β_1. The remaining columns list the cumulative adjustment of the respective institutional rate to a one percentage point change in the money market rate after one, four and twelve months for each of the sub-periods after taking account of short-run dynamics. The figure in parentheses in these columns is the percentage of adjustment completed one, four and twelve months after a change in the money market rate. The formula is provided in Appendix 3.

[12] The Indonesian rates are weighted averages for all deposit banks – the private banks and the more sluggish State banks. Rates from private banks were also used for the 90M1-94M12 sub-sample but with little effect.

Table 3:Adjustment of Domestic Deposit Interest Rates to Domestic Money Market Interest Rate Changes

	β_1 (adj to deposit rate)				cumulative adjustment of deposit rate to 1 percentage point rise in the money market rate after 1,4 and 12 months											
	β_2 (adj to money rate)				1975-79			1980-84			1985-89			1990-94		
	75-79	80-84	85-89	90-94	1	4	12	1	4	12	1	4	12	1	4	12
Australia	-	0.29	0.15	0.51	-	-	-	0.30	0.49	0.59	0.15	0.49	0.87	0.62	0.85	0.88
	-	0.18	0.15	0.45	-	-	-	(50%)	(82%)	(99%)	(15%)	(49%)	(86%)	(70%)	(97%)	(100%)
Hong Kong	-	-	0.21	0.23	-	-	-	-	-	-	0.65	0.71	0.76	0.57	0.75	0.88
	-	-	0.17	0.21	-	-	-	-	-	-	(84%)	(92%)	(99%)	(63%)	(83%)	(98%)
Indonesia	-	n/c	0.03	0.05	-	-	-	0	0	0	0	0	0	n/e	n/e	n/e
	-	n/c	0.03	0.10	-	-	-	(0%)	(0%)	(0%)	(0%)	(0%)	(0%)	n/e	n/e	n/e
Japan	0.24	0.63	n/c	0.47	0.36	0.47	0.54	0.27	0.41	0.42	0.31	0.31	0.31	0.54	0.59	0.59
	0.13	0.27	n/c	0.28	(66%)	(85%)	(98%)	(63%)	(98%)	(100%)	n/a	n/a	n/a	(91%)	(99%)	(100%)
Malaysia	n/c	0.37	0.18	0.48	0	0	0	0.28	0.64	0.76	0.14	0.41	0.69	0.78	1.02	1.06
	n/c	0.28	0.14	0.50	(0%)	(0%)	(0%)	(37%)	(84%)	(100%)	(18%)	(55%)	(91%)	(74%)	(96%)	(100%)
Philippines	n/c	0.49	0.54	0.45	-	-	-	0.48	0.60	0.62	0.40	0.55	0.56	0.54	0.86	0.93
	n/c	0.30	0.31	0.41	-	-	-	(78%)	(97%)	(100%)	(71%)	(97%)	(100%)	(58%)	(93%)	(100%)
Singapore	n/c	0.60	0.11	0.21	0	0	0	0.73	0.91	0.93	0.20	0.42	0.74	0.23	0.49	0.69
	n/c	0.55	0.10	0.15	(0%)	(0%)	(0%)	(79%)	(99%)	(100%)	(21%)	(43%)	(77%)	(32%)	(67%)	(95%)

Taiwan	-	0.11	0.17	0.08	-	-	-	0.19	0.39	0.56	0.43	0.69	0.97	0.13	0.22	0.36
	-	0.19	0.16	0.04	-	-	-	(32%)	(64%)	(93%)	(41%)	(65%)	(91%)	(28%)	(42%)	(70%)
Thailand	n/c	n/c	0.21	0.21	0	0	0	0	0	0	0.11	0.32	0.49	0.18	0.52	0.81
	n/c	n/c	0.11	0.18	(0%)	(0%)	(0%)	(0%)	(0%)	(0%)	(21%)	(61%)	(94%)	(21%)	(60%)	(94%)
Canada	n/c	n/c	0.46	1.01	0.23	0.23	0.23	0.20	0.20	0.20	0.77	0.92	0.95	0.94	0.93	0.93
	n/c	n/c	0.44	0.94	n/a	n/a	n/a	n/a	n/a	n/a	(82%)	(97%)	(100%)	(100%)	(100%)	(100%)
US	-	0.71	0.33	0.36	-	-	-	0.97	0.99	0.99	0.96	0.96	0.96	0.93	0.96	0.97
	-	0.70	0.31	0.35	-	-	-	(99%)	(100%)	(100%)	(100%)	(100%)	(100%)	(96%)	(99%)	(100%)

Explanatory notes: '-' indicates data not available; 'n/c' indicates no cointegration; 'n/a' indicates not applicable, 'n/e' indicates not estimated. The figures in parentheses in columns 3 to 6 in both tables are the percentage of total adjustment expected in the first, fourth and twelfth month after a change in the moneymarket rate.

Table 4: Adjustment of Domestic Loan Interest Rates to Domestic Money Market Interest Rate Changes

	β_1 (adj to loan rate)				cumulative adjustment of loan rate to a 1 percentage point rise in the money market rate after 1, 4 and 12 months											
	β_2 (adj to money rate)				1975-79			1980-84			1985-89			1990-94		
	75-79	80-84	85-89	90-94	1	4	12	1	4	12	1	4	12	1	4	12
Australia	-	0.17	0.45	0.53	-	-	-	0.38	0.52	0.68	0.68	0.96	1.02	0.49	0.84	0.87
	-	0.12	0.46	0.49	-	-	-	(53%)	(72%)	(94%)	(67%)	(95%)	(100%)	(56%)	(96%)	(100%)
Hong Kong	-	-	0.45	0.20	-	-	-	-	-	-	0.62	0.84	0.89	0.52	0.67	0.81
	-	-	0.40	0.17	-	-	-	-	-	-	(70%)	(95%)	(100%)	(61%)	(80%)	(97%)
Indonesia	-	-	n/c	0.12	-	-	-	-	-	-	0	0	0	0.12	0.43	0.90
	-	-	n/c	0.10	-	-	-	-	-	-	(0%)	(0%)	(0%)	(10%)	(33%)	(70%)
Japan	n/c	0.34	0.30	0.69	0.25	0.25	0.25	0.55	0.55	0.55	0.43	0.57	0.65	0.82	0.87	0.87
	n/c	0.19	0.19	0.60	(n/a)	(n/a)	(n/a)	(100%)	(100%)	(100%)	(66%)	(88%)	(99%)	(94%)	(100%)	(100%)
Malaysia	n/c	n/c	0.11	0.17	0	0	0	0	0	0	0.06	0.21	0.43	0.13	0.41	0.71
	n/c	n/c	0.06	0.13	(0%)	(0%)	(0%)	(0%)	(0%)	(0%)	(11%)	(37%)	(75%)	(17%)	(52%)	(89%)
Philippines	n/c	0.23	0.63	0.54	0	0	0	0.23	0.64	0.94	0.58	0.82	0.83	0.69	0.84	0.86
	n/c	0.23	0.52	0.46	(0%)	(0%)	(0%)	(23%)	(65%)	(96%)	(70%)	(98%)	(100%)	(80%)	(98%)	(100%)

Singapore	n/c	0.36	0.12	0.18	0	0	0	0.55	0.85	0.95	0.14	0.28	0.45	0.12	0.36	0.60
	n/c	0.35	0.07	0.12	(0%)	(0%)	(0%)	(58%)	(89%)	(100%)	(26%)	(50%)	(83%)	(18%)	(55%)	(91%)
Taiwan	n/c	0.02	0.09	n/c	0	0	0	0.32	0.60	0.80	0.30	0.46	0.71	n/e	n/e	n/e
	n/c	0.23	0.11	n/c	(0%)	(0%)	(0%)	(39%)	(72%)	(96%)	(34%)	(52%)	(80%)	n/e	n/e	n/e
Thailand	n/c	0.39	0.18	0.14	0	0	0	0.06	0.12	0.14	0.06	0.21	0.42	0.13	0.36	0.64
	n/c	0.06	0.06	0.10	(0%)	(0%)	(0%)	(39%)	(86%)	(100%)	(12%)	(40%)	(78%)	(18%)	(46%)	(83%)
Canada	n/c	n/c	0.28	0.59	1.11	1.11	1.11	0.19	0.19	0.19	0.57	0.79	0.91	0.80	0.94	0.95
	n/c	n/c	0.26	0.56	n/a	n/a	n/a	n/a	n/a	n/a	(62%)	(86%)	(99%)	(84%)	(99%)	(100%)
US	n/c	0.61	0.44	0.15	1.13	1.13	1.13	0.87	1.07	1.08	0.78	1.01	1.06	0.78	0.79	0.81
	n/c	0.66	0.47	0.13	n/a	n/a	n/a	(81%)	(99%)	(100%)	(73%)	(95%)	(100%)	(96%)	(97%)	(99%)

Explanatory notes: '-' indicates data not available; 'n/c' indicates no cointegration; 'n/a' indicates not applicable, 'n/e' indicates not estimated. The figures in parentheses in columns 3 to 6 in both tables are the percentage of total adjustment expected in the first, fourth and twelfth month after a change in the money market rate.

