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ASIA-PACIFIC CAPITAL MARKETS: INTEGRATION AND IMPLICATIONS FOR ECONOMIC ACTIVITY

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ABSTRACT

The apparent success of several East Asian countries in sterilizing capital inflows seems to contradict findings of high capital mobility. This paper argues that empirical studies examining money market rates may be misleading, since most lending is mediated through domestic banking systems. In developing countries with repressed domestic financial markets bank deposit yields might be closely tied to international interest rates but bank loan rates might be more independent. A simple open-economy macro model incorporating bank credit is used to motivate alternative tests of financial market integration. Capital inflows are found to affect bank lending in cases where deposit and loan markets are integrated with world markets and hence sterilization is not effective. In cases where loan rates are more independent sterilization seems to be more effective. Next, we examine the effect of bank lending on economic activity. The data suggest that the link between bank credit and investment is important in countries with isolated bank loan markets.

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1. INTRODUCTION

The measurement of capital market integration in the Pacific Basin typically takes the form of tests of interest rate parity conditions, the extent of interest rate covariations, or measurements of the savings-retention coefficient of the Feldstein-Horioka type. Unfortunately, the conclusions derived from differing approaches typically do not agree. For instance, Chinn and Frankel (1994) and Dooley and Mathieson (1994) concluded that capital mobility is relatively high, although not complete, in most East Asian countries. Glick and Hutchison (1990) concluded, on the basis of real interest differentials, that capital mobility was increasing over time, although parity did not hold. On the other hand, Kim (1993) found that the savings-retention coefficient indicated relatively low capital mobility for a number of these countries.

In this paper, we attempt to reconcile these seemingly contradictory results by arguing that for some questions, the wrong asset returns have been examined. We appeal to the stylized fact that most firms in both developed and less-developed countries rely on bank credit, rather than some type of tradable debt instrument such as commercial paper. Even in the US, the share of business borrowing accounted by commercial paper is only about 15% (Becketti and Morris, 1992, p.73). Moreover, recent work has demonstrated that access to this market is largely restricted to larger firms. Small firms rely much more heavily on bank loans (Gertler and Gilchrist, 1994).

Consequently, capital market integration depends upon the extent to which bank credit is highly substitutable across different countries. Tests of covered interest parity using highly tradable money market returns will capture some relevant measure of capital market

integration only to the degree to which either (i) commercial paper supplies a large proportion of total business borrowing, or (ii) bank loans are highly substitutable for these assets. To the extent that bank loans constitute a large portion of borrowing, and neither of the above conditions hold, this type of asset nontradableness may explain observed high savings retention coefficient (Dooley, Frankel and Mathieson, 1987).

The issue of whether capital is effectively mobile or immobile has recently taken on increased prominence in light of a recent debates regarding the optimal response to capital inflows. Calvo et al. (1993) have argued that sterilization of capital inflows is difficult because of high capital mobility. Reisen (1993) has argued, on the basis of East Asian experience, to the contrary. We argue that sterilization is possible because capital is not completely mobile (in contrast to Reisen), because the market in bank lending is not well integrated with either other domestic or international capital markets.[1]

The paper is organized in the following manner. In section 2 we update and review the evidence regarding capital market integration in East Asia. This assessment includes updated calculations of covered interest and interest differentials. We contrast and compare these results over time. In section 3, we describe the behavior of bank lending rates in these countries, especially as they compare to those in developed countries. Section 4 outlines a simple model in which to analyze the effect of capital inflows on bank lending. Empirical testing of this model is implemented and bank lending on economic activity (as compared to the role of money). The fact that credit has a greater effect than money provides a rationale

[1] Frankel (1994) has suggested that the nontraded aspect of bank loans as a possible reason why countries which have not liberalized their financial systems can sterilize.

for why capital mobility has been mismeasured in the past -- the wrong interest rate has been examined. Section 5 assesses the role of capital inflows in inducing rapid expansion of bank lending and consequent financial fragility. Section 6 concludes.

2. WHAT THE CONVENTIONAL MEASURES IMPLY

The most common measure of capital market integration is the magnitude of the covered interest differential. For the case where political risk is zero, and assets are exactly alike in default, liquidity and maturity characteristics; covered interest rate parity should hold.

$$f_t^k - s_t = i_t^{k,\ell} - i_t^{k*} \qquad (1)$$

In Table 1, the mean and mean absolute covered interest differentials for seven Pacific Rim countries are reported, for two subsamples: 1982:09-1988:04 and 1988:05-1995:01. [The first subsample corresponds to that examined by Frankel (1990)]. The mean differentials indicate that the extent of political risk, assessed using money market rates[2] is quite low, and hence financial capital mobility high, but not complete. Since averages can mask deviations of opposite sign, we also report the mean absolute deviations. Particularly in the early period, there are substantial differentials for Australia, Malaysia, and New Zealand. In the latter period, most of these figures are approximately the same, or smaller. The exceptions are notable. Malaysia still appears somewhat insulated. Even more surprisingly, Singapore,

[2] See the Data Appendix for a description of the money market rates examined.

typically thought of as well-integrated into world markets via the Asian dollar market, evinces an increased absolute differential of approximately 1.25%.[3]

Since forward markets are usually well-developed in cases where the extent of capital and exchange controls are minimal (and political risk, observable or unobservable, is low), the use of the covered interest parity criterion begs the question of capital mobility. In principle, one could try to assess the degree uncovered interest parity holds, using the rational expectations methodology of substituting the ex post values of depreciation for the ex ante. Such a procedure yields implausibly negative estimates of the response of the domestic interest rate to the foreign plus expected depreciation (excepting the pegged case of Hong Kong). This result obtains because most variation in spot exchange rates is unanticipated. A different issue arises when the expected spot rate is proxied by a forecast from a rolling ARIMA. This procedure results in very small estimates of the coefficient, so that uncovered interest rate parity does not hold.[4]

One alternative is to adopt the assumption that the exchange rate is a driftless random walk (as in Faruqee (1992)), so that expected depreciation is zero. Inspection of the local minus Eurodollar interest rate differentials, reported in Table 2, indicates that there is scant evidence of convergence. Certain countries, notably Korea, Taiwan, and Malaysia continue to show marked deviations.

Other studies, also using money market rates, show increasing capital mobility.

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[3] See Woo and Hirayama (1995) for a discussion of imperfect capital mobility in the cases of Malaysia, Singapore, and Indonesia.

[4] An alternative approach is to use survey data to measure expected depreciation. In Chinn and Frankel (1994), UIP was statistically rejected for all the Pacific Basin currencies examined.

Dooley and Mathieson (1994) demonstrate that foreign interest rates have had an increasing role in affecting various Pacific Basin interest rates. Jwa (1994) and Reisen and Yèches have applied similar methodologies to Korea and Taiwan, and found episodic openings and closings.[5]

A more fundamental question arises from the possibility that these interest rates may not be representative of those that govern the economy, particularly investment behavior. These rates, typically interbank deposit or CD rates, are highly tradable, and may obtain in extremely thin markets. Nonfinancial firms must borrow either through the commercial paper market or from the banking system. The commercial paper rate is likely to closely follow these interbank rates, if that market exists. However, in these countries most enterprise or firm borrowing is typically through the banking sector. As indicated in Table 3, commercial paper constitutes a small fraction of total credit extended in most of these countries.

