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Stock Prices and Bank Lending Behavior in Japan

Sun Bae Kim and Ramon Moreno

Economists, Federal Reserve Bank of San Francisco. The authors would like to thank, without otherwise implicating, Elizabeth Laderman, Chan Huh, and Bharat Trehan for helpful comments. Research assistance by Dung Anh Nhan and Jacob Pozharny is gratefully acknowledged.

This study attempts to shed light on whether stock price movements have contributed to recent fluctuations in bank lending in Japan by examining the historical relationship between stock prices and bank lending in that country. It is found that prior to the mid-1980s the relationship between stock prices and bank lending was weak, but subsequently strengthened considerably. This coincided with a change in the regulatory environment that encouraged banking institutions to pay more attention to their capital positions. Since the late 1980s, fluctuations in stock prices appear to have made important contributions to fluctuations in bank lending in Japan.

I. Introduction

Japan has experienced unusually sluggish growth in bank lending in recent years. Following double-digit growth in the second half of the 1980s, bank lending slackened markedly as the Japanese economy entered the current economic downswing. Nominal loan growth averaged 3.6 percent annually between February 1991 (when the Economic Planning Agency's coincident index of business conditions peaked) and May 1993. In contrast, in the three previous recessions Japan experienced since 1977, loan growth averaged nearly 11 percent.[1]

While the reasons for sluggish credit and money growth are not yet fully understood, the timing is suggestive: the credit slowdown followed a steep decline in the Nikkei stock price index, which more than halved in value since reaching its peak at the end of 1989.[2] Indeed, the impact of such a steep asset price deflation on the Japanese financial system and on the real economy recently has been the subject of serious debate. To shed some light on this question, this article examines the historical relationship between movements in the stock price and bank lending in Japan, and explores whether stock price fluctuations appear to have contributed to explaining recent sluggish loan growth.

Changes in stock prices may influence bank lending through two channels. First, stock price fluctuations may affect loan demand by signaling changes in future economic activity. For example, the decline in the stock price after 1989 may reflect contractionary influences that lower loan demand, such as the decline in corporate capital spending triggered by the slump in final demand, poor

1. In real terms, loan growth fell to 1.2 percent over the same period, compared to 7.2 percent in the preceding 3 recessions. Note that loan growth was sluggish even though economic activity picked up for a time in the first half of 1993. The growth in broad monetary aggregate has also been sluggish. After expanding at an average annual rate of 11 percent in the late 1980s, nominal M2 + CDs growth slowed to 3.7 percent in 1991 and to 0.6 percent in 1992. Money growth actually turned negative during the second half of 1992.

2. After closing at ¥38,915 on the last trading day of 1989, the Nikkei 225 Stock Average bottomed out at ¥14,309 in August 1992. The index subsequently traded in the ¥18,000–¥20,000 range up to the time this paper was being completed (November 1993).

corporate earnings, and excess capacity.[3] Loan demand in the recent downturn may have been weakened further by the need to roll over large amounts of equity-linked bonds that Japanese firms issued in the late 1980s and by sharp declines in land prices.

Second, stock price fluctuations may affect loan supply by affecting the capital position of banks. This second channel is potentially of greater importance in Japan than, say, in the U.S., because Japanese banks traditionally have taken significant positions in the equity as well as debt of the same firm.[4] Under these conditions, a Japanese bank may be willing to lend more when Japanese stock prices are high or rising, and conversely, to lend less when stock prices are falling, since the bank can use capital gains on stocks to cushion itself from adverse shocks to assets.

Analysis of these demand and supply factors is complicated in part because it is likely that up to the early to mid-1980s, Japan's regulatory regime tended to dampen the relationship between stock prices and lending. Up to that time bank credit was heavily influenced by Bank of Japan (BOJ) credit guidelines (or "window guidance"), which limited the ability of banks to adjust lending in response to market conditions or their capital positions. Banks in any case had little incentive to pay attention to their capital positions. One reason is that the government is likely to have cushioned banks from adverse shocks that might be related to government-sanctioned credit. Another reason is that Japanese banks were not subject to explicit capital adequacy requirements until the 1980s. Under these conditions, stock prices would be expected to have little influence on bank lending.

Two developments in the 1980s are likely to have strengthened the link between stock prices and lending in Japan. First, the Bank of Japan deemphasized credit guidelines and gave Japanese banks more leeway in making loan decisions. The primary role of BOJ lending has been increasingly geared to very short-term adjustments in the financial market rather than to serve as a means to (implicitly) guarantee liquidity in the banking system (Suzuki 1987).

Second, there was growing international concern in the early 1980s about weak capital positions of banking institutions (Cooke 1984). In particular, partly as a result of the adoption of more stringent capital guidelines in the U.S. in 1981 and 1983, Japanese banks that were expanding their international operations in the 1980s faced pressure to strengthen their capital positions, so as to ensure that the Japanese banks faced foreign banks on an even competitive footing.[5] The concern with harmonizing capital adequacy requirements eventually resulted in the drafting of risk-adjusted capital standards in Basle in December 1987. These were formally adopted by Japan and other industrial countries in July 1988.

Under the Basle Accord, by 1993 Japanese banks were to achieve risk-adjusted capital-to-asset ratios of 8 percent, in two tiers. Banks are allowed to count up to 45 percent of unrealized gains on equity holdings as Tier II capital. Under these rules, it is possible that during the stock market boom of the second half of the 1980s, rising stock prices fueled lending to a greater extent than if banks could not hold corporate shares. The subsequent decline in stock prices may have put the capital of some Japanese banks near the regulatory floor, thus constraining their loan supply. One indicator that this effect may have been important is the strong contraction in hidden reserves (reflecting unrealized capital gains) of city, long-term credit, and trust banks, from a combined total of ¥55.4 trillion in March 1989 to ¥14.6 trillion in September 1992 (Japanese Ministry of Finance 1993).