6. A DISCUSSION ON DOMESTIC INTEGRATION

Even a glance at the graphs of domestic money, deposit and lending interest rates set out in Appendix 2 shows that rates in Australia, Canada, Japan, Malaysia, the Philippines, Singapore, Taiwan and the US are closely linked to each other. Rates in Indonesia and Thailand, on the other hand, were not well-linked for most of the period but have become more so in the 1990s, especially in Thailand. Posted institutional rates in Korea are barely linked with money market interest rates[13], but curb loan rates do tend to follow money market developments. This pattern is reflected in the correlations between money and institutional rates, the nature of the equilibrium relationships between rates, and the speed of adjustment of institutional rates to changes in money market rates.

The average correlation between both deposit and loan rates and money market rates across both time and the Western Pacific region is substantially below one, indicating that shocks, foreign or otherwise, which affect domestic money rates are not immediately transmitted in full to the rates on non-traded domestic financial assets. This can be explained by the static nature of correlation analysis, the existence of interest rate ceilings or controls, imperfect competition in the banking sector, by shocks which only affect part rather than the whole of the term structure, or by implicit contracts between financial intermediaries and their customers to smooth retail deposit and loan rates either over the cycle or during periods of volatility in money markets.

On the other hand, correlation co-efficients, error-correction and the time taken to complete adjustment differ substantially by country and over time. *By country*, correlations are higher and the adjustment to equilibrium is relatively fast in Australia, Canada, Japan, Malaysia (deposit rates only), the Philippines and the United States. Adjustment is slower in Hong Kong, where deposit and loan rates are set by an officially sanctioned bank cartel (HKBA), and in Singapore, where branching and foreign competition are tightly controlled. Interestingly, the result that the speed of adjustment of Japanese institutional rates is similar to that of other non-cartelised banking systems suggests that its 'main bank' system does not generate abnormal behaviour in institutional rates. While cross-country comparisons are difficult to

[13] The Korean institutional interest rates analysed in this paper have been liberalised, but other rates are yet to be deregulated. The published figures do not report actual market rates.

make, since the maturity profile of the instruments differs across countries, correlations tend to be negative or zero and adjustment negligible when countries set retail rates in a way which does not conform with market rates. In Korea, for example, the correlation between changes in money and deposit rates was significantly negative in the early 1980s, and not different from zero otherwise. Correlations for Thai and Indonesian rates are also not different from zero.

By period, correlations and the speed of adjustment to equilibrium have increased for Australia[14], Canada, Indonesia, Japan, Malaysia and the Philippines. In Malaysia in the first half of the 1980s, for example, a third of the expected adjustment of the deposit rate to a rise in the money market rate had taken place by the end of the first month after the rise, but, by a decade later, this had risen to three-quarters of the expected adjustment. Moreover, while there were no equilibrium relationship between rates in Indonesia and Thailand during the 1970s or 1980s, such a relationship emerged in the 1990s. All this points to substantial and increasing integration of domestic financial markets. In Singapore and Taiwan, on the other hand, equilibrium adjustment appears to have slowed, and the adjustment of the loan rate has slowed in the US. In the case of Singapore, this is partly due to the insulating domestic institutional rates through 1988, 1989 and 1990 from money market rates. Excluding this period, the co-movement of rates rises slightly. The deterioration in the case of Taiwan may be due to an increase in the volatility of money market rates in the 1990s,[15] while the slowdown in the adjustment of the US prime rate may reflect the decreasing importance of that rate for pricing bank loans. Nonetheless,

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[14] Note that the adjustment of the deposit rate to the bill rate slows down in the 85M1-89M12 sub-period. As official interest rates rose during 1985 and 1986, savings banks, whose assets chiefly comprised housing loans, became constrained by the 13.5 per cent ceiling on loans for owner-occupied housing. They responded to tighter margins by rationing housing credit and, taking advantage of price-making power in the deposit market, by limiting the rise in deposit rates, thereby driving a wedge between deposit and bill rates. The impasse was broken by providing special subsidies to savings banks and the liberalisation of interest rates on new loans for owner-occupied housing in April 1986, after which the wedge between deposit and bill rates narrowed. When the regression excludes this period, and is run from 87M1 to 89M12, β_1 is 0.48 and β_2 is 0.47, implying that 48 per cent of adjustment is completed after 1 month, 93 per cent after 4 months, and 100 per cent after 12 months. This is considerably faster than the 80M1-84M12 period but not as fast as the 90M1-94M12 period.

[15] The money market rate used in this case is the average of call rates across all maturities, which is dominated by very short call transactions. Since the term structure of money and institutional rates is not well matched, an increase in short-lived shocks to the money market rate will depress the adjustment coefficients. Other money market interest rate data, such as the 1 to 90 day NCD secondary market rate exhibits a similar pattern.

there has been a notable increase in the co-movement of institutional rates with money market rates in most Western Pacific economies over the past decade, largely attributable to deregulation and a greater focus on competition in the banking sector.

It is worth noting that regulation and control *per se* are only impediments to domestic rate integration if they are not market-conforming. Japan and Taiwan are cases in point. While deposit rate liberalisation started in Japan in 1985 and was only completed in 1994, the rate was based on the CD rate, and so moved fairly closely with interbank rates. On the other hand, the margin between the deposit rate and CD rate only narrowed *after* deregulation, suggesting that the aim of regulation was to subsidise the cost of bank funds. Taiwan's deposit rates also seem to have been set with money market developments in mind. The story is less clear with loan rates. In Japan's case, until 1989 the short-term prime rate was set with respect to the ODR, *below* the money market rate, which is in violation of a market model of loan rate determination. This rate was formally liberalised in January 1989, but informal practices ensured that it initially remained relatively inflexible: banks met considerable borrower resistance in trying to implement a market-based lending rate when the rate was first liberalised and were forced to forego the requirement that borrowers place compensatory balances with them (so that the effective cost of borrowing rate was less affected). At the same time, risk of default increased markedly in 1992 as the economy deteriorated and the number of bankruptcies jumped, and the loan-call rate spread widened. The speed of adjustment also increased in the 1990s, especially when compared to the second half of the 1980s. One further reason why the deposit rate may have conformed more to the market than the loan rate is that Japan, like some other East-Asian countries, consistently sought to maintain positive real rates of interest on financial assets in order to promote saving, while at the same time trying to subsidise industry with cheap credit.

More generally, there is an apparent difference between the adjustment process of deposit rates and loan rates. Correlations tend to be higher, the adjustment process simpler, and the adjustment to equilibrium faster in deposit markets than in loan markets. This is most apparent in Indonesia, Malaysia and Thailand, but it also occurs in other countries. The fact that it occurs generally is consistent with a

number of hypotheses[16]: firstly, the maturity matching with money market rates is more precise with deposit rates than with lending rates; secondly, the smoothing of rates under implicit contracts is more important in the loan market than the deposit market, since borrowers may be more concerned with fixing costs than depositors are with fixing income; thirdly, it is easier and less expensive for a depositor to change accounts or financial intermediary than it is for a borrower, which means that arbitrage between deposit rates will be faster than for lending rates for any given change in market rates (see Lowe and Rohling (1992)).

The fact that the difference is most pronounced in Indonesia, Malaysia and Thailand suggests that it is difficult to enforce controls when substitutes to the controlled instruments can be readily created. In South-East Asian countries, there have usually been close substitutes for domestic currency denominated deposits, either in the form of foreign currency (US$) deposits at local banks or access to off-shore foreign currency deposits, for example in Singapore. If the authorities hold deposit rates below the 'market' rate, they risk hollowing out the banking sector and increasing the volatility and size of capital flows and exchange rate fluctuations. Substitutability is typically greater for deposits than loans, given the additional contracting costs and information asymmetries in the loan market, and this implies a lower adjustment coefficient on loan rates. However, this is not tenable over time if the banking system is to be stable. Moreover, one would expect that the ability of the authorities to insulate the domestic market has declined over the past decade as capital inflows to South-East Asia have increased (so the range of foreign substitutes for loans has increased) and as domestic capital markets have grown apace (so the range of domestic substitutes for both deposits and loans has expanded).

As discussed in Section 2, banks in most countries in the region have experienced periodic deterioration in the quality of their assets. The loan pricing rule for a free market predicts that this forces the loan rate up, and the positive constant in the loan

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[16] In any sub-sample, the adjustment of deposit rates will be faster than that of loan rates if the deposit market is liberalised ahead of the loan market, as occurred in Malaysia (October 1978 compared to February 1991) and Thailand (March 1990 compared to June 1992). The 90M1-94M12 sub-sample for the loan rate is re-estimated for Malaysia and Thailand with the starting date being the date the loan rate was liberalised. The coefficients are almost identical for Thailand but change substantially for Malaysia. In this case, β_1 is 0.28 (up from 0.17) and β_2 is 0.19 (up from 0.13). These coefficients are still significantly lower than the corresponding values for the deposit rate (0.48 and 0.50), and so the different speed of adjustment is not simply due to the timing of liberalisation.

rate equation should rise, which is what actually occurs. The constant term in the Philippine loan equation is positive, relatively large and statistically significant in all sub-periods, as expected. The constant term increases substantially in the Japanese, Canadian and Australian loan rate equations in the 90M1-94M12 sub-period, coincident with a substantial rise in business risk and non-performing loans (Okina and Sakuraba 1993; Lowe 1995). Indonesia has also experienced severe problems with non-performing loans, but the constant term for 90M1-94M12, while positive, is not significant, and this may indicate that the pricing of risk and the recovery of the banking system is being effected through non-market mechanisms (such as central bank bailouts). The constant term in the Thai loan equation is very large, positive and significant in the 80M1-84M12 sub-period, reflecting the series of banking crises from 1983 to 1986. The constant subsequently falls over successive periods, following substantial and effective reform of bank supervision, though it is still statistically significant. The constant is positive, significant and mostly stable in Singapore and the US over the sub-periods.[17] The constant is positive but insignificant in Malaysia in 90M1-94M12, apparently reflecting sound banking practices and effective supervision in that country.