Commercial paper is most visible in Korea and Taiwan (as measured by a ratio to total credit extended by the consolidated banking system to the private sector). Perhaps this is because of the highly regulated nature of the banking sector in these two countries. Still, even the commercial paper market is regulated; data for the Taiwanese commercial paper rates is not available, so the extent of intervention is difficult to assess. However, in Korea, the 3 month investment and finance bill/commercial paper rate shows barely any variation over time. In most of the other countries, the commercial paper ratios are substantially smaller.

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[5] In contrast, Chinn and Maloney (1994) find individual and sustained breaks in the relationship between domestic interest rates and domestic determinants in these countries.

We proceed under the assumption that most borrowing will be conducted through the local banking systems. Foreign banking has some role, but by and large, in those countries with high proportions of foreign bank lending to nonbanks, most of that lending appears directed towards the public sector.[6]

3. INTERBANK RATES VERSUS BANK LOAN RATES

A natural procedure would be to consider the lending rate differentials, adjusted by the forward rate or expected depreciation, as the measure of capital mobility. Alternatively, one could examine how movements in offshore rates induce comovements in bank lending rates. Something like this approach is adopted in Brown and McNelis (1990), for the case of Ireland. They show that bank rates are not very sensitive to changes in offshore rates, thereby suggesting that bank credit is an asset that is not very tradable.

There are two key difficulties with this approach. First, LDC banking systems are usually highly regulated thereby making the market determined lending rate unobservable. Second, even in the absence of government intervention, bank loan rates are "sticky" due to the special functions performed by banks, specifically the screening and monitoring of projects (Stiglitz and Weiss, 1981). Thus, even in the absence of banking sector liberalization

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[6] Indonesia, Malaysia, Korea, Australia and New Zealand all exhibit declining ratios of foreign bank lending to the sum of domestic bank credit and foreign bank lending to nonbanks. For these countries, the presence of foreign bank lending represents about 30%, 15%, and 5%, 15% and 10%, respectively, of total lending. Part of this pattern is due to the changing value of the dollar. Indonesia (at end-of-1992), in particular, exhibits a particularly high ratio due to the large amount of borrowing by the state-owned oil enterprise. At the end of the Marcos regime the Philippines had a ratio of 60% (presumably mostly government borrowing). It has since come down to under 20%. For purposes of comparison, the US ratio is 8%.

one would expect time-variation in the spread between the riskless rate and the bank lending rate due to the agency costs of external finance (e.g., Gertler, Hubbard, Kashyap, 1991).

This variation in "stickiness" is confirmed by visual inspection of the time series plots of the interbank and loan rates. In the US, the prime rate follows the Fed Funds rate, by and large. At the opposite pole is the Korean loan rate, which barely moves even as the interbank rate moves widely. In this latter case, the bank rate is obviously highly regulated, and hence appeal to market determined (although not necessarily market clearing) rates is clearly uncalled for.[7] The same is true of the Taiwanese rate, while the Thai rate is a less extreme version. In between these two polar cases are the Singapore, Indonesian, Malaysian and Japanese series.

Recently, Cottarelli and Kourelis (1994) have provided a measure of rate "stickiness" estimated from a regression of changes in bank lending rates on the change in the discount rate, a distributed lag of changes in money market rate and on the changes in lagged bank rate. De Brouwer (1995) estimates a similar specification to several Pacific Basin countries. Using our data set (which differs in sample period from the others), we estimate the following equation:

$$\Delta \rho_t = \psi_0 + \sum_{i=1}^{k} \psi_i \Delta \rho_{t-i} + \sum_{i=1}^{k} \sigma_i \Delta i_{t-i} + \gamma_i \Delta i^d_{t-1} + \delta_1 \rho_{t-k} + \delta_2 i_{t-k} + \epsilon_t \qquad (2)$$

where ρ is the bank loan rate, and i^d is the discount rate.

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[7] Although Korea has implemented several banking reform efforts, they have been of a hesitant nature. See the discussion in Park (1994), especially pages 147-154. The Taiwanese banking system has remained dominated by government-owned banks, so that despite interest rate decontrol, rates remain largely insulated from market pressures (Shen, 1994, p. 259).

Table 4 presents the results, as well as those reported by de Brouwer. While the estimates differ somewhat, they show the same general pattern. Using these estimates, a reasonable categorization of covariability would look be:

Group 1 Hi-covariability	Group 2 Med-covariability	Group 3 No-covariability
Australia	Japan	Indonesia
Canada	Malaysia	Korea
Hong Kong	New Zealand	Taiwan
Singapore	Philippines	Thailand
United States		

The group 1 countries appear to coincide with countries believed to have small covered interest differentials, and high capital mobility. Consequently, one might be tempted to deduce that the same conclusions would be obtained regardless of whether money market or bank lending rates were used. However, the Group 2 countries of New Zealand and Japan also fall into the small-covered differential camp. The stickiness in bank loan rates could be driven by differences in the portfolio of projects facing banks in these countries, by differences in monitoring technologies, as well as bank rate regulations, all factors not typically identified with capital mobility. Hence, it is not possible to determine whether these markets are integrated by inspecting the correlations among lending rates. In fact, we take as our prior that these portions of the capital market are not well-integrated with offshore markets (and the rest of the economy). Recent work by Reisen (1993) has suggested that exactly because several East Asian countries have reversed the order of liberalization to put external reform before internal financial reform, that sterilization is fairly easy. Frankel

(1994) points out that this result relies upon assumptions about the nature of the disturbance impacting upon the country of interest.

4. APPLICATION OF A SIMPLE MODEL

4.1. Derivation of a Model with Credit

Consider an economy where bank credit is imperfectly substitutable for bond finance, as in Bernanke and Blinder (1988), augmented by allowing the credit supply to depend on a shift variable, the "riskiness" of the marginal investment project. Banks hold liabilities of deposits. On the asset side, the banks hold loans, reserves and either domestic government debt.

Loan demand is given by:

$$L^d = \underset{- + +}{L(\rho,i,y)} \tag{3}$$

Loan supply is given by:

$$L^s = \underset{+ - -}{\lambda(\rho,i,Z)D(1-\tau)} \tag{4}$$

where Z is a measure of riskiness of the marginal investment project. The data generating process of Z is not modelled explicitly. The credit market equilibrium is given by equating loan supply and demand.

The money market equilibrium is given by equating the demand for deposits with the supply; hence the LM schedule is:

$$D(i,y) = mR \qquad (5)$$
$$- \; +$$

where m is the money multiplier, and R is the stock of reserves. (Excess reserves are ignored in this analysis.) The money multiplier is assumed constant. Allowing it to depend positively on the interest rate does not change the qualitative conclusions.

The open-economy IS curve is conventional, except that it depends upon the bank lending rate as well as the interest rate:

$$y = Y(i,\rho,q) \qquad (6)$$
$$\quad - \; - \; +$$

where q is the real exchange rate. Substituting money market equilibrium into the loan market equilibrium yields:

$$L(\rho,i,y) = \lambda(\rho,i,Z)mR(1-\tau) \qquad (7)$$

Solving for the equilibrium loan rate, ρ, one obtains:

$$\rho = \varphi(i,y,R,Z) \qquad (8)$$
$$\quad + \; + \; - \; +$$

In this formulation, the spread between the bank loan rate and the risk free rate (proxied by a tradable interest rate), ρ-i, is a positive function of Z, the riskiness of the marginal project. The CC schedule is obtained by substituting (8) into (6).

