International Financial Markets in North-East Asia: Assessment and Prospects

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Foreign Exchange Intervention and Sterilization Dynamics in Japan

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I. Introduction

The conflict between internal and external equilibrium has been an ongoing focus of open economy macroeconomic analysis. The conflict arises when domestic credit measures appropriate for attaining a domestic policy target cause the economy to diverge from a particular external target. Central banks have typically sought to resolve this dilemma by sterilizing the monetary effects of foreign reserve flows in the expectation of at least temporarily divorcing their domestic policies from external considerations. With sterilized intervention, the exchange of domestic money for foreign currency assets associated with intervention by the central bank in the foreign exchange market is offset by an accompanying exchange of domestic securities for domestic money, leaving the monetary base unaffected. To the extent that the monetary base is thus insulated from the effects of efforts to influence the exchange rate, domestic monetary control can be maintained.

This paper is concerned with the Bank of Japan's use of sterilization during the floating rate period. The experience of Japan illustrates both the nature of the conflict that arises between domestic and external objectives and the role of sterilized intervention. On the one hand, the Bank of Japan (BOJ) has long emphasized domestic policy goals, particularly price stability. On the other hand, it has actively intervened in the foreign exchange market over most of the floating rate period. (See Figure 1).

Have Japanese monetary authorities sought to sterilize the effects of these interventions on money aggregates and to what extent have they been successful? These questions are answered by analyzing the relation between domestic credit and official foreign asset levels in Japan. Particular

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attention is placed on the dynamics of this relation and how the short-run and long-run control of monetary aggregates may differ.

The paper reports results of estimating a domestic credit reaction function in order to measure the extent to which the BOJ explicitly offsets purchases (or sales) of foreign reserves in order to maintain internal policy objectives. These "sterilization coefficient" estimates provide some insight into the extent to which Japanese monetary authorities face a tradeoff between external and internal policy objectives.

The paper also considers a more general estimation approach that permits better identification of the full-reduced form effects of foreign reserve changes on domestic credit. The full-reduced form effect depends on the policy response itself as well as on the simultaneous interaction of money aggregate components with the rest of the economy over time. This approach is implemented by estimating a vector error correction model (VECM) of the dynamics of intervention and sterilization operations in Japan. It permits a better separation of the short- and long-term effects of foreign exchange market operations on domestic credit and the monetary base.

Several broad findings emerge from the analysis. First, evidence is found that the sterilization policy responses of Japanese monetary authorities have varied across different time periods and particular episodes of strong yen appreciation and depreciation. This finding is attributable to policy preference shifts, external developments, and financial market liberalization in Japan that have influenced the timing and magnitude of foreign exchange intervention, sterilization, and their ultimate impact on monetary conditions.

Second, the analysis identifies differences between the contemporaneous and longer-term influence of foreign reserves on domestic credit. VECM estimates of the direct impact of a given foreign exchange market intervention on domestic credit declines markedly after few months, implying the degree of sterilization lessens. This suggests a possible trade-off in the pursuit of conflicting short-run and long-run policy objectives by Japanese monetary authorities.

Third, evidence is found for a dynamic intervention strategy whereby initial foreign exchange purchases (sales) are partially offset by counteracting sales (purchases) over a period of about six months. This "unwinding" of central bank foreign exchange positions over time changes the interpretation of the extent to which exchange rate intervention policy influences domestic monetary conditions. Domestic medium-term monetary control in Japan appears largely insulated from foreign exchange market interventions by a combination of both offsetting sterilization operations and an "unwinding" of foreign exchange positions over time.

The paper is organized as follows. Section II presents stylized facts relevant to Japanese monetary and exchange rate policy and looks at monetary developments during episodes of large yen appreciations and depreciations. Section III presents an empirical analysis of Japan's sterilization policy using single equation estimates. Section IV presents results from a vector error correction model. Section V concludes the paper.

II. A Look at the Data

This section presents some stylized facts about movements in the value of the yen, Japanese official reserve holdings, and Japan's money aggregates over the period 1971-1993. Attention is also drawn to macroeconomic and monetary developments in several episodes of sharp yen appreciation and depreciation. The construction and source of all data are described in the appendix.

1. General Developments

Figure 1 plots an index of the nominal dollar value of the yen together with Japan's holdings of foreign exchange reserves, measured in dollars. Focus is placed on the nominal U.S. dollar value of the yen since the U.S. dollar is dominant in any measure of the effective exchange rate index of the yen. A higher index value indicates a higher dollar value of the yen and a yen appreciation. The secular increase in the value of the yen since 1971 has been accompanied by a corresponding rise in Japan's reserve stocks. In particular, note that during the period 1986-1988, as Japanese intervention policy led to the rapid accumulation of foreign exchange reserves in support of the dollar, its foreign exchange reserves jumped more than four-fold, from $22 billion to $90 billion. In 1989 and 1990 official foreign reserves declined because of intervention to support a falling yen. The continued fall of foreign exchange reserves in 1991, even as the yen began again appreciating, can be attributed in part to Japan's finance of its contribution to the Persian Gulf war effort.[1] In 1992 and 1993, reserves resumed rising as the yen generally continued to appreciate.

Figure 2 plots growth rates of the nominal dollar value of the yen (XR) and of the dollar-denominated (FA$, in the top panel), and yen-

[1]Approval of a contribution of 1.17 trillion yen (roughly $9 billion at an exchange rate of 130 yen per dollar) was approved by Japan's Diet in March 1991.

denominated (FA, in the bottom panel) value of official foreign exchange reserve assets, held by Japanese monetary authorities. Here positive values indicate a rise in the dollar value of the yen and a yen appreciation. Growth rates are calculated as the percent change over 4 quarters.

Movements in the yen exchange rate and Japanese foreign reserves are positively correlated over most of the period, suggesting leaning-against-the wind intervention behavior. Yen appreciation (depreciation) tends to be accompanied by increases (decreases) in foreign reserves. This is also clear from Figure 1 where dollar-denominated reserves are expressed in level terms (rather than in percent changes). Thus Japanese monetary authorities have generally sold (bought) yen and bought (sold) foreign reserves when the value of the yen appreciates (depreciates), seeking to dampen or slow exchange rate fluctuations.

Particularly significant increases in reserves can be observed following the periods of sharp yen appreciation accompanying the breakup of Bretton Woods in the early 1970s and the decline of the dollar in the mid-1980s; large declines in the stock of official reserves occurred following the oil price hikes and depreciations of the yen in 1973-74 and 1978-79. Note the decline of the yen-denominated reserves in 1991 is exaggerated by the Persian Gulf war financing effect pointed out above.[2]

Figure 3 plots quarterly growth rates of Japan's broad money supply and monetary base. Broad money is defined as M2 prior to May 1979, and as M2+CDs afterwards. Growth rates are again calculated as the percent change over 4 quarters. Movements in broad money and monetary base growth display the same secular trend, although the contemporaneous covariation between the two series is generally low, particularly through the late 1970s. The BOJ's decisive action in the mid-1970s to reduce trend money growth is the most striking feature of the behavior of both money aggregates. After a decade of trend decline, however, the rate of growth of broad money picked up in late 1983, gradually increased, and then jumped almost 4 percentage points to double-digit levels in 1987. In 1990 and 1991 both money

[2]Leaning-against-the-wind intervention behavior combined with the valuation effects of exchange rate changes tend to magnify (dampen) the magnitude of decreases (increases) in the yen value of foreign reserve holdings in comparison to changes in the dollar-denominated value. For example, as the monetary authorities sell dollar reserves and buy yen in order to limit depreciation of the yen (a rise in the yen price of the dollar), the depreciation of the yen renders the value of remaining dollar reserve holdings less in yen terms. Hence yen-denominated reserve holdings decline more in response to a given exchange rate change. Correspondingly, when dollar reserves are accumulated during efforts to limit yen appreciation, reserve holdings rise less in yen terms.

aggregates fell sharply as the monetary authorities sought to slow down the economy.[3]

Observe that two episodes of relatively high money growth, the first in the early 1970s and the second in the late 1980s, both followed periods of rapid yen appreciation, substantial foreign exchange intervention, and the accumulation of international reserves, identified in the prior figures. This suggests a link between rapid money growth during periods of sharp yen appreciation and unsterilized dollar-support foreign exchange market intervention.

It should be noted that some argue that interest rates, such as the call money rate or the Bank of Japan's official discount rate, provide a better indicator of the stance of Japan's monetary policy than do money aggregates (see Takagi, 1991; Ueda, 1993). However, a plot (not reported) of the discount rate together with broad money growth indicates that the two series tend to move inversely. The recent period 1991-92 is an exception to this general pattern; over this period money aggregates fell steadily, even as the Bank of Japan was reducing the discount rate to stimulate the real economy.