There are two additional issues to be considered. The first is whether foreign rates should be included in the institutional rate estimating equation. Consider the loan rate. The simple bank balance sheet from which the rules for institutional rates are derived ignores foreign liabilities, which can be important sources of funds when the capital account is open. This is unlikely, however, to be important in practice, since banks typically cover foreign currency borrowing in the forward exchange market, and so the cost of foreign funds will be the same as the money market rate when covered interest parity holds.[18] In regard to the deposit rate, on the other hand, it is reasonable to think of the foreign interest rate as a determinant of the domestic deposit rate when foreign currency deposits are close substitutes for home currency denominated deposits, as in Indonesia and Malaysia. The foreign interest rate, however, is not significant in deposit rate equations.

The second issue is the relevance of the other institutional rate in the determination of institutional rates, discussed above in Section 4. If institutional rates are determined

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[17] In the case of the US, however, the adjustment coefficient declines over sub-periods, which may be due to risk or the declining significance of the prime rate as an indicator lending rate.

[18] This is generally a reasonable assumption for most of these markets – see Chinn and Frankel (1994a) and de Brouwer (1995).

by fiat, then the money market rate and both institutional rates may contain information about the process for each of the institutional rates, whereas if they are market-determined, only the money market rate and the particular institutional rate under consideration should contain information about its process. Using data for Thailand and Australia, regressions which included the money market rate and both institutional rates were conducted for each country for the last two sub-sample periods, 85M1-89M12 and 90M1-94M12. The countries and periods were selected on the grounds that institutional rates were liberalised in both periods in Australia, but only the second period in Thailand, and so implicitly provide a test of the model.[19] The estimation proceeded as follows. The lagged level of the other institutional interest rate and its lagged first-difference were added to the preferred equation estimated using equation (16), which effectively nests the hypothesis that the regulatory regime makes a difference to the determination of institutional interest rates. Table 5 reports the chi-square (2) statistic for *excluding* the other institutional rate.

Table 5: Chi-Square (2) Test that the Other Institutional Rate Should be Excluded

	Australia		Thailand	
	Deposit equation	Loan equation	Deposit equation	Loan equation
85M1-89M12	2.48 (0.289)	1.99 (0.370)	5.31# (0.070)	1.52 (0.468)
90M1-94M12	0.03 (0.984)	2.47 (0.291)	3.04 (0.219)	19.00* (0.000)

Note: * indicates 5 per cent significance, # indicates 10 per cent significance; marginal significance in parentheses.

The results are relatively straightforward. For Australia, it is unambiguous that, in both periods, including the deposit rate in the loan rate equation provides no additional information and vice versa. For Thailand, the loan rate (in this case, the lagged level) did provide information about the deposit rate before deregulation but not afterwards. On the other hand, the deposit rate provides information about the loan rate in the 1990s, though in this case the first lag of the differenced deposit rate

[19] This test was also applied to the other Western Pacific economies from 90M1-94M12. As for Australia and Thailand, the other institutional rate is not significant for Japan, Malaysia and the Philippines, but is for Hong Kong, Indonesia, Singapore and Taiwan. Rates are market-determined in the latter set of countries, but these markets are the relatively more closed or cartelised. For Hong Kong and Singapore, where cartels are dominant, the interbank rate becomes statistically insignificant in the loan rate equation once the deposit rate is included, but is significant in the deposit rate equation along with the loan rate.

provides information, and not the lagged level, which indicates the information concerns dynamics and not fundamentals. Moreover, the loan rate was only liberalised in mid 1992 and so the results are the average of two regimes.[20] Overall, the evidence suggests that the rules are reasonable first approximations of institutional rate determination. Australian institutional rates are market-determined, as expected, and Thai deposit rates have been market determined this decade, although the evidence is less clear for Thai loan rates. The impact of money market rates on institutional interest rates has increased.

7. CONCLUSION

This paper addresses the integration of *domestic* financial markets – an unexamined issue in the literature of international financial integration – by exploring the relationship between money market interest rates and deposit and loan interest rates. Rules for setting interest rates on deposits and loans were derived, and these were shown to conform to banking practice and capture recent key developments in the banking sectors of Western Pacific economies, namely progressive deregulation and liberalisation, increasing competitiveness and episodic deterioration in the quality of loan assets.

The modelling shows that the integration of domestic institutional financial markets has increased substantially over the past decade, due to pervasive liberalisation and, more recently, growing competitiveness. The adjustment of domestic institutional rates to changes in money market rates has increased, often significantly, and by the first half of the 1990s the speed and pattern of adjustment of institutional rates in most of the developing/newly developed economies of East Asia had become similar to that in economies with developed financial systems. There is also a difference between the adjustment of deposit and loan rates, with the former adjusting more rapidly. This may be explained by differences in the maturity, substitutability and transactions costs associated with loans and deposits. The riskiness of private borrowers and the poor health of the banking system were shown to have a significant, deleterious effect on the level of loan rates in the region.

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[20] When the first lags of the differenced money and loan rates are included in this equation, the lag of the differenced deposit rate remains significant but the coefficient (0.28) is offset by the other dynamics on the loan rate (-0.20) and on the interbank rate (-0.05).

There are a number of policy implications that flow from this analysis. First, when monetary policy is implemented by indirect monetary management techniques, its effectiveness is significantly enhanced when institutional interest rates are liberalised: the transmission from the money market to institutional markets is considerably more rapid when the latter markets are deregulated. Regulation can be market conforming, and the gains from deregulation are obviously smaller in this case, but most regulations have been non-conforming. All the economies examined had substantially liberalised institutional interest rates by the mid 1990s, although this does not preclude the authorities from using non-market influence over rates. Second, competition in banking is crucial, both to securing greater rewards for savers and lower costs for borrowers, and to ensuring that innovations in money market interest rates are transmitted to institutional rates. There is still considerable progress to be made in this area, particularly in dissolving cartels and oligopolistic behaviour in the Korean, Taiwanese and some South-East Asian economies. Third, sound bank management and effective prudential supervision are necessary conditions to securing a lower level of lending rates given funding costs. There is again still a considerable way to go in this regard for most economies, but Hong Kong, Singapore, Malaysia and Thailand stand out as striking examples of success.

APPENDIX 1: SUMMARY OF DEREGULATION IN BANKING AND IN DEPOSIT AND LOAN MARKETS

Australia

Date	Banking sector	Deposit market	Loan market
February 1972			maximum interest rate on overdrafts and housing loans over A$50,000 removed
January 1975	banks' agreement to maintain uniform fee structure discontinued since it was contrary to Trade Practices Act		
February 1976			limit extended to A$100,000
December 1980		interest rate ceilings on all bank deposits removed	
June 1982			Reserve Bank of Australia ceased quantitative lending guidance
August 1984		all remaining controls on deposits (terms and conditions) removed	
February 1985	entry of 16 foreign banks		
April 1985			remaining ceilings on interest rates removed, except for owner-occupied housing loans under A$100,000
April 1986			interest rate ceiling on new owner-occupied housing loans removed, existing loans still subject to maximum rate of 13.5 per cent
February 1992	further entry by foreign banks approved		
February 1992 to June 1994	foreign banks have the choice of operating as branch or locally incorporated subsidiary; foreign bank branches not allowed to conduct retail banking business		

Source: Battellino and McMillan (1989), Reserve Bank of Australia (1994), *Annual Report*.

Hong Kong

Date	Banking sector	Deposit market	Loan market
July 1981		banks required to observe rates set by the Hong Kong Association of Banks (HKAB) which sets the maximum interest rate payable on deposits up to HK$500,000 with a maturity less than 15 months	banks required to observe rates set by HKAB which sets the prime lending rate
March 1989	3-tier system of banking introduced, comprising licensed banks (LBs), restricted licensed banks (RLBs or merchant banks) and deposit-taking companies (DTCs). (Only licensed banks are required to follow rates set by the HKAB but RLBs and DTCs are subject to minimum deposit requirements and DTCs are excluded from taking short-term deposits.)		
October 1994		interest rates on deposits fixed for more than 1 month liberalised	
January 1995		interest rates on deposits fixed for more than 7 days liberalised	
April 1995		interest rates on deposits fixed for more than 24 hours on call liberalised	
second half of 1995		interest rates on deposits fixed for more 24 hours to be liberalised	

Source: Ho (1991); Hong Kong Monetary Authority (1994), *Quarterly Bulletin*, November.

Indonesia

Date	Banking sector	Deposit market	Loan market
April 1974		stabilisation package including continued regulation of state bank deposit interest rates	stabilisation package including introduction of credit ceilings for all banks; continued regulation of state bank lending interest rates; extension of provision of liquidity credits to state banks and of direct credits to priority sectors
June 1983		removal of interest rate ceilings on time deposits by state banks (but banks entered into an agreement of understanding to avoid 'undue competition')	removal of interest rate ceilings on loans by state banks (and introduction of money market instruments); abolition of credit ceilings; reduction in liquidity credits to state banks and direct credit credits to priority sectors; priority shifts to non-oil exports
October 1988	prudential system overhauled; foreign banks allowed access to Tabanas and Taska rupiah savings schemes; entry and branch establishment requirements eased for domestic and foreign banks; restrictions on ATMs and mobile cash units eased	tax-free status of interest earned on time deposits removed	
January 1990			substantial reduction in scale and scope of liquidity credits
February 1991	bank supervision policy overhauled; domestic banks permitted to establish branches overseas; restrictions on bank mergers eased		
1992	foreigners allowed to buy up to 49 per cent of publicly listed shares in banks		

Source: Bank Indonesia, *Annual Report*, various; MacIntyre (1993); APEG (1995).