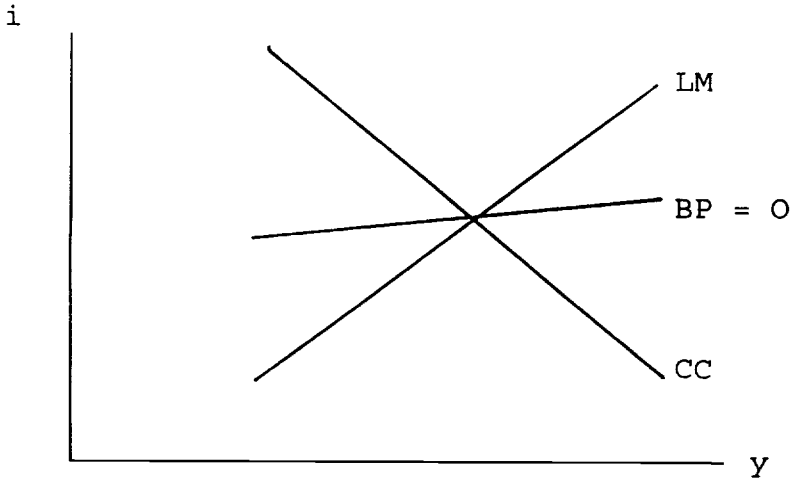
$$y = \tilde{Y}(i,\varphi(i,y,R,Z),q) \qquad (9)$$

The external equilibrium condition is conventional:

$$BP = KA(i - i^{US} - \Delta s^e, X) + TB(q, y) = 0 \quad (10)$$

where X is a vector of exogenous variables, such as default risk, etc., which may shift the KA function. Assuming that the responsiveness of capital flows to the interest differential is not infinite, then the BP=0 schedule is upward sloping, and domestic interest rates may deviate from the world interest rate.

Such a model yields Figure 14.



This model resembles the conventional Mundell-Fleming model, except that unsterilized capital inflows cause increases in deposits, which in turn shift out both the LM and the CC schedules. The extent to which they shift out depends upon the magnitudes of the parameters. (The solution to this model is presented in the appendix.)[8]

4.2. Implications of a Capital Inflow for Bank Lending

Assume an exogenous shock lowers the rate of return in the rest of the world (i*).

[8] For a slightly different treatment, see Spiegel (1995).

Ceteris paribus, the BP=0 schedule shifts down, and foreign capital will tend to flow into the country. The capital inflows take the form of a deposit in the home country bank. Deposits rise, as do reserves. Since excess reserves yield zero interest, the bank will not hold any excess reserves. This means that bank loans increase, and both the CC and LM curves shift out. Interest rates and lending rates may rise or fall depending upon the parameters of the model. If expansion causes banks to undertake lending to riskier projects, this must drive up lending rates or drive down deposit rates. The second tendency will reestablish interest parity in the deposit market with perhaps small changes in domestic lending.

The central bank can sterilize the capital inflow but in this case the increase in the commercial banks' assets consist of claims on the government rather than bank loans to the private sector. Since the government liability is riskless there is no change in the wedge between interbank deposit and loan rates. Thus, all the adjustment must come in the risk premium on domestic deposits which is, of course, zero if domestic and foreign deposits are perfect substitutes. This is the risk premium that most research has found hard to find - hence that capital is mobile. The implication is that the central bank will give up since sterilization is not effective. In the typical model domestic credit expands and domestic deposit and loan deposit rates will fall to match foreign interest rates. In our model, the domestic deposit rate is driven down, but the domestic loan rate might rise with only a very small expansion of domestic bank loans. Thus, if we are interested in the effects of capital mobility, we should look directly at changes in bank credit rather than interest rates. Notice also that if the government does "sterilize", the domestic money supply might rise with no change in bank credit to the private sector. If the view that bank credit is special is right then

there might be no impact on investment.

We test two predictions of the model. First, if the countries have not undertaken sterilization policies, then the response of domestic lending to the capital inflow should be positive. Second, that economic activity responds more strongly to bank lending than to money, in countries where bank loans are not highly substitutable with other lending.

The response of bank lending to the private sector is evaluated first. The change in bank credit to the private sector is regressed on the current and lagged capital inflows (not including direct investment).

$$\Delta(BC/Y)_t = \Gamma_0 + \sum_{i=1}^{4} \Gamma_i (KA/Y)_{t-i} + quarterly\ dummies + u_t \qquad (11)$$

where

BC is bank credit extended to the private sector

Y is gross domestic product

KA is capital inflows minus direct investment

The results are reported in Table 5. Impact parameters are reported in the first column. The second column is the sum of the inflow parameters. Wald denotes a Chi-squared test statistic for the null hypothesis that the sum of coefficients on the inflows is zero. Notice that the proportion of variance explained is quite low in certain cases, notably Indonesia.

The results confirm Glick and Moreno's (1994) conclusion that Indonesia and Malaysia engaged in large scale sterilization of capital inflows. That is, in response to capital

inflows, some of the reduction of bank credit was manifested in a reduction in bank lending to the private sector. Taiwan, Korea, Malaysia evidenced short run (within-quarter) reductions. Indonesia and Malaysia have negative long run estimated impacts.

These estimates of nonstructural relationships are seldom statistically significant. Only in a few cases are the positive parameters statistically significant (Canada, New Zealand, Thailand). The negative effects are always statistically insignificant, except in the case of Indonesia, where something else appears to be going on. Certain accounts indicate domestic banking crises caused rapid reductions in bank lending.[9] To a certain extent, one would not expect statistically significant coefficient estimates, because the change in bank lending to capital inflows depends upon the intervention response function of the central bank, which is unlikely to be constant over time.

4.3. Bank Credit and Economic Activity

Previous analyses have implicitly assumed that the money and bonds are the only two domestic assets of importance in LDCs. Consequently, the money market interest rates were the appropriate variables of analysis. In the framework adopted in this paper, there are three domestic assets of interest -- money, bonds and bank credit. We find that financial indicators of risk do seem to respond to capital inflows. We now investigate whether credit has significant effects on the economy, above and beyond the effect of money. Hence, we ask the question whether omitting the banking sector's behavior misses a crucial aspect of capital market integration.

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[9] There is some discussion of the Indonesian banking crises in Andersen (1993).

The role of credit has enjoyed a revival in the recent literature pioneered by Lown (1988), Romer and Romer (1990), and Friedman and Kuttner (1993). These researchers implemented nonstructural regressions in the tradition of the St. Louis monetary equations. Romer and Romer found that bank credit was a significant determinant of US industrial output.[10] Friedman and Kuttner concur, although they argue that relative prices (in particular the T-bill/commercial paper spread) matter as much as the credit quantities. More recent work involving structural VARs has been implemented by, among others, Fackler and Rogers (1993). They also conclude that "[c]redit is at least as important as any other variable in explaining movements in output, prices and interest rates" (p.223).

To assess whether this conclusion also applies to Pacific Basin countries, we estimate the following regressions of changes in income on lagged changes in real bank credit or narrow money (M1), real exchange rates, and income:

$$\begin{aligned} \Delta y_t &= \alpha_0 + \sum_{i=1}^{k} \alpha_i \Delta bc_{t-i} + \sum_{i=1}^{k} \beta_i \Delta q_{t-i} + \sum_{i=1}^{k} \gamma_i \Delta y_{t-i} + e_t \\ \Delta y_t &= \alpha_0 + \sum_{i=1}^{k} \tau_i \Delta ml_{t-i} + \sum_{i=1}^{k} \beta \Delta q_{t-i} + \sum_{i=1}^{k} \gamma_i \Delta y_{t-i} + e_t \end{aligned} \qquad (12)$$

The results are reported in Table 6 for those countries for which the data are available.

