The Effect of Bank Credit on Asset Prices:

Evidence from the Japanese Real Estate Boom during the 1980s

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Abstract

This paper studies whether bank credit fuels asset prices. I show that I have an instrument for the supply of real estate loans. Financial deregulation during the 1980s allowed keiretsus to obtain finance publicly and reduce their dependence on banks. Banks that lost these blue-chip customers increased their property lending. Using this instrument I find that a 0.01 increase in a prefecture's real estate loans as a share of total loans causes 14-20% higher land inflation compared to other prefectures over the 1981-1991 period. The timing of losses also coincides with subsequent land inflation in a prefecture.

Keywords: bank credit, asset prices, financial regulation

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1 Introduction

The purpose of this paper is to determine whether bank credit affects asset prices. The Japanese real estate boom during the 1980s provides a unique episode to help answer this question. In particular, this paper studies to what extent an exogenous shock to the supply of bank credit contributes to fuelling land prices. I show that I have an instrument for the supply of real estate loans, which is the decrease in banks' loans to keiretsu firms beginning in the early 1980s. I then take advantage of the cross-sectional and time-series variation in Japan's 47 prefectures. Using this instrument I find that a 0.01 increase in a prefecture's real estate loans as a share of total loans causes 14-20% higher land inflation over the 1981-1991 period. The timing of losses also coincides with subsequent land inflation in a prefecture.

There is consensus in the literature on Japan that some initial shock in the 1980s led banks to increase lending towards the real estate sector. However the keiretsu shock to bank credit must be exogenous, not endogenous to banks' decisions. The first part of this paper tests and determines that lending to keiretsus declined as a result of the financial deregulation which enabled keiretsu firms to obtain financing from the public market. This supports the Hoshi and Kashyap (hereafter HK) hypothesis, which is that large known firms (mostly keiretsus) substantially reduced their dependence on bank financing by issuing bonds during the 1980s. Therefore it was a choice by firms to move away from banks. In contrast, the "good opportunities" hypothesis would imply that banks chose to move away from keiretsu firms. Real estate may have been perceived to have good opportunities, rationalizing a shift of bank lending towards the real estate sector during the 1980s[1]. The results of extensive tests do not suggest that this was the case in Japan. Therefore, the HK hypothesis can be applied to help answer the question motivating this paper.

The main part of this paper explains the Japanese bubble in land prices and its differential impact across Japan's prefectures using the keiretsu loan shock as an instrument. When banks lost their keiretsu (large and known) customers, they increased their lending to the real estate sector and that in turn fuelled land prices. This main result is shown in both the cross-sectional and time-series view. First, those prefectures that experienced a larger loss in their banks' proportion of keiretsu loans experienced a larger increase in real estate lending which fuelled land inflation. An increase of 0.01 in a prefecture's instrumented real estate loans as a share of total loans implies 14-20% higher land inflation over the 1981-1991 period. Second, the timing of losses coincides with the subsequent land inflation in a prefecture. A 0.01 increase in a prefecture's instrumented real estate loan share corresponds to a

[1] A third view emphasizes monetary factors which can be related to the "good opportunities" view. Ueda (2000) and Hoffmaister and Schinasi (1994) are of the view that monetary policy was responsible for the wide swings in asset prices that caused increased bank lending towards real estate.

15%-27% higher land inflation rate. From 1983 to 1993 and based on the fixed effects model, the average predicted land price inflation coming from instrumented real estate lending is close to the Japan-wide average land price inflation during this period, 6.4 percent annually.

Previous papers assessing the importance of various factors for why banks in Japan increased their lending to real estate during the 1980s take land prices as given. They overlook the idea that the increase in banks' credit to real estate may itself have also contributed at the aggregate to land price inflation. This paper attempts to further research into this question. Within the popular press, an article in the Economist (4/24/2003) attributed the rise in property prices in Australia not only to low interest rates but also to the observation that "banks and other institutions have competed to offer cheap loans." With no imperfections in credit markets and in a standard asset pricing model, banks' willingness to offer loans would have no impact on asset prices. Therefore, fundamental to the empirical analysis in this paper is the presence of credit constraints. A useful frame of reference is Kiyotaki and Moore (1997) who treat assets as not just factors of production, but also as collateral for loans, so that credit limits are affected by the price of these assets. Therefore it is straightforward that a firm's borrowing capacity and therefore its demand for credit is affected by changes in asset prices. This leads to an upward sloping demand for land because firms can borrow more and their net worth rises when the price of land increases.