2. Focal Episodes

Clear patterns over the full period since the end of the Bretton Woods era may be difficult to discern if policy responses tend to vary with episodes of sharp movements in the exchange rate. In this case, looking at particular focal episodes may provide more information on the extent to which monetary control has been influenced by external considerations. To this end, it is useful to examine the policy response of Japanese monetary authorities during specific episodes of yen appreciation and depreciation. Four periods of appreciation are identified beginning with (i) 1971:Q3 when the yen appreciated with the unraveling of the Bretton Woods system; (ii) 1976:Q1 when the yen strengthened with Japan's recovery from the effects of earlier oil price rises and recession, (iii) 1985:4 following the Plaza Agreement, and (iv) 1990:Q3 when the yen resumed appreciating after a period of dollar strength. Three periods of yen depreciation are also examined, two associated with oil price shocks in 1973:Q4 and 1978:Q4, and a third beginning in 1989:Q1 associated in part with political uncertainties in

[3]Kim and Moreno (1994) attribute much of this fall to the effects on commercial bank lending of Tokyo stock market and real estate price declines and to greater attention to bank capital positions by regulators.

Japan.[4]

1) Episodes of Appreciation

The six panels of Figure 4 show various monetary policy indicators before and after the beginning of the four yen appreciation episodes. Time 0 indicates the beginning of each episode. Points to the right (left) refer to variable values in subsequent (preceding) quarters. Indicators of change in the exchange rate, foreign exchange reserves, monetary base, broad money (M2+CDs), and the CPI, as well as the call money rate level, are shown. All variables are measured as four quarter rates of change, except the call money rate which is in percent levels.

(i) Breakup of Bretton Woods. Existing exchange rate parities came under increasing pressure in 1971, with the overvaluation of the dollar at Y/$360 forcing the Japanese authorities to intervene heavily to maintain the exchange rate peg. As a consequence, Japanese foreign exchange reserves grew rapidly in the months prior to August 1971 when the U.S. finally closed the gold window and the yen was subsequently revalued. Pressures on the dollar continued in the following months, however, and the yen appreciated further despite large scale intervention by the Japanese monetary authorities. Even the new realignments sanctioned by the Smithsonian Agreement in December 1971 ceased to halt the rise in the yen against the dollar in early 1972.

Against this background, monetary base growth began to accelerate sharply in 1972 and peaked at over 35 percent in early 1973. The broad money supply, which had been growing at almost 20 percent per year prior to the initial appreciation of the yen, rose even faster, at almost 25 percent per year, through the latter part of 1971 and into 1973. Loose monetary conditions also were reflected in call money interest rate declines through most of 1971-1972. Japanese inflation rose to double-digit levels at the beginning of 1973, in response to the monetary stimulus. Japan completely abandoned its fixed parity with the dollar in early 1973 and, together with most other industrial countries, moved to the present system of managed floating.

(ii) Mid-1970s. Beginning in early 1976, the yen experienced a second period of sustained appreciation. During this episode the Japanese monetary authorities again engaged in substantial intervention operations designed to moderate yen appreciation by dollar purchases in the foreign exchange market. The authorities intervened particularly heavily when yen appreciation accelerated in late 1977 and early 1978. This intervention

[4]The discussion of the first three appreciation episodes and the first two depreciation episodes is adapted from Glick and Hutchison (1994a).

was accompanied by increased growth in the monetary base through 1976 and into the first half of 1977. However, money supply growth declined somewhat in the 1976-77. Money market interest rates and inflation also fell gradually during this episode.

(iii) Post-Plaza Agreement. After a moderate appreciation in early 1985, the yen began a sharp and sustained appreciation following the agreement of the G-5 countries held in September 1985 at the Plaza Hotel in New York. The Japanese monetary authorities joined other central banks in selling dollars in coordinated intervention from late September through the end of October, and immediately tightened monetary conditions somewhat by raising interest rates. From the spring of 1986 through the end of 1988, however, the stance of intervention policy abruptly changed to limiting yen appreciation by buying dollars, particularly in 1987 after the February Louvre Accord.

Monetary base growth increased through 1986 and 1987 from 5 percent to near 15 percent per year. Japanese broad money supply growth initially remained steady at around 8 percent, but then rose to around 10 percent by mid-1987. The generally accommodative stance of policy during this time was also marked by successive declines in interest rates. Nonetheless, virtual price stability was maintained during much of this period, as import price declines help to offset some increases in the domestic component of the overall CPI index. Inflation began to accelerate towards the end of 1988, however, and peaked at almost four percent two years later.[5]

(iv) Early 1990s. Beginning in the latter half of 1990, the yen experienced another period of sustained appreciation. In contrast to the experience of the prior three episodes of appreciation, it does not appear that the Bank of Japan intervened to limit this appreciation by buying foreign reserves. The overall robustness of the economy evidently lessened concerns about the adverse impact of a stronger yen on competitiveness. However, Persian Gulf war financing costs beginning in 1991:Q1 (two quarters after the start of the episode) may have masked any leaning-against-the-wind intervention effects and may explain the observation that reserves actually fell during this period. Through the latter half of 1990 and the first half of 1991 monetary policy followed a contractionary to neutral stance as inflation remained a concern. In mid-1991 monetary policy was loosened to stimulate a slowing economy, as evidenced by the downturn in the call money rate. Monetary base and broad money supply growth both continued to fall, however.

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[5]The rise in consumer price inflation was preceded by bursts of financial asset and real estate inflation.

A comparison of these four episodes of yen appreciation indicates that, with the exception of the last one, they were generally characterized by the accumulation of foreign exchange reserves and rising monetary base growth, indicating less than complete sterilization, at least in the short run. However, only in the first episode, at the time of the breakdown of the Bretton Woods system, was the increase in monetary base growth immediately followed by a sharp rise in the broad money supply. This may indicate that structural shifts in the relationship between the monetary base and the broad money supply since then, perhaps attributable to financial market developments in Japan, have lessened the impact of base money changes on the broad money supply.

2) Episodes of Depreciation

Figure 5 illustrates the three episodes of yen depreciation. In each case the monetary authorities intervened by selling foreign exchange reserves to strengthen the yen.

(i) First Oil Price Rise. In the case of the first oil price rise at the end of 1973, monetary base growth rate fell sharply in response to monetary tightening already begun early in the year in response to building inflationary pressures. Broad money growth, which also had been declining several quarters prior to the depreciation of the yen, fell further as well. Money market rates rose again after the oil shock, further tightening monetary conditions. Thus foreign exchange sales during this episode were unsterilized and contributed to the overall restrictive monetary policy stance.[6]

(ii) Second Oil Price Rise. Monetary conditions were quite different prior to the second oil price shock at the end of 1978. Inflation pressure was not evident, aggregate money growth rates were fairly stable, and interest rates had been steady for some time. In the year and a half following the oil shock, the yen depreciated by more than 25 percent against the dollar; substantial foreign exchange market dollar sales to support the yen led to a sharp drop in international reserves. Base money growth declined substantially as the yen depreciated, reflecting unsterilized intervention operations and a sharp discretionary rise in short-term interest rates. Broad money also declined, albeit gradually, during this episode.

(iii) Political Uncertainties in late 1980s. In late 1988 and early 1989 the dollar rebounded against the yen after three years of sharp declines. The

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[6]Broad money growth declined from over 25 percent in early 1973 to about 11 percent in mid-1974 and short-term interest rates more than doubled from 6 percent to 13 percent.

weakness of the yen was attributed partly to political uncertainties associated with Japan's change of governments. After 4 quarters the yen had depreciated by almost 30 percent. In Spring 1989 the Bank of Japan sold dollars for the first time since the beginning of 1985. In the subsequent year and a half, however, growth of the monetary base and money supply remained relatively constant (though high), suggesting successful sterilized intervention.

In the first two depreciation episodes the fall of the yen was accompanied by declining foreign exchange reserves, declining monetary base growth, and monetary policy tightening. Substantial unsterilized foreign exchange market intervention is clearly evident, perhaps more so than in the episodes of yen appreciation in 1976-77 and post-Plaza. It is not clear, however, how to separate the policy response to yen depreciation from the oil price hikes themselves or, in the 1973 case, from prior concerns and policy actions about inflation. In the most recent depreciation episode, there does not appear to have been any effect of the reserve losses on money aggregate growth. This comparison of episodes suggests some possible asymmetries in the behavior of Japanese monetary authorities during depreciations and appreciations of the yen.

The preliminary examination of the data in this section indicates some linkage of money growth performance in Japan with foreign exchange intervention activity. The linkages between foreign exchange operations and monetary growth are potentially complex. The paper now turns to more formal statistical analysis.

III. Single Equation Sterilization Regressions

The data inspection in Section II suggests that Japan has tended to follow a leaning-against-the-wind intervention policy for much of the floating rate period.[7] An activist intervention policy, however, does not necessarily impede a central bank's ability to control monetary targets and pursue domestic policy targets. The authorities may sterilize most or all of the effects of foreign exchange reserves changes on money aggregates by systematically adjusting the level of domestic credit. Under this

[7]Formal econometric analysis of Japan's intervention behavior can be found in Quirk (1977), Hutchison (1984), Takagi (1991), Glick and Hutchison (1994a), and Watanabe (1994). They find evidence of leaning-against-the-wind behavior, although the extent of intervention in response to exchange rate changes has varied over time.

circumstance, monetary control would be insulated from exchange intervention operations, at least in the short run.[8] To explore this aspect of policy, the degree of sterilization of foreign exchange intervention by the BOJ is estimated over the managed floating rate period.

