Volume Title: Japanese Monetary Policy

Volume Author/Editor: Kenneth Singleton, editor

Volume Publisher: University of Chicago Press

Volume ISBN: 0-226-76066-9

Volume URL: http://www.nber.org/books/sing93-1

Conference Date: April 18-19, 1991

Publication Date: January 1993

Chapter Title: Japanese Corporate Investment and Bank of Japan Guidance of Commercial Bank Lending

Chapter Author: Takeo Hoshi, David S. Scharfstein, Kenneth J. Singleton

Chapter URL: http://www.nber.org/chapters/c7458

Chapter pages in book: (p. 63 - 94)

3 Japanese Corporate Investment and Bank of Japan Guidance of Commercial Bank Lending

Takeo Hoshi, David Scharfstein, and Kenneth J. Singleton

Throughout the postwar period of rapid economic growth in Japan, the Bank of Japan (BOJ) has guided lending by financial institutions. This "window guidance," as it is called, sometimes takes the form of restrictions on lending by major financial institutions, particularly during periods of tight monetary policy (Suzuki 1987). In this paper, we explore the impact of these direct credit restrictions on the borrowing and investment activity of Japanese corporations. We take two approaches. At the macroeconomic level, we first explore the extent to which Japanese firms substitute alternative sources of funds for bank borrowing when it is restricted by window guidance. Then we examine whether this guidance has real effects on investment in capital and inventories. At the microeconomic level, we analyze a panel of Japanese firms to determine whether there are any distributional effects of window guidance. In particular, we are interested in whether some firms have preferential access to capital and are more prone to invest during episodes of tight monetary policy.

Window guidance is used by the BOJ to supplement its main monetary policy instruments—loans through the discount window and open-market operations. In principle, if firms have alternative financing sources that are unrestricted by window guidance, it is difficult to see how such guidance can have much effect on investment decisions. But if firms do not have alterna-

Takeo Hoshi is assistant professor at the Graduate School of International Relations and Pacific Studies, University of California, San Diego. David Scharfstein is associate professor of finance at the Sloan School of Management, Massachusetts Institute of Technology, and a research associate of the National Bureau of Economic Research. Kenneth J. Singleton is C.O.G. Miller Distinguished Professor of Finance at the Graduate School of Business, Stanford University, and a research associate of the National Bureau of Economic Research.

The authors are grateful for comments from Professor Akiyoshi Horiuchi of the University of Tokyo and other participants at the NBER Conference on Japanese Monetary Policy held in Tokyo in April 1991. Helpful research assistance was provided by Yoshito Sakakibara.

tives, or those alternatives are substantially more costly, then window guidance could have a large impact on corporate borrowing and investment. In fact, prior to the mid-1980s, Japanese companies were quite restricted in their ability to raise funds outside the banking sector. Most corporations—even large ones listed on the Tokyo Stock Exchange—were effectively prohibited from issuing bonds domestically and abroad. Their only feasible alternative financing sources during this period were the financial institutions that were not restricted by window guidance, such as insurance companies. This changed in the mid-1980s, when the Ministry of Finance relaxed a series of restrictions on bond financing. The result has been a marked disintermediation of Japanese financial markets: in 1970, 97% of all corporate debt was held by banks and insurance companies; by 1990, they held only 60% of the outstanding corporate debt. So window guidance may have had an important effect on corporate borrowing and investment, particularly before the mid-1980s.[1]

The macroeconomic effects of monetary policy are examined in the context of a vector autoregression (VAR) in which real economic activity is measured by the growth rate of the real stock of capital and the growth rate of the real value of inventories. Since we do not have a long time series on BOJ guidance of bank loans, our measure of the impact of window guidance must necessarily be indirect. We argue that the proportion of loans to corporations from financial institutions that are restricted by guidance to total loans by financial institutions is an informative indicator of the stance of window guidance.[2] This ratio declines substantially during the two episodes in our sample when window guidance was constraining, and is relatively high or rising during periods of monetary ease. The mix of external financing may, of course, also be influenced by open-market operations and lending through the discount window. Indeed, our information-based motivation for examining the loan mix suggests that imposing window guidance enhances the effectiveness of monetary policy and reinforces the use of the loan mix as a measure of the stance of monetary policy more generally. As a more traditional measure of the stance of monetary policy, we also include the change in the interbank call rate, which is strongly influenced by the BOJ, in the VAR.[3] The evidence supports the conclusion that monetary policy generally and window guidance in particular had an important effect on aggregate inventory accumulation and the growth rate of the aggregate capital stock during our sample period.

1. See Hoshi, Kashyap, and Scharfstein (1990a) for an analysis of the increased use of bond financing.

2. Kashyap, Stein, and Wilcox (1991) use a similar mix variable based on bank loans to corporations and transactions in the commercial paper market as a measure of the stance of U.S. monetary policy. We will compare our findings for Japan to their results for the United States in section 3.3.

3. The call market is the market for interbank loans in Japan. City banks were consistently net borrowers in the call market until the 1980s (Suzuki 1987). The regional banks, who had fewer large corporations as their customers, consistently invested their surplus funds in the call market. The interest rate on call loans was one of the few interest rates that was not regulated by the Ministry of Finance during this period.

This macroevidence may mask potentially important distributional effects of window guidance on corporate investment activity. Some firms may have an easier time finding alternative financing sources or may be given preferential access to bank credit. In particular, firms with close bank relationships or those affiliated with banks and insurance companies through the keiretsu system may be favored in receiving financing. This could be because banks prefer to allocate capital to firms they already know well or to those in which they own equity. Moreover, insurance companies—the largest of which are in a keiretsu—may also prefer to lend to other keiretsu firms with whom they have dealt before and in whom they own equity. The empirical question that we address is whether the investment activities of firms that are members of a keiretsu are hampered less by restrictive window guidance policies than are those of independent firms.

The evidence we present is consistent with this view. We examine the investment response of keiretsu and nonkeiretsu firms to restrictive window guidance in 1979 and 1980. We find that, all else equal, keiretsu firms tend to invest more than nonkeiretsu firms during the 1979–80 period, but this is not the case when window guidance is lax. In addition, nonkeiretsu firms appear to be liquidity-constrained in their investment; they tend to cut capital expenditures when they have relatively low cash flow. This is not the case for group firms. Interestingly, during 1979 and 1980 nonkeiretsu firms appear to be even more liquidity-constrained than do keiretsu firms. This evidence is also consistent with the view that group firms get preferential access to capital.

The remainder of this paper is organized as follows. In section 3.2 we describe the concept of window guidance in more detail and review the implementation of this guidance by the BOJ during the past thirty years. In section 3.3 we explore the macroeconomic relations among monetary policy, capital investment, and inventory accumulation. In section 3.4 we analyze the investment behavior of a panel of Japanese manufacturing firms. Concluding remarks are presented in section 3.5.

3.2 The Historical Use of Window Guidance

Window guidance by the BOJ has taken several forms during the past thirty years. Operationally, the BOJ receives information from its client financial institutions about the actual loan and borrowing positions of these financial institutions. Based on this information, the BOJ provides guidance to these institutions regarding their lending positions. The guidance may take the form of regulation of increases in loans or of limitations on overall loan positions.

In the conduct of monetary policy by the BOJ, window guidance has been used as a supplementary instrument for monetary control. The primary instruments have been lending through the discount window and open-market operations in securities markets. For the control of very short-term fluctuations in reserves, lending by the BOJ through the discount window, mainly to city

banks, has been the chief operating instrument. The BOJ started open-market operations in government bonds in 1962, but only purchases were made to supply the necessary funds to sustain economic growth. Open-market sales began in 1972. Currently, the BOJ conducts open-market operations in several markets, including commercial bills, treasury bills, and commercial paper, in order to adjust seasonal fluctuations in funds of two or three months in duration. The BOJ still purchases outright long-term government bonds from financial institutions to control secular increases in funds. Since December 1987 these purchases have sometimes been accompanied by resale agreements.

Prior to the mid-1960s, guidance was carried out primarily through city banks that had high levels of borrowing from the BOJ. In the mid- to late 1960s, guidance was occasionally expanded from city and long-term credit banks to include trust, regional, and sogo banks. During the tight money period in early 1973, the scope of window guidance was expanded further to include virtually all of the client institutions of the BOJ, including the larger foreign banks in Japan. The broad scope of guidance during this and later episodes probably increased the impact of guidance on firm investment compared to earlier periods, by reducing the nonrestricted sources of funds. During this episode, window guidance not only applied to the overall level of loans but also restrained the lending by banks to trading companies and provided guidance on the level of securities investment (Suzuki 1987). Thus, window guidance has been used by the BOJ to influence the flow of funds to specific sectors in the economy.

In July 1977, a new formula for establishing window guidance was introduced. The voluntary lending plans of financial institutions were essentially accepted by the BOJ, though the window guidance system was maintained in order to give the BOJ the option of using guidance as a policy instrument. This option was exercised in 1979 when strict guidance similar to that of earlier periods was implemented.

After 1982 and until 1989, window guidance played an insignificant role in the conduct of monetary policy, as the lending programs of financial institutions were accepted completely. During 1990, the BOJ once again relied on window guidance in an effort to control inflation in Japan. For instance, in the last quarter of 1990, the BOJ reduced the net lending of the twelve city banks by more than 30% from a year before. For seven consecutive quarters beginning in the third quarter of 1989, the BOJ set lending growth limits lower than the results for the same period of the previous year. Moreover, the guidance for the last quarter of 1990 was more restrictive than in the past sixteen years. The announced intent of this window guidance policy was to reduce the growth in the money supply and inflationary pressures, as well as to provide encouragement for city banks to adjust toward meeting the BIS capital-level requirements (*Japan Times Weekly*, October 1990). In June 1991, the BOJ announced that it would no longer use window guidance as a policy instrument.

There is an extensive theoretical literature on the effectiveness of window guidance, most of which is in Japanese. All of the models that we are aware of analyze window guidance in economic environments with unregulated interest rates and symmetric information among participants in the loan and call markets. One of the most important papers on window guidance is by Horiuchi (1977, 1978), who argued that window guidance is completely ineffective by itself as long as the lending limits are imposed on a subset of institutions. The following argument captures the essence of Horiuchi's analysis. Suppose that there are only two types of financial institutions, city banks and regional banks, and that window guidance is imposed only on the city banks. When the BOJ tightens its window guidance, the city banks' demand for call loans falls as they reduce their loan levels. This, in turn, leads to a decrease in the equilibrium call rate, which induces the regional banks to increase their level of loans. The new equilibrium is achieved when the decrease in the city banks' lending is fully offset by lending from the regional banks.