Japan

Date	Banking sector	Deposit market	Loan market
April 1972			long-term prime rate freed and set at 90 basis points above the subscribers' yield on 5 year debentures issued by long-term credit banks
March 1985		introduction of money market certificates (MMC), Y50m minimum deposit requirement and period of 1 to 6 months	
October 1985		interest rates on time deposits of 3 months to 2 years with minimum deposit of Y1b liberalised; minimum deposit requirement on MMCs extended to 1 month to 1 year	
March 1986		minimum deposit requirement on free time deposits cut to Y500m	
September 1985		minimum deposit requirement on MMCs cut to Y30m; minimum deposit requirement on free time deposits cut to Y300m	
April 1987		minimum deposit requirement on MMCs cut to Y20m; minimum deposit requirement on free time deposits cut to Y100m	
October 1987		minimum deposit requirement on MMCs cut to Y10m; period on free time deposits extended to 1 month to 2 years	
April 1988		minimum deposit requirement on free time deposits cut to Y50m	
November 1988		minimum deposit requirement on free time deposits cut to Y20m	

Continued

Japan *(Continued)*

Date	Banking sector	Deposit market	Loan market
January 1989			while the maximum short-term prime rate remains set at 15 per cent under the Temporary Interest Rate Adjustment Law, the rate is freed from the ODR and determined by bank funding costs and expenses
June 1989		small MMC introduced with minimum deposit requirement of Y3m	
October 1989		minimum deposit requirement on free time deposits cut to Y10m; MMC merged into large-denomination time deposits	
April 1989		minimum deposit requirement on small MMC cut to Y1m	
April 1989		minimum deposit requirement on small MMC cut to Y500,000	
April 1991			long-term prime rate set at a spread above short-term prime rate
November 1991		minimum deposit requirement on free time deposits cut to Y3m	
June 1992		minimum deposit requirement on small MMCs abolished	
June 1993		minimum deposit requirement and period on time deposits abolished; small MMCs merged into time deposits	
October 1994		interest rates on demand deposits freed (though payment of interest on current deposits remains prohibited)	

Source: Bank of Japan (1994), *Quarterly Bulletin*, November.

Korea

Date	Banking sector	Deposit market	Loan market
June 1981 to 1983	privatisation of the 4 government-owned commercial banks (taking total of private commercial banks to 5)		
1981	lowering of entry barriers to domestic and foreign banks		
December 1982	maximum ownership of bank by one shareholder set to 8 per cent		
1980	elimination of discriminatory tax on NBFI deposit interest		
1982	lowering of entry barriers to NBFIs		
1985		banks allowed to establish high-yielding savings deposits	
December 1988		interest rates on time deposits of more than 2 years liberalised	interest rates on loans from banks and NBFIs, other than interest rates on loans subsidised by government, fully liberalised; introduction of a prime rate system; interest rates on money market instruments fully liberalised
1989	3 new commercial banks established		
April 1989		December 1988 reform reversed	December 1988 reform reversed
October 1990	facilitation of NBFI conversion to bank status		
July 1991	restrictions on foreign banks eased considerably, covering branching, limits on capital, access to local funding and participation in trust business		
November 1991		rates on deposits >3 years liberalised	short-term rates on bank overdraft loans, commercial and trade bill discounts liberalised

Continued

Korea *(Continued)*

Date	Banking sector	Deposit market	Loan market
November 1993		rates on deposits >2 years liberalised	rates on all bank lending (excluding loans financed by the official sector) liberalised; export financing incentives and government-directed funds for capital investment, housing funds and agricultural funds remain
November 1994		rates on deposits >1 years liberalised	
1995			plan to free all lending rates
1996		plan to liberalise rates on all deposits except demand deposits, introduce products linked to money market rates	
1997		plan to set up plan to deregulate demand deposits	

Source: Lee (1992), Bank of Korea (1994).

Malaysia

Date	Banking sector	Deposit market	Loan market
October 1978		commercial banks allowed to set interest rates on deposits 1 year or less	commercial banks allowed to set base lending rates (BLR) under guidance of Bank Negara Malaysia
March 1983			bank lending rates pegged to banks' declared BLR
October 1985		pegged interest rate agreement whereby rates on deposits 1 year or less are aligned to 2 lead banks' rates	
February 1987		pegged interest rate agreement disbanded	
1987			margin of lending rates over BLR restricted to 4 percentage points

Continued

Malaysia *(Continued)*

Date	Banking sector	Deposit market	Loan market
February 1991			BLR freed from Bank Negara Malaysia's administrative control
	note: controls on entry of foreign banks and establishment of new banks remain; domestic bank branch numbers not controlled but foreign bank branch numbers are		

Source: Bank Negara Malaysia, *Quarterly Bulletin*, various; Abidin (1986).

Philippines

Date	Banking sector	Deposit market	Loan market
July 1981		interest rate ceilings removed	interest rate ceilings removed except on loans for up to 1 year
January 1983			interest rate ceiling on loans up to one year removed
early 1980s			25% of loanable funds directed to agriculture and agrarian reform credits
November 1985			major reduction in subsidy element of central bank refinancing; interest rate ceilings removed
1989	lifting of moratorium on the establishment of new banks		
April/May 1991	bank branching and ATM restrictions liberalised		5-10% of loanable funds directed to small and medium cottage enterprises
June 1993	restructuring of the central bank		
May 1994	foreign bank entry allowed (as a full branch, as a local subsidiary or by acquisition of an existing domestic institution). 10 foreign banks granted full branch status		

Source: Bangko Sentral ng Pilipinas, *Annual Report*, various; Hutchcroft (1993).

Singapore

Date	Banking sector	Deposit market	Loan market
July 1975		domestic interest rate cartel abolished, all banks free to quote their own interest rates	domestic interest rate cartel abolished, all banks free to quote their own interest rates

Source: Monetary Authority of Singapore, *Annual Report*, various; APEG (1995).

Taiwan

Date	Banking sector	Deposit market	Loan market
1975			Central Bank of China authorises the Interest Rate Committee of the Banks' Association to set the ceiling and floor of lending rates
November 1980			prescribed interest rate band widened; interest rates on bank debentures, NCDs, FX deposits and interbank call loans liberalised
December 1983	offshore banking allowed		
April 1984	banks allowed to increase branches by 3 each year (up from 2 each year)		
March 1985			10 large local banks free to set prime rate according to market pressures and customers' credit rating but within the prescribed band
September 1985			prime rate system available to all banks
November 1985			Interest Rate Control Statute abolished, giving financial institutions more autonomy in setting interest rates
January 1986		categories of deposits simplified from 13 to 4; interest rate floor abolished	
1986-1987	restrictions on foreign bank business, NT$ financing and branches moderately eased		

Continued

Taiwan *(Continued)*

Date	Banking sector	Deposit market	Loan market
1987			decontrol of foreign exchange outflow, reducing the privilege of foreign banks to import cheap capital
July 1989		ceiling on interest rates removed	band on interest rates removed
July 1989	lifting of ban on establishment of private banks (new banks limited to 5 branches, not allowed to deal in foreign exchange and, for the first three years of operation, securities)		
1989-1993	privatisation of state-owned commercial banks announced		
1994		non-residents allowed to open NT$ accounts	

Source: Chen (1990), Yang (1991), Cheng (1993), Asia-Pacific Economic Group (1995).

Thailand

Date	Banking sector	Deposit market	Loan market
1983			18 per cent ceiling on growth in commercial bank private credit imposed
1984			ceiling on commercial bank credit growth abolished
1985	Bank of Thailand to conduct on-site bank examinations, remove bank directors and officers, restrict transactions between directors and their banks, and bring action against shareholders		
June 1989		interest rate ceiling on fixed deposits >1 year removed	
March 1990		interest rate ceiling on fixed deposits <1 year removed	

Continued

Thailand *(Continued)*

Date	Banking sector	Deposit market	Loan market
early 1992	as part of the goal of universal banking, banks permitted to underwrite public securities and provide financial consultation and information services		
January 1992		interest rate ceiling on savings deposits removed	
June 1992			interest rate ceiling on loans by banks, finance companies and credit fonciers removed (except for housing loans to low income earners) but some lending restrictions remain
April/May 1986	issue 5 new bank licences to foreign banks and 20 new offshore banking licences; allow foreign banks to open 2 new branches (1 outside Bangkok)		
January 1993	banks required to maintain BIS ascetand liability ratios		

Source: Wibulswasdi and Tanvanich (1992); Doner and Unger (1993); Kirakul, Jantarangs and Chantanahom (1993).

APPENDIX 2: MONEY, DEPOSIT AND LOAN RATE DATA DEFINITIONS AND GRAPHS

Australia

Money market rate: average 90-day bank bill rate for week ending last Wednesday of the month, Reserve Bank of Australia *Bulletin*.

Deposit rate: bank 3-month deposit rate, Reserve Bank of Australia *Bulletin*.

Lending rate: bank maximum prime rate, Reserve Bank of Australia *Bulletin*.