1. Domestic Credit Reaction Equation

The change in the monetary base, ΔMB, can be expressed as

$$\Delta MB_t = \Delta FA_t + \Delta DC_t \tag{1}$$

where ΔFA and ΔDC denote the change in the official foreign reserve and domestic credit components of the monetary base, respectively, all valued in yen. It is assumed that domestic credit changes depend on current and lagged interventions ΔFA_{t-j}, as well as autoregressive lags:

$$\Delta DC_t = \sum_{j=0}^{m} \gamma_j \Delta FA_{t-j} + \sum_{j=1}^{n} \alpha_j \Delta DC_{t-j} + v_t \tag{2}$$

where v_t is a random variable that represents other changes. The lag pattern of the individual γ_j coefficients reflect how sterilization is distributed over time. The long-run multiplier response of domestic credit to foreign asset changes is given by

$$\sum_{j=0}^{m} \gamma_j / \left[1 - \sum_{j=1}^{n} \alpha_j \right].$$

If $\gamma_0 > -1$, intervention is less than fully sterilized in the current period, and there is an initial effect on the monetary base. Whether or not foreign exchange interventions are sterilized completely in the long run depends on the lagged pattern of intervention.

Eqns. (1) and (2) imply that base monetary growth in the current period can be expressed as

[8]The extent to which sterilization is possible, and more generally, the ability to insulate domestic policy objectives from external considerations, is dependent on the degree of capital mobility and other factors. See Herring and Marston (1977), Obstfeld (1983), and Roubini (1988).

$$\Delta MB_t = \sum_{j=1}^{n} \alpha_j \Delta MB_{t-j} + (1+\gamma_0)\Delta FA_t + \sum_{j=1}^{n} (\gamma_j-\alpha_j)\Delta FA_{t-j} + \sum_{j=m}^{m-n} \gamma_j \Delta FA_{t-j} + v_t \,, \tag{3}$$

assuming m>n. Observe that the coefficients on lagged intervention terms in eqn. (3) are linear combinations of lagged sterilization and lagged adjustment coefficients. This points to the difficulty of interpreting coefficients in dynamic monetary base equations to draw conclusions about the extent of sterilization.[9] Thus eqn. (2) is the preferred specification for analyzing the sterilization behavior of Japanese monetary authorities.

2. Empirical Estimates

For the purposes of econometric analysis, ΔFA is measured by changes in the yen value of the BOJ's official foreign assets that are independent of the effects of exchange-rate-induced fluctuations as well as of reinvested interest earnings. It reflects the incipient addition to domestic base money resulting from the BOJ's acquisition of foreign exchange. Changes in domestic credit, are defined as the difference between the changes in a liability sources-side measure of the monetary base and foreign reserves. The source and construction of the data are described more fully in the appendix. All estimates of eqn. (2) included two lags of domestic credit (n=2), contemporaneous and three lags of foreign assets (m=3), a constant, and a trend term. This specification appeared to suitably capture the dynamics of domestic credit adjustment.

One potential econometric problem with estimating (2) by ordinary least squares arises from the possible simultaneity of ΔMB and ΔDC, on the one hand, and ΔFA, on the other, because of systematic foreign-exchange intervention. In this case the change in reserves valued at a constant exchange rate may be correlated with the disturbance to the monetary base and domestic credit equations. If such a correlation exists, then OLS estimates are inconsistent. To take account of this possibility, eqn. (2) is estimated with instrumental variables (INST) as well as OLS.

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[9] Von Hagen (1989), for example, estimates a monetary base equation like (3) for Germany over the period 1979-88, and finds that the sum of the coefficients on ΔFA terms is significantly different from zero, thus rejecting complete sterilization. He also finds, however, that the sum of coefficients in a regression like eqn. (2) of domestic credit on contemporaneous and lagged changes of international reserves is insignificantly different from minus unity, implying full sterilization.

Table 1 presents estimates of the contemporaneous coefficient (γ_0) as well as the long-run multiplier ($\sum_{j=0}^{3} \gamma_j / [1 - \sum_{j=1}^{2} \alpha_j]$) of foreign asset changes on domestic credit using seasonally-adjusted monthly data. The sample periods considered include the managed-floating period 1973:5 - 1990:12 as well as various subperiods corresponding to possible policy regime shifts by the BOJ in 1978:7 with the announced adoption of official monetary growth targets, and in 1985:9 following the Plaza Agreement by the G-5 countries to coordinate intervention.[10] Tests for asymmetry in the sterilization response between episodes of yen appreciation and depreciation are also performed.

Focusing on the OLS results, observe that over the full period the contemporaneous coefficient on foreign exchange reserves of -.75 is significantly different from -1 at better than 1 percent; the long-run multiplier of -.88 is significantly different from -1 only at the 13 percent level. Thus in the long run it cannot be rejected that foreign asset changes were fully offset by domestic credit changes, leaving the monetary base unchanged. For the period 1973:5 - 1978:6, the offset was less than one-for-one, both in the short run (-.47) and in the long run (-.64). This implies that during this period, foreign intervention had some positive effect on the monetary base. A one-for-one long-run offset, leaving the monetary base unchanged, cannot be rejected during either the period 1978:7 - 1985:8 or the period 1985:9 - 1990:12.[11] The results using instrumental variables suggest a similar shift in the extent of sterilization between the 1973:5 - 1978:6 period and afterward.

Figure 6 reports rolling OLS regression results for the long-run multiplier response of domestic credit to foreign exchange asset changes, based on 33-month rolling regressions (i.e., the first estimation period covers 1973:3-1975:12, the second period covers 1973:4-1976:1, and so on until the last period covering 1988:4-1990:12). Each regression has 25 degrees of freedom. The identifying date noted in the chart represents the end of the 33-month sample period for each of the rolling regressions. The figure confirms the finding above of a less than one-for-one degree of long run sterilization of foreign asset changes in the mid- to late-1970s, in contrast to

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[10]See Takagi (1991) and Ueda (1993) for characterizations of different monetary and exchange rate policy regimes in Japan since 1973. See Suzuki (1985) and Fukui (1986) for discussion of the introduction of Japan's "money-focused" monetary policy in the late 1970s.

[11] These results contrast somewhat with those of Takagi (1991) who concludes that the Bank of Japan is able to achieve complete sterilization. However, he estimates an equation for the monetary base that assumes only contemporaneous intervention, using quarterly data over the period 1973:Q1 to 1989:Q2.

near-complete sterilization in subsequent periods.[12] This suggests a shift in the ability or desire of Japanese monetary authorities to sterilize the effects of foreign asset changes on the monetary base.

OLS tests of sterilization asymmetry across periods of yen appreciation and depreciation are reported in the lower panel of Table 1. Observe that the initial response appears to be virtually identical irrespective of whether the yen is appreciating or depreciating. The contemporaneous sterilization coefficient estimate for the full sample period 1973:5 - 1990:12 is -.74 for intervention when the yen is appreciating and -.73 when it is depreciating. But estimates of subsequent sterilization, indicated by the long-run multipliers in the table, suggest that the Bank of Japan sought more vigorously to insulate the monetary base during intervention episodes associated with yen appreciation. In particular, the estimated long-run sterilization coefficient is -.96 for episodes of yen appreciation and -.78 for episodes of yen depreciation. Thus Japanese sterilization policy appears more reluctant to allow intervention activity to influence the monetary base during periods of yen appreciation, i.e. when it is likely to prove expansionary in nature.

IV. VECM Analysis of Sterilization

1. Methodology

The sterilization coefficient estimates derived in Section III were obtained from estimation of a single structural equation -- the policy reaction function (2) -- within the context of a broader simultaneously-determined system of equations representing the macroeconomy. As such, these estimates represent a partial equilibrium effect, as opposed to the full reduced-form effect, of official reserve changes on domestic credit. The full reduced-form effect in principle depends both on the policy response itself as well as on simultaneous portfolio adjustment of the private sector to the sterilization and intervention operations. Hence, the ultimate effects of intervention operations on monetary control are not adequately described by policy reaction function estimates alone. This suggests the desirability of reduced-form estimates from a broader simultaneous equation system that

[12] There is some evidence at the end of 1980 of "oversterilization," i.e., a greater than proportionate change in domestic credit in response to foreign asset changes.

takes account of the complete dynamic path of private as well as central bank adjustment behavior.[13]

This is done by employing a simultaneous equation time-series methodology that analyzes the behavior of a data system (X_t) consisting of the logarithm of real output as measured by industrial production (IP), the logarithm of the consumer price level (CPI), central bank foreign assets (FA), central bank domestic credit assets (DC), a vector of seasonal dummy variables (D), and a vector of constant terms (v).[14] Since the time series elements of X_t are likely non-stationary processes, the model is expressed in first differences in vector error correction model (VECM) form:

$$\Delta X_t = \Gamma_1 \Delta X_{t-1} + \ldots + \Gamma_{k-1} \Delta X_{t-k+1} + \pi X_{t-k} + \phi D + \mu + v_t \qquad (4)$$

where Γ_i, π, and ϕ are matrices of coefficients, Δ=1-L (L is the lag operator), and denotes the lag length.

The long-run relationships in the system are captured in the π matrix. As demonstrated by Johansen (1991), the rank (r) of π determines the number of distinct cointegrating vectors which exist between the 4 variables in X_t. If r>0, π may be 'decomposed into two matrices α and β (each 4Xr) such that $\pi=\alpha\beta'$. β contains the coefficients of the r distinct cointegrating vectors that render $\beta' X_t$ stationary even though X_t itself is non-stationary, and α contains the speed-of-adjustment coefficients in each equation.