More generally the imposition of window guidance on a subset of the creditors of manufacturing firms should lead to the substitution of loans from unrestricted sources for those from restricted banks. In the United States, an important nonbank source of funds for large corporations is the commercial paper market. A commercial paper market did not exist in Japan until November 1987, however, when notes with maturities of one to six months were introduced. Similarly, issuance of long-term corporate debt was highly restricted, and until 1977, access to the Euroyen bond markets was not available even to the largest firms in Japan. Only after 1983 did large Japanese firms issue large amounts of corporate bonds, either domestically or internationally. Consequently, a large portion of corporate liabilities consisted of loans from banks and insurance companies. Insurance companies were the primary nonbank source of loans to manufacturing firms. It follows that, if substitution of nonbank sources of funds mitigated the effects of tight monetary policy, then we should see this in the relative growth rates of loans from banks and insurance companies.

The episode of tight monetary policy that we focus on in our analysis of firm-level data is the 1979–80 period. The BOJ's *ex ante* guidance on increases in lending by city banks on a quarterly basis for the first quarter of 1978 through the second quarter of 1988 is displayed in figure 3.1. There is clearly a pronounced seasonal component to this guidance. Adjusting for this seasonality, guidance notably declines during the period of tight monetary policy in 1979 and 1980. The gaps between the *ex ante* window guidance (G) and the actual increases (A) in lending for city banks, long-term credit banks, trust banks, and regional banks are displayed in figures 3.2 through 3.5. The strict guidance during 1979 and early 1980 is reflected in the zero or negative values of $G - A$ during this period.[4] Together, figures 3.1 through 3.5 sug-

4. As noted previously, the period of zero gaps between 1985 and 1988 is indicative of accommodative, not restrictive, guidance.

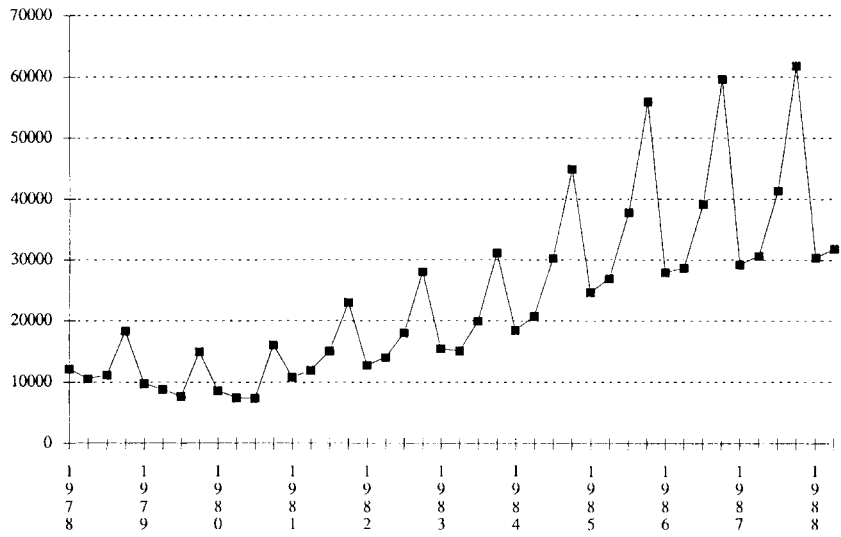

Fig. 3.1 Guidance, city banks (in 100 million yen)

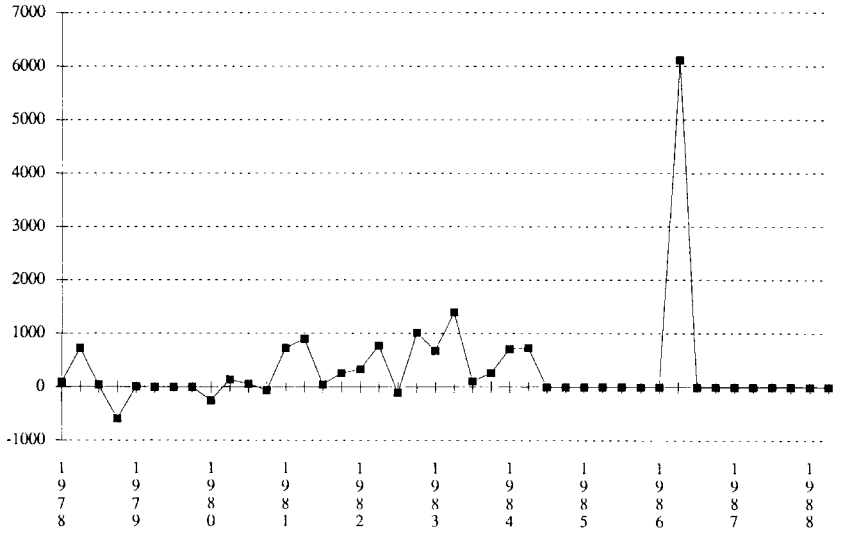

Fig. 3.2 Gap ($G - A$), city banks (in 100 million yen)

gest that window guidance hindered rather than accommodated bank lending activity during this period.

The annual growth rates of loans to corporations, individuals, and governments from city banks (GCB), trust banks (GTB), life insurance companies (GLI), and casualty insurance companies (GCI), as well as the growth of total

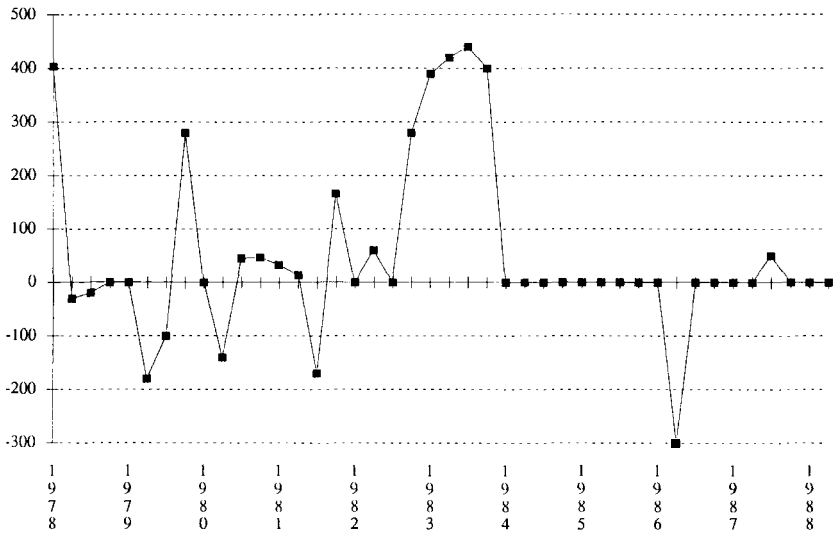

Fig. 3.3 Gap ($G - A$), long-term credit banks (in 100 million yen)

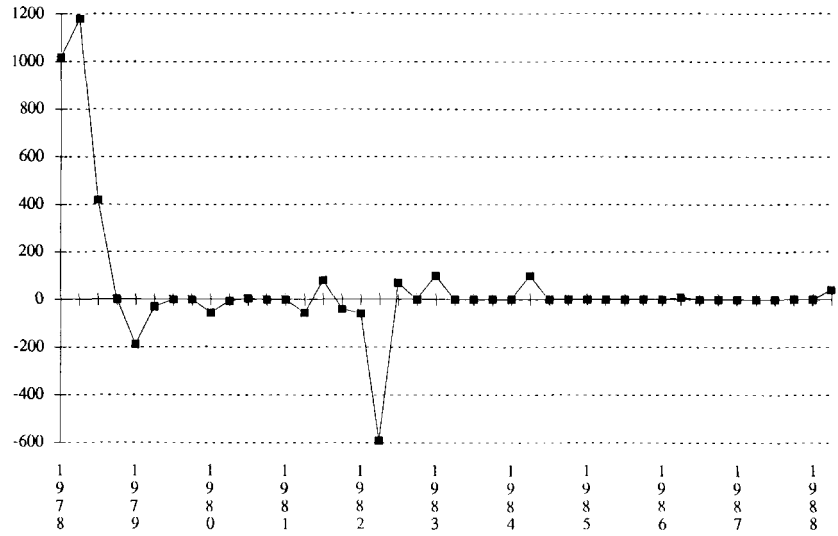

Fig. 3.4 Gap ($G - A$), trust banks (in 100 million yen)

loans from these institutions (GTOT), are displayed monthly for the period January 1978 through December 1982 in figure 3.6. The impact of the tight window guidance from late 1979 through the second quarter of 1980 is striking. GCI increases the most in late 1979 and early 1980, followed by GLI. The growth rate in loans from banks and total loans decline. The high corre-

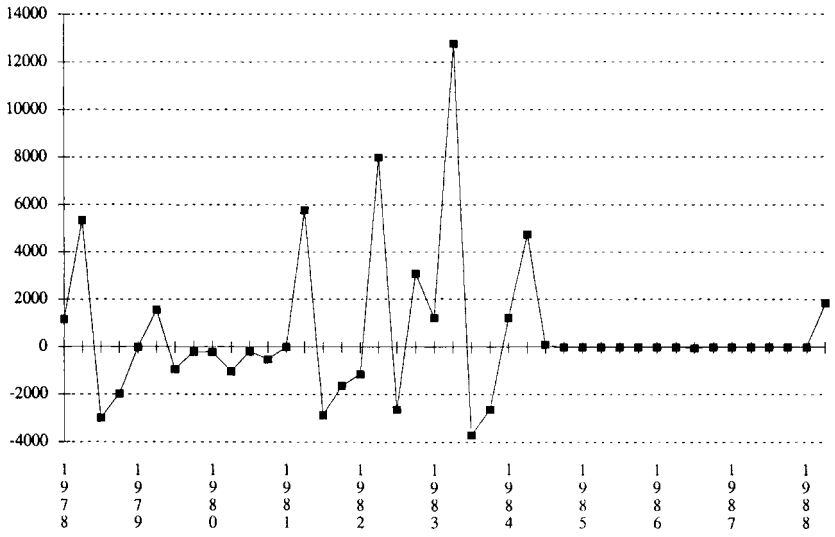

Fig. 3.5 Gap ($G - A$), regional banks (in 100 million yen)