The possibility appears to be widely recognized that the Basle capital standards may have strengthened the link between fluctuations in Japanese stock prices and the supply of Japanese bank lending in the 1980s. For example, the Japanese Ministry of Finance (1993) points out that as a result of the Basle standard, broad fluctuations in asset prices "could have a destabilizing influence on the balance between fund supply and demand," and that (in the wake of asset price declines) the Basle standard "could be making it difficult to expand quantitative lending levels. . . ." Similarly, the Bank of Japan (1992), cites "the possible negative influence of BIS capital requirements in the event of any further slide in stock prices" on bank loan decisions. Since Japanese stock prices began declining, the financial press has also focused a great deal of attention on how such declines would affect the ability of banks to meet their capital requirements under the Basle Accord and the implications for bank lending behavior.[6]

3. See for example the report by the Institute of Fiscal and Monetary Policy, Japanese Ministry of Finance (1993) and the Bank of Japan (1992).

4. Until 1987 the legal limit on corporate equity holding by financial institutions was set at 10 percent of outstanding shares of any single firm. Since then, the limit was lowered to 5 percent. In 1991, close to 45 percent of the total number of corporate shares outstanding was held by financial institutions; about half of this share is estimated to be held by banks. In the U.S., where the Glass-Steagall Act strictly separates commercial and investment banking, corporate shareholding by banks is virtually nil.

5. See Kareken (1984).

6. From time to time the financial press offers estimates of the approximate level of the Nikkei stock price at which the Basle constraints

To examine the relationship between the stock price and bank lending in Japan, we estimate a small vector autoregression model of the Japanese economy using monthly data covering two samples: 1970.1–1983.12 and 1984.1–1992.12. To anticipate the main findings of this paper, we find that in the first period innovations in stock prices are followed by positive, but very small increases in bank lending. In contrast, innovations in the stock price are followed by relatively large increases in bank lending in the second period. In line with this, stock price changes play a negligible role in explaining fluctuations in bank lending in the first period, and a much more important role in the second period. In particular, stock price increases appear to have contributed to unexpectedly rapid increases in lending in the late 1980s and to unexpectedly slow growth in lending in the early 1990s.

These findings are consistent with the shift in the regulatory environment in the 1980s. Prior to the 1980s, banks attached relatively little importance to the amount of capital held and government credit guidelines may have limited their ability to adjust lending fully in response to shocks to their capital position. Other things equal, this would have loosened the linkage between stock price and lending. Growing concern about capital adequacy, eventually formalized in the Basle Accord, changed the rules of the game, inducing Japanese banks to pay more attention to their capital position. The unexpectedly steep decline in stock prices appears to have made this new regulatory constraint binding, or at least of concern, for the Japanese banks during the current economic downturn. However, because of the wide variety of contractionary influences affecting the Japanese economy, we cannot rule out sluggish demand as a contributor to the marked decline in loan growth.

This paper is organized as follows. In Section II, we briefly discuss the possible link between stock price movements and bank lending. We then examine regulatory and institutional factors in Japan that have affected this linkage and propose some hypotheses. Section III implements the empirical analysis, followed by concluding remarks in Section IV.

II. THE LINK BETWEEN STOCK PRICE FLUCTUATIONS AND BANK LENDING

As the mechanism by which fluctuations in stock prices may affect loan demand is relatively straightforward, we will focus here on clarifying the possible link between stock price fluctuations and bank loan supply. To discuss such a link, it is necessary first to examine the relationship between bank capital and the supply of bank loans.[7]

To serve as a benchmark, the discussion initially abstracts from the role of regulation. We later relax this assumption and examine how the regulatory and other institutional environments in Japanese banking may have strengthened or weakened this capital to loan relationship.

Bank Capital and Lending

The bulk of assets that intermediaries hold consists of loans, each of which pays off only if the borrower's investment project succeeds. The deposits that banks collect, by contrast, are noncontingent liabilities with a fixed amount of promised payment, regardless of the outcome of the projects that the bank finances. An unexpected drop in the value of its assets, due to, say, borrowers' investment projects going awry, may thus force the bank into insolvency.

Banks can cushion themselves against such an adverse shock by maintaining equity capital. Bernanke and Gertler (1987) present a model where banks "voluntarily" adjust their capital-to-asset ratios to control default risk. Their model assumes that depositors have imperfect information on the quality of a bank's assets, which precludes the possibility of a payoff to depositors contingent on the return to the bank's investments. In such a setting, an incentive-compatible contract is for the bank to issue a noncontingent liability and collateralize it with bank equity capital. Ceteris paribus, a greater amount of capital allows banks to issue more deposits and to finance riskier investment projects. A similar equilibrium can arise if financial distress or insolvency is costly to the bank. For example, banks may hold capital because managers value their reputations, which would be lost in the event of bank default.

The supply of capital facing banks is not likely to be perfectly elastic, however. There is a limit, at least in the short run, to the extent to which capital can be accumulated through retained earnings. Capital market imperfections such as "lemons" or agency problems will also constrain banks' ability to raise capital through new equity

become binding. These estimates were particularly prevalent in 1992, when the Nikkei hit a trough. More recently, an article expresses concern about recent stock price declines in Japan, which are seen as ". . . beginning to crimp Japanese banks' ability to lend to business." (Wall Street Journal, November 16, 1993, p. 1). Nikkei stock price fluctuations are also believed to have affected the international operations of Japanese banks. See Terrell (1993).