The Johansen (1991) maximum likelihood method is employed to determine the number of cointegrating vectors (using both the trace and λ_{max} tests) and the β' vector estimates.[15] Any long-run constraints implied by the estimated cointegrating vectors ($\beta' X_t$) are then imposed on the first-difference of the vector autoregression (VAR) model via lagged error correction terms as in equation (4).

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[13] Glick and Hutchison (1994b) illustrate the dynamic interaction of intervention and sterilization policy in a structural portfolio balance model where the extent of capital mobility rises over time following a shock because of gradual private portfolio adjustment. Their model demonstrates that the ability of the central bank to insulate domestic monetary conditions by sterilizing foreign exchange reserve flows from exchange market intervention operations depends on the speed of private portfolio adjustment, private asset demand parameters, as well as on central bank intervention parameters.

[14] The series used for FA and DC are the same as in Section III. See the appendix for data sources. The 3-month U.S. Treasury bill interest rate is also included in an expanded formulation of the multivariate model that is considered in Glick and Hutchison (1994b).

[15] Johansen and Juselius (1990) present tables of asymptotic critical values for the two test statistics.

After estimating the VECM, the impulse response functions (dynamic forecasts) and variance decompositions are calculated by employing the Sims recursive approach (Choleski decomposition) to identify the contemporaneous error terms. Specifically, the system is ordered v_y, v_p, v_{FA}, v_{DC}, so that financial shocks (v_{FA}, v_{DC}), do not influence either output or prices within the current month. The foreign asset shock (v_{FA}), the focus of interest, is identified as having an immediate effect on domestic credit, but influences output and prices with a one-month lag.

2. Unit Root Tests

The data consist of monthly observations over the sample period of 1978:07-1990:12. The sample period begins with the start of public announcements of central bank money growth projections, which were part of the "money-focused" monetary policy introduced in the late 1970s.

Table 2 presents Dickey-Fuller (DF), Augmented Dickey-Fuller (ADF) and Phillips-Perron unit root tests. The unit root null hypothesis of the FA and DC variables in level form can not be rejected (except in one instance -- the DF test for FA). The tests results also indicate a unit root in CPI (except the Phillips-Perron test) and IP. By contrast, all of the tests overwhelmingly reject the unit root null hypothesis for the variables in first difference form. Since the bulk of the evidence indicates the variables are non-stationary in levels, but stationary in differences, the analysis proceeds on this assumption and tests for cointegration.

3. Cointegration Test Results and Formulation of the VECM Model

Table 3 presents Johansen maximum likelihood cointegration tests, based on both maximum eigenvalue and trace statistics, using the four variable (DC, FA, CPI, IP) multivariate system. Seasonally unadjusted data is used in the tests, which include constant terms and eleven seasonal dummy variables. The lag length of the VECM model in which the cointegrating tests are imbedded is six months.

The cointegration results are consistent across both the maximum likelihood and trace tests. They indicate that no cointegrating vectors exist. Thus, the Japanese four-variable system is modelled as a VAR (i.e. a VAR system in first-differences with no error correction mechanism).

4. Variance Decompositions

Table 4 presents the forecast error variance decompositions of domestic credit using the VECM model estimates and identifying restrictions described above.

Foreign asset shocks are found to dominate other disturbances in explaining unexpected movements in domestic credit at both the short and long run horizons. They account for 56 percent of the explained variance in the short run (5 months ahead) and 40 percent in the long run (30 months ahead). Thus, regardless of the forecast horizon, it appears that a substantial part of domestic credit movements of the Bank of Japan represent a response to fluctuations in foreign asset holdings.[16]

5. Impulse Response Functions

Figure 7 presents the response of domestic credit (upper panel), foreign assets (middle panel) and the monetary base (MBS, lower panel) to a one unit rise in foreign assets held by the Bank of Japan for the four-variable, six-lag VAR model. 95 percent confidence boundaries are also shown.[17] The cumulative monetary base response to the foreign asset shock need not be estimated separately as it is simply the sum of the domestic credit and foreign asset responses.

The model estimates indicate that a foreign asset purchase by the Bank of Japan is followed by an initial sterilization of about 80 percent, but that this weakens over time to a value of about 40 percent after 4-6 months. The very high offset coefficient initially, presumably indicating an initially high degree of insulation from exchange rate policy actions, declines markedly over time.[18] Thus sterilization by the Bank of Japan is less in the long run than in the short run.

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[16] Glick and Hutchison (1994b) find that, with U.S. interest rates as part of the system, foreign asset shocks account for almost 60 percent of the domestic credit variance in the long run as well as the short run.

[17] Standard error bands for the impulse response functions are found by taking 1000 draws from a Normal-inverse Wishart distribution, shocking the variance-covariance matrix of the VAR residuals (the posterior distribution of the VAR coefficients) and calculating impulse responses for each draw. We compute the confidence band by calculating boundaries such that 5 percent (50 draws) of the simulated values lie above the upper boundary value and 5 percent lie below the lower boundary value.

[18] Watanabe (1994), using a two-variable VAR composed of net intervention and real broad money, also finds evidence of complete sterilization in the short run, with incomplete sterilization in the long run.

Interestingly, however, the lower sterilization coefficient over time does not seem to indicate any lack of monetary control. The monetary base (the lower panel in Figure 7) does not seemingly respond to foreign exchange market intervention at either the short horizon, when offsetting sterilization operations in domestic credit appear high, or longer (two year) horizons, when offsetting sterilization operations in domestic credit appear low.

The reason for this seeming anomoly, shown in the middle panel of Figure 7, is that the Bank of Japan seems to partly "unwind" its initial intervention operations (purchases of foreign assets) within about four to six months through offsetting interventions (sales of foreign assets). The combination of the two offsetting operations -- partly on domestic credit and partly on foreign assets -- largely insulates the monetary base, and presumably the broader monetary aggregates, from exchange rate policy in Japan over the sample period investigated.[19]

These results contrast, for example, with Takagi (1991). Takagi directly estimates a single equation for the monetary base with only contemporaneous foreign asset changes included. He also includes the call money rate, inflation and a lagged value of the monetary base in the model specification. He finds only partial sterilization, particularly in the late 1980s, indicating that the Bank of Japan has allowed the exchange rate policy to have a greater influence on the money aggregate. The analysis in this paper, which considers the dynamic path of both domestic and foreign assets, gives quite different results.

V. Conclusion

This paper has explored the linkages between foreign exchange market intervention policy and monetary policy in Japan in order to answer whether efforts to engage in sterilized intervention in Japan have been successful.

Estimates of the sterilization coefficients of a domestic credit equation indicate that the Bank of Japan has attempted to offset a large part of the

[19] See Takagi (1991) and Glick and Hutchison (1994a) for discussions of the link between the monetary base and broader money supply. Both argue that intervention against the rise of the yen in the late 1980s contributed to an expansion of monetary aggregates. They suggest that only an offsetting increase in money demand associated with financial liberalization limited the inflationary impact of this monetary stimulus. See also Poole (1992) and Tschoegl (1989) who argue that exchange rate targeting has tended to exacerbate business cycles in Japan.

monetary effects of foreign exchange intervention operations. It is also found, however, that, when a more complicated simultaneous dynamic system structure is estimated, international reserve changes eventually do impact domestic credit growth in Japan. Thus in the long run foreign exchange intervention in Japan is not fully sterilized.

However, it is nonetheless concluded that the monetary base has been in large part insulated from exchange rate policies in Japan over most of the post-Bretton Woods period. This is because the Bank of Japan apparently makes systematic efforts to "unwind" its foreign asset position after initial intervention actions. An initial purchase of foreign exchange, for example, is followed by a pattern of (smaller) foreign exchange sales. Thus it appears that the Bank of Japan successfully insulates the domestic base from intervention operations first by offsetting domestic credit operation, followed later by offsetting foreign exchange operations.

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Data Appendix

All data, except where noted, were obtained from the IMF International Financial Statistics.

The quarterly exchange rate data plotted in Figures 1 and 2 are averages of monthly period-average figures from line rf. Dollar-denominated foreign exchange reserve data plotted in Figure 1 and the top panel of Figure 2 were obtained from line 1d.d ("Foreign Exchange"). Yen-denominated foreign exchange reserve data plotted in the bottom panel of Figure 2 were obtained from line 11 ("Monetary Authorities, Foreign Assets"). Monetary base and broad money data in Figure 3 are from line 14 ("Monetary Authorities, Reserve Money") and the sum of lines 34, 35, and 36aa ("Money", "Quasi-money", "CDs"), respectively. Quarterly figures for the reserve and money aggregate stocks plotted in Figures 2 and 3 were constructed as the average of the end-of-month stock figures obtained, after seasonally adjusting the monthly series using the X-11 procedure. Quarterly data on the consumer price index and call money rate in Figures 4 and 5 were obtained from line 64 and line 60b, respectively. The other series in Figures 4 and 5 are the same as in prior figures.