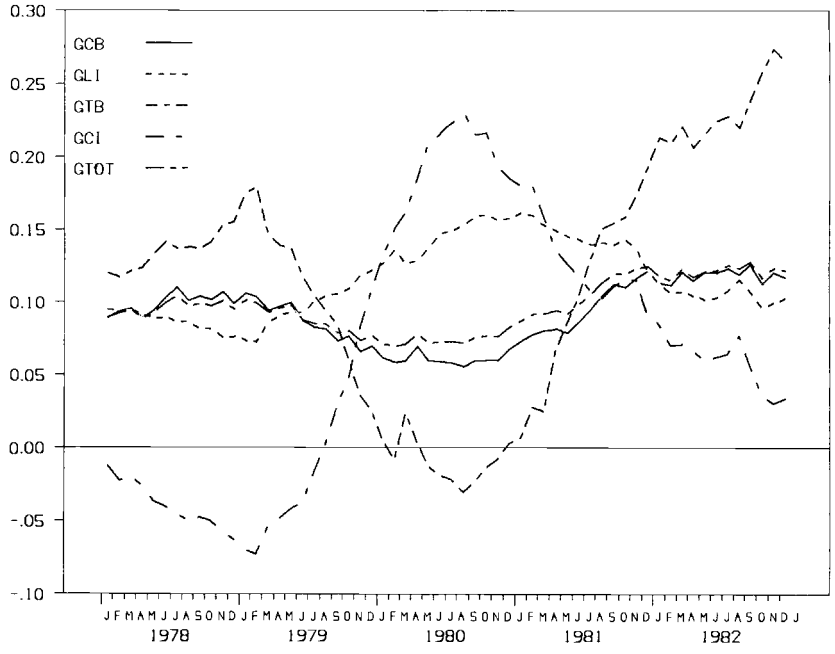

Fig. 3.6 Monthly growth rates of loans from financial institutions

lation between GCB and GTOT reflects the fact that loans from city banks were by far the largest component of total loans. The corresponding graphs of growth rates of industrial loans by city banks (GCB), trust banks (GTB), long-term credit banks (GLTCB), and insurance companies (GINS) are displayed quarterly in figure 3.7. From the middle of 1979 through the middle of 1980, GINS grew most rapidly and the growth rates of loans from the banks, especially trust banks, declined. Similar patterns of substitution are documented in Bank of Japan (1982) in its discussion of the effects of window guidance on lending by insurance companies during this period.

Growth rates for the period January 1988 through March 1990 corresponding to those in figure 3.6 are displayed in figure 3.8. Again the growth rate of loans from life insurance and casualty insurance companies increased during a period of declining growth in bank loans, especially in late 1989 and early 1990 when monetary policy, including window guidance, was relatively tight.

Horiuchi's work stimulated a large body of theoretical work on the role of window guidance in Japanese monetary policy. The earliest critique of Horiuchi's model was by Eguchi (1977, 1978). He argued that window guidance would be effective if banks' holdings of excess reserves are a decreasing function of the call rate, which is the opportunity cost of holding excess reserves. Tightening loan limits through window guidance leads to a lower call

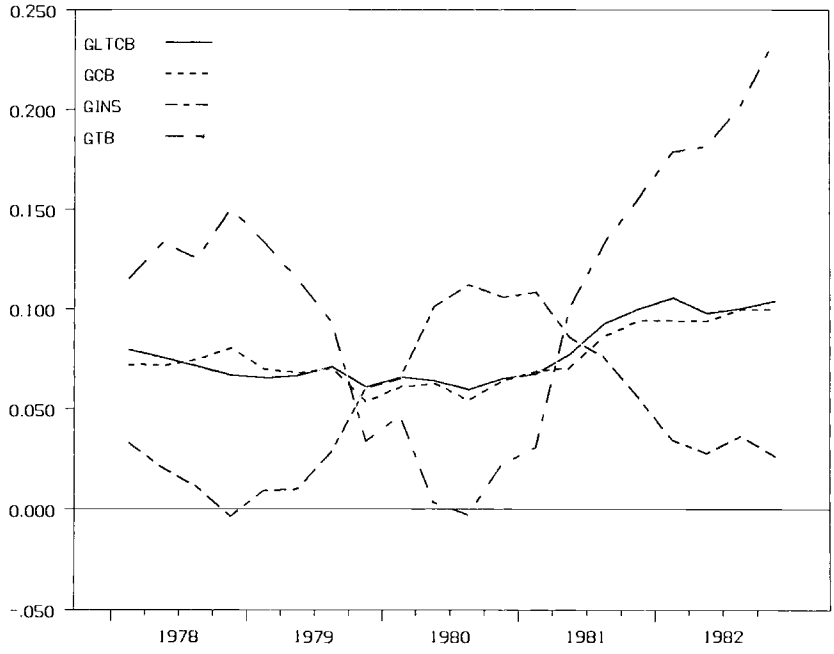

Fig. 3.7 Quarterly growth rates of loans

Fig. 3.8 Monthly growth rates of loans from financial institutions

rate, which induces not only more lending by regional banks but also larger holdings of excess reserves by regional and city banks. Thus, the increase in lending by regional banks does not fully offset the decrease in lending by city banks.

Teranishi (1982, chapter 10) and Shinohara and Fukuda (1982) note that another case where window guidance may be effective is when the BOJ's lending policy has a "passive" component. The BOJ has followed an accommodative lending policy under which lending has been an increasing function of the call rate. As Teranishi points out, the BOJ justified this passive component of credit in terms of its position as lender of last resort: given regulated interest rates, high call rates are indicative of excess demand in the interbank loan market, which should be at least partially fulfilled by the lender of last resort.[5] Evidence that there were in fact numerous periods of excess demand for loans in the interbank market during the postwar period and that BOJ policy was a key determinant of call rates is presented in Asako and Uchino (1987).

5. See Nihon Ginko Chosa-kyoku (1962), for example. In fact, representatives of the BOJ seemed to believe high-powered money was not controllable by the BOJ, contrary to the standard view of monetary policy. As Komiya (1988, chapter 3) has noted critically, those responsible for monetary policy in Japan seemed to take the amount of BOJ credit as *determined* by the state of the economy and as not controllable by the BOJ.

The effectiveness of window guidance under accommodative lending policies can be seen as follows. A tightening of window guidance reduces the excess demand for funds in the call market and leads to a decline in the call rate. This decrease in the call rate leads to a reduction in lending by the BOJ to private banks. Although financial institutions that are not restricted by guidance increase their loans, because of the reduced BOJ credit, the amount is not enough to offset the initial decrease in the lending by city banks. As this example makes clear, the effectiveness of window guidance cannot be evaluated without consideration of the status of the other instruments of policy used by the BOJ (see also Kuroda 1979).

There is limited empirical evidence on the effects of window guidance. Patrick (1962), in one of the earliest studies, compares the deviation of the expected level of loans by city banks from the BOJ's forecast and the deviation of the actual level of loans from the BOJ's forecast. He finds that the latter deviation was on average 83% of the former during the period of tight monetary policy in 1957–58. The corresponding number for the year preceding the start of the tight monetary policy was 153%, so he concludes that window guidance was very effective.

Horiuchi's (1977, 1980, chapter 4) findings are less supportive of the conclusion that window guidance is effective. He estimates a regression model of the growth rate of loans by private financial institutions using quarterly data for the period 1963 to 1975. The explanatory variables are the call rate, a proxy for firms' demand for funds, a proxy for firms' internal funds, and three dummy variables that are unity during the periods of tight window guidance. The coefficients on these dummy variables were not significantly negative, so he concluded that window guidance was ineffective during this period.

Furukawa (1981) reports the findings from a more indirect test. He estimated a function that determines the amount of excess reserves held by financial institutions. Included in the set of explanatory variables were the amount of required reserves and the call rate. As discussed above, a sufficient condition for window guidance to be effective is that excess reserves are sensitive to the call rate. Using monthly data from 1966 to 1978, Furukawa found that the excess reserves held by financial institutions were significantly influenced by the call rate, which indirectly supports the effectiveness of window guidance.

Subsequently, Horiuchi (1981) criticized Furukawa's results on the grounds that they were heavily influenced by a few observations during a period when the required reserve ratio was revised substantially. After dropping these observations and reestimating the regression model used by Furukawa, Horiuchi found that excess reserves were not related to the level of the call rate.

All of these studies focus on portfolio-theoretic models of the effectiveness of window guidance under the assumption of perfect capital markets. A key premise of this paper is that there are informational asymmetries in loan markets that partially explain the structure of corporate financial relationships in

Japan. One of the key ways in which Japanese firms differ from each other is the strength of their relationship to their suppliers of capital. It is common for firms to have a "main bank" that provides much of the company's debt financing, owns some of its equity (by statute no more than 5%), and may place bank executives in top management positions. For many firms, the main bank relationship is part of a larger industrial structure known as the keiretsu, which is an informally organized group of companies characterized by strong product-market ties among nonfinancial members and extensive cross-share ownership. Historically, the links have been strongest in the six largest groups—Mitsubishi, Mitsui, Sumitomo, Fuyo, Dai-ichi Kangyo, and Sanwa.

In principle, these keiretsu and main bank relationships may be helpful in promoting investment, because banks that own both large debt and equity stakes will have strong incentives to monitor the investment activities of affiliated firms. This monitoring may lower the cost of bank loans compared to the costs for companies with a weak or no main bank relationship. Indeed, Hoshi, Kashyap, and Scharfstein (1990b, 1991) find that the investments of group firms appear to be influenced less by current income than are the investments of independent, nongroup firms. While independent firms cut investment by about 50 yen in response to a 100-yen decline in cash flow, group firms cut investment by only 5 yen. They also find evidence that these financing arrangements can help firms overcome difficulties in raising capital when they are in financial distress. After the onset of financial distress, group firms and those with close main bank relationships appear to be able to invest more than independent firms.