The results indicate that for Australia, Canada, New Zealand, Singapore and Taiwan, money is more positively correlated with output than bank credit (although the sum of the coefficients is seldom statistically significantly different from zero). Of these countries, all have low degrees of bank rate stickiness. Japan, Korea and the Philippines show the reverse

[10] Although in more recent work, Romer and Romer (1993) argued that due to decreased Fed reliance on credit controls, the influence of credit on economic activity has decreased.

pattern, and at the same time exhibit relatively high rates of stickiness, excepting Taiwan. Unfortunately, three of the most interesting countries -- Indonesia, Malaysia and Thailand -- are missing the either quarterly bank credit data for a sufficiently long period, or quarterly GDP data, thereby making comparisons for these countries impossible.

Since savings-investment correlations have long occupied economists interests, we decided also to investigate the effects of money and credit on investment. Adequate data were available only for Australia, Canada, Japan and Korea. Of these, two have low stickiness (Australia and Canada), one has intermediate (Japan), and one has a very high degree (Korea). Our prior expectations are therefore that Australia and Canada would have a higher association between money and investment than bank credit and investment; on the other hand, Korea, and to a lesser extent Japan should evidence the reverse.

Regressions of changes of investment on lagged changes in narrow money or bank credit, GDP, and the real exchange rate were estimated.

$$\Delta inv_t = \theta_0 + \sum_{i=1}^{k} \theta_i \Delta bc_{t-i} + \sum_{i=1}^{k} \phi_i y_{t-i} + \sum_{i=1}^{k} \eta_i q_{t-i} + w_t$$
$$\Delta inv_t = \theta_0 + \sum_{i=1}^{k} \Theta_i \Delta ml_{t-i} + \sum_{i=1}^{k} \phi_i y_{t-i} + \sum_{i=1}^{k} \eta_i q_{t-i} + w_t \qquad (13)$$

Where inv is log real investment in plant and equipment.

The results are presented in Table 7. They conform to expectations: for Australia and Canada, the money coefficients are jointly statistically significant, while the bank credit coefficients sum to a negative number, and are not significant. For both Japan and Korea, bank credit is positively associated with investment, while money is not. However, it is important to note that only the Japanese bank credit coefficients are jointly significant.

5. BANK LENDING AND INCREASING FINANCIAL FRAGILITY

A common view is that countries that rapidly expand their domestic lending to the private sector will tend to have riskier portfolios of investment projects. Thailand has large shares of bank credit extended to risky construction and real estates sectors, while both Indonesia and Malaysia have experienced problems with large amounts of nonperforming loans (see Folkerts-Landau, et al., 1995, pp. 37-39).

Another means of assessing the riskiness of bank loan portfolios is to examine the spread between the lending rate and the risk free rate. In this model, in the absence of bank rate regulation, the spread between the bank lending rate (ρ-i) is an increasing function of the riskiness of the marginal investment project, Z.[11] We posit that rapid expansion of bank credit is associated with riskier and riskier projects. This suggests that a regression of the spread on lagged bank lending will yield a positive coefficient (for countries where the bank lending rate is not regulated; hence Korea and Taiwan are omitted).

$$(\rho - i)_t = \textit{constant} + \beta_1[(BC/Y)_{t-1} - (BC/Y)_{t-9}] + \textit{dummies} + v_t$$

The results of these regressions are reported in Table 8. Because there is evidence of serial correlation in almost all the regressions, the standard errors are calculated assuming N/3 independent observations. Adoption of this procedure means that we have been extremely conservative in our inferences.

For Australia, the estimate in negative, but not statistically significant. For Canada, New Zealand, and Singapore, the estimates are statistically significant and positive. This

[11] That is $\partial(\rho\text{-i})/\partial Z > 0$.

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pattern of results is reassuring because these are banking systems relatively free from rate regulation. In the other cases of Indonesia, Japan and the Philippines, the estimates are not statistically significant, although for the latter two they are positive.

These results suggest that the rapid expansion of lending, in the absence of government regulation of bank lending rates, leads to increases in the spread between the lending rate and the interbank deposit rate. Since the results are not statistically significant, one would not wish to overinterpret the numbers; in fact, in many countries with more highly regulated banking sectors, the spread may depend more critically on differing money and non-money deposit reserve requirements. As is well-known, manipulation of reserve requirements has been a favorite means of effecting sterilization in several of these economies. Dooley and Chinn (1995) examine this issue.

6. CONCLUDING REMARKS

The policy implication of opening capital markets continue to attract attention and debate primarily because we do not understand much about the transmission process for monetary policy in developing countries. It seems to us plausible that the "bank credit is special" argument that has received considerable attention in the U.S. in recent years is quite likely to be relevant in this transmission process. Moreover, developing countries that engage in large amounts of sterilized intervention provide a natural way to test the relative importance of money and credit. The model developed also provides a plausible reason for why interest differentials on traded bank deposits are a largely uninformative indicator for the degree of dependence of bank credit and in turn investment on foreign interest rates.

Data Appendix

1. Interest rates

1.1. Eurocurrency deposit rates

The US, UK and Japanese 3 month Eurocurrency deposit rates were the arithmetic average of the bid and offer rates in London at close of market, as reported by Bank of America up to October 6, 1986, and Reuters' Information Service thereafter, and recorded by DRI in the DRIFACS database.

1.2. Local Market Rates

Where source is both WFM and DRI, then WFM is source until 1989:10, at which time DRIFACS is source.

Country	Source	DRI Code	Description	Variable Name
US	DRI	FIP90Y	Financial Paper, industrial firms, 90 days	IUS
US	DRI	USD03	3 month Eurodollar rate	IEUS
Australia	WFM,DRI	ADBBL90Q	90 day bank bill, quote	IAU
Canada	WFM,DRI	CACP90B,A	3 month prime finance company paper	ICN
Hong Kong	WFM,DRI	HKM03B,A	3 month interbank deposit rate corrected by FEER data	IHK
Indonesia	WFMr		1 month interbank deposit rate	IIN
Japan	WFM,DRI	JAGBDS03 JACD03B,A	3 month Gensaki bond rate 3 month CD rate IJP up 86.09, IJP2 after	IJP IJP2 IJP3
Japan	DRI	JAD03	3 month EuroYen rate	IEJP
Korea	WFMr		3 month finance and investment bill rate; later same as commercial paper rate.	IKO1
Korea	WFMr		MSB until 1991:12; call money thereafter	IKO5
Malaysia	WFMr		3 month interbank deposit rate	IMA

Country	Source	DRI Code	Description	Variable Name
New Zealand	WFM,WFMr		3 month commercial bills to Dec. 1987., 90 day bank bills thereafter.	INZ
Philippines	WFMr fm IFS		3 mo. T-bills at tender	IPH
Singapore	WFM,WFMr		3 mo. banker's acceptances to Aug.87; 3 month commercial bills thereafter	ISI
Taiwan	WFMr		90 day bankers acceptances	ITI
Thailand			call money rate until 91:12, BIBOR thereafter.	ITH2

1.3. Local Bank Lending Rates

Where source is both WFM and DRI, then WFM is source until 1989:10, at which time DRIFACS is source.