In the econometric analyses of Sections III and IV, the approach of Takagi (1991) was followed to construct an estimate (FA) of the yen value of the BOJ's official foreign assets that is independent of the effects of exchange-rate induced fluctuations in the yen value of existing foreign reserves as well as reinvested interest earnings on foreign assets. This measure, obtained by subtracting available information on the consolidated credit balance of the Bank of Japan and the Foreign Exchange Fund Special Account (FEFSA) to the central government from the BOJ's outstanding credit to the central government, represents an estimate of the outstanding value of the Bank of Japan's credit to the FEFSA. It may be interpreted as the cumulative sum of all purchases (and sales) of foreign exchange bills by the BOJ from the FEFSA, valued at historical exchange rates. Changes in this sum measure the effect of intervention on the monetary base at the exchange rate prevailing at the time foreign exchange transactions were made.

DC is measured by the difference between a liability sources-side measure of the monetary base, MBS, and the above measure of FA. The liability sources-side measure of the BOJ's monetary base, MBS, is defined as the sum of bills discounted, loans, bills purchases, and government bonds held by the BOJ. Other components are excluded because they are relatively

minor and/or stable. The end-of-month stock figures necessary to calculate FA and MBS were obtained from the BOJ Economics Statistics Monthly.

Monthly data on the consumer price index (CPI) is obtained from line 64; the industrial production (IP) index is from line 66..c.

Table 1. Response of Domestic Credit to Foreign Asset Changes

Sample period	Contemp-oraneous	Long-run multiplier	Q-msl	Adj. R^2	Regression Technique
1973:5-1990:12	-.75 (.00)	-.88 (.13)	.01	.52	OLS
	-.90 (.74)	-1.02 (.95)	.01	.50	INST
1973:5-1978:6	-.47 (.00)	-.64 (.13)	.90	.30	OLS
	-.20 (.03)	-.35 (.16)	.96	.23	INST
1978:7-1985:8	-.85 (.08)	-.99 (.94)	.02	.53	OLS
	-.80 (.46)	-.95 (.86)	.01	.53	INST
1985:9-1990:12	-.76 (.00)	-.90 (.27)	.45	.66	OLS
	-.84 (.55)	-.95 (.79)	.48	.65	INST
1978:7-1990:12	-.79 (.00)	-.90 (.24)	.02	.58	OLS
	-.84 (.55)	-.95 (.81)	.02	.57	INST

	Exchange Rate Appreciation		Exchange Rate Depreciation		
Sample period	Contemp.	Long-run multiplier	Contemp.	Long-run multiplier	Adj. R^2
1973:5-1990:12	-.74 (.00)	-.96 (.75)	-.73 (.00)	-.78 (.04)	.53
1978:7-1990:12	-.78 (.02)	-.95 (.69)	-.77 (.00)	-.83 (.14)	.58

Notes: All equations included contemporaneous and three lags of foreign asset changes, two lags of the dependent variable, a constant, and a time trend. Numbers in parentheses for the contemporaneous effect denote marginal significance levels of t-statistic against -1; numbers in parentheses for the long-run multiplier effect denote marginal significance levels of F-test against -1; Q-msl refers to the marginal significance level of the Ljung-Box Q statistic for serial correlation.

Table 2. Unit Root Tests[1]

	Level	First Difference
Foreign Assets (FA)		
DF	-3.36*	-15.47*
ADF[2]	-1.65	-5.61*
Phillips-Perron[2]	-2.89	-18.04*
Domestic Credit (DC)		
DF	-1.41	-15.04*
ADF[2]	0.43	-7.09*
Phillips-Perron[2]	-0.30	-17.73*
Prices (CPI)		
DF	-2.80	-11.49*
ADF[2]	-2.42	-3.20*
Phillips-Perron[2]	-3.41*	-11.59*
Industrial Production (IP)		
DF	-0.29	-19.52*
ADF[2]	-0.05	-3.60*
Phillips-Perron[2]	-0.10	-18.66*

Notes: 1. A constant term is included in all tests. *denotes rejection of the null hypothesis of a unit root at a 95% level of confidence.
2. Test conducted with six lags.

Table 3. Johansen Maximum Likelihood Cointegration Tests[1]

Null	Alternative	Statistic	Critical Value 95%	Critical Value 90%
Maximum Eigenvalue				
r=0	r=1	22.75	27.14	24.78
r≤1	r=2	14.65	21.07	18.90
r≤2	r=3	6.07	14.90	12.91
r≤3	r=4	0.55	8.18	6.50
r≤4	r=5	na	na	na
Trace				
r=0	r≥1	44.02	48.28	45.23
r≤1	r≥2	21.28	31.53	28.71
r≤2	r≥3	6.63	17.95	15.66
r≤3	r≥4	0.55	8.18	6.50
r≤4	r≥5	na	na	na

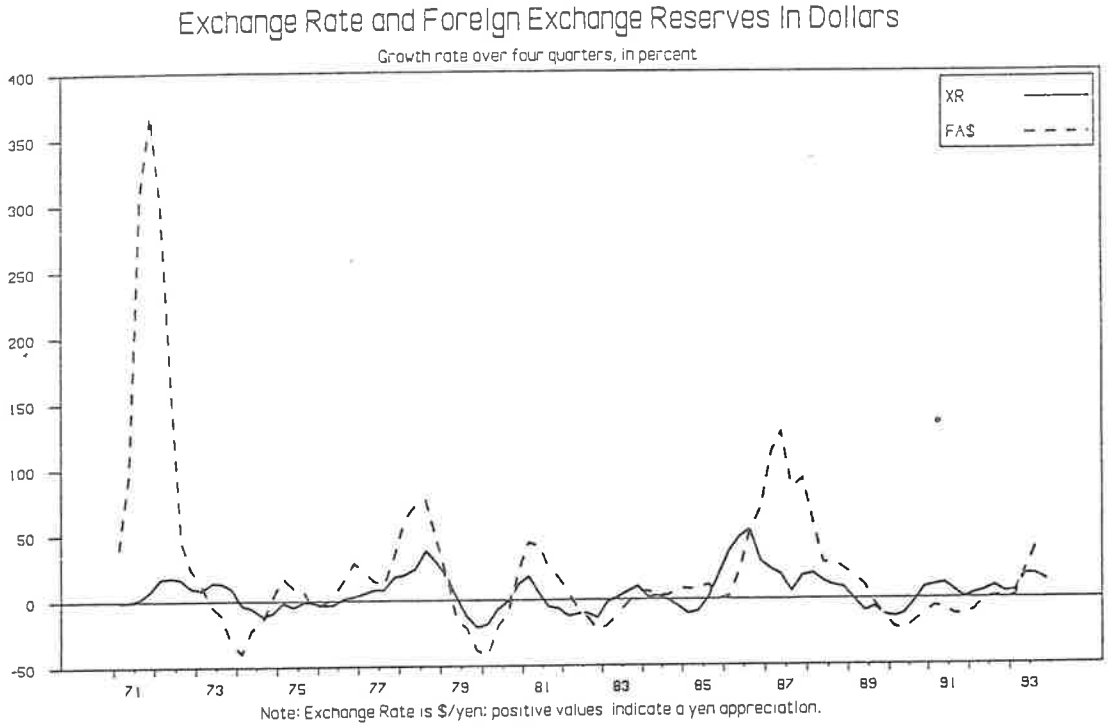
Note: 1. A constant and 11 seasonal dummy variables are included in the estimation.
**(*) denotes significance at 95% (90%) level or higher.