Canada

Money market rate: average of the 7 days ending the last Wednesday of the month of overnight money market financing rate, IMF *International Financial Statistics*.

Deposit rate: last Wednesday in the month chartered banks' rates on 90-day C$ deposits, IMF *International Financial Statistics*.

Lending rate: last Wednesday of the month chartered banks, rates on loans to the most credit-worthy large businesses, IMF *International Financial Statistics*.

Figure 1: Money Market, Deposit and Loan Interest Rates in Australia

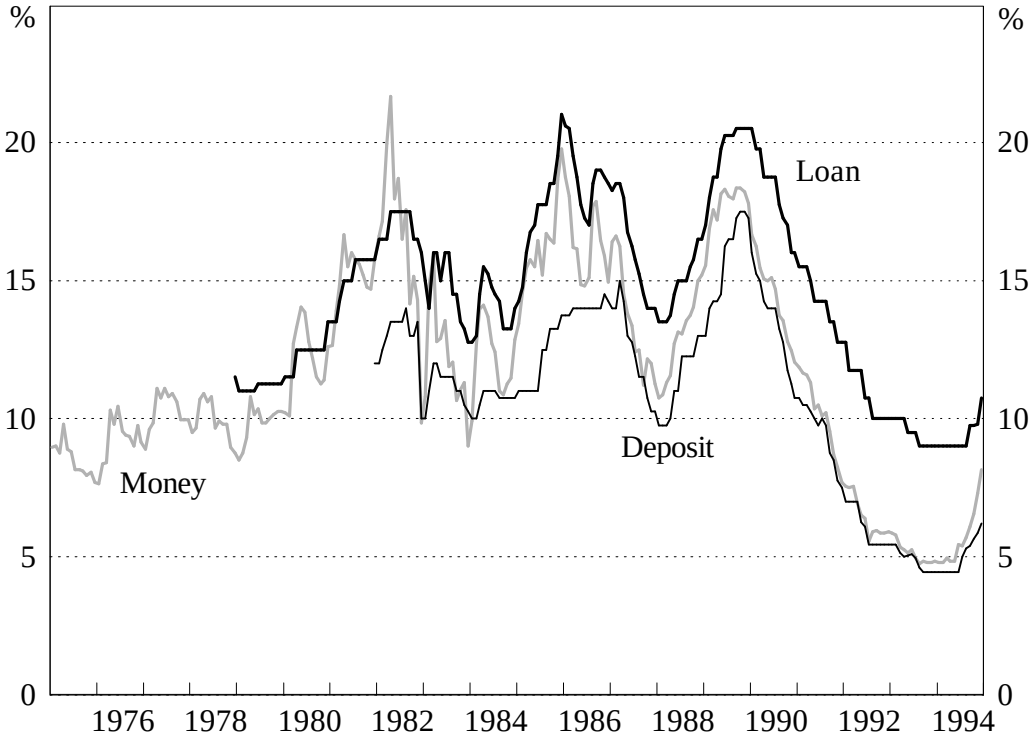
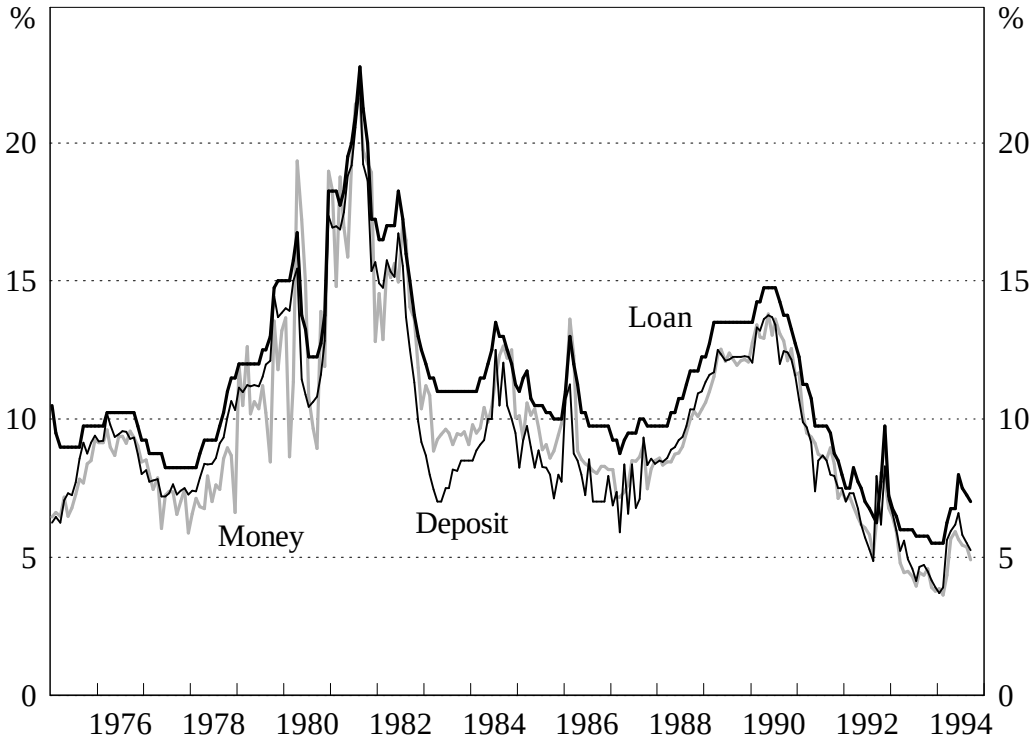


Figure 2: Money Market, Deposit and Loan Interest Rates in Canada



Hong Kong

Money market rate: end-month 3-month Hong Kong dollar interbank offered interest rate, *Hong Kong Monthly Digest of Statistics*.

Deposit rate: end-month maximum interest rate paid by licensed banks under the HK Association of Banks' interest rules on 3-month time deposits, *Hong Kong Monthly Digest of Statistics*.

Lending rate: end-month Hong Kong Shanghai Bank's quoted best lending interest rate, *Hong Kong Monthly Digest of Statistics*.

Indonesia

Money market rate: weighted average of all maturities, Bank Indonesia *Indonesian Financial Statistics*.

Deposit rate: 6-month deposit rate at deposit money banks, Bank Indonesia *Indonesian Financial Statistics*.

Lending rate: average working capital lending rate at deposit money banks, Bank Indonesia *Indonesian Financial Statistics*.

Figure 3: Money Market, Deposit and Loan Interest Rates in Hong Kong

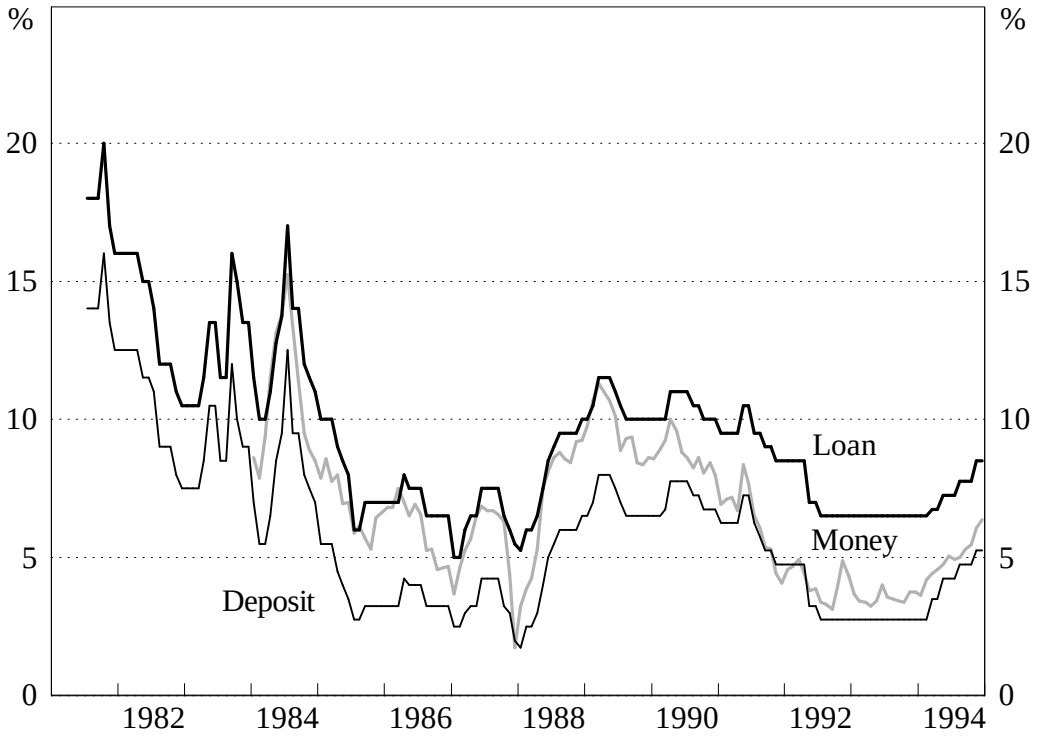
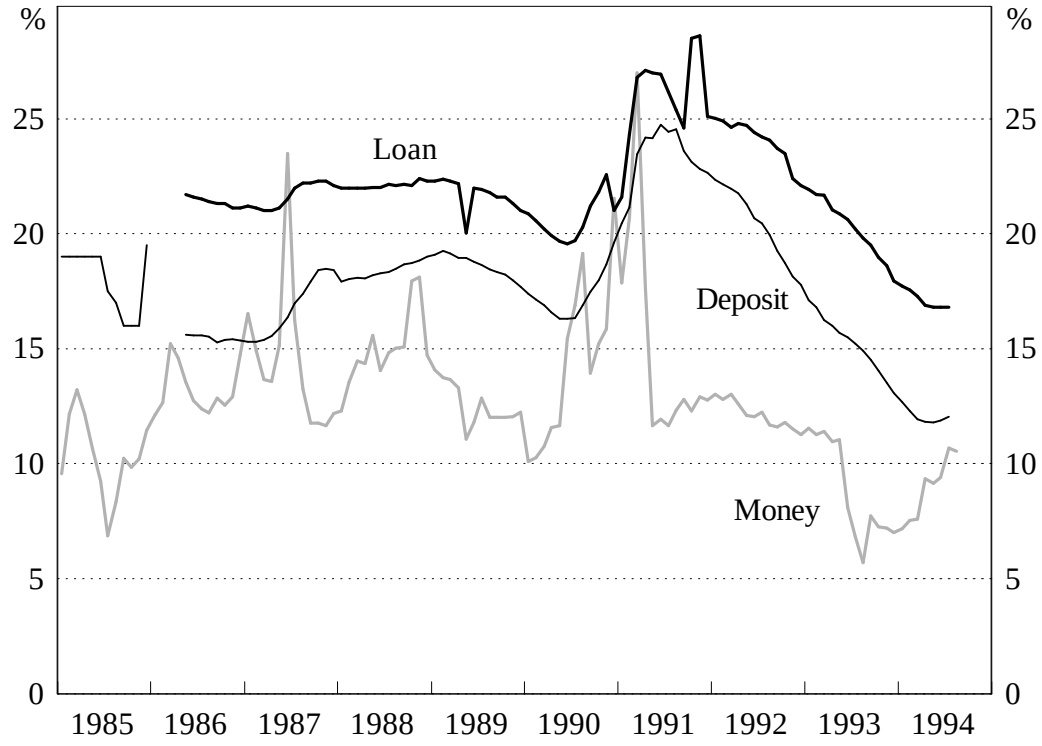