7. Our discussion abstracts from the demand side of the loan market. For example, to the extent stock prices reflect expectations on future corporate performance or economic conditions in general, a decline in stock price will be associated with a decline in loan demand.

issues.[8] Given the imperfectly elastic equity capital then, a bank's loan supply can be constrained by its capital position. For example, a bank with a low capital-to-assets ratio—due either to large loan losses or rapid growth in deposits and loans in the past—may be forced to improve its capital position by reducing the growth in assets, and one way to achieve this is to decrease loan growth.

Stock Price Movements and the Supply of Bank Loans

Up to this point, we have focused on the ratio of book value capital to assets as an indicator of bank default risk. However, the capacity of a bank to absorb adverse shocks may vary significantly according to its off-balance sheet characteristics; that is, the market value of the bank's capital should also be a relevant factor determining bank risk and hence its loan supply behavior.

To see why, suppose that in addition to risky loans, the asset side of the bank's balance sheet also includes corporate shares, as is the case in Japan. Changes in the market value of the bank's shareholding clearly will have a bearing on its default risk. For example, a bank with substantial unrealized capital gains on its stockholdings will be able to write off larger amounts of loan losses by selling the securities and realizing the gains. By implication, loan supply will be relatively less constrained by book capital position for banks with sufficiently large "hidden reserves."

Conversely, a significant decline in stock prices will expose the bank to a greater amount of default risk than would be suggested by book capital position alone. Other things equal, therefore, we would expect a positive relationship between stock prices and bank lending.[9]

Regulatory and Institutional Factors

While theory suggests that capital position should affect bank loan behavior, the relationship also may be affected by regulation. A generally accepted view in the U.S. is that regulation tightens the linkage between bank capital position and lending (Keeley 1988, Bernanke and Lown 1991, Furlong 1992, Peek and Rosengren 1993). Some view the tightening of linkage through regulation as necessary because banks, as leveraged enterprises, have an incentive to undertake more risk at the expense of depositors. The incentive problem is exacerbated if banks have access to an underpriced deposit insurance.[10]

Until the second half of the 1980s, Japanese banks were not subject to explicit capital-asset ratio requirements. Article 5 of the Banking Law (1981) stipulates a minimum bank capitalization of ¥1 billion for banks.[11] Although no liquid asset-to-deposit ratio is imposed by law, the Ministry of Finance provided administrative guidance that in the first half of the 1980s limited the average ratio of lending to deposit to below 80 percent, and maintained bank liquidity ratios above 30 percent. Banks also faced a maximum lending limit to one borrower: 20 percent of capital and reserves for city banks and 30 percent for long-term credit and trust banks. However, none of these provisions, legal or informal, directed Japanese banks to maintain some minimum ratio of capital to assets (Hendrie 1986).

In fact, throughout most of the postwar period, the regulatory and institutional environment in Japan appears to have worked to loosen rather than tighten the linkage between banks' capital position and lending. First, the Japanese financial system sought to minimize default risks of financial institutions by limiting competition. Under the so-called "convoy system" governing banking regulation, the authorities sought to reduce "destructive competition" and create a stable business environment for banks. To this end, the domestic financial market was isolated from foreign competition, and strict controls were applied to deposit rates, new entry into banking, and separation of long-term versus short-term finance.[12] Under the convoy system, all incumbent city banks grew at about the same pace, earning substantial rents from interest rate spreads and, tellingly, no financial institution was allowed to fail throughout the entire postwar period. The implicit socialization of risk is likely to have diluted individual banks' incentive to control risk and contributed to the low capital-to-asset ratios observed throughout most of the postwar period.

Second, lending by the BOJ provided a substitute to bank equity capital as a cushion against shocks to asset value. In fact, one defining characteristic of the postwar Japanese financial system is "overloan," which denotes a chronic tendency of commercial banks to extend more credit, either by lending or by purchase of securities, than they acquired from deposits or own capital, with the gap

8. Asquith and Mullins (1986) show, for example, that a firm's stock price decreases upon announcement of new equity issue, suggesting that the market discounts a lemons premium.

9. For purposes of this discussion, it is assumed that stock price changes are sufficiently persistent that they may be treated as permanent.

10. See Furlong, (1992) for further discussion.

11. Federation of Bankers Associations of Japan (1989).

12. See for example Suzuki (1987) and Aoki, Patrick, and Sheard (1993).

filled primarily by relying on borrowing from the BOJ. As noted by Suzuki (1987, p. 24) "the policies of allowing over-loan. . . reduced the banks' consciousness of their own funding position; that is, there was a diminution of self-reliance by banks because they were not forced to adjust total credit granted so long as reserves were available from the Bank of Japan. . . ." Third, the dependence of commercial banks on BOJ credit provided leverage for the monetary authority to influence the quantity and allocation of loans by banks under the system of window guidance. By constraining banks' lending decisions, window guidance would have further weakened the link between bank capital and lending.

Finally, close supervision and prudential control by the regulatory authorities provided an effective substitute for bank capital regulation as a means to control the moral hazard problem in banking discussed earlier. For example, in the course of conducting window guidance, the BOJ closely monitored on a daily basis individual banks' operations and fund positions.[13] The Ministry of Finance (MOF) also played an instrumental role as monitor, especially in situations when a bank was judged to be mismanaged and needed drastic organization and asset restructuring. Typically, banks undergoing restructuring would be forced to accept a retired high-ranking MOF bureaucrat as an executive or even as president. Close monitoring of individual banks was possible to a greater extent in Japan than would have been possible in the U.S. because of the relatively smaller number of financial institutions.[14]

Under the convoy system, Japanese banks pursued a strategy of aggressively expanding deposits and lending, paying little heed to capital position (Goldsmith 1983, Suzuki 1987). For example, throughout most of the rapid growth period (roughly from the early 1950s to the early 1970s), the own capital-to-asset ratio averaged a little over 5 percent.[15] Excluding various reserves, bank capital has averaged well under 1 percent of total assets since the early 1970s. These ratios are low by international standards. For example, the average ratio of primary book capital to asset in the U.S. was a little under 6.7 percent in the first half of the 1980s (Keeley 1988). They are also low by Japan's own historical standard: In the prewar period, bank own capital was about 20 percent of total liabilities and total capital was 15 percent of liabilities[16] (Suzuki 1987, p. 193).