Table 4. Domestic Credit Variance Decompositions

Step	IP	CPI	FA	DC
1	2	0	54	44
5	3	3	56	38
10	2	5	49	44
20	2	6	42	50
30	2	6	40	52

Figure 1. Exchange Rate and Foreign Exchange Reserves

Figure 2. Exchange Rate and Foreign Exchange Reserves



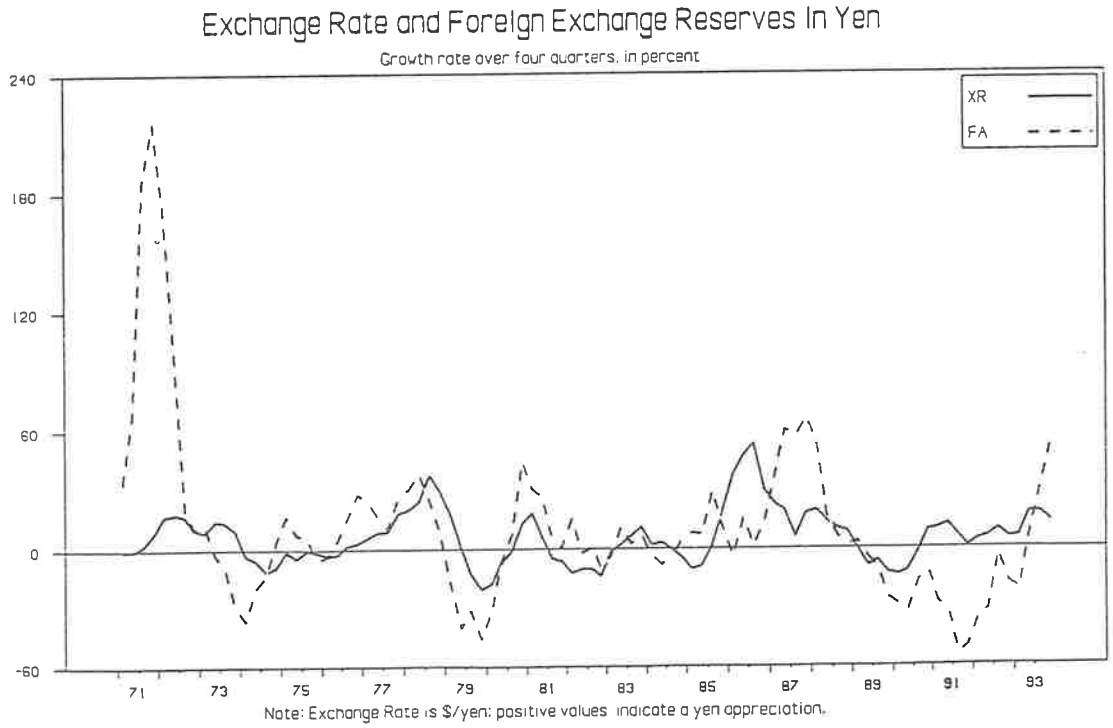


Figure 3. Broad Money and Monetary Base

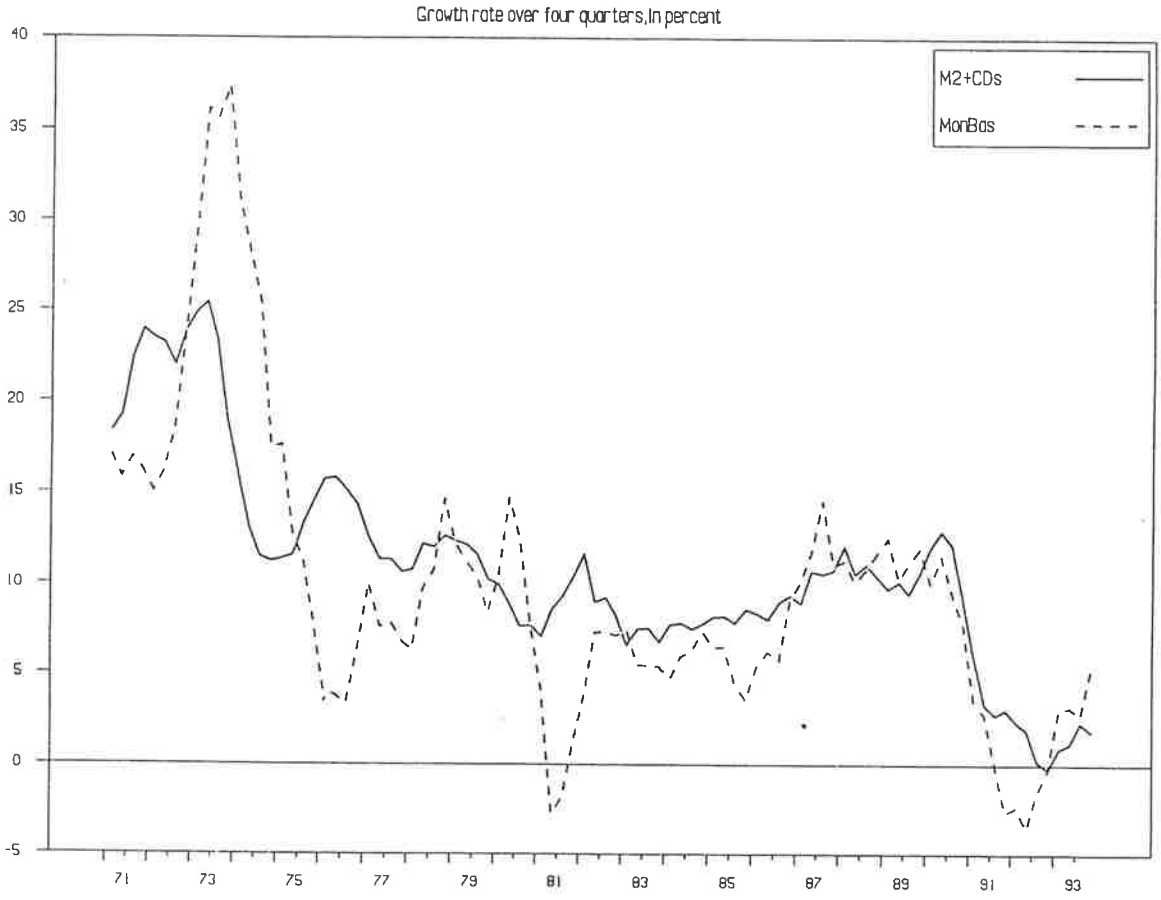
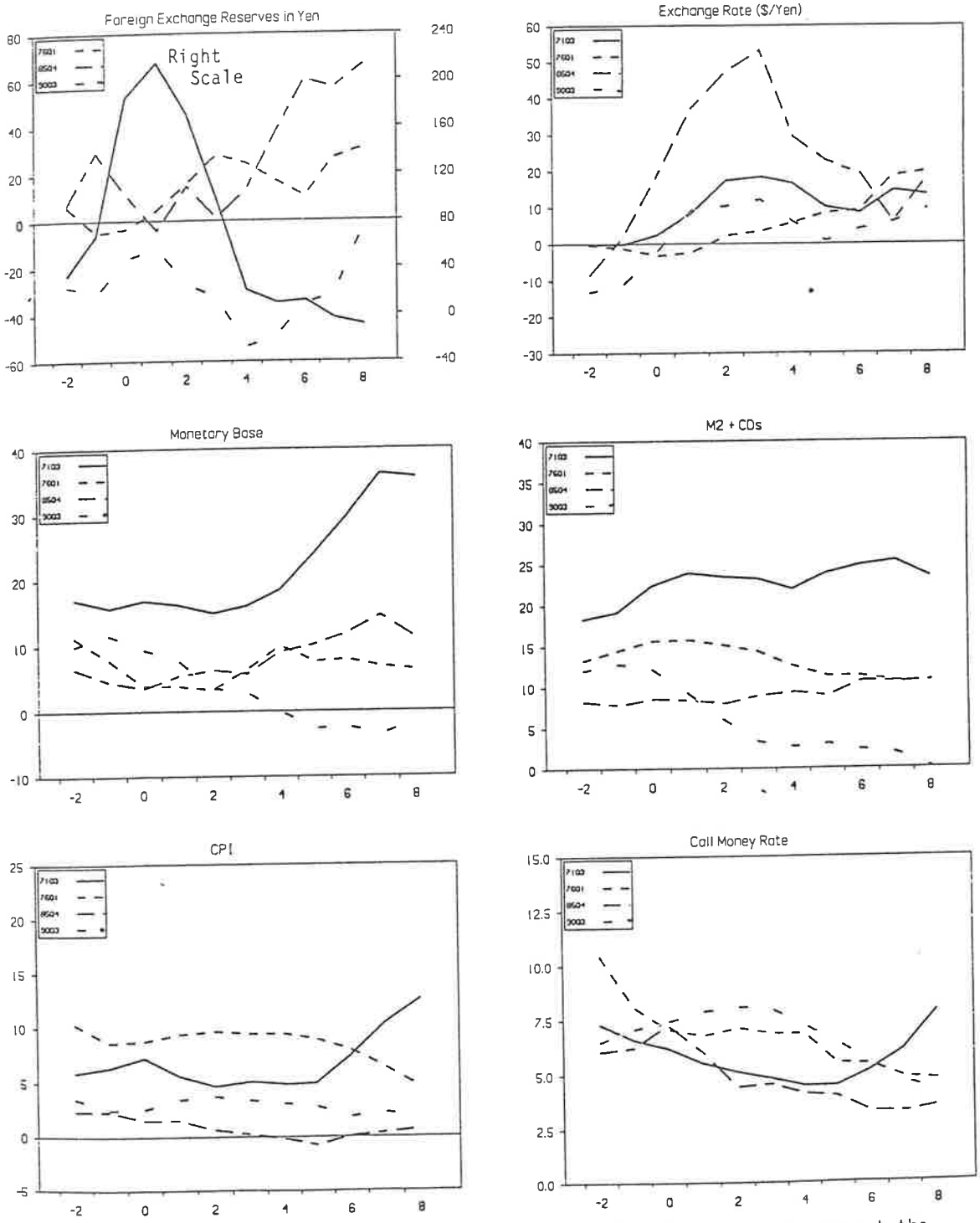
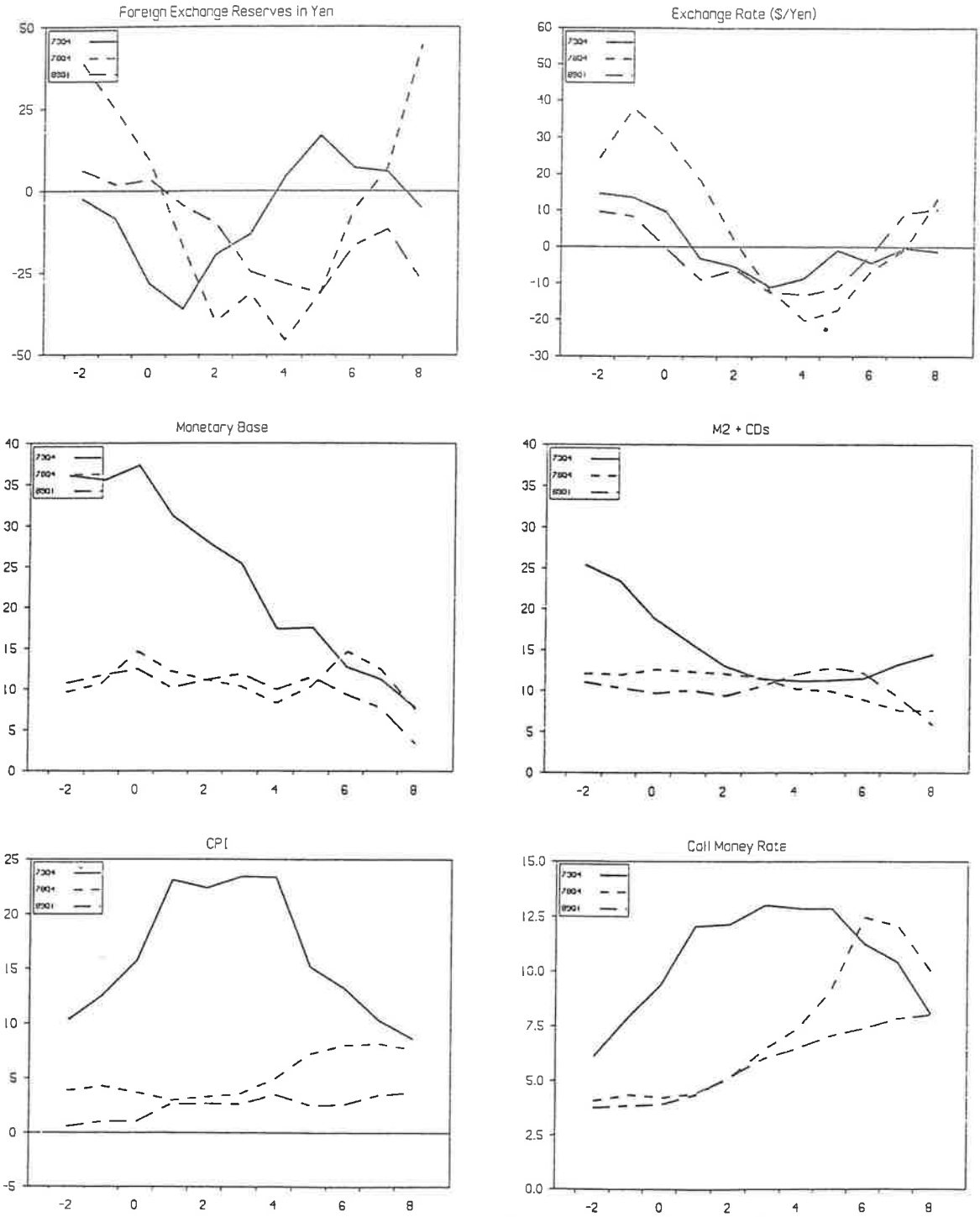