Country	Source	Description	Variable Name
US	WFMr	Prime Rate, JP Morgan	IBLUS
Australia	WFMr (RBNZ fm Telerate)	Major trading banks overdraft rate.	IBLAU
Canada	WFMr (Telerate)	Chartered banks prime rate	IBLCN
Hong Kong	WFMr	Prime lending rate	IBLHK
Indonesia	WFMr (IFS)	weighted average lending rate working capital of nonproprietary sector	IBLIN
Japan	WFMr (BoJ)	short term prime rate	IBLJPS
Japan	WFMr (BoJ)	long term prime rate	IBLJPL
Korea	WFMr (BoK)	Minimum lending rate charged to general enterprises by deposit banks.	IBLKO
Malaysia	WFMr (BNeg.)	Base lending rate	IBLMA
New Zealand	WFMr (RBNZ)	Overdraft rate, prime borrowers	IBLNZ
Philippines	WFMr (IFS)	Average commercial lending rate	IBLPH

Country	Source	Description	Variable Name
Singapore	WFMr (MAS)	Overdraft rate of major banks	IBLSI
Taiwan	WFMr (CBoC)	Short term lending rate, max. for up to one year	IBLTI
Thailand	WFMr (BoTh.)	Minimum loan rate (MLR)	IBLTH

2. Exchange rates

End-of-period exchange rates (except those indicated below) are London 3PM, arithmetic average of bid and offer rates as reported by Barclay's until end of March 1990, at which time the series is no longer recorded by DRIFACS. Thereafter, the London close rate is used, as reported by Reuters' Information Services. A consistent series is not used (i.e., the London close all the way) because these series only begin in 1986. XTI is from Ramon Moreno at FRBSF until 1991:12, and from DRIFACS thereafter. The market exchange rates for Indonesia, Korea, Philippines and Thailand were obtained from the International Monetary Fund's International Financial Statistics. (Thai rate is official). For conversion of dollar values to domestic currency, period average exchange rates from IFS are used (line rf).

3. Output

Quarterly Gross Domestic Product (output) in nominal and real terms are from IFS, March 1995 CD-ROM. Nominal Malaysia, New Zealand and Singapore GDP figures estimated via regression on real output and CPI. Indonesia and Thailand figures estimated via a 4-quarter moving average. Hong Kong GDP data from Census and Statistics Dept., Hong Kong, Revised Estimates of GDP, 1961 to First quarter, 1994, August 1994. Taiwan data from Directorate-General of Budget, Accounting and Statistics, Exec. Yuan, Rec, Quarterly National Economics Trends, various issues. Annual output figures are from the same sources.

4. Credit and International Banking Statistics

Bank credit to private sector is line 52d, IFS if available; line 22d otherwise. Domestic credit to the private sector is from line 32d, IFS; Foreign credit to nonbanks (reported in footnote 4) is from Table 7yrd, IFS, converted to domestic currency using the average market exchange rate.

5. Capital Flows

All figures are from IFS, except those for Hong Kong and Taiwan:

Current account:	line 77a.d IFS
Direct investment:	line 77bad IFS
Portfolio investment:	line 77bbd IFS
Net errors and omissions:	line 77e.d IFS
Other capital, nie:	line 77g.d IFS

The inflow measure used in the paper is constructed using the following formula:

INFLOW##1 XR*(PI+ER+OC)/GDP (also dividing by billions)

where DI, PI, ER, and OC are direct, portfolio investment, net errors, and other capital, respectively. XR is the period average exchange rate expressed as FMU/US$ (line rf, IFS).

Technical Appendix

Set dZ = 0. The semi reduced form equation representing the CC equation is:

$$y = Y(i, \rho, q) \tag{6'}$$

Taking the total differential yields:

$$dY = Y_i di + Y_\rho(\rho_i di + \rho_Y dY + \rho_R dR) + Y_q dq \tag{A1}$$

Rearranging:

$$dY(1 - Y_{\rho_Y}) = (Y_\rho \rho_i + Y_i)di + Y_\rho \rho_R dR + Y_q dq \tag{A2}$$

The LM curve is obtained by differentiating (5):

$$\begin{gathered} dD = m\times(dR) = D_i di + D_Y dY \\ m \equiv D_R \end{gathered} \tag{A3}$$

Solving for the deposit interest rate:

$$di = \frac{m(dR) - D_Y dY}{D_i} \tag{A4}$$

Substituting (A4) into (A2):

$$dY\left[1 - Y_\rho \rho_Y + \frac{(Y_\rho \rho_i + Y_i)D_Y}{D_i}\right] = \left[\frac{(Y_\rho \rho_i + Y_i)m}{D_i} + Y_\rho \rho_R\right]dR + Y_q dq \tag{A5}$$

Solving for income:

$$\begin{gathered} dY = \frac{1}{\Delta}\left(\left[\frac{(Y_\rho \rho_i + Y_i)m}{D_i} + Y_\rho \rho_R\right]dR + Y_q dq\right) \\ \Delta \equiv (1 - Y_\rho \rho_Y + (Y_\rho \rho_i + Y_i)D_y/D_i)^{-1} \end{gathered} \tag{A6}$$

Rather than solving the system including the BP=0 schedule, assume capital flows and real exchange rates to be exogenous. Then in the absence of sterilization, dR = dKA, so that the

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effect of an exogenous capital inflow on income is given by:

$$\frac{dY}{dKA} = \frac{1}{\Delta}\left[\frac{(Y_\rho \rho_i + Y_i)m}{D_i}\right] > 0 \qquad \text{(A7)}$$

As indicated in the text, both curves shift to the right in response to an unsterilized capital inflow:

$$\frac{dY}{dKA}\Big|_{CC} = \frac{Y_\rho \rho_R}{1 - Y_\rho \rho_Y} > 0 \qquad \frac{dY}{dKA}\Big|_{LM} = \frac{m}{D_Y} > 0$$

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Table 1
Covered Interest Differentials
(in percentage points)

	1982:09-88:04		1988:05-94:11	
	Mean	Mean Abs.	Mean	Mean Abs.
Australia	-0.20	0.88	0.27	0.29
Canada	-0.01	0.16	0.10	0.22
Hong Kong	0.11	0.20	0.14	0.17
Japan[a]	0.08	0.14	0.01	0.05
Malaysia	-1.41	1.51	-0.01	1.28
New Zealand	-0.49	1.63	0.27	0.30
Singapore	-0.47	0.49	-0.91	0.91

Notes: Figures in percentage points, estimated by regressing the end-of-month covered interest differential on a constant.
[a] CD-Euroyen differential. Data up to 1986:09 is Gensaki rate. Estimate is from a regression with a dummy for Gensaki series, so that the differential is interpretable as that pertaining to a CD rate.