The regulatory environment affecting bank capital and lending changed in the early 1980s in light of international concern about the weaker capital positions of banking institutions (Cooke, 1984). A particularly significant development was the concern expressed by U.S. regulators about the low capital ratios of Japanese banks expanding in the U.S. market. For example, in December 1983, the Federal Reserve Board approved Fuji Bank's application to acquire a nonbank subsidiary of a bank holding corporation (Walter E. Heller International Corporation) in the U.S. However, in its order, the Board observed that Fuji's reported capital ratio was much less than the 5 percent ratio that applied to U.S. banks. The Board also raised "the general question of whether the capital standards applicable to domestic bank holding companies should also be applied to foreign banking organizations making acquisitions in the United States . . ." (see Kareken 1984, p. 43–46).

The concern with harmonizing capital adequacy requirements eventually resulted in the drafting of risk-adjusted capital standards in Basle in December 1987. These standards were formally adopted in July 1988. The Basle capital adequacy standard requires that international banks achieve an overall risk-adjusted capital-asset ratio equal to at least 8 percent.[17] The Accord provides a role for both book as well as market value capital. Specifically, at least half of the overall 8 percent ratio must consist of Tier I capital, which includes shareholders' equity and retained earnings. The balance can be met by Tier II capital, which can include subordinated debt, preferred shares, and hidden reserves, that is, unrealized gains on stockholding. To allow for its relatively risky nature, banks are allowed to count only up to 45 percent of unrealized gains as hidden reserves.

13. See Moreno and Kim (1993) for further details on window guidance and related procedures.

14. For instance, strict entry restrictions limited the number of city banks to a maximum 13 since 1953.

15. Own capital of a bank includes capital, legal reserves (capital reserves and profit reserves), surplus accounts (voluntary reserves and undistributed profits), and provisions for payment (reserve for loan loss, retirement pension payment, etc.).

16. To be sure, the book value capital to asset ratio would understate the market value capital to asset ratio to the extent that stock prices have been appreciating throughout most of the postwar period. However, this effect is likely to have been significant only towards the second half of the 1980s, when the regulatory environment had already shifted towards more stringent capital standards. According to a recent BOJ study (Shinagawa, 1993), hidden reserves represented over 2½ times the value of banks' own capital when the Nikkei stock index reached its peak in the fall of 1989.

17. The initial plan for the risk-based capital standards was proposed in 1986 and the Accord itself was reached among the Group of Ten countries in July 1988. The deadline for Japanese banks was March 31, 1993.

Questions for Empirical Analysis

Our review of the institutional features of the Japanese financial system and the process of regulatory change poses the following questions for empirical analysis.

First, does Japanese bank lending increase in response to an increase in the stock price, as predicted by either view of the relationship between stock price and lending (that stock price changes affect loan demand or loan supply)? This question will be addressed by examining the dynamic response of bank lending to innovations in the stock price.

Second, how significant is the effect of stock prices on bank lending and has this relationship changed over time? To address these questions, we proceed in three steps: (i) we examine the magnitude of impulse responses to unit shocks in the stock price; (ii) we assess the predictive ability of stock prices for bank lending according to exclusion restrictions and variance decompositions; (iii) we compare the magnitude of the response of bank lending to stock prices and the ability of stock prices to predict lending (according to exclusion restrictions and variance decompositions) over the sample periods 1970.1–1983.12 and 1984.1–1993.5.

Third, have fluctuations in Nikkei been important in explaining specific recent episodes of loan expansion or contraction? This question will be addressed by performing a historical decomposition of the forecast error in lending that allows us to determine the sources of loan fluctuations over the two samples.

III. EMPIRICAL ANALYSIS

The Model and Estimation

To address the empirical questions, we estimate a VAR model for Japan that includes macroeconomic variables that may be expected to affect lending as well as the Nikkei. The model may be expressed compactly as follows:

$$A(L)z_t = u_t$$

where $A(L)$ is a matrix of polynomials in the lag operator, $z_t = [l_t\, y_t\, p_t\, i_t\, s_t]$, in which l_t = bank loans, y_t = industrial production, p_t = consumer price index, i_t = call money rate, and s_t = Nikkei stock average, and u_t is a vector of residuals that may be contemporaneously correlated. While the primary focus of this paper is the relationship between the Nikkei stock price and bank lending, the inclusion of industrial production, the consumer price index and the call money rate is meant to control for cyclical factors that might affect bank lending.

To identify orthogonalized innovations in each of the variables and the dynamic responses to such innovations we factor the variance-covariance matrix of the VAR using the Choleski decomposition to obtain the moving average representation:

$$z_t = A(L)^{-1} BB^{-1}u_t = C(L)\epsilon_t$$

where the variables in z_t are entered in the order described earlier, ϵ_t, = $[\epsilon_{1t}\, \epsilon_{2t}\, \epsilon_{3t}\, \epsilon_{4t}\, \epsilon_{5t}]$ and ϵ_{1t} to ϵ_{5t} respectively refer to orthogonalized innovations in bank loans, output, goods prices, short-term interest rates and stock prices. This ordering assumes that lending is contemporaneously unaffected by all the other variables in the system, whereas the stock price is affected by all these variables.