Figure 4. Yen Appreciation Episodes



Note: All variables are expressed as percent change over four quarters, except the call money rate, which is in percent levels.

Figure 5. Yen Depreciation Episodes



Note: All variables are expressed as percent change over four quarters, except the call money rate, which is in percent levels.

Figure 6. Long Run Response of Domestic Credit to Foreign Exchange Reserves

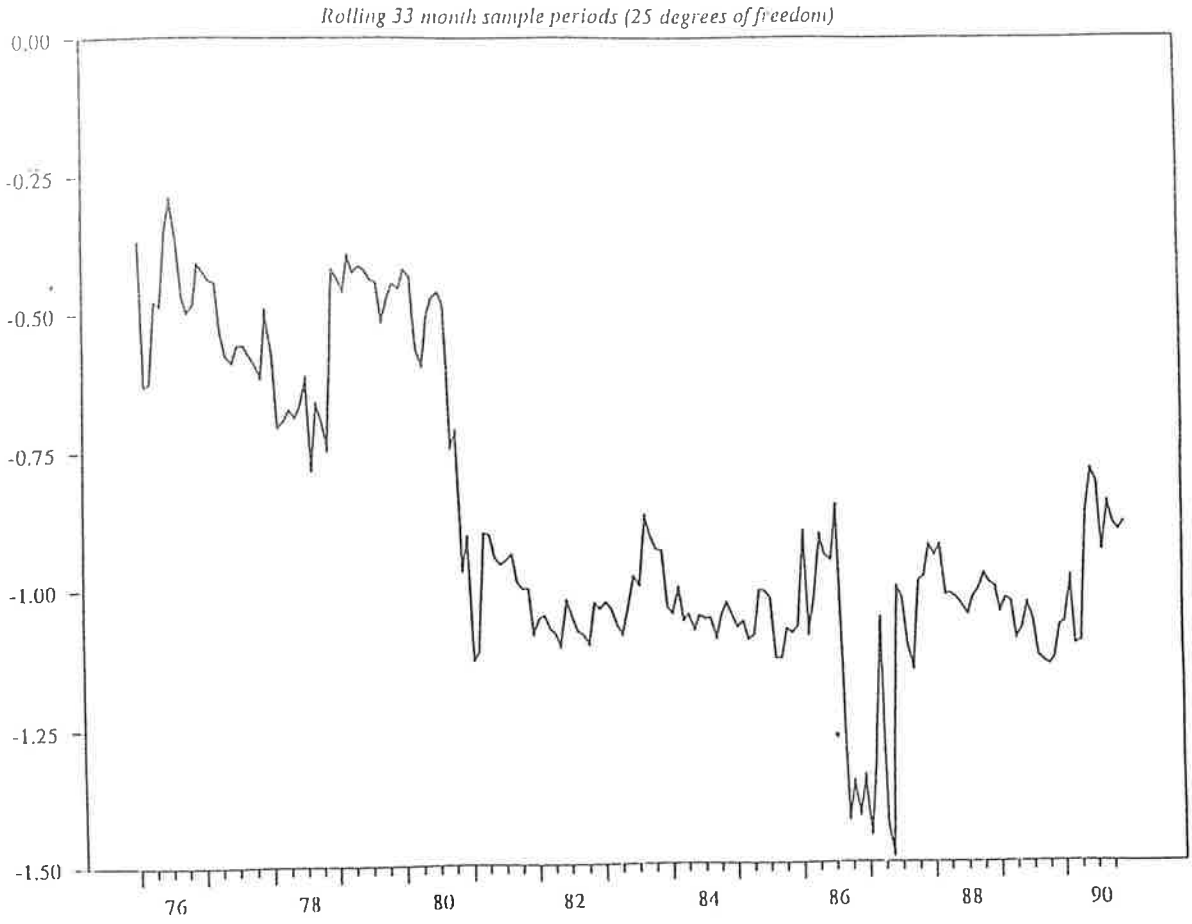
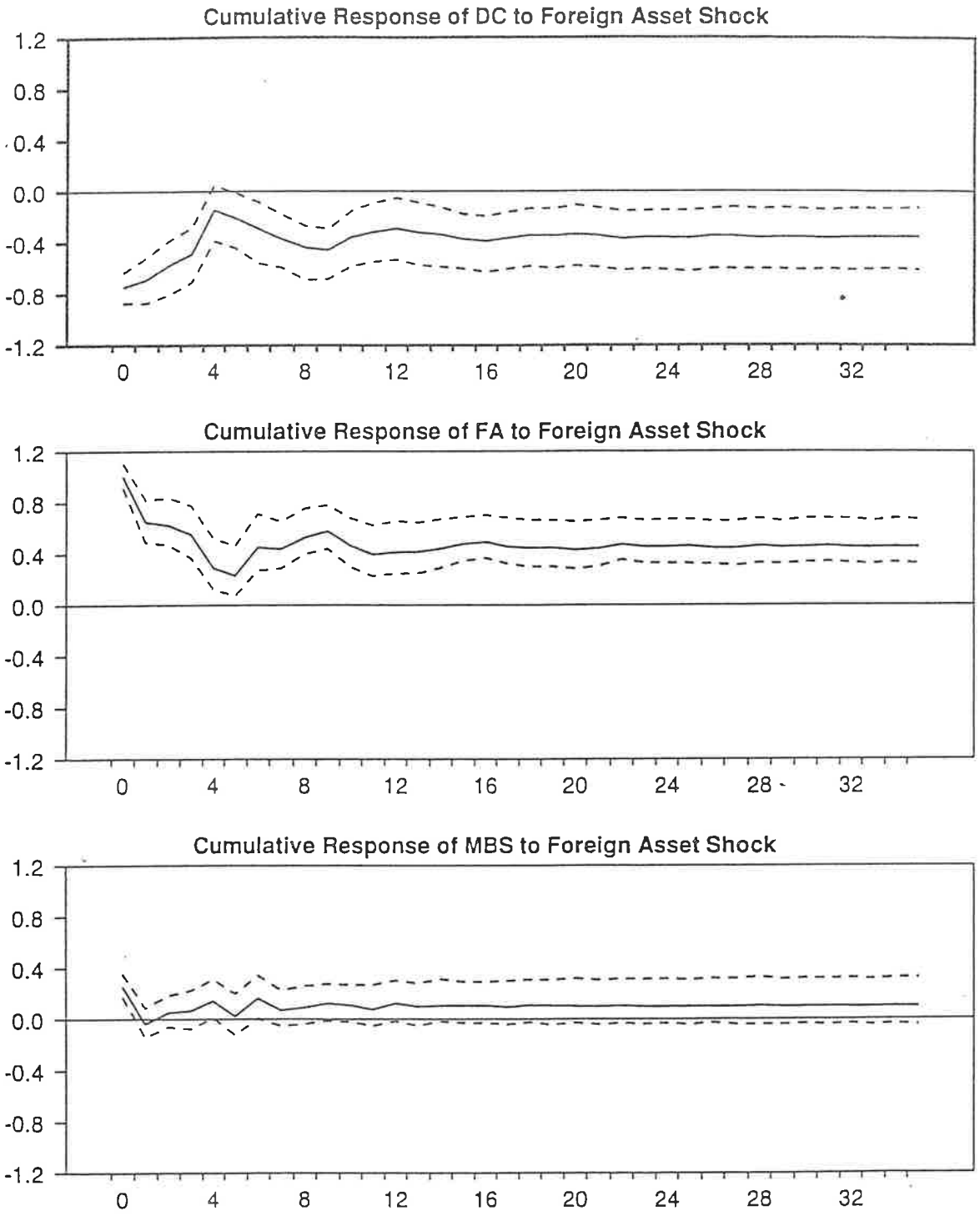


Figure 7.