However what motivates this paper is what happens when we allow for shocks to the supply of loans. I show in Appendix 1 that this implies that asset prices (and asset holdings) can also be affected by shocks to credit limits, based on an extension of the Kiyotaki and Moore model. A similar credit cycle is created when banks ease binding credit limits independent of firms' net worth, allowing them to borrow more, invest more in the asset and in the process increase the price of the asset. Gerlach and Peng (2005) note that there can be a role for credit in asset valuations by increasing available liquidity, an idea that goes back to Kindleberger (1978). This is also in the spirit of Ito and Iwaisako (1996) who argue that in a setup with asymmetric information, it matters how much banks are willing to finance projects that require acquisition of land or stocks. They support their argument with VAR results based on total bank loans to real estate and the aggregate real estate price index in Japan. They find that the bank loans to real estate leads the land price, while only current land price inflation helps explain the growth of bank loans.

The main contribution of this paper is in isolating the effect of bank credit on real estate prices, using an instrument for the supply of real estate loans. I am then able to apply the analysis to disaggregated data, which is also new to the best of my knowledge. This paper therefore contributes to the current policy debate on land price inflation and banks' role in fuelling real estate lending.

The rest of this paper is organized as follows. Section 2 tests whether the fall in keiretsu loans was a choice by firms or a choice by banks. Having determined that the evidence supports the former,

Section 3 comprises the core of the paper and assesses whether and to what extent bank credit has an effect on land prices. Section 4 concludes.

2 The Fall in Lending to Keiretsus: Firm or Bank Choice?

Japan liberalized its financial system in the 1980s. As part of this deregulation, firms reduced their borrowing from banks. The Hoshi and Kashyap (HK) hypothesis is that large and known firms substantially reduced their dependence on bank financing by issuing bonds during the 1980s (with the market substituting reputation for monitoring). Therefore it was a choice by firms to move away from banks. In contrast, the "good opportunities" hypothesis implies that banks chose to move away from keiretsu firms to a promising real estate sector.

In this section I briefly summarize existing evidence for the HK hypothesis, i.e. the idea that the development of the Japanese corporate bond market caused an exogenous fall in demand for bank loans, which then fuelled an increase in bank real estate lending (as shown in Figure 1). I then present new evidence consistent with the HK hypothesis using both bank-level and firm-level data.

2.1 Previous Literature on this Question

Hoshi and Kashyap articulate their view in several papers. For example, they draw several stylized facts from figures for bank debt as a percent of total assets for publicly traded Japanese firms from 1970 to 1997 (refer to HK, 2001). First, there was a large decrease among large firms, and particularly manufacturing firms. The ratio of bank debt to total assets for large manufacturing firms fell from 35 % in the 1970s to below 15 % by 1990. Second, firms that decreased their bank dependence primarily replaced it with bond financing. Third, the shift appears to have occurred relatively soon after they became eligible to do so.

In an earlier paper, HK (2000) test their view's implications for cross-bank differences. Those banks that relied more heavily on loans to customers who then obtained access to capital markets should have under-performed after deregulation. They test this using return on assets as a performance measure and find it to have been true. A recent paper by Hoshi (2001) carries out more extensive tests also using individual bank data. He tests the hypothesis in two steps. The first is a cross-section regression of a bank's bad loan ratio in 1998 on the change in the bank's proportion of loans to real estate from 1983 to 1990. He confirms that banks that increased their lending to real estate during the 1980s boom later ended up with higher non-performing loans. The second part relates more directly to the HK hypothesis. He estimates a 150 bank panel from 1984-90 with the change in a bank's real estate loan ratio regressed on lags in the change in keiretsu loan ratios, controlling for land prices and time

dummies. He finds that banks that experienced a larger decline in their keiretsu loan share subsequently increased their real estate loans. Although this offers support for the HK view, it does not rule out the "good opportunities" view.