To estimate the model, data were collected for Japan over the period 1970.1–1993.5, which spans the years after Japan's "high growth period." Data and sources are described in the Appendix. The model was estimated over two subsamples, 1970.1–1983.12 and 1984.1–1993.5. As there is no reason to expect that any effect stock prices have on loan demand changed over the full period, the sample was broken to attempt to see how the changes in Japan's regulatory environment may have affected the relationship between stock prices and lending. While the choice of a date to break the sample is to some extent arbitrary, an effort was made to pick a date when Japanese banks became aware that capital adequacy was assuming priority in the minds of regulators, which would tend to strengthen the links between stock price changes and total lending. Plausible dates include 1984.1, the month after the Federal Reserve Board openly expressed concern about the capital adequacy of foreign banks in its approval of a Fuji Bank acquisition in the U.S., 1987.12, when the Basle risk-adjusted capital standards agreement was drafted, and 1988.7, when the standards were officially adopted. The date 1984.1 was selected, as it allows enough degrees of freedom to strengthen confidence in the results.

Unit root tests provide mixed evidence that the data in the model are non-stationary over the period 1970.1–1993.5.[18] To account for such possible non-stationarity, the VAR model was estimated using the first difference of the logs of the variables (with the exception of the call money rate, where the first difference was used). Lag lengths were set at 9 in the first subsample and 7 in the second subsample. At these lag lengths, the null hypothesis of residual white noise could not be rejected according to the Q statistic.

18. Tests for unit roots are performed over the full period 1970.1–1993.5 because they attempt to identify long-run properties of the data that are not well captured by the smaller subsamples. The Phillips-Perron test (16 lags) fails to reject the unit root null for all the series in levels. However, the Augmented Dickey-Fuller test (12 lags) rejects the unit root null for the call money rate at 1% and for industrial production at 5%.

Dynamic Responses to Shocks

To assess the qualitative responses to shocks, Figure 1 reports the dynamic responses to innovations in the Nikkei stock price over the two subsamples. As expected, the response of loans to innovations in the stock price is positive.

Figure 1 reveals that two features distinguish the response of loans to Nikkei innovations over the two subsamples. First, the magnitude of the response of loans to Nikkei innovations is much smaller in the first period than in the second. Second, the response of loans is temporary in the first period and permanent in the second. The smaller response in the first sample is consistent with the interpretation offered earlier, namely, that the ability of banks to obtain funding from the BOJ reduced the importance of capital constraints on lending behavior. The transitory nature of the response in the first period suggests that window guidance may have effectively constrained lending decisions.

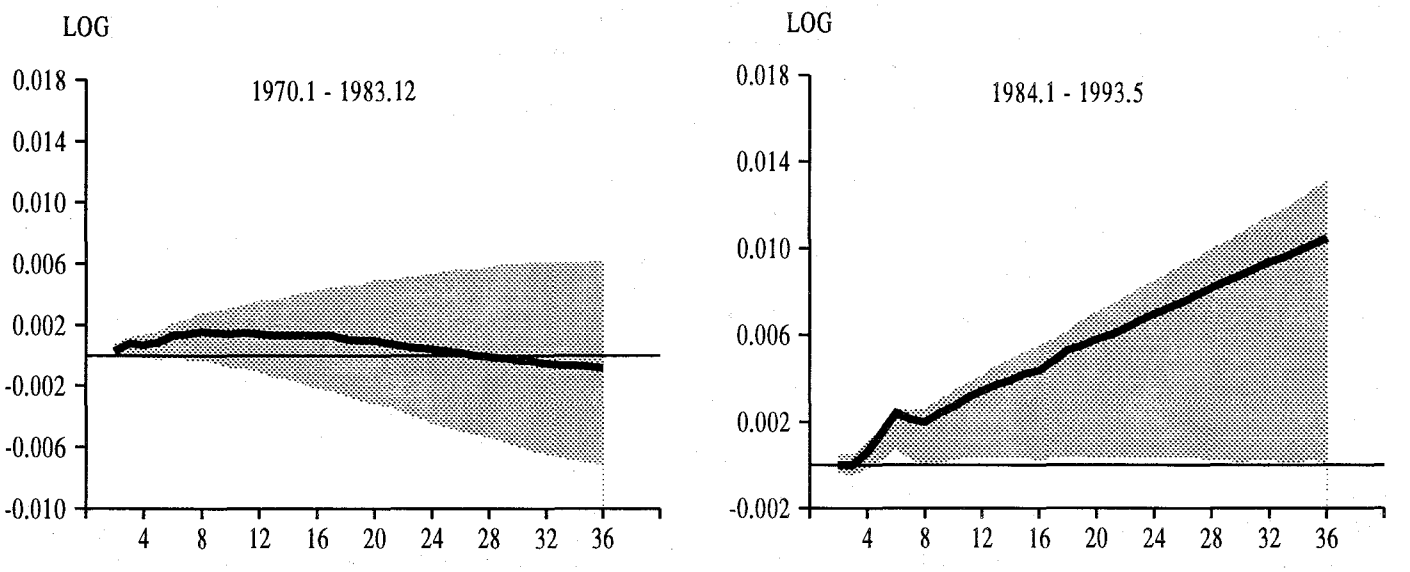
To conserve space, other impulse responses are not illustrated here. However, to facilitate interpretation of the historical decomposition later on, it is worth summarizing some of the responses of lending to innovations in other variables in the second sample period, when stock price effects are important. In this period, lending rises permanently in response to its own innovations as well as to innovations in the Nikkei stock price. Lending falls permanently in response to innovations in the call money rate, industrial production, and the CPI.