Table 2
Interest Differentials
(in percentage points)

	1982:09-88:04		1988:05-94:11	
	Mean	Mean Abs.	Mean	Mean Abs.
Australia	5.40	5.47	4.20	4.20
Canada	1.16	1.27	2.57	2.57
Hong Kong	-0.64	1.57	0.28	0.38
Indonesia	9.24	9.24	10.94	10.94
Japan[a]	-2.90	2.90	-1.17	1.80
Korea[b]	6.27	6.27	7.97	7.97
Malaysia	-0.51	2.13	0.20	2.99
New Zealand	9.63	9.64	3.90	3.90
Philippines	10.47	10.47	11.08	11.08
Singapore	-2.62	2.62	-2.02	2.02
Taiwan	-2.64	2.69	1.04	2.74
Thailand[c]	2.05	2.51	2.85	3.01

Notes: Figures in percentage points, obtained by regressing the local minus US Eurodollar interest differentials on a constant.
[a] CD-Euroyen differential. Data up to 1986:09 is Gensaki rate. Estimate is from a regression with a dummy for Gensaki series, so that the differential is interpretable as that pertaining to a CD rate.
[b] MSB until 1991:12; call money thereafter. Estimate is from a regression with a dummy for call money series, so that the differential is interpretable as that pertaining to a MSB rate.
[c] Call money rate until 1991:12; BIBOR thereafter. Estimate is from a regression with a dummy for BIBOR series, so that the differential is interpretable as that pertaining to a call money rate.

Table 3
Sources of Credit, 1989

Country	Comm. Paper	Money Market	Total Credit	Ratio to MM	Ratio to DC
Australia			215.5		
Canada			295		
Hong Kong	93	673		14%	
Indonesia[a]	1,475		51,942		3%
Japan[c]	157.6	965.4	524,380	16%	0.2%
Korea	12,237	36,734	80,795	33%	15%
Malaysia	0	31	68,219	0%	0%
New Zealand			.03		
Philippines[b]	[21]	[905]	1,988	[2%]	na
Singapore	0	22.7	48.8	0%	0%
Taiwan	135	581	3,723	23%	4%
Thai.	1[e]	29.7[e]	926	3%	0%
US[d]	525.8		2,715.3		19%

Notes: End-of-year outstanding stocks, in billions of domestic currency units. Commercial paper and money market figures from Emery (1991). Domestic credit to private sector (line 32d) is from IFS.

[a] Data for 1989Q3

[b] Commercial paper and money market figures are volume.

[c] 1990 figures for commercial paper, money market from Takagi (1993).

[d] Total (financial and nonfinancial) from Post (1992).

[e] Estimate from Emery (1991)

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Table 4
Estimates of Bank Loan Rate Stickiness

Country	Ψ_1	$\Sigma_i\Psi_i$	Long Run	de Brouwer Impact	de Brouwer Long Run
Australia	0.17	1.10	0.91	0.59	0.95
Canada	0.48		1.04	0.69	0.94
Hong Kong	0.50		0.86	0.57	0.87
Indonesia	0.03		0.50	0.06	1.25
Japan(s)	0.08	0.41	1.09	--	--
Japan(l)	0.22		0.68	0.63	0.75
Korea	0.01	-.05	0.05	--	--
Malaysia	0.15		0.82	0.10	0.66
New Zealand	0.26	0.37	0.76		
Philip-pines	0.13	0.54	0.80	0.64	0.84
Singapore	0.41		0.69	0.13	0.63
Taiwan	0.10	0.08	0.44	0.18	0.55
Thailand	0.05	0.01	0.72	0.10	0.63
US	0.35		0.85	0.78	0.97

Notes: Coefficients can be interpreted as elasticities. Impact is the within quarter coefficient. Long run is the estimate obtained from δ_2/δ_1. The de Brouwer estimates are averages for the subsamples that most closely conform to that used in the estimates in the left-hand columns.

Table 5
Response of Bank Credit to Capital Inflows

Country	Γ_1	$\Sigma_i\Gamma_i$	$\bar{R}^2$	DW	N	Wald
Australia	-0.584	0.744	-0.01	1.49	54	1.148 [.284]
Canada	0.186	1.311	0.22	1.53	53	11.054 [.001]
Indonesia	-0.061	-0.790	-0.07	1.03	49	3.357 [.067]
Japan	1.474	-0.115	0.15	2.20	53	0.013 [.908]
Korea	-0.788	0.311	0.95	2.13	53	0.980 [.322]
Malaysia[a]	0.175	-0.109	0.17	1.69	51	0.225 [.635]
New Zealand	1.200	2.277	0.18	2.51	33	4.749 [.029]
Singapore	1.805	0.214	0.58	1.93	33	0.280 [.597]
Taiwan	-0.092	0.077	0.33	1.36	52	0.067 [.796]
Thailand[a]	0.090	0.511	0.30	1.14	47	11.483 [.001]

Notes: Coefficients can be interpreted as elasticities. Wald is an F-test for the null that $\Sigma_i\Gamma_i = 0$ [p-values in brackets].
[a] Bank credit data not available. Estimates for total domestic credit.

Table 6
Response of Output to Bank Credit or Money

Country	$\Sigma_i\alpha_i$	$\Sigma_i\tau_i$	k	$\bar{R}^2$	LM(4)	N	Sample
Australia	-0.087 [.356]		6	-0.02	0.851 [0.095]	52	81.4-94.3
Australia		0.173* [0.525]	4	0.11	4.028 [0.402]	54	82.1-94.3
Canada	-0.462*** [0.000]		4	0.26	1.052 [0.902]	53	81.2-94.2
Canada		0.224*** [0.000]	4	0.09	1.889 [0.756]	54	81.2-94.2
Japan	0.487*** [0.003]		4	0.25	2.983 [0.561]	51	81.2-93.4
Japan		0.110 [0.420]	4	0.10	1.703 [0.770]	51	81.2-93.4
Korea[a]	0.090 [0.867]		4	0.41	6.643 [0.156]	47	83.1-94.3
Korea[a]		0.028 [0.869]	4	0.38	8.986 [0.062]	47	83.1-94.3
New Zealand	-0.121 [0.370]		2	0.20	4.409 [0.354]	36	85.4-94.3
New Zealand		0.022 [0.780]	2	0.20	4.290 [0.368]	36	85.4-94.3
Philip-pines	0.088 [0.331]		2	0.98	0.628 [0.428]	29	87.3-94.3
Philip-pines		0.060 [0.859]	4	0.98	2.814 [0.589]	27	88.1-94.3
Singapore	-0.164 [0.254]		3	0.93	6.822 [0.146]	35	85.3-94.1
Singapore		0.035 [0.654]	1	0.87	2.814 [0.589]	37	85.1-94.1

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Country	$\Sigma_i\alpha_i$	$\Sigma_i\tau_i$	k	$\bar{R}^2$	LM(4)	N	Sample
Taiwan[b]	-0.025 [0.499]		2	0.61	7.601 [0.107]	36	83.3-92.2
Taiwan[b]		0.045 [0.448]	4	0.79	7.076 [0.132]	34	84.1-92.2

Notes: Coefficients can be interpreted as elasticities. *(**)[***] denotes significance at the 10%(5%)[1%] marginal significance level according to an F-test for the null that $\Sigma\alpha_i = 0$ [p-values in brackets]. k is the number of lags in the regression. LM(4) is the Breusch-Godfrey LM test for serial correlation of order 4 [p-values in brackets].

[a] Estimated using a filter of $(1-L^4)(1-L)$.

[b] Estimated using a filter of $(1-L^4)$.