It is better to look directly at firm data to distinguish between the two hypotheses and I will take this up in Section 2.2.3 below. Hoshi, Kashyap and Scharfstein (1993) tabulate the ratio of bank debt to total debt for those firms eligible and ineligible to issue bonds, respectively, from 1975 to 1992. For the 112 firms that were permitted to continuously issue convertible bonds from 1982 to 1989 the bank debt ratio is throughout lower and increasingly so compared to the remaining 424 firms in their sample. By 1992 only 30 % of the eligible firms' debt was bank debt compared to over 50% for the ineligible firms. The rest of the econometric analysis in their paper concerns the choice to issue conditioning on those firms eligible to do so. Therefore they do not specifically look at the time-series for a firm's choice before and after it becomes eligible. Hirota (1999) finds that regulation criteria on new equity issues influence a firm's leverage. Firms that are ineligible to issue are more highly leveraged than firms eligible to issue. The policy was similar to the bond issuance criteria and was a voluntary rule concerning equity issues, but enforced by the major securities companies and continued until 1996.

A paper by Weinstein and Yafeh (1998) emphasizes the holdup problem of firms by banks prior to liberalization. Using data on manufacturing firms, they find that while close bank-firm ties increase the availability of capital to borrowing firms, their cost of capital is higher. However, they find that much of the difference in capital use between affiliated and unaffiliated firms disappeared by 1981. They interpret this as evidence of the importance of the liberalization of the foreign exchange law in 1980.

Even if one were to agree with the finding that firms reduced their borrowing from banks in favor of public finance, it does not fully explain the shift of bank loans to real estate. What are the alternatives available to banks? Faced with a decrease in demand for bank loans from keiretsus, they could look for other loans, invest in government bonds, look for foreign opportunities, or choose to reduce deposit rates and shrink. These are all points that I will test in Section 2.2.2. I first briefly summarize what the existing literature has to say on these points.

Hoshi and Kashyap argue that the answer lies in the incomplete and skewed financial deregulation implemented gradually over two decades. One implication of the gradual deregulation was that households had limited savings options and continued to channel their funds to banks. When combined with interest rate controls to ensure profit margins and a policy of government deposit guarantees, banks attempted to make up through volume whatever decrease in margins they received on loans during the period of deregulation. The "convoy" system in Japan ensured that no bank was allowed to go bankrupt. Therefore the government assumed banks' credit risk. As the main bank system receded in importance, it was not effectively replaced with a proper regulatory alternative to evaluate and monitor risk-taking by banks. More details on the implications of deregulation are

highlighted in Appendix 2. Variations of this argument are also raised by Kitigawa and Kurosawa (1994), Nagajima and Taguchi (1995), Ito and Iwaisako (1996), Cargill, Hutchison and Ito (1997), Lincoln (1998), Hanazaki and Horiuchi (2000), and Tsuru (2001).

While the gradual deregulation combined with the government policy of limited liability can explain the fact that banks did not shrink as they lost their favored keiretsu customers, it still does not fully explain why banks predominantly shifted to real estate and not to other types of loans, government bonds or foreign opportunities. This is best left for the data to answer in Section 2.2.2 below, but I briefly summarize what the literature has to say on the question. Hoshi (2001) argues that because banks lacked close knowledge of new customers, they relied on collateralized loans. Land was considered the most secure collateral because its value had not fallen throughout the postwar period. Therefore a plausible explanation is that banks may (on average) have wrongly perceived low volatility in real estate. This view is echoed by Ueda (1994) who comments that banks strongly competed for loans to land and equity investment-related loans because credit analysis was considered relatively easy as it consisted of forecasting future land prices. Cargill, Hutchison and Ito (1997) also point out that loans to real estate and construction were extended on the expectation of future price increases.