Cumulative Response of DC to Foreign Asset Shock
1.2
0.8
0.4
0.0
-0.4
-0.8
-1.2
0
4
8
12
16
20
24
28
32
Cumulative Response of FA to Foreign Asset Shock
1.2
0.8
0.4
0.0
-0.4
-0.8
-1.2
0
4
8
12
16
20
24
28
32
Cumulative Response of MBS to Foreign Asset Shock
1.2
0.8
0.4
0.0
-0.4
-0.8
-1.2
0
4
8
12
16
20
24
28
32

My final comment concerns the most important lemma, Lemma 3. I can pretty much follow the logic here. On the basis of this lemma, you have some very crude empirical observations. The only comment I have on that point is that, at least in the case of Japan, liberalization of capital flows has been associated with outflows of capital. Starting in the mid-1960's, Japan has always been a capital exporter. I guess that your results do not depend on whether a country is an importer or an exporter of capital. I wonder if you think the sign is the only thing that is important. Does the fact that Japan has been a capital exporter have nothing to do with your conclusions?

Reuven Glick

I would like to refer to the argument that there is a natural order of development of financial markets from self-finance, to bank intermediation, to open markets. While there is a lot of logic to that, I would like to suggest that there is another argument that government regulatory policies have a lot to do with whether a market is liberalized.

To give some examples, in the case of Germany, Germany does not have relatively developed, open capital markets by developed country standards. The reason is that regulatory policies there are given universal powers that allow savings to be more or less efficiently channeled through the banking sector without the need for open capital markets. In Eastern Europe right now, for better or for worse, there is a lot of emphasis by policymakers on developing stock markets, rather than a focus on developing the commercial banking sector. One final example is that at an early stage of economic development in the U.S., in the 19th century, a lot of its investment was financed by bond sales, not by bank loans. So I would say that government regulations have a lot to do with the order, and probably the reason why in Asia and other countries you see this so called "natural order" is because government policymakers feel they have more control over commercial banks, and they limit the development of local markets at the beginning. Over time, regulators become more comfortable and they let their markets develop, rather than the private markets creating the incentive.

Chon Pyo Lee

Yesterday, you asked me about the universal order of the Indonesian case. Having seen that you compared the process of financial liberalization of several countries, especially Asia, I would like to know how you put the addition of capital liberalization in the context of financial liberalization; and the relationship between capital liberalization and financial liberalization. How do you perceive Indonesia's capital liberalization? Did

deposit insurance, people tend to take greater risks. I think that we have seen some examples of this in the recent past.

I appreciate your suggestion that the impact on the real sector from financial sector development should be discussed, and I certainly hope to do that. Reuven's comment is very well-taken. My paper does tend to suggest that there is a natural order, but I do give a number of examples that refute that. If I could backtrack a little, I do suggest that government regulations differed across countries, although there was a general similarity in terms of the extent of government intervention. The changes that took place in terms of deregulation were dictated by the role the government had played. For example, if you look at the differences between say, Indonesia, Thailand, the Philippines, and Malaysia in terms of their attitudes towards universal banking, the role of the government, set for itself, determined the kinds of changes that took place. That is one example and there are several others that can be looked at. But, I do agree with you. Government regulatory policies have in many instances indicated the direction of change. The examples you give are very good.

Dr. Lee threw my own question back at me. The only thing I would like to add is that for capital account liberalization versus current account liberalization, and financial sector liberalization versus real sector liberalization, in both cases, Indonesia went in the reverse order. I am not dictating what they should have done, or that they would have been more or less successful if they had done it in the usual order. I would not venture a guess on that. I am not sure what their explanation was. I do have my personal opinion, but I would not rather discuss it at this point.

Dr. Shin's question was on whether internal or external pressures dictated deregulation, and you suggested that in Korea it was half-and-half. I agree with you that perhaps in Korea it was half-and-half, although I think that to be fair to Korean policymakers, the external pressure that we are talking about was not necessarily overt external pressure. It was more pressure exerted by the internationalization of the economy, which was in a sense an external pressure.

What about Southeast Asia, and Taiwan? I think that the safest answer there would also be half-and-half. I think that there have been external pressures for almost all the countries in the region for liberalization. Much of that pressure has been in the form of suggested policies, not necessarily in the form of arm-twisting. I think that there were suggestive policies, more in terms of showing the direction of change, suggesting that things would be much easier, if you have to deal with the international economy, if liberalization took place. The internal pressure has been in terms of attracting investment and investors. By opening up the financial sector, many of these economies have allowed external finance to enter the economy, and they provided new instruments, and new means

We focus on the issue of whether there is an area with stable enough real exchange rates, vis-a-vis Japan, so that it would make sense for those countries to choose to be part of a yen bloc. If such areas don't exist, then I don't think that it is going to happen. I do not see why it should happen. There does not seem to be a political reason to do it, even though it may mean that you occasionally go through a depression. For the U.S., there is a political reason to have one currency within the U.S. When we look at Europe, they went ahead and changed from the European Community to the European Union, but not the European Monetary Union. They backed off from that. Maybe they will, but my conclusion is that there is no compelling reason for anybody to go to the yen standard, for Tokyo to become the dominant financial center in this time zone, or for Tokyo not to. Those are largely separate issues.

Shahid Zahid

Just a small comment on the Asian Development Bank's point of view, mainly related to the concept of the yen bloc. The ADB portfolio uses the U.S. dollar as a standard. This issue of the yen bloc has come up once in a while, not too seriously I might add, and there are two points of view. One is in terms of the portfolio size. If we had been linked with the yen, our portfolio size would be substantially different. The other more important point of view is the attitude of borrowers and the attitude of the donors, and I think that it is closely related to the value of the yen. I think this issue of whether the yen can keep from appreciating substantially in the future is very important. If it cannot, and suppose we were to move to the yen standard or used the yen as a vehicle currency, and all the countries in the region still had the dollar as a standard -- they would all be in deep trouble. If on the other hand the yen became the standard for the region and we then use the yen as the vehicle currency, there would not be too much of a problem. However, I think it all depends on what happens to the value of the yen in the future. I will not disclose what Prof. Ueda predicted last night, but if he is right, we may be moving in the right direction. But for the time being, moving towards the yen bloc, certainly in terms of the ADB's lending in the region, seems to be a highly risky venture.

Reuven Glick

People mean different things when they use the phrase "yen bloc". Prof. Ueda started out by using the vehicle currency definition, but there is another definition of the yen bloc which has not been discussed much, which is more of the trade union definition: to what extent are you going to, in your trade relations, pursue policies that encourage trade within or

between countries in that bloc? This is sort of along the lines with what is occurring in North America, where NAFTA is supposedly moving towards encouraging trade between Mexico on one hand, and Canada and the U.S. on the other. That is the major focus of APEC. There are more forces pushing towards a trade union, and the interesting issue is, what will be the role of Japan versus the U.S. in that trade union? We are all familiar with the discussions on whether this trade bloc will not be a yen bloc, but a Pacific trade bloc, in some sense to counter the pressures and forces from the trade blocs forming in Europe and North America. I think that should be the focus of the discussion; how do we lower trade barriers between countries in the region? I do not think you are going to see a monetary union. I think that these discussions about why does Japan not make its currency more stable, vis-a-vis the dollar, is not very important. As Mike Darby just mentioned, it is really the problem of the small countries deciding whether to fix their currencies to the U.S. dollar or the yen. It is not a problem for Japan because it is a large country. I would like to hear more discussion about trade union-types of issues. You can have a trade union without having a monetary union. The U.S., Canada, and Mexico can have totally free trade without those countries having either fixed exchange rates or even worse, having the same currency. Currently, there is no thought in the U.S. of sharing a common currency with Mexico. I do not see why small countries in Asia should think about having a fixed exchange rate vis-a-vis Japan, when they should be more concerned about open trade markets.

Yoon Dae Euh

Let's stop here. It was a very enlightening discussion. Korea is trying to make Seoul the international financial center. To become a international financial center in Asia is very important. But, perhaps the more important thing is that by creating competition, the entire Asian financial sector will become freer and more liberalized, and that will help the economies in this region to develop. Thank you.