These results suggest several reasons why group firms and those with close bank ties may respond differently to window guidance than do independent firms. First, during restrictive window guidance periods, the large city banks and trust banks that form the core of the six large groups might prefer to lend to members of their group rather than to firms outside the keiretsu. Moreover, even if the firm is not in a keiretsu but has a close main bank relationship, that bank may be more willing to lend to its main customers. This could be because they own equity in their client firms, giving them a greater incentive to lend to them when money is tight. Or it could be because the strength of their relationship allows them to better evaluate their credit; this is particularly important during periods of tight monetary policy when uncertainty is high.

Second, as our evidence in figure 3.7 suggests, during window guidance periods firms substitute away from restricted bank sources of finance to unrestricted sources, mainly insurance companies. Since the large life insurance and casualty insurance companies are members of the six major groups, they may give preferential access to funds to firms within the same group.

Finally, quite apart from these standard sources of finance, group firms may have greater access to trade credit from other nonfinancial corporations in the group with whom they have close trading and equity links. Thus, cash-rich group firms may be more prone to finance cash-poor members of the group.

Similar reasoning suggests that there will also be an aggregate effect of monetary policy in Japan on real economic activity through a credit channel of the type discussed by Bernanke and Blinder (1990) and Kashyap, Stein, and Wilcox (1991) for the U.S. economy. Window guidance will affect investment even in the absence of the use of other instruments of monetary policy in Japan, because of the imperfect substitutability of bank and nonbank loans. Window guidance may also enhance the effectiveness of the primary instruments of monetary policy. If, during periods of restrictive open-market operations and/or discount window policy, banks do not offset changes in loanable funds by selling other assets, and bank and nonbank loans are imperfect substitutes, then investment is likely to decline. In Japan, window guidance assures the imperfect substitutability of loans and other investments in the asset portfolio of banks. This credit channel is a more general phenomenon, however, and may be operative in the absence of window guidance if there are other reasons for the imperfect substitutability of bank assets.

3.3 The Mix of External Finance and Aggregate Real Growth

In this section, we explore the aggregate relations between the mix of external debt financing of corporate investment and changes in capital expenditures and inventory accumulation. Pursuant to our discussion in section 3.2, attention is focused on the proportion of loans from institutions restricted by window guidance to loans from all financial institutions, including insurance companies.[6] For the 1972–88 period examined subsequently, guidance applied generally to city banks, long-term credit banks, trust banks, and regional banks. The ratio of industrial loans from these institutions to the total of industrial loans from all banks and insurance companies is CRMIX in figure 3.9. The other series, CMIX, differs in the exclusion of regional bank loans from the numerator and denominator of this ratio. (A description of the composition of the denominator of CRMIX is presented in the appendix.) The declines in CRMIX during the periods of tight monetary policy following the first oil crisis and during the 1979–80 period, and the increases during periods of monetary ease, corroborate our interpretations of figures 3.6 through 3.8 and suggest that CRMIX is an informative indicator of the stance of monetary policy. The two series CRMIX and CMIX behave very similarly over our sample period, and so we will focus on CRMIX.

By construction, CRMIX reflects the restrictiveness of window guidance. However, changes in CRMIX may also reflect changes in the other instruments of BOJ monetary policy. For instance, the BOJ has actively used the discount rate as a policy instrument; between April 1979 and April 1980 the

6. Borrowings through the corporate bond market are not considered, since this was not a major source of debt financing for most of our sample period.

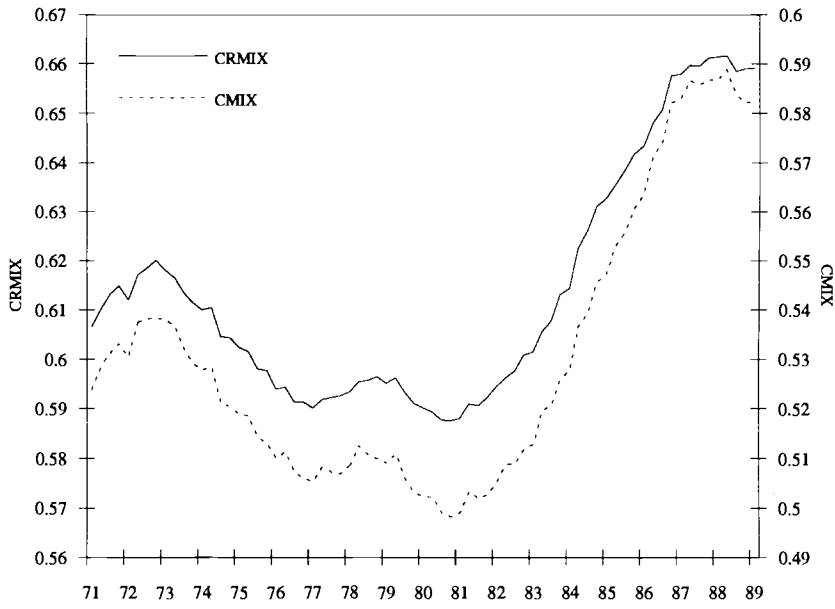

Fig. 3.9 Ratios of loans from restricted institutions to loans from all institutions

discount rate was increased 5.5 percentage points. The majority of industrial loans are issued by city banks (to large corporations) and regional banks (to small and medium-sized companies).[7] And city banks are relatively large borrowers from the discount window of the BOJ. Therefore, such discount rate increases, by disproportionately affecting loans by city banks, may have reduced CRMIX. Thus, CRMIX is not purely an indicator of window guidance. With this caveat in mind, we proceed to fit VARs to investigate the dynamic relations between monetary policy and investment.

The VARs examined are four-variable systems including the growth rate of the real capital stock, GCAP; the growth rate of inventories of corporations; the change in the ratio of industrial loans from banks subject to guidance to the total of industrial loans from financial institutions including insurance companies, $DCRMIX_t = CRMIX_t - CRMIX_{t-1}$; and the change in the call rate, DCALL. Two VAR systems were estimated using different measures of inventories: the first system used the growth rate of inventories of raw materials and stored goods (GINVR), and the second system used the growth rate of finished goods inventories (GINVF). Inventories of raw materials are related

7. In the first quarter of 1978, for instance, industrial loans from these two institutions composed just under 60% of the total. Furthermore, the rapid increase in CRMIX between 1982 and 1986 is a manifestation of the relatively rapid growth in industrial loans by city and regional banks during this period, with their share of the total being just over 63% in the fourth quarter of 1987.

to an early stage of the production process and are typically kept at minimal levels in Japan through a very efficient inventory management system. Thus, changes in this measure of inventories may reflect primarily the effects of shocks to supply. Finished goods inventories, on the other hand, may be more responsive to the decisions of final demanders and, hence, have a different response pattern to monetary policy. A complete description of the construction of these series is presented in the appendix. Four lags of each variable were included in each equation of the VAR, along with a constant term and quarterly seasonal dummies. The sample period was from the first quarter of 1971 through the first quarter of 1989.

The F-statistics for the null hypotheses that the four lags of each variable have zero coefficients in the VAR that includes raw materials inventories are presented in table 3.1, with the associated marginal significance levels in parentheses. The responses of DCRMIX, DCALL, and GCAP to innovations (one-step-ahead forecast errors) in the explanatory variables are displayed in figures 3.10 through 3.12.[8] The ordering of the variables in the VAR is given by the ordering in table 3.1. Though there is some correlation among the one-step-ahead forecast errors (see table 3.2), the qualitative features of the plots were similar for the alternative orderings we examined. We also fit this VAR for the shorter sample period of the first quarter of 1971 through the fourth quarter of 1984 to determine whether our findings were influenced substantially by the important changes in the structure of financial markets during the latter half of the 1980s. In particular, new sources of funds became available to corporations, and the BOJ introduced major reforms in the structure of money markets during the latter part of the 1980s. There were some minor differences in the test statistics, but the innovation response plots were similar for the two sample periods.

Only lagged values of DCRMIX as a group are useful for forecasting current DCRMIX at conventional significance levels, which implies that the mix of external financing is an indicator of a Granger exogenous component of monetary policy. In contrast to DCRMIX, the histories of all variables except GINVR have significant explanatory power for changes in the call rate. As expected, a positive innovation in DCRMIX (increase in the proportion of industrial loans from city, long-term credit, regional, and trust banks) leads to decreases in the call rate for about four quarters (fig. 3.11).

A positive innovation in GCAP leads to decreases in the call rate for about five quarters.[9] From the perspective of demand, the inverse negative responses of DCALL to increases in GCAP may seem surprising, since increases in GCAP are typically associated with increases in the demand for funds in the interbank market as loans to finance fixed investments are increased. However, inspection of the time series for GCAP and DCALL shows a notable

8. See Sims (1980) for a discussion of innovation accounting using VARs.
9. This pattern is not altered by reversing the order of DCALL and GCAP in the VAR.

Table 3.1 F-Statistics from the VAR with Raw Materials Inventories, April 1972–January 1990

Dependent Variable	DCRMIX	DCALL	GCAP	GINVR	R^2
DCRMIX	16.85	1.62	0.69	0.71	.75
	(.000)	(.184)	(.600)	(.584)	
DCALL	3.52	8.02	5.07	0.541	.63
	(.014)	(.000)	(.002)	(.706)	
GCAP	3.43	1.72	1.20	1.04	.74
	(.015)	(.162)	(.323)	(.399)	
GINVR	0.90	0.87	0.20	1.65	.21
	(.731)	(.487)	(.935)	(.177)	