Figure 4: Money Market, Deposit and Loan Interest Rates in Indonesia



Japan

Money market rate: monthly average collateralised overnight Tokyo call money rate, IMF *International Financial Statistics* and Bank of Japan *Economic Statistics Monthly*.

Deposit rate: before June 1992, the guideline rate set by the Bank of Japan on three-month time deposits, from June 1992, monthly average deposit rate set by city banks on 3 to 6 month time deposits (so-called small money market certificates), Bank of Japan *Economic Statistics Monthly*.

Lending rate: before 23 January 1989, rate on discount and loans on bills of especially high credit, from 23 January 1989, short-term prime lending rate set by a majority of the city banks, Bank of Japan *Economic Statistics Monthly*.

Korea

Money market rate: average daily rate on call money, weighed by volume of transactions, Bank of Korea *Monthly Statistical Bulletin*.

Deposit rate: maximum guideline rate set by the Bank of Korea for deposits of 3 months to 1 year with deposit money banks, Bank of Korea *Monthly Statistical Bulletin*.

Lending rate: maximum rate charged to general enterprises by deposit money banks on loans of general funds for up to one year, Bank of Korea *Monthly Statistical Bulletin*.

Figure 5: Money Market, Deposit and Loan Interest Rates in Japan

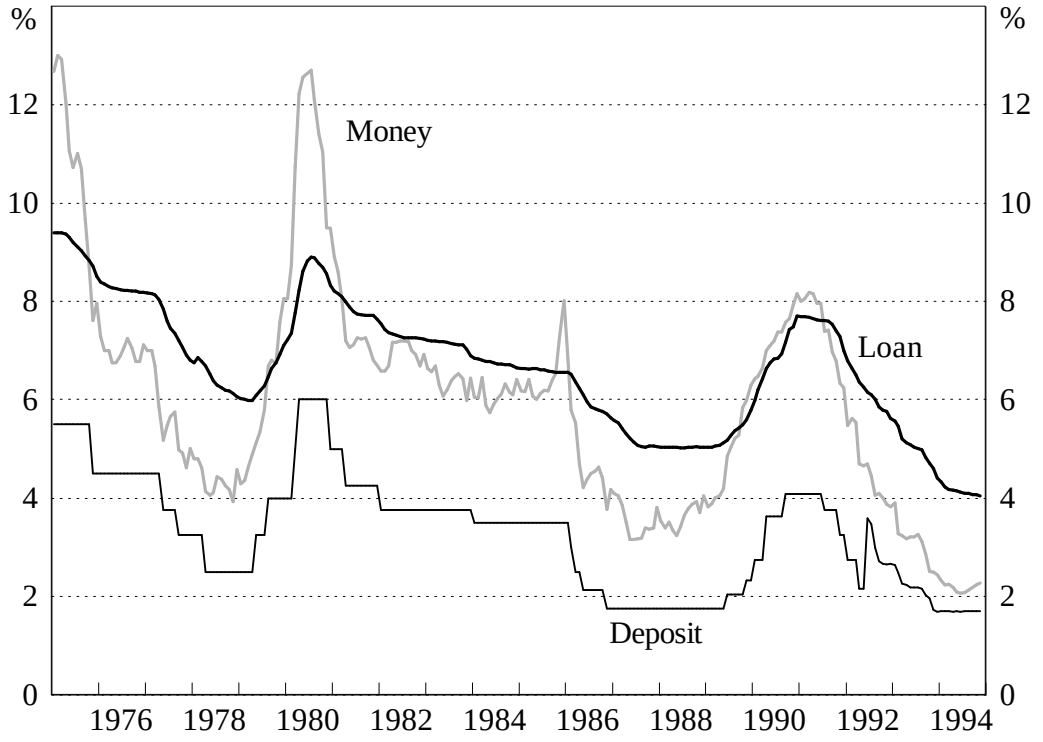
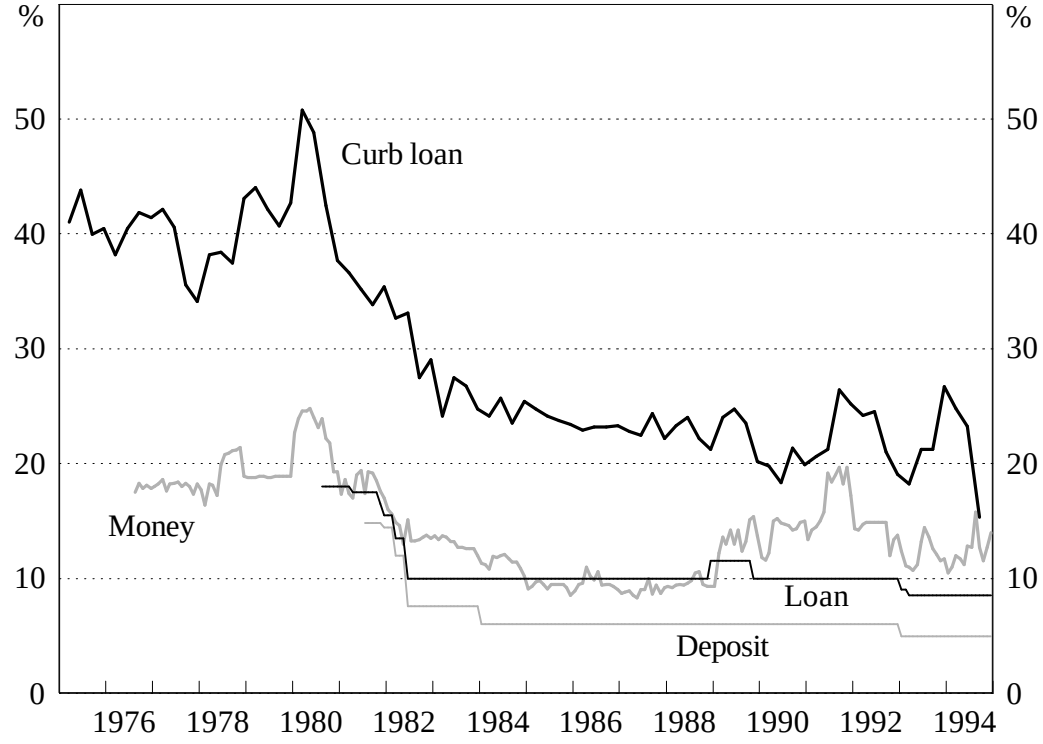


Figure 6: Money, Deposit and Loan Interest Rates in Korea



Malaysia

Money market rate: daily average overnight lending rates of 10 banks for the last week of the month, IMF *International Financial Statistics*.

Deposit rate: mode of the range of quotes qouted on 3-month deposits, IMF *International Financial Statistics*.

Lending rate: mode of the range of quotes for for the base lending rate, IMF *International Financial Statistics*.

Philippines

Money market rate: rate on 91-day treasury bills, IMF *International Financial Statistics*.

Deposit rate: rate on 61-90 day time deposits, IMF *International Financial Statistics*.

Lending rate: average commercial lending rate, IMF *International Financial Statistics*.