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Table 7
Response of Investment to Bank Credit or Money

Country	$\Sigma_i\theta_i$	$\Sigma_i\theta_i$	k	$\bar{R}^2$	LM(4)	N	Sample
Australia	-0.267 [.356]		4	0.04	6.679 [0.154]	54	81.2-94.3
Australia		0.438* [0.060]	4	0.27	7.478 [0.113]	54	81.2-94.3
Canada	-0.499 [0.169]		4	0.22	5.339 [0.254]	53	81.2-94.2
Canada		0.509** [0.016]	4	0.29	7.987 [0.092]	54	81.2-94.2
Japan	1.505*** [0.000]		4	0.46	2.168 [0.705]	51	81.2-93.4
Japan		0.452 [0.109]	4	0.18	7.537 [0.110]	51	81.2-93.4
Korea[a]	0.269 [0.796]		4	-0.02	6.635 [0.157]	46	83.1-94.2
Korea[a]		-0.048 [0.869]	4	0.09	3.697 [0.449]	46	83.1-94.2

Notes: Coefficients can be interpreted as elasticities. *(**)[***] denotes significance at the 10%(5%)[1%] marginal significance level according to an F-test for the null that $\Sigma_i\theta_i = 0$ or $\Sigma_i\theta_i = 0$ [p-values in brackets]. k is the number of lags in the regression. LM(4) is the Breusch-Godfrey LM test for serial correlation of order 4 [p-values in brackets].
[a] Estimated using a filter of $(1-L^4)(1-L)$.

Table 8
Response of Spread to Growth of Bank Credit to Private Sector

Country	constant	2 year growth	$\bar{R}^2$	DW	N
Australia	0.038**	-0.053	-.04	0.76	49
	(0.019)	(0.121)			
Canada	0.009	0.166**	0.24	0.66	48
	(0.007)	(0.066)			
Indonesia	0.043**	-0.135	0.03	1.14	44
	(0.022)	(0.156)			
Japan	-0.043**	0.035	-0.08	1.13	48
	(0.016)	(0.087)			
New Zealand	0.019**	0.064**	0.25	0.69	31
	(0.008)	(0.029)			
Phil.	0.012	0.030	-0.09	1.23	26
	(0.022)	(0.073)			
Sing.	0.090**	0.190**	0.31	0.62	31
	(0.009)	(0.084)			

Notes: Dependent variable is the bank lending - money market rate spread, in decimal form. All standard errors estimated assuming N/3 independent observations. *(**) denotes significance at the 10%(5%) marginal significance level.