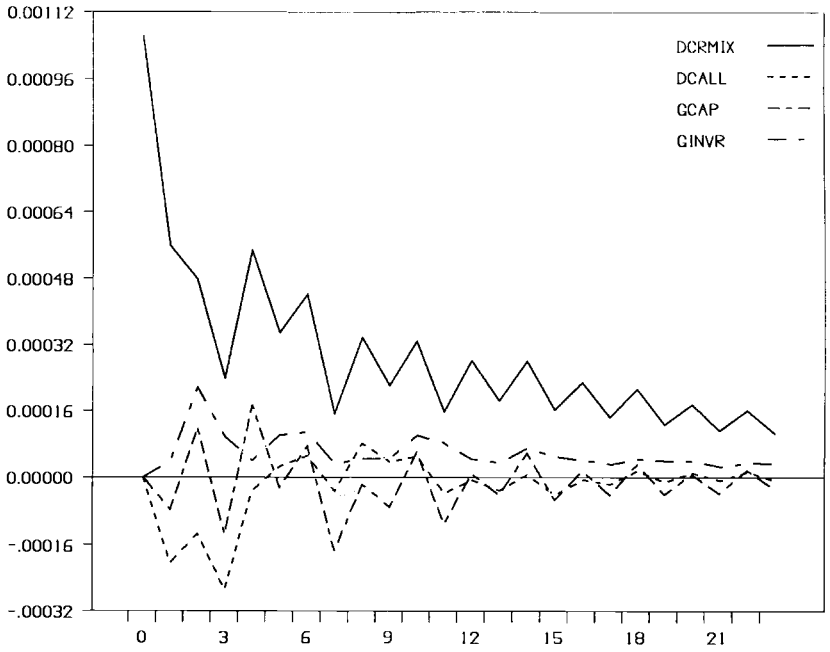

Fig. 3.10 Plot of responses of DCRMIX in VAR with GINVR

tendency for increases in GCAP to lead decreases in DCALL. This pattern may be attributable to the operating procedures of the BOJ. The BOJ operates under what is effectively a lagged reserve accounting system (Okina paper in this volume), and, hence, they must accommodate short-term demands for funds in the interbank market in order for this market to clear. This accommodation mitigates the upward pressure on rates due to an increased demand for funds. Moreover, the BOJ influences interest rates by communicating a target call rate for the end of a reserve accounting period (Okina paper in this volume), and so firms may adjust capital expenditures in anticipation of a

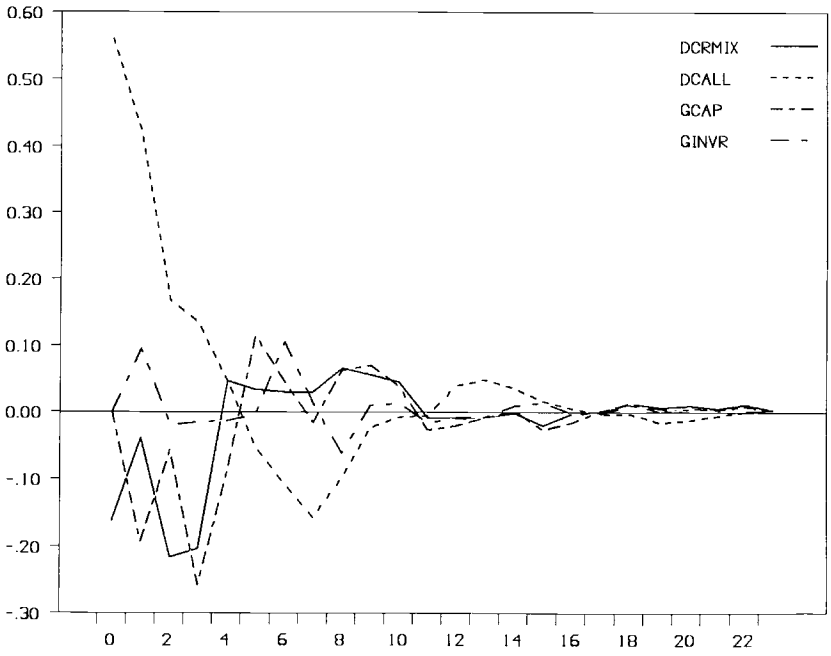

Fig. 3.11 Plot of responses of DCALL

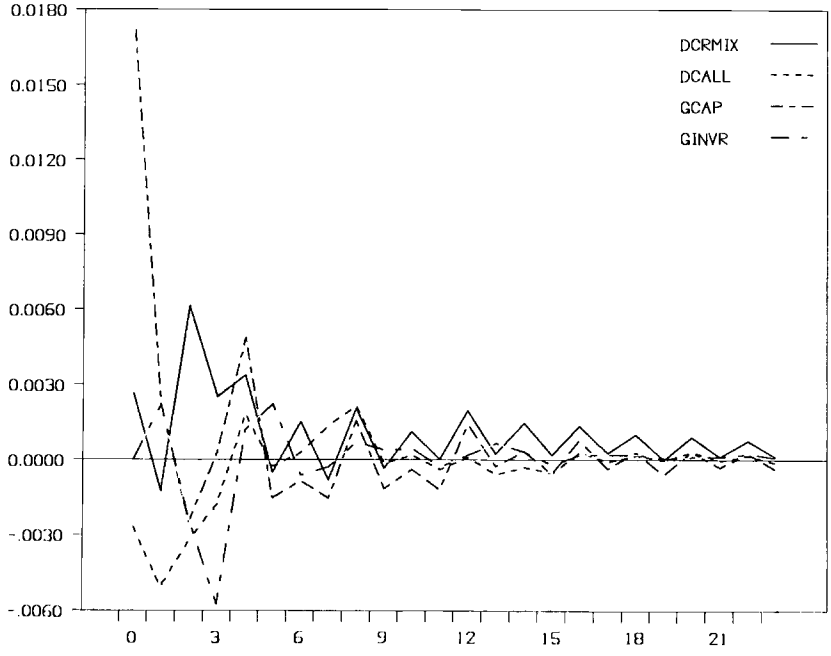

Fig. 3.12 Plot of responses of GCAP

Table 3.2 Correlations of Innovations for Table 3.1

	DCRMIX	DCALL	GCAP	GINVR
DCRMIX	1.	−.278	.150	−.000
DCALL		1.	−.183	.053
GCAP			1.	−.059
GINVR				1.

subsequent favorable movement in the call rate, based on announcements by the BOJ. These adjustments can potentially explain the patterns in figure 3.11.

The growth rate of the capital stock is significantly correlated with lagged values of DCRMIX as a group and the first lagged value of DCALL. A positive innovation in the DCRMIX is associated largely with positive increases in GCAP for about five quarters, as would be expected from the easing of monetary policy signaled by DCRMIX (figure 3.12). Unexpected increases in the call rate lead to a decline in GCAP. Together these results suggest that monetary policy, and in particular window guidance, have significant effects on capital expenditures.

The primary explanator of raw materials inventory growth is itself. However, none of the histories of explanatory variables has significant explanatory power at conventional significance levels, and the coefficient of determination is relatively low. This is consistent with our earlier remarks regarding inventory management policies in Japan.

Replacing raw material inventory growth by finished goods inventory growth in the VAR leads to somewhat different response patterns, particularly with regard to inventory shocks. Notice first of all in table 3.3 that the null hypothesis of zero coefficients on GINVF is rejected at the 4% marginal significance level in the DCRMIX equation. Figure 3.13 shows that there is a relatively weak positive response of DCRMIX to a positive shock to GINVF that persists for about eight quarters. This response suggests that unexpected accumulations of finished goods inventories are financed in part by borrowings from city and regional banks. Inventories play a relatively minor role in the equation for DCRMIX, however. For the most part, DCRMIX is Granger exogenous in this second VAR.

Another difference between the two VARs is that finished goods inventory growth is more forecastable than raw materials inventory growth. Lagged values of both DCALL and GCAP are significant at conventional significance levels. Responses of GINVF to innovations in these variables are displayed in figure 3.14. An increase in the call rate leads to increases in the growth rate of inventories for about seven quarters. Evidently, a contractionary monetary policy as reflected in increases in the call rates leads to a contraction in aggregate demand and an accumulation of finished goods inventories. This aggregate demand effect dominates the effects of the increased costs of financing inventories at the higher interbank rates. In contrast, an increase in GCAP

Table 3.3 **F-Statistics from the VAR with Finished Goods Inventories, April 1972–January 1990**

Dependent Variable	DCRMIX	DCALL	GCAP	GINVF	R^2
DCRMIX	18.8	1.54	0.34	2.73	.83
	(.000)	(.206)	(.847)	(.040)	
DCALL	2.67	6.55	5.56	0.71	.64
	(.044)	(.000)	(.000)	(.586)	
GCAP	3.17	1.61	1.12	1.49	.75
	(.022)	(.188)	(.359)	(.221)	
GINVF	0.61	3.08	5.02	0.64	.71
	(.660)	(.008)	(.002)	(.640)	

Table 3.4 **Correlations of Innovations for Table 3.3**

	DCRMIX	DCALL	GCAP	GINVF
DCRMIX	1.	−.235	.221	−.018
DCALL		1.	−.139	.034
GCAP			1.	−.221
GINVF				1.