Figure 7: Money Market, Deposit and Loan Interest Rates in Malaysia

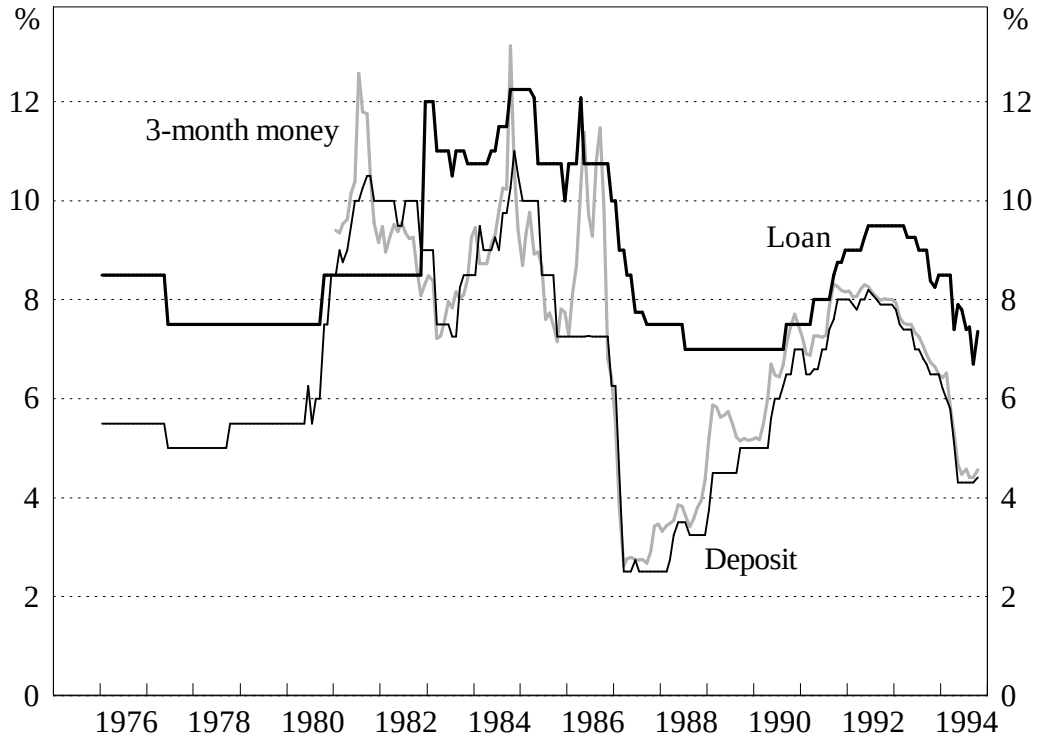
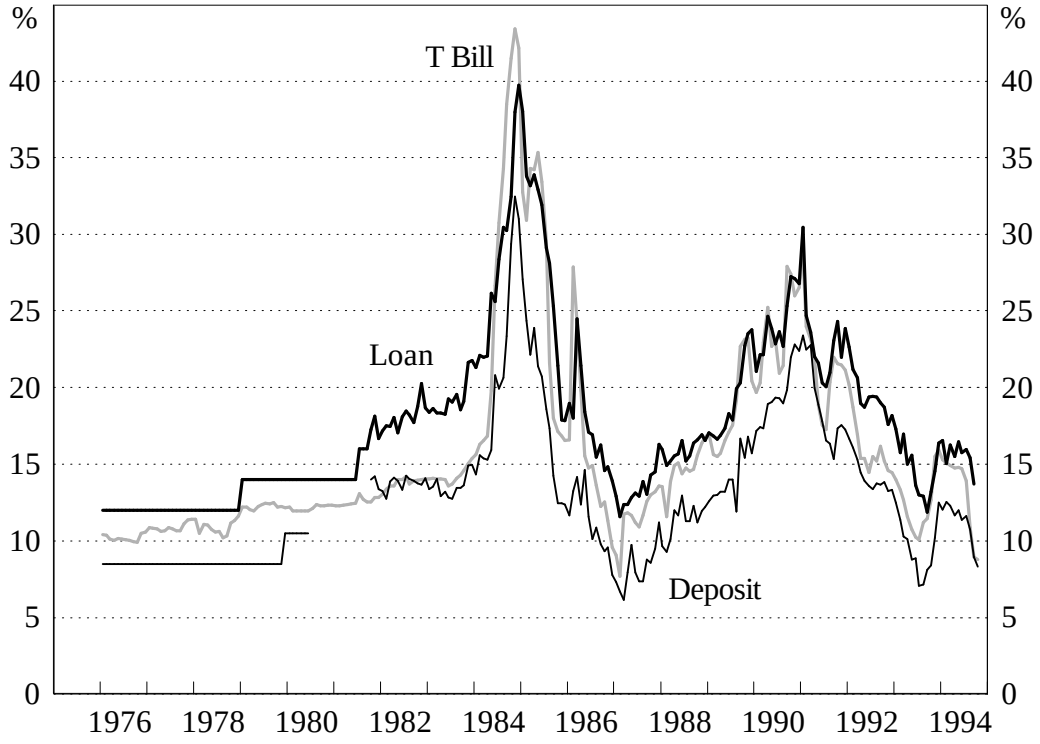


Figure 8: Treasury Bills, Deposit and Loan Interest Rates in Philippines



Singapore

Money market rate: mode of the 3-month interlink rate quoted by brokers on the last Friday (or closest working day thereto) of the month, IMF *International Financial Statistics*.

Deposit rate: average of 3-month deposit rates quoted by the 10 leading commercial banks, IMF *International Financial Statistics*.

Lending rate: average minimum lending rates quoted by the 10 leading commercial banks, IMF *International Financial Statistics*.

Taiwan

Money market rate: weighted average interbank lending rate, Central Bank of China *Financial Statistics Monthly.*

Deposit rate: until November 1985, the maximum rate on 3-month time deposits, and after, the 3-month time deposit rate offered by First Commercial Bank, Central Bank of China *Financial Statistics Monthly.*

Lending rate: from 1975 to 1979, the maximum rate on unsecured loans, from 1980 to December 1989, the maximum rate on unsecured loans on maturities 1 year or less, from 1990, the Bank of Taiwan prime rate, Central Bank of China *Financial Statistics Monthly.*

Figure 9: Money Market, Deposit and Loan Interest Rates in Singapore

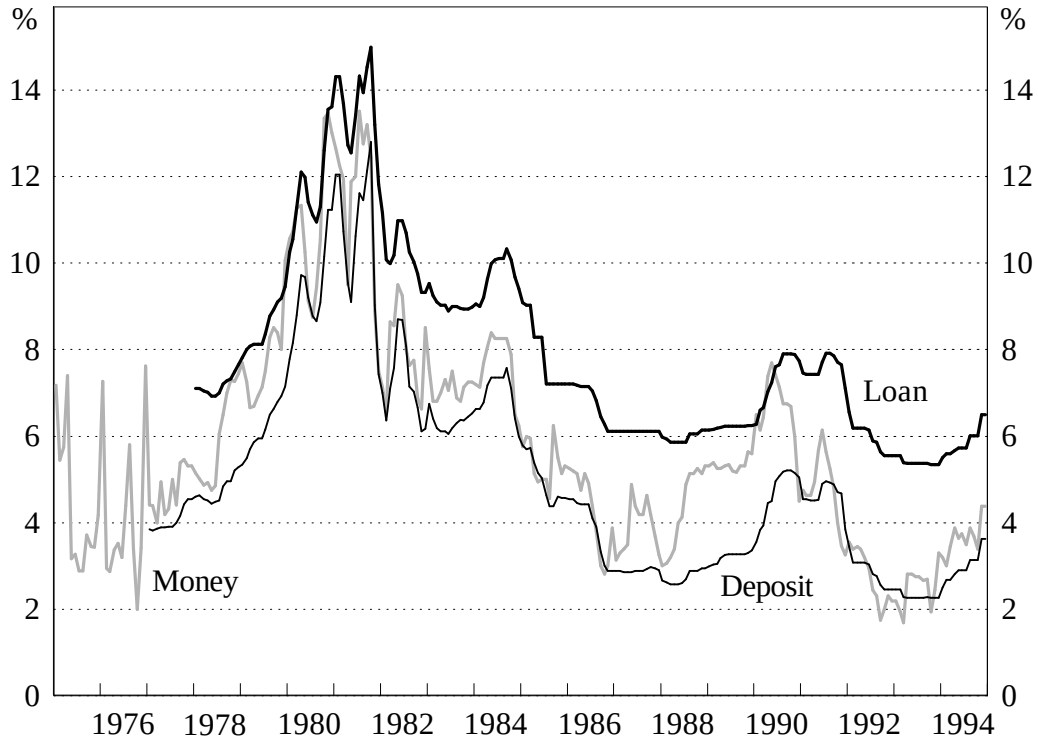
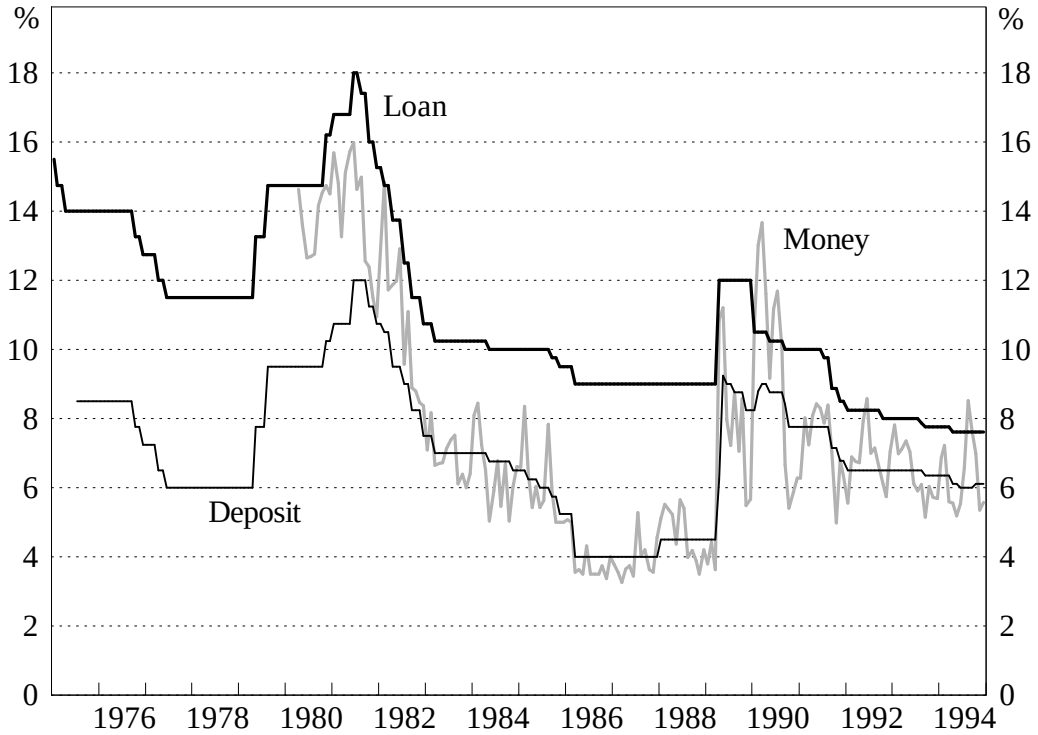