The qualitative responses of lending to innovations in the Nikkei stock price, lending, or the call money rate do not clarify whether such responses reflect changes in loan demand or loan supply. It is also apparent that the countercyclical response of lending to macroeconomic activity (industrial production and CPI) is inconsistent with a change in loan demand. However, it may reflect changes in loan supply that in turn reflect monetary policy. This last interpretation is supported (or at least not contradicted) by the fact that interest rates also rise (temporarily) in response to innovations in industrial production and the CPI.[19]

19. In isolation, the rise in interest rate in response to innovations in industrial production and the CPI may be interpreted as reflecting increased demand. Together with a contraction in loan demand, however, it suggests that a countercyclical policy response has taken place. It is worth stressing, however, that innovations in interest rates or in aggregates such as lending cannot necessarily be interpreted as innovations in monetary policy over this period. See Moreno and Kim (1993).

FIGURE 1

RESPONSE OF LENDING TO INNOVATIONS IN THE STOCK PRICE



Exclusion Restrictions and Variance Decompositions

The importance of the various innovations in influencing lending will be apparent from the tests of predictive ability and the historical decomposition.[20] Table 1 reports the marginal significance levels of tests of exclusion restrictions on the lagged variables of the VAR model for the loan equation and the decomposition of the variance of the forecast error of lending at various forecast horizons. As can be seen, according to the exclusion restrictions, the Nikkei is a poor predictor of lending in the first subsample, 1970.1–1983.12, and a good predictor in the second subsample 1984.1–1993.5. In the second sample, the hypothesis that lagged changes in the Nikkei stock price do not affect bank lending is rejected at the 1 percent level. This is consistent with our findings that the response of lending to innovations of the stock price was small and temporary in the first subsample, and larger and more persistent in the second subsample.

A similar impression is conveyed by the variance decompositions. According to Table 1, at a two-year horizon, innovations in the stock price accounted for about 1 percent of the variance of the forecast error of lending in the first sample period, and 28 percent in the second sample. The success of the stock price as a predictor of loan behavior is remarkable, because in a four-variable VAR model that excludes stock prices, lending is predicted largely by its own lags. Thus, it appears that stock prices have had an important effect on loan behavior since the mid-1980s.

The VAR methodology used here does not allow us to determine whether stock prices affect loan supply or loan demand. However, the stock price exerts an influence on bank lending after a significant change in the regulatory regime that placed greater emphasis on the capital position of banks. This suggests that the effect of changes in the stock price on Japanese bank lending at least partly reflects the impact on loan supply. The view that loan supply effects may have been important is supported by the large magnitude of fluctuations in hidden reserves associated with fluctuations in stock prices. At the same time, the fact that stock prices do not predict lending prior to the mid-1980s suggests that any effects of stock prices on loan demand have historically been weak.[21]

TABLE 1

TESTS OF EXCLUSION RESTRICTIONS FOR LOAN EQUATIONS AND VARIANCE DECOMPOSITION OF THE FORECAST ERROR IN LENDING

	Exclusion Restrictions		Variance Decomposition					
	70.1–83.12	84.1–93.5	70.1–83.12			84.1–93.5		
			Horizons (months)					
			12	24	36	12	24	36
Lending	4.0×10^{-8}	6.9×10^{-8}	91	84	80	57	49	44
Int. Rate	0.5	0.5	1	2	1	0	1	2
Output	0.1	4.2×10^{-3}	4	12	17	27	11	15
CPI	0.7	2.2×10^{-2}	0	0	1	11	10	10
Nikkei	0.4	9.2×10^{-7}	4	1	0	25	28	29

NOTE: Totals may not sum to 100 because of rounding.

The Nikkei's Contribution during Episodes of Loan Expansion and Contraction

To assess the Nikkei's contribution to loan behavior, we use the estimated coefficients to compute the forecast error in lending at a two-year horizon. A large forecast error means that lending was unexpectedly large or small, given the information available at the time the forecast was being made. A historical decomposition can be performed (using the coefficients of the moving average representation of the model) to determine the contribution of (orthogonalized) innovations in each of the components of the model to this forecast error. One advantage of this approach is that it controls for factors other than the Nikkei that may account for sluggish loan growth, including output.

Figures 2 and 3 report historical decompositions for the first and second subsamples respectively. (Note that some observations are lost in setting a 24-month forecast horizon.) Inspection of the figures indicates that in the first sample, a number of episodes involved relatively large "surprises" (forecast errors) in lending—positive errors around the time of the first oil shock and in 1982; and negative errors in 1975, 1977, and 1981. These episodes are largely attributable to unexpected innovations in lending. The exception is 1977, when unusually sluggish loan growth occurred in response to innovations in output. The Nikkei appeared to make some contribution to the large positive forecast errors in lending in the early 1970s and the subsequent contraction, but this contribution was very small in relative terms.

20. The responses of other variables to the stock price suggest that innovations in the stock price reflect permanent supply shocks. The nominal interest rate, industrial production and the stock price rise permanently in response to a stock price innovation. The response of the CPI is small and erratic, initially falling, and then tending to rise.

21. We also ran a similar model for the U.S., where banks do not hold equity capital and hence any stock price effects would be through loan demand. We found that the stock price has little or no influence on bank lending. The U.S. evidence therefore suggests that the effects of the stock price on loan demand are unimportant.