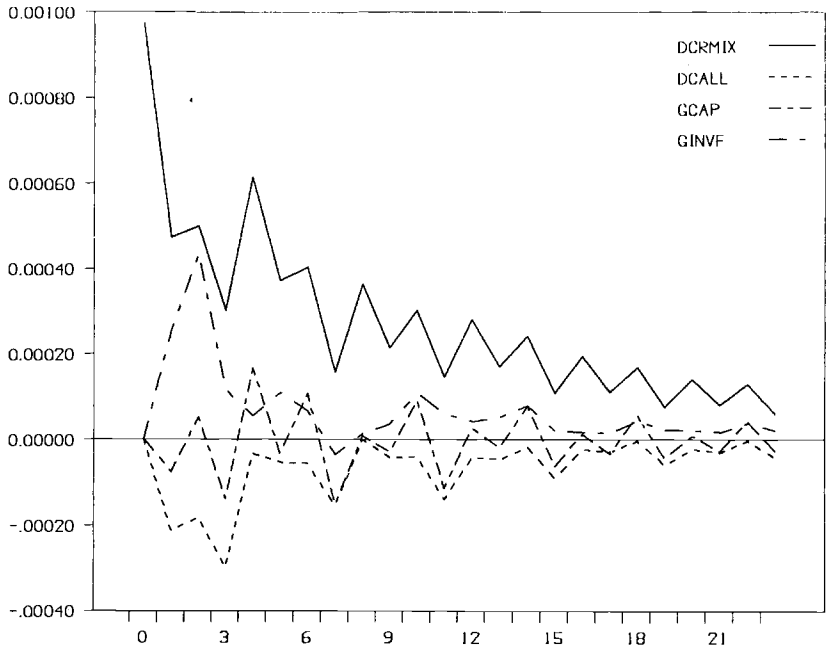

Fig. 3.13 **Plot of responses of DCRMIX in VAR with GINVF**

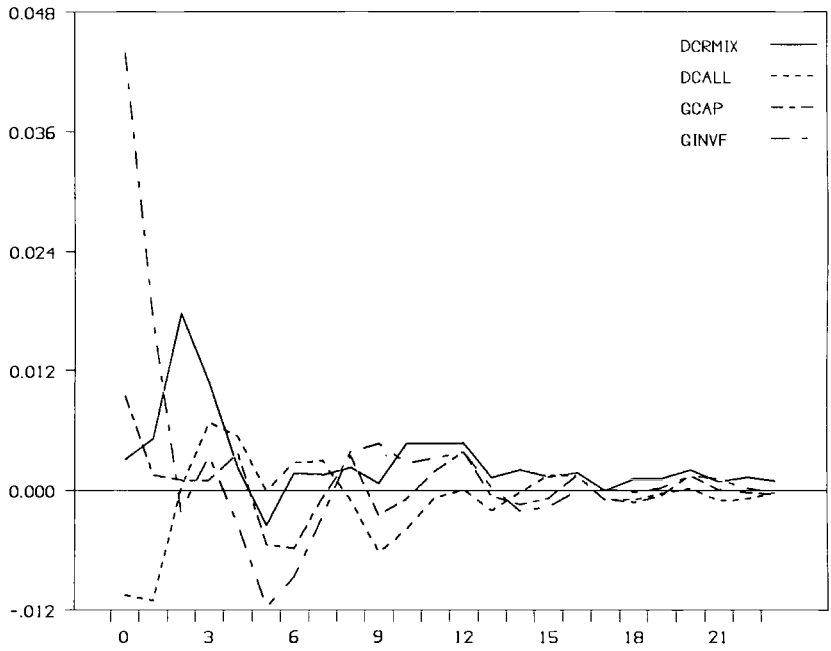

Fig. 3.14 Plot of responses of GINVF

leads to an immediate increase in GINVF followed by declines in GINVF for about three quarters. Declining inventory growth in the presence of an increase in the growth rate of capital goods is plausible during episodes of increasing aggregate demand for capital goods.

In summary, we have argued that the variable DCRMIX may be interpreted as an indicator of the stance of monetary policy, with an increase in DCRMIX reflecting an expansionary stance and a decline representing a contractionary stance. In addition, the evidence from industrial loans by city, trust, long-term credit, and regional banks and insurance companies suggests that DCRMIX also moves closely with the stance of window guidance. Therefore, we interpret the effects of DCRMIX on GCAP and GINVF as indirect evidence of the effect of window guidance on investment and inventory accumulation. Moreover, there was negligible feedback from other variables to DCRMIX, so that unexpected changes in DCRMIX are interpretable as Granger exogenous shocks to the stance of monetary policy.

3.4 Evidence from Firm-Level Panel Data

In this section, we examine the effects of window guidance on corporate investment using data on a panel of Japanese firms. We turn to microdata

because the macroevidence presented above may mask potentially important differences in firms' responses to window guidance. In particular, we explore whether differences across firms in their corporate financial structures lead to different investment and borrowing activities during a tight monetary episode.

The investment behavior of group and independent firms before, during, and after the 1979–80 tight monetary regime is examined.[10] This tight monetary stance was intended to avoid an increase in inflation after the 1979 oil shock. In addition to providing relatively stringent window guidance, the BOJ increased the discount rate by 5.5 percentage points between April 1979 and April 1980. As a result of this tightening, the growth rates of high-powered money and industrial production fell substantially during 1980 and the first half of 1981.

We analyze a sample of manufacturing firms drawn from the Nikkei Financial Data tapes that were continuously listed on the Tokyo Stock Exchange from 1965 to 1988. The sample selection and data construction are described in more detail in Hoshi and Kashyap (1990). We further restricted ourselves to firms with fiscal years ending in March (by far the most common fiscal year end) because it is important to compare firms across the same period. The sample period of this study is the fiscal year ending in March 1978 to the fiscal year ending in March 1983.

We also follow Hoshi, Kashyap, and Scharfstein (1990a) in distinguishing between group and independent firms. This distinction is admittedly imprecise. Indeed, several publications (*Keiretsu no Kenkyu, Industrial Groupings in Japan,* and *Nihon no Kigyo Shudan*) attempt to classify firms according to keirestu affiliation, each resulting in somewhat different classifications. We chose *Keiretsu ho Kenkyu*'s classification scheme because it focuses on the strength of a firm's relationship to the financial institutions in the group: the propensity to borrow from group banks and insurance companies and the percentage of shares held by other group firms. We use Nakatani's (1984) refinement of *Keiretsu no Kenkyu*'s classification scheme, which selects firms in the six largest groups and eliminates firms that switched groups. *Keiretsu no Kenkyu* also identifies firms that appear to be entirely independent of a keiretsu, which we use to form our sample of independent firms. Many of the firms in the sample, however, do not fit neatly into one of these two categories, and so we eliminated them from our sample. These criteria, combined with the elimination of outliers[11] in the investment data, leave us with 103 keirestu firms and 23 independent firms.[12]

We start by comparing investment in depreciable assets during fiscal years

10. For the moment, we leave aside the question of whether main bank relationships outside the keiretsu can also aid companies during this period.

11. An outlier has an investment-to-capital ratio greater than 1 or less than -1. Nine firms were dropped from our sample using this definition.

12. The small number of independent firms in the sample is consistent with numbers for all listed companies: according to *Keirestu no Kenkyu,* as of 1981, only 83 out of 859 nonfinancial corporations listed on the Tokyo Stock Exchange were independent.

ending in March of 1979 and 1980—the years corresponding to the tight monetary episode—with investment in the remaining years. The basic question is whether independent firms were more prone than group firms to cut back on their investment during this period.

We address this question at the simplest level by comparing changes in investment over the 1978–83 period. The first column of table 3.5 reports the mean of the first difference of the investment-to-capital ratio for the entire sample of 126 firms.[13] Investment declines slightly in 1979, although the change is statistically insignificant; investment actually increases in 1980, and the change is statistically significant. The second and third columns of table 3.5 partition the sample according to whether the firm is in a group or is independent. In both 1979 and 1980 the mean change in investment is larger for group firms than for independent firms, but in neither case is the difference statistically significant at conventional levels. The only statistically significant difference is in 1981, when group firms appear to invest more than independent firms.

Of course, these statistics ignore other determinants of investment. Indeed, as discussed above, the results of Hoshi, Kashyap, and Scharfstein (1991) suggest that liquidity is an important determinant of investment. Moreover, their results indicate that current income is a more important determinant of investment for independent firms than for group firms, suggesting that independent firms have less access to short-term loans. Two natural questions arise. First, is investment particularly sensitive to liquidity when bank lending is constrained by window guidance? And second, do independent firms appear to be even more dependent than group firms on their current income for financing investment during this period?

We address these questions by estimating an investment equation along the lines of Hoshi, Kashyap, and Scharfstein (1991). The dependent variable is gross investment normalized by the capital stock and the regressors are Tobin's q for depreciable assets (the ratio of the market value of depreciable assets to their replacement cost[14]); lagged output (calculated by adding the change in finished goods inventories to total sales) normalized by the beginning of period capital stock; liquidity (as measured by income after tax plus accounting depreciation less dividend payments) normalized by the capital stock, LIQ; a dummy variable that takes the value 1 if the firm is in a group, GROUP; an interaction term, GROUP times LIQ, GROUPLIQ; and yearly dummies for 1978–82. Investment, q, lagged output, liquidity, and the interaction term are first differenced to eliminate firm-specific effects. The results are reported as model 1 of table 3.6.[15]

13. Investment in year t is measured as the changes in the value of the depreciable assets during year t plus depreciation during that year.

14. The market value of depreciable assets is measured as the market value of debt plus equity less the market value of nondepreciable assets such as land.

15. Ratios of coefficients to their estimated standard errors are reported in parentheses. These estimates are calculated using the method due to White (1984), so that they are consistent under

Table 3.5 **Mean First Differences of Investment/Capital Ratios**

	Full Sample	Group Firms	Independent Firms
1978	.0347	.0160	.118
	(.0133)	(.0130)	(.0400)
1979	−.0028	.0074	−.0408
	(.0143)	(.0132)	(.0509)
1980	.0335	.0417	−.0030
	(.0120)	(.0134)	(.0254)
1981	.0563	.0596	−.0414
	(.0157)	(.0182)	(.0282)
1982	−.0107	−.0168	.0166
	(.0190)	(.0207)	(.0492)
1983	−.0261	−.0196	−.0555
	(.0200)	(.0207)	(.0599)
Number of observations	126	103	23

Note: Standard errors are in parentheses.

Although there are slight differences in the specification and sample, the results are consistent with the findings in Hoshi, Kashyap, and Scharfstein (1991). Tobin's q measures the profitability of investment. All else equal, the firm should invest more, the greater Tobin's q is. We find no statistically significant relationship between Tobin's q and investment. This is consistent with findings in numerous studies that Tobin's q explains a surprisingly small portion of the variation in investment.

More interesting from our point of view are the coefficients of the liquidity variables, LIQ, and the interaction term, GROUPLIQ. The coefficient of LIQ measures the sensitivity of investment to liquidity for independent firms, while the sum of the coefficients of LIQ and GROUPLIQ measures the sensitivity for group firms. The positive, statistically significant coefficient of liquidity could be interpreted as evidence that independent firms are liquidity-constrained in their investment: they are more prone to invest when they have the internally generated cash to do so. One should exercise caution in jumping to such a conclusion, however. To the extent that q is mismeasured, it could be that LIQ proxies for the value of investment opportunities, and not the liquidity position of the firm.[16]

In contrast, the finding that the coefficient of GROUPLIQ is negative and statistically significant is more compelling evidence that independent firms are liquidity-constrained in their investment. Although the liquidity coefficient

the assumption of heteroscedasticity and first-order autocorrelation (within a firm) of the disturbance.

16. This is the well-known criticism of the important study of investment by Meyer and Kuh (1957). Recent work by Fazzari, Hubbard, and Petersen (1988) is an attempt to overcome such problems.