Figure 10: Money, Deposit and Loan Interest Rates in Taiwan



Thailand

Money market rate: weighted average interbank lending rate, Bank of Thailand *Monthly Bulletin.*

Deposit rate: maximum offered rate by the largest 4 commercial banks on 3-6 month savings deposits, Bank of Thailand *Monthly Bulletin*.

Lending rate: from 1975 to 1984, the maximum rate charged by commercial banks for priority (export-related) loans and, from 1985 to 1994, the minimum prime loan rate charged by commercial banks, Bank of Thailand *Monthly Bulletin*.

United States

Money market rate: calendar month average of federal funds rate, IMF *International Financial Statistics*.

Deposit rate: monthly business day average of 3-month CDs in the secondary market, IMF *International Financial Statistics*.

Lending rate: monthly average of prime rates offered to most credit-worthy customers of the largest banks, IMF *International Financial Statistics*.

Figure 11: Money Market, Deposit and Loan Interest Rates in Thailand

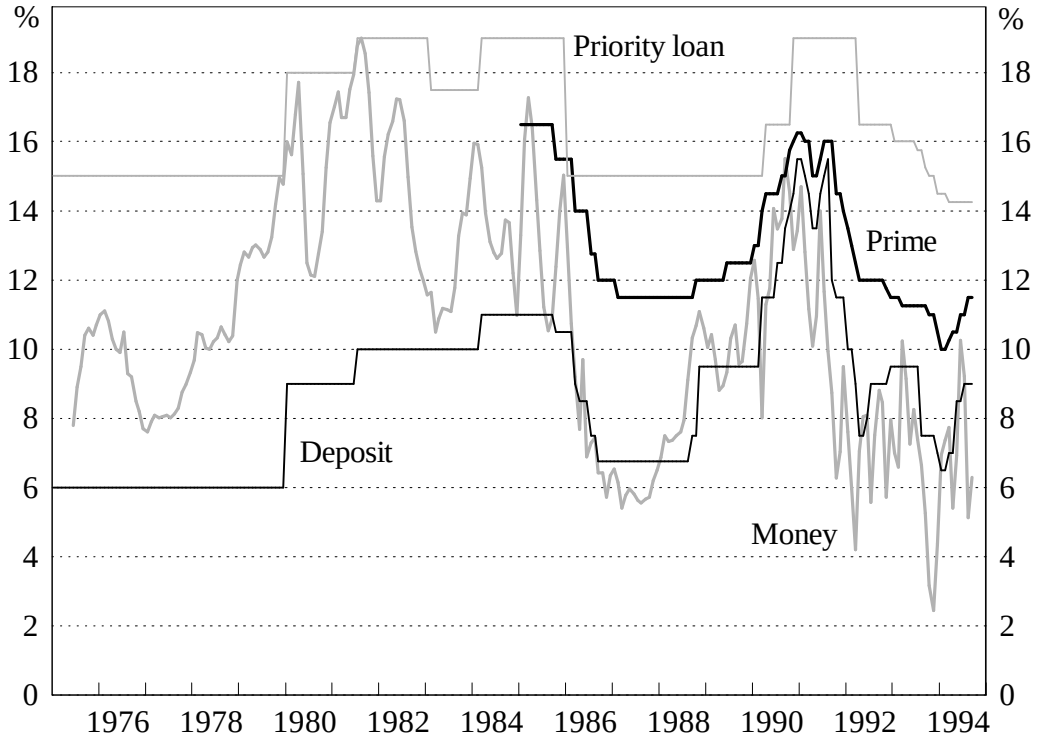
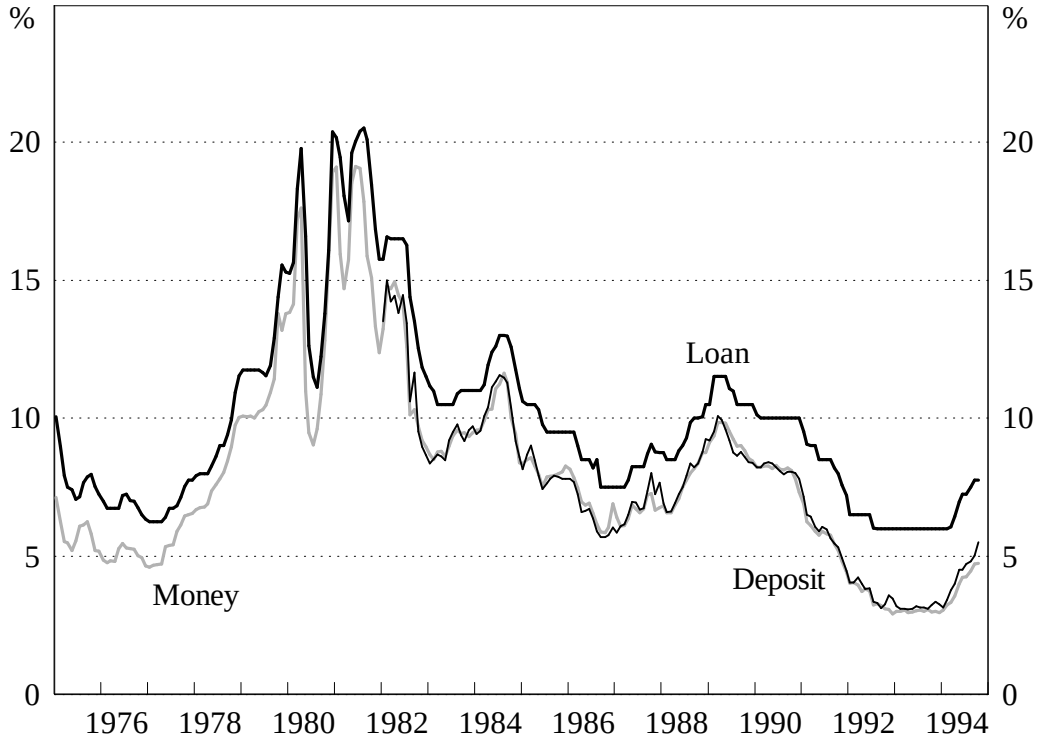


Figure 12: Money Market, Deposit and Loan Interest Rates in the United States



APPENDIX 3: SPEED OF ADJUSTMENT

The error-correction model of the institutional interest rate is:

$$\Delta i_t = m - b_1 i_{t-1} + b_2 m_{t-1} + \sum_{j=1}^{n-1} p_j \Delta i_{t-j} + \sum_{j=0}^{n-1} q_j \Delta m_{t-j} \qquad \text{(A3.1)}$$

which is equation (14) in the text. In all cases apart from the Indonesian deposit rate and Taiwanese loan rate, lags of the dependent variable are not statistically significant. In the remaining cases, apart from the Australian loan rate from 1980M1 to 1984M12, the parsimonious regression includes at most only the error-correction term and the contemporaneous change in the money market rate. In the case of the Australian loan rate from 1980M1 to 1984M12, the first lag of the change in the money market rate is also statistically significant. Short-run dynamics are fast and speed up the adjustment to equilibrium as they eliminate the disequilibrium that exists between the money and institutional rate.

The parsimonious equation is:

$$Di_t = m - b_1\left(i_{t-1} - bm_{t-1}\right) + q_0 Dm_t + q_1 Dm_{t-1} \qquad \text{(A3.2)}$$

where $b = b_2 / b_1$. Assuming that the series have been demeaned and that the money market rate rises by one percentage point, the cumulative adjustment after n-periods, n≥2 is:

$$g + (1-g)\sum_{j=2}^{n} b_1 (1-b_1)^{j-2} \qquad \text{(A3.3)}$$

$$\text{where } g = \left(b_1 / b_2\right)\left(b_2 + q_0(1-b_1) + q_1\right)$$

Note that γ sums the adjustment that occurs in the contemporaneous and first period. When the dynamics terms are statistically insignificant, the error-correction alone drives the changes in the institutional rate and (A3-3) reduces to:

$$\sum_{j=1}^{n} b_1 (1-b_1)^{j-1} \qquad \text{(A3.4)}$$

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