FIGURE 2

HISTORICAL DECOMPOSITION OF THE FORECAST ERROR IN LENDING
(SAMPLE 1970.1–1983.12)

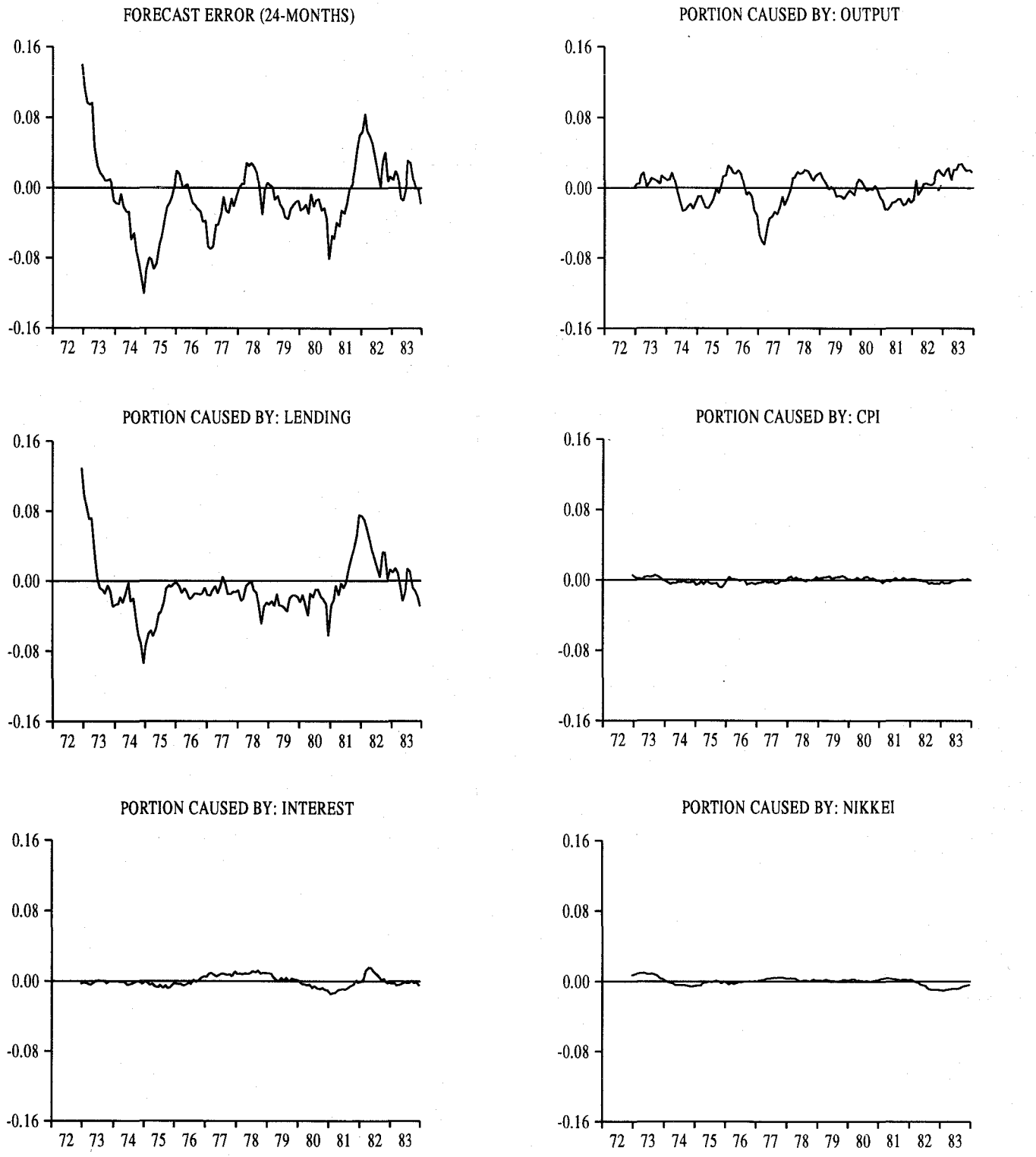
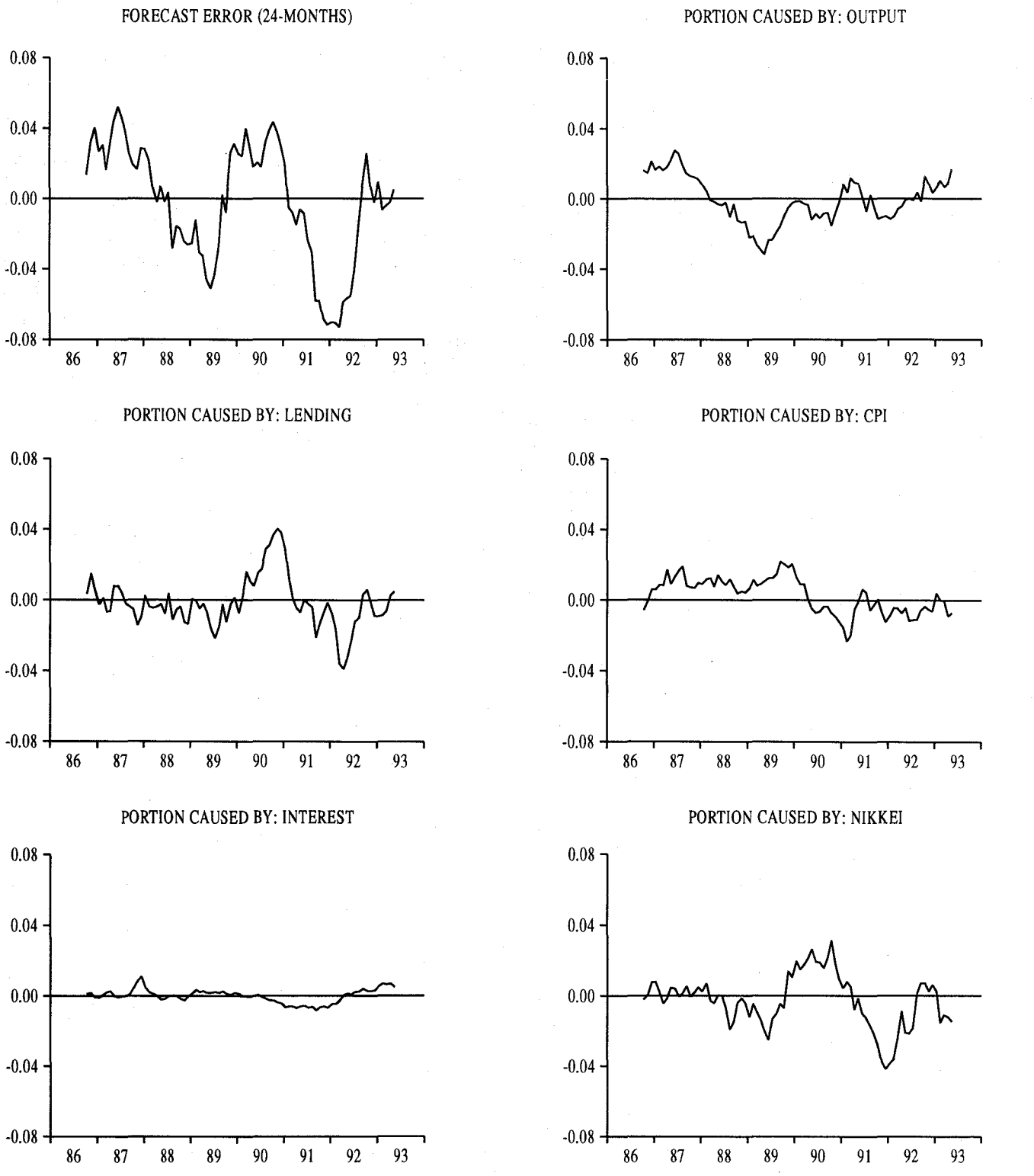