Table 3.6 **Group Affiliation and Investment**

Variable	Model 1	Model 2	Model 3
Tobin q	−.0047	−.0045	−.0045
	(−0.93)	(−0.95)	(−0.95)
Lagged output	.076	0.76	.076
	(6.61)	(7.22)	(7.17)
LIQ	.372	.299	.299
	(2.44)	(1.77)	(1.77)
GROUPLIQ	−.347	−.222	−.222
	(−2.18)	(−1.23)	(−1.23)
GROUP	.0042	−.012	−.012
	(0.39)	(−0.69)	(−0.69)
GROUP7980		.077	
		(2.37)	
LIQ7980		.462	
		(1.49)	
GROUPLIQ7980		−.653	
		(−2.04)	
GROUP79			.091
			(2.04)
GROUP80			.054
			(1.83)
LIQ79			.641
			(1.57)
LIQ80			.089
			(0.33)
GROUPLIQ79			−.831
			(−2.00)
GROUPLIQ80			−.281
			(−0.99)
Adjusted R^2	.247	.258	.256

Notes: The dependent variable is gross investment (change in the capital stock plus depreciation) normalized by the beginning-of-period capital stock. The other variables are defined in the text. Investment, Tobin's q, output, and all liquidity variables are first differenced. The sample period is 1978–83. There are 756 observations (126 firms for six years). The numbers shown in parentheses below the coefficient estimates are t-statistics. The standard errors used to calculate t-statistics are corrected for possible heteroscedasticity and first-order autocorrelation of the error term using the method suggested by White (1984).

itself may be biased upward by measurement error in q, the difference of the coefficients of group and independent firms is less likely to be biased. Thus, the negative coefficient of GROUPLIQ indicates that independent firms do appear to be more dependent on internally generated funds than are group firms. According to the point estimates, a 100-yen decrease in liquidity leads to a 37-yen drop in investment by independent firms, but only to a 3-yen drop in investment by group firms, which is not statistically different from zero.

A key issue in our analysis is whether liquidity and group membership are more important during the 1979–80 period of window guidance. Accordingly,

we next add to the basic specification three additional regressors: an interaction term between the group membership dummy and a dummy for whether the year is 1979 or 1980, GROUP7980; an interaction term between liquidity and the 1979/80 dummy, LIQ7980; and a three-way interaction of the group membership dummy, the 1979/80 dummy, and liquidity, GROUPLIQ7980.

The results are reported under model 2 of table 3.6. As in the basic regression, the coefficient of q is not different from zero and the coefficient of liquidity is positive, although statistically significant only at the 10% level. The coefficient of GROUPLIQ is negative, but not significant at conventional levels. More interestingly, the coefficient of GROUP7980 is positive and statistically significant. This variable indicates that, all else equal, group firms increase their investment more relative to the independent firms during the 1979–80 period. In all other years, however, they do not; the coefficient of GROUP is essentially zero.

The effects of liquidity also appear to be more important during the 1979–80 period. The coefficient of LIQ7980 is positive, indicating that an increase in liquidity during the credit-constrained period of 1979–80 had a larger effect on investment than an increase in liquidity in other years. Although the effect is positive, as we would predict, the coefficient is significant only at about the 15% level.

Finally, the coefficient of GROUPLIQ7980 is negative and statistically significant. As we have already noted, liquidity appears to be a more important determinant of investment for independent firms than for group firms. The coefficient on GROUPLIQ7980 measures whether liquidity is even more important for independent firms relative to group firms during 1979–80 than in the other years. The result here indicates that it indeed is, and the difference in liquidity effects between group and independent firms is substantial. The liquidity effect for independent firms during 1979–80 is given by the sum of the coefficients on LIQ and LIQ7980, which is .761. Although both LIQ and LIQ7980 are only marginally significant, the sum of the coefficients is highly significant, with t-statistics of 3.05. Thus, for a typical independent firm, a 100-yen reduction in the cash flow during the period of tight window guidance leads to a 76-yen drop of the investment. The comparable number for the group firms is obtained by adding up the coefficients on LIQ, LIQ7980, GROUPLIQ, and GROUPLIQ7980. The point estimate is $-.114$ and is not statistically different from zero (t-value is -0.25).

These estimates pool 1979 and 1980 under the maintained assumption that the effects on investment of tight monetary policy are the same in the two years. This is a strong assumption. Restrictive window guidance begins at the start of 1979; what we call year 1979 in our sample ends on 31 March 1979, so that the overlap is only three months. By contrast, restrictive window guidance lasts through the entire year of 1980. So, on the one hand, we would expect the effects to be stronger in 1980. On the other hand, it appears that during fiscal year 1980 guidance became less restrictive at least for one quar-

ter (figure 3.1). To explore these possibilities, we repeat the specification of model 2 but include separate interaction terms for 1979 and 1980. The results are reported as model 3 in table 3.6.

The coefficients on GROUP79 and GROUP80 are positive, suggesting that group firms were particularly prone to invest more than independent firms in both 1979 and 1980, though their magnitudes are different. The coefficient on GROUP79 is large and significant, but the coefficient on GROUP80 is a bit smaller and significant at about the 7% level. The liquidity effects also appear to be stronger in 1979 than in 1980. The point estimate of the LIQ79 coefficient is positive with a t-statistic of 1.57, while LIQ80 has a much lower point estimate and is less precisely estimated. The three-way interaction terms, GROUPLIQ79 and GROUPLIQ80, also suggest that this effect is more pronounced in 1979 than in 1980. The coefficient on GROUPLIQ79 is large and significant; that on GROUPLIQ80 is smaller and insignificant. The more pronounced effects of liquidity in 1979 cast some doubt on whether the findings can reasonably be attributed to monetary policy. Interestingly, however, the yearly dummies, which are supposed to pick up the macroeconomic effects (including those of monetary policy) that affect all firms equally and cannot be captured by the regressors, show a similar pattern. The estimate of the coefficient of the 1979 dummy is $-.087$ with a t-value of -2.05 and that of the 1980 dummy is $-.024$ with a t-value of -0.84. Thus, 1979 seems to have been a worse year for investment than 1980. This suggests that, so far as the investment is concerned, the monetary tightening during this period had stronger effects in 1979 than in 1980.

The results above show that group affiliation mattered most during the period of tight window guidance. A related question is whether firms with relatively strong ties to their main banks behaved differently during this period. To address this question, we first need a measure of the strength of a firm's ties to its main bank. We identify such firms as those that borrow a large fraction of their funds from their largest lender. More specifically, we identify the largest lender for each firm each year during the period 1978–83. The largest lender could be one of thirty-six major private financial institutions in Japan: thirteen city banks, seven trust banks, seven life insurance companies, six casualty insurance companies, and three long-term credit banks. During the sample period, the borrowings from these thirty-six financial institutions on average account for about 85% of total borrowings from domestic private financial institutions. The remaining 15% comes from smaller financial institutions such as regional banks and credit unions. After identifying the largest lender, we calculate the proportion of the total borrowings that come from the largest lender for each firm during each year and compute the average proportion over the sample period for each firm. Finally, we create our measure of dependence on the main bank, MAIN, by assigning 1 if this average is over 22% (the median of the sample) *and* if the identity of the lar-

gest lender did not change throughout the sample period; MAIN takes 0 otherwise.[17]

There is some ambiguity in the interpretation of MAIN and its implications for investment. On the one hand, firms may have chosen not to diversify their financing sources despite the ability to do so. This interpretation leads us to expect that liquidity will not be a major determinant of investment when MAIN = 1. On the other hand, firms with MAIN = 1 may be substantially constrained by their liquidity position if the concentration of borrowing is indicative of their inability to diversify at comparable borrowing rates.

With this caveat in mind, we add our measure of main bank dependence to the basic specification. We include MAIN, an interaction between MAIN and LIQ (MAINLIQ), an interaction between MAIN and the 1979–80 dummy (MAIN7980), and an interaction among MAIN, the 1979–80 dummy, and LIQ (MAINLIQ7980).

The results in table 3.7 show that the group effects we found in table 3.6 are still present. Group firms tend to invest more during the period of tight monetary policy, and their investment is less constrained by liquidity. The difference in the sensitivity of investment to liquidity between group and independent firms is especially large during the period of tight monetary policy.

Controlling for the effects of group affiliation, a strong dependence on a main bank does not affect the change in investment before, during, or after the period of tight monetary policy. The coefficients on MAIN and MAIN7980 are both insignificant and essentially zero. The strong ties to the main bank, however, appear to change the liquidity effects. The coefficient on MAINLIQ is positive and highly significant, suggesting that, after controlling for group affiliation, the investment of a firm with higher dependence on a main bank is more constrained by the liquidity during normal times. Thus, the second interpretation of MAIN discussed above seems to emerge here: a firm with a strong main bank tends to have trouble diversifying its sources of borrowings. These firms, however, also seem to benefit from this close relation with their main banks during the period of tight monetary policy. The coefficient on MAINLIQ7980 is negative, though it is not significant, suggesting that liquidity may be less of a problem for the firms with strong ties to the main banks during this period of tight monetary policy.

3.5 Conclusions

This paper presents evidence that window guidance can have real effects on economic activity. Others have argued that window guidance need not change

17. Since we could not find the borrowings information broken down by the financial institutions for one firm in 1978, we could not create the MAIN variable for that firm, leaving us with 125 firms (102 group firms and 23 independent firms).

Table 3.7 **Group Affiliation, Main Bank Dependence, and Investment**

Variable	Coefficient Estimate
Tobin's q	−.0040
	(−0.80)
Lagged output	.080
	(7.75)
LIQ	.258
	(1.59)
GROUPLIQ	−.321
	(−1.86)
GROUP	−.013
	(−0.74)
MAINLIQ	.283
	(2.93)
MAIN	.0020
	(0.16)
GROUP7980	.076
	(2.42)
MAIN7980	−.0048
	(−0.20)
LIQ7980	.488
	(1.60)
GROUPLIQ7980	−.580
	(−1.80)
MAINLIQ7980	−.198
	(−1.24)
Adjusted R^2	.270

Notes: The dependent variable is gross investment (change in the capital stock plus depreciation) normalized by the beginning-of-period capital stock. The other variables are defined in the text. Investment, Tobin's q, output, and all liquidity variables are first differenced. The sample period is 1978–83. There are 750 observations (125 firms for six years). The numbers shown in parentheses below the coefficient estimates are t-statistics. The standard errors used to calculate t-statistics are corrected for possible heteroscedasticity and first-order autocorrelation of the error term using the method suggested by White (1984).

the total availability of credit in the economy, only the source of the credit—inducing firms to shift from constrained capital suppliers such as city banks to unconstrained suppliers such as insurance companies. Our point is that, when there are information asymmetries in particular and capital market imperfections, these financing sources are not perfect substitutes and, as a result, window guidance can have real effects. Moreover, window guidance may have distributional effects: constrained banks may be more prone to cut loans to firms with whom they do not have close ties and more prone to continue lending to those firms with whom they have close lending relationships. In addition, some firms—in particular group firms—may have better access to unrestricted sources of finance, such as from group insurance companies.