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Group 1 Countries

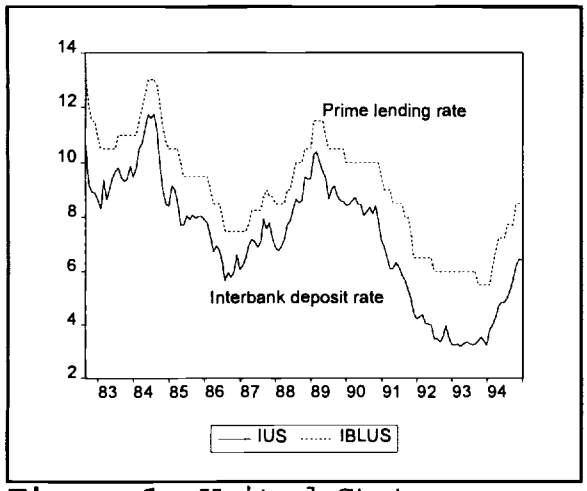

Figure 1: United States

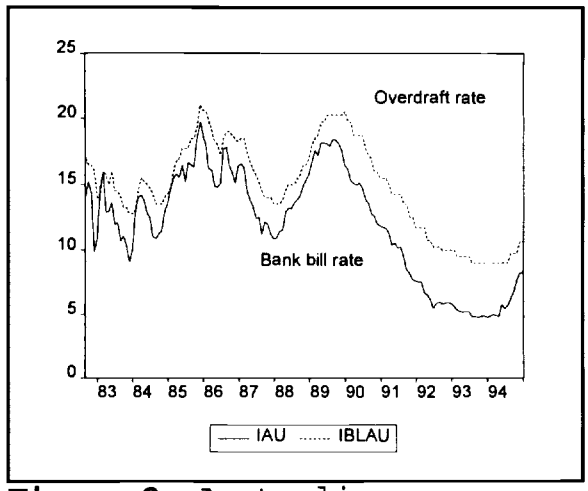

Figure 2: Australia

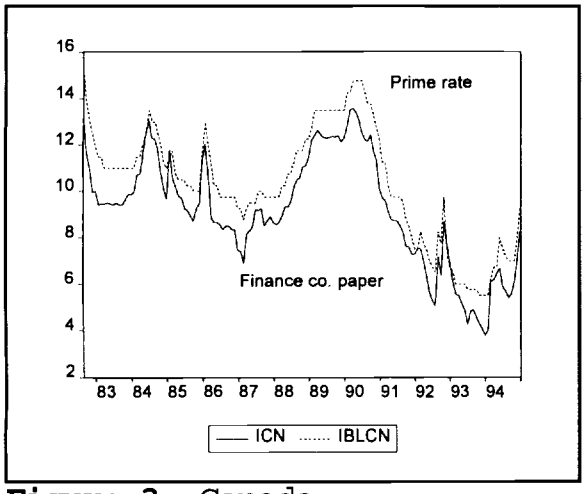

Figure 3: Canada

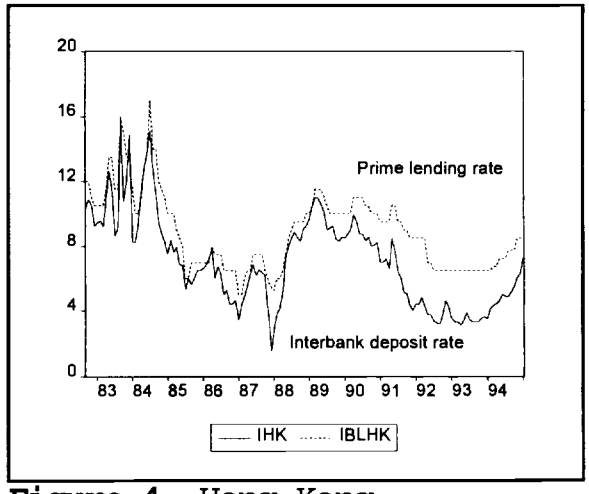

Figure 4: Hong Kong

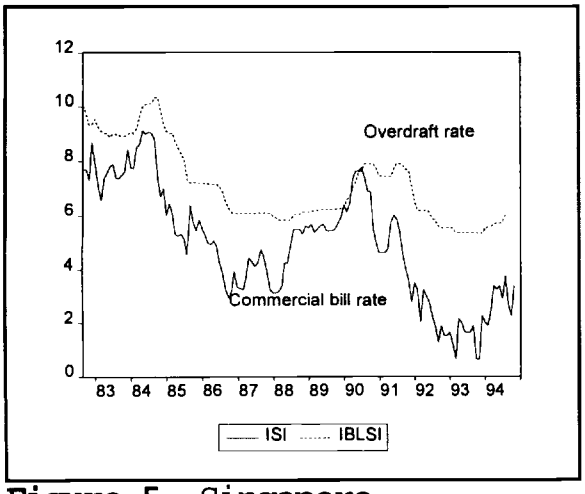

Figure 5: Singapore

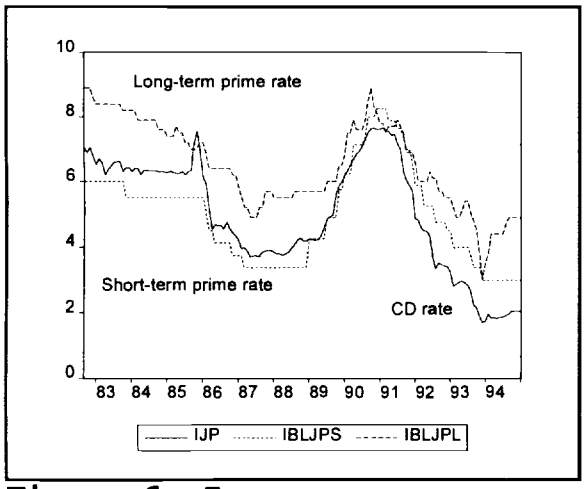

Figure 6: Japan

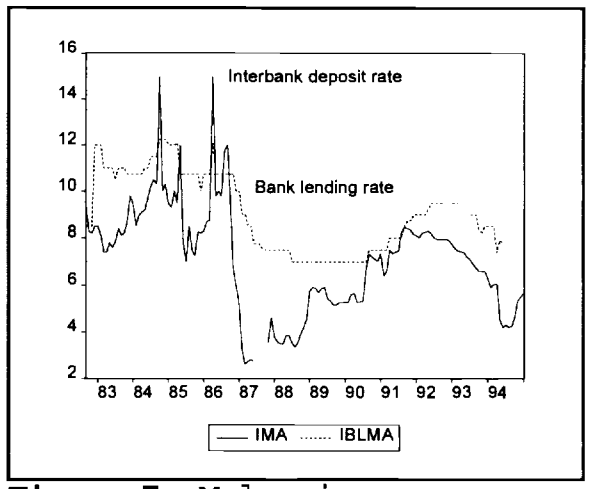

Figure 7: Malaysia

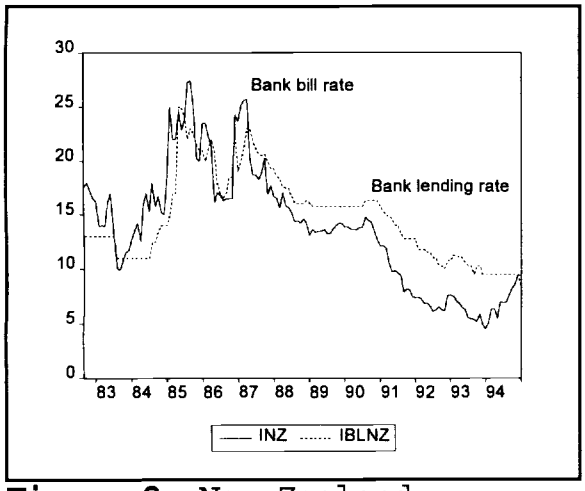

Figure 8: New Zealand

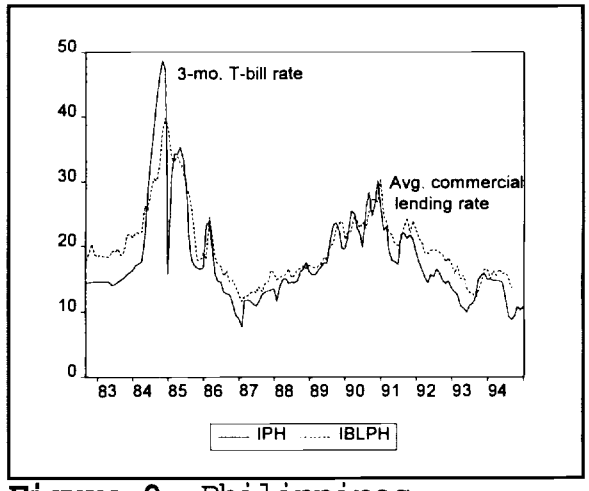

Figure 9: Philippines

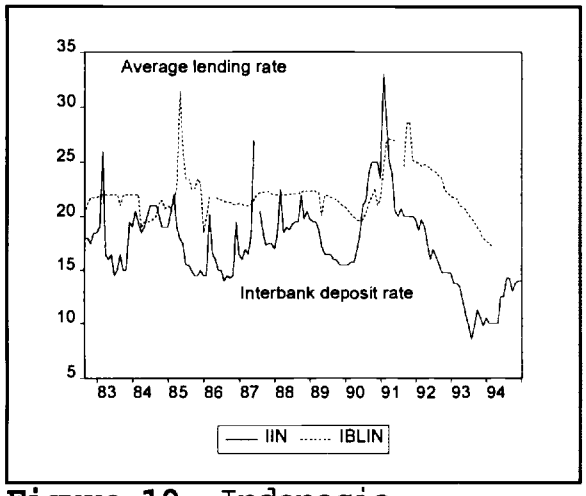

Figure 10: Indonesia

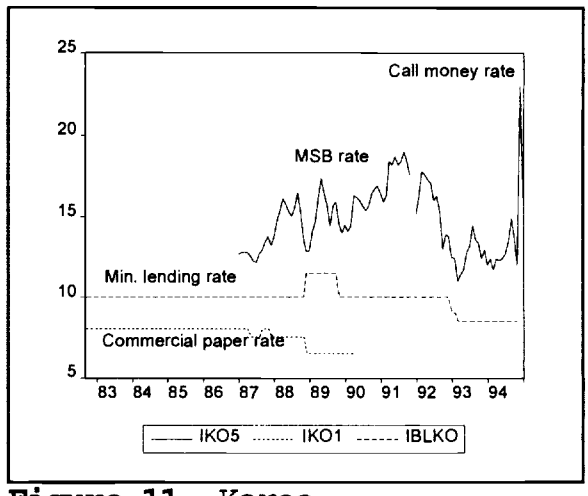

Figure 11: Korea

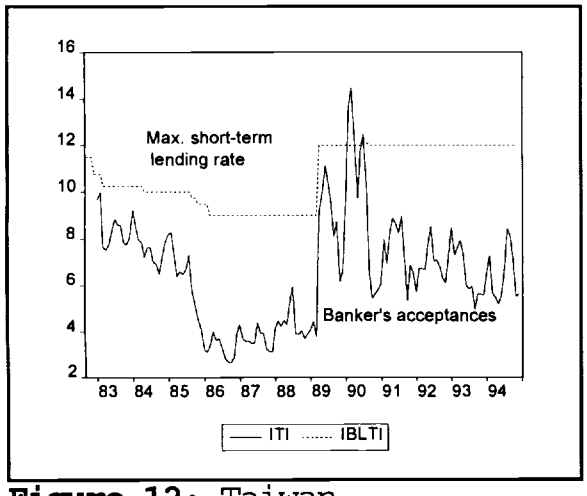

Figure 12: Taiwan

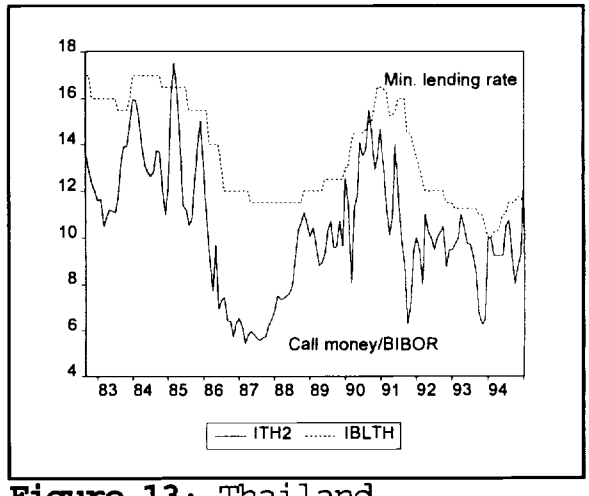

Figure 13: Thailand