FIGURE 3

Historical Decomposition of the Forecast Error in Lending
(Sample 1984.1–1993.12)



The second historical decomposition is of more immediate interest, as it helps shed light on the factors that have affected recent loan behavior in Japan. We observe positive forecast errors (unusually robust lending) in 1986–1987 and 1990, and negative forecast errors (unusually weak lending) in 1988–1989 and 1991–1992.

Rapid loan growth in 1986 and 1987, and slower loan growth in 1988 and 1989 are in part attributable to fluctuations in output. As discussed previously, the response of lending to output fluctuations is negative in the second sample, so these loan movements may reflect the effects of countercyclical monetary policy. In particular, this historical decomposition is consistent with statements by the Japanese Ministry of Finance (1993, p. 6) that monetary conditions eased between 1986 and 1987. However, the historical decomposition suggests monetary tightening began in 1988, whereas policy actions that might reflect tightening (such as increases in the official discount rate) only became apparent in 1989 or 1990. Thus, some care needs to be taken in interpreting the responses of lending to output as entirely reflecting countercyclical policy.

Starting in 1989, a larger portion of the forecast error in lending is due to its own innovations. Innovations in the Nikkei account for little of robust lending in 1986–1987, but they make a distinct positive contribution in 1989–1990. Innovations in the Nikkei have contractionary effects in 1988–1989, and 1991–1992. In particular, the recent episode of sluggish growth in lending appears to be largely associated with negative innovations in lending and in the Nikkei stock price.

IV. CONCLUSIONS

The preceding empirical analysis allows us to shed some light on certain characteristics of the relationship between the Nikkei stock price and bank lending in Japan. First, the response of Japanese bank lending to an increase in the stock price is positive in the two sample periods (1970.1–1983.12 and 1984.1–1993.5) examined in this paper. This result is intuitive and is consistent with the stock price affecting loan demand or loan supply.

Second, there has been a change in the historical relationship between stock prices and bank lending. This relationship was weak until about the mid-1980s, but became quite significant subsequently.

Third, recent fluctuations in the Nikkei stock price appear to have contributed significantly to fluctuations in bank lending in Japan. In particular, the Nikkei stock price appears to have played an important role in accounting for the recent sluggish growth in lending in Japan.

While the techniques used in this paper do not allow us directly to isolate the effects of the stock price on loan demand and loan supply, the stock price appears to exert an influence on Japanese bank lending following a significant change in the regulatory regime that placed greater emphasis on the capital position of banks. This suggests that the effect of changes in the stock price on Japanese bank lending at least partly reflect their impact on loan supply. At the same time, the weak relationship between stock prices and lending prior to the mid-1980s suggests that any effects of stock prices on loan demand have historically been weak. However, Japan's recent cyclical downturn is quite unusual, so we cannot rule out the possibility that the stock price has affected loan demand without further analysis.

Future research in two directions may shed further light on the relationship between stock prices and lending and the factors that underlie such a relationship: (i) developing structural models that distinguish explicitly between the loan demand and loan supply effects of stock prices; (ii) isolating the role of other asset prices, notably land prices, in influencing bank lending.

APPENDIX

DATA DESCRIPTION AND SOURCES

Consumer Price Index, Seasonally Adjusted. Index of consumer prices covering the whole country excluding single-person households and those engaged mainly in agriculture, forestry, and fishing. Base year is 1985. Seasonally adjusted by Federal Reserve Bank of San Francisco staff using X-11 filter. Source: International Monetary Fund, *International Financial Statistics* (IFS).

Industrial Production, Seasonally Adjusted. Index of monthly production by 9 mining and 523 manufacturing industries, weighted by 1985 value-added data. Base year is 1985. Seasonally adjusted by Federal Reserve Bank of San Francisco staff using X-11 filter. Source: IFS.

Call Money Rate. Rate in interbank call money market. Source: *Economic Statistics Monthly*, Bank of Japan.

Nikkei stock price index. Composite for 255 Companies. Monthly averages. Source: *Economic Statistics Monthly,* Bank of Japan.

Bank Loans, Seasonally Adjusted. Total loans and discounts, all banks to nonbank sector. Seasonally adjusted by Federal Reserve Bank of San Francisco staff using X-11 filter. Source: *Economic Statistics Monthly,* Bank of Japan.

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