Finally, group firms may have greater access to trade credit from other member firms, which might serve as a close substitute for bank loans.

The empirical evidence from both macro- and microdata is consistent with these hypotheses. VAR results suggest that monetary policy in general and window guidance in particular have important effects on the aggregate capital stock accumulation and inventory investment. The results from firm-level regressions show that group firms tended to invest more than do independent firms during the 1979–80 period of tight window guidance. Moreover, the investment of independent firms is more sensitive to cash flow than for group firms, and this differential importance of cash flow was particularly prominent during the 1979–80 period.

In general, it is hard to distinguish the effects of window guidance per se from those of tight monetary policy. Nevertheless, in the VAR, we included the change in the call rate (DCALL) to account for the overall state of monetary policy. It is interesting to note that changes in the ratio of industrial loans from banks subject to guidance to total industrial loans (DCRMIX) has strong effects on the capital and inventory accumulation (GCAP and GINV) even when DCALL is included in the VARs. In addition, DCRMIX appears to be Granger exogenous in the VAR system. These results suggest some independent effects of window guidance.

Although this paper presents evidence on the role of window guidance, the results are far from complete. There are some obvious ways to extend our investigation of microdata. In addition to the real investment effects we have focused on so far, there are also predictions about how firms should finance this investment. Are group firms favored by group banks in the allocation of capital during the period of tight monetary policy? Are firms with close main bank ties favored by their banks? Are group firms given preferential access to financing from group insurance companies? These financing questions are left as agenda for future work.

Another important question that arises is whether the recent window guidance episode beginning in 1989 is substantially different from the 1979–80 episode. Deregulation of the financial markets in the 1980s enabled firms to supplement insurance company financing with bond financing during this period, expanding the alternatives to restricted bank financing. Thus, window guidance may have become less effective. On the other hand, the BOJ is said to be implementing window guidance, more stringently directing banks to reduce their so-called latent loans.[18] Unfortunately, the data we need to investigate this question are not yet available, and we must leave it for future work.

18. The biggest city banks have about 1 trillion yen each in loans outstanding, which they by various manipulative measures take off their books at the end of each quarter to make it appear they are in conformity with BOJ window guidance on loan growth. The BOJ, which has been well aware of the practice, is now telling the banks they should reduce the amount of these so-called latent loans by half as of March 1991, and completely eliminate them by the end of March 1993 (*Nihon Keizai Shimbun*, 13 November 1990).

Appendix

This appendix describes the data used in the macroeconomic analysis.

GCAP (the growth rate of capital). The capital stock for all manufacturing was collected from the *Quarterly Reports of Incorporated Enterprise Statistics,* which is based on a survey by the Ministry of Finance. The sample size for this survey changes the second quarter of every year. To adjust for these changes, a smoothed series of the number of firms in the sample was constructed by linearly interpolating the number of firms in the second quarter of each year. Then the aggregate amount of capital was divided by the actual number of firms to get the amount of capital per firm. The latter series was multiplied by the smoothed series of number of firms to get the capital stock series used in our analysis. The wholesale price index for capital goods was used to compute the real value of the capital stock, and then the first differences of the logarithms of the capital stock were computed to get growth rates.

GINV (the growth rate of inventories). The inventory levels were also collected from the *Quarterly Reports* used to compute GCAP. The same method was used to smooth the inventory levels for finished goods in manufacturing, and raw materials and stored goods in manufacturing. These smoothed series were deflated by the wholesale price index for raw materials for processing and finished goods in manufacturing, respectively; logarithms were computed; and then first differences were taken to get growth rates.

DCALL (the first difference of the call rate). The call rate is the unconditional average of daily call rates in Tokyo reported in the *Economics Statistics Monthly* by the BOJ.

DCRMIX (the first difference of the mix variable). The mix variable CRMIX was computed as the ratio of the industrial loans by banks subject to window guidance, to the total level of industrial loans from all financial institutions. The numerator included loans by city, long-term credit, trust, and regional banks. The denominator included loans from those institutions in the numerator plus the trust accounts from these institutions, sogo banks, shinkin banks, Shoko Chukin Bank, Japan Development Bank, the Export-Import Bank of Japan, the Small Business Finance Corporation, and insurance companies. The only institutions excluded from the denominator are agricultural, forestry, and fisheries financial institutions, which are not likely to be an important factor in our analysis of manufacturing. The series were obtained from the *Economics Statistics Monthly* published by the BOJ and reported in the annex table for tables 49 and 50. Industrial loans were computed by subtracting loans to local governments and individuals from total loans.

References

Asako, Kazumi, and Yuko Uchino. 1987. Bank Loan Market of Japan: A New View on the Disequilibrium Analysis. *Bank of Japan Monetary and Economic Studies* 5:169–216.

Bank of Japan. 1982. Recent Portfolio Management by Institutional Investors. Special Paper No. 97, Research and Statistics Department.

Bernanke, Ben, and Alan Blinder. 1990. The Federal Funds Rate and the Channel of Monetary Transmission. NBER Working Paper No. 3487. Cambridge, MA: National Bureau of Economic Research, October.

Eguchi, Hidekazu. 1977. Comment: Horiuchi Akiyoshi, "'Madoguchi Shido' no Yuko-sei" (Comment: Akiyoshi Horiuchi, The effectiveness of the "window guidance"). *Keizai Kenkyu* 28:242–245.

———. 1978. Tanki Kin'yu Shijo no Working ni Tsuite: Horiuchi Akiyoshi shi no Rejoinder he no Kotae mo Kanete (On the working of short-term financial markets: also answering the rejoinder by Mr. Akiyoshi Horiuchi). *Keizai Kenkyu* 29:81–84.

Fazzari, Steven M., R. Glenn Hubbard, and Bruce C. Peterson. 1988. Investment and Finance Reconsidered. *Brookings Papers on Economic Activity No. 1*, 141–95.

Furukawa, Akira. 1981. Madoguchi Kisei no Yuko-sei: Horiuchi-Eguchi Ronso o Mogutte (The effectiveness of window guidance: On Horiuchi versus Eguchi). *Keizai Kenkyu* 32:43–48.

Horiuchi, Akiyoshi. 1977. "Madoguchi Shido" no Yuko-sei (The effectiveness of window guidance). *Keizai Kenkyu* 28:204–13.

———. 1978. Eguchi Eiichi shi no Comment ni Kotaeru: Madoguchi Kisei no Yuko-sei ni Tsuite (Answering the comment by Mr. Eiichi Eguchi, on the effectiveness of the window guidance). *Keizai Kenkyu* 29:78–80.

———. 1980. *Nihon on Kin'yu Seisuku* (Japanese monetary policy). Tokyo: Toyo Keizai Shinpo-sha.

———. 1981. Ginko-Kinyu Kikan no Junbi Juyo ni Tsuite: Hamada-Iwata oyobi Furukawa no Keisoku Kekka to Sai-Kentoh (On the excess reserve holding by banks and other financial institutions: reconsidering the empirical results by Hamada-Iwata and Furukawa). *Keizai Kenkyu* 32:178–87.

Hoshi, Takeo, and Anil Kashyap. 1990. Evidence on q and Investment for Japanese Firms. *Journal of the Japanese and International Economies* 4:371–400.

Hoshi, Takeo, Anil Kashyap, and David Scharfstein. 1990a. Bank Monitoring and Investment: Evidence from the Changing Structure of Corporate Banking Relationships in Japan. In *Asymmetric Information, Corporate Finance, and Investment*, ed. R. Glenn Hubbard, 105–26. Chicago: University of Chicago Press.

———. 1990b. The Role of Banks in Reducing the Costs of Financial Distress in Japan. *Journal of Financial Economics* 27:67–88.

———. 1991. Corporate Structure, Liquidity, and Investment: Evidence from Japanese Industrial Groups. *Quarterly Journal of Economics* 106:33–60.

Kashyap, Anil, Jeremy Stein, and David Wilcox. 1991. Monetary Policy and Credit Constraints: Evidence from the Composition of External Finance. MIT, Cambridge.

Komiya, Ryutaro. 1988. *Gendai Nihon Keizai* (Contemporary Japanese economy). Tokyo: University of Tokyo Press.

Kuroda, Iwao. 1979. Madoguchi Shido o Meguru Bunseki no Sai-Kentou (Reconsidering the debates on window guidance). *Kikan Gendai Keizai* 37:141–47.

Meyer, John, and Edwin Kuh. 1957. *The Investment Decision*. Cambridge, MA: Harvard University Press.

Nakatani, Iwao. 1984. The Economic Role of Financial Corporate Grouping. In *The*

Economic Analysis of the Japanese Firm, ed. Masahiko Aoki, 227–58. Amsterdam: North-Holland.

Nihon Ginko Chosa-kyoku (Bank of Japan Research Bureau). 1962. Nihon Ginko Shin'yo no Seikaku to Shin Kin'yu Chosetsu Hoshiki (The nature of the Bank of Japan credit and the new method of monetary control). *Chosa Geppo*, November.

Patrick, Hugh T. 1962. *Monetary Policy and Central Banking in Contemporary Japan: A Case Study in the Effectiveness of Central Bank Techniques of Monetary Control.* Bombay: The University of Bombay Press.

Shinohara, Soichi, and Atsuo Fukuda. 1982. Nichi-Gin Kashidashi to Madoguchi Shido no Yuko-sei (BOJ lending and the effectiveness of window guidance). *Keizai Kenkyu* 33:259–62.

Sims, Christopher A. 1980. Macroeconomics and reality. *Econometrica* 48:1–48.

Suzuki, Yoshio. 1987. *The Japanese Financial System.* Oxford: Clarendon Press.

Teranishi, Juro. 1982. *Nihon no Keizai Hatten to Kin'yu* (Economic development and the financial system in Japan). Tokyo: Iwanami Shoten.

White, Halbert. 1984. *Asymptotic Theory for Econometricians.* Orlando, FL: Academic Press.