It is interesting to discuss the actions of the Bank of Japan and the Ministry of Finance during the real estate boom. Ueda (1994) argues that although the Bank of Japan and the Ministry of Finance were concerned about the increase in land prices, they did not stop it because the general price level was stable and they were unable to perceive the collapse. Only in April 1990 did the Ministry of Finance and the Bank of Japan introduce quantitative controls and effectively capped bank lending to the real estate-related sector. Ito (2004) suggests that this action contributed to the end of the land bubble. This further adds to the evidence that it was a bank-led real estate boom as opposed to one led by real estate demand. No caps were placed on the ability of firms in real estate and construction to raise funds from capital markets and other sources.

2.2 New Empirical Tests on Firm or Bank Choice

2.2.1 Stylized Evidence

I now turn to presenting new evidence consistent with the HK hypothesis discussed above. I begin with firm survey data, which provides insight into the question of whether keiretsu firms chose to reduce bank financing or vice versa. The Central Bank of Japan conducts a quarterly survey of enterprises (disaggregated by sector and by size) with questions on short-term economic conditions, known as the Tankan survey. One of the questions pertains to their assessment of the lending attitudes

of financial institutions. Figure 2 shows the "diffusion" index for manufacturing and real estate & construction enterprises, respectively. A higher value of the index indicates that more firms perceived accommodative lending conditions. Since keiretsu firms are typically large manufacturing firms (e.g. Hoshi 2001), the index for the large manufacturing enterprises in addition to that for enterprises in construction and real estate is shown. If the "good opportunities" hypothesis were the correct one, then it would be expected that the index (or its difference) for real estate and construction firms to be higher than that for large manufacturing firms during the 1980s. This is not the case. In fact, during the first part of the 1980s when the share of bank loans to keiretsus declined from around 15% to 5% (Figure 1), large manufacturing enterprises reported increasingly accommodative lending attitudes in contrast to stable lending attitudes perceived by construction and real estate firms.

Table 1 presents evidence on the source of flow of funds to the real estate market based on data reported in Cargill, Hutchison and Ito (1997). Additional evidence on the financing of real estate firms will be presented in Section 2.2.3 based on firm-level data. If large real estate companies with the ability to borrow in the bond market were fuelling the boom, then bank lending would not be expected to be the dominant means of financing real estate investment. It turns out that banks accounted for the principal source of funds (59 out of 120 trillion yen total in June 1991 at the peak of the boom). Non-bank financial institutions accounted for another 50-55, insurance companies, credit unions and foreign banks accounted for 9.1, and only a residual of 2 came from the capital market. It is important to note that a significant share of non-bank financial institutions were the "jusen", which were specialized housing loan companies created as subsidiaries of banks in the 1970s. Therefore if we account for the indirect flow of funds from banks to real estate via non-banks, banks would account for the vast majority of the flow of funds to real estate (since 72 trillion yen is reported to be the flow of funds from banks to non-banks).

Another interesting comparison from Table 1 is that of foreign banks' behavior to that of Japanese banks. Table 1 reports that the flow of funds from foreign banks to real estate was 0.6 trillion yen compared to 59 trillion yen for domestic banks. However this needs to be normalized by a valid measure of the size of these institutions to compare their behavior. In Section 2.2.2 below, only domestic individual bank data is available. Foreign bank balance sheet data is available in aggregate form through the Bank of Japan[2] but it is sufficient for the purpose of this stylized comparison. I divide the flow of funds to real estate by the total assets of domestically licensed banks and foreign banks, respectively, as of end-June 1991. It turns out that the flow of funds to real estate as a share of banks' total assets was approximately 7.8% for domestically licensed banks in contrast to only 2.3% for

[2] Refer to the series "Principal Assets and Liabilities of Foreign Banks in Japan" and for comparison "Assets and Liabilities of Domestically Licensed Banks(Banking Accounts)(excluding trust subsidiaries and foreign trust banks, through September 1993" available from the Bank of Japan, http://www.boj.or.jp/en

foreign banks. Again, this does not support the "good opportunities" demand view, where we would expect foreign banks to behave similarly to domestic banks.

2.2.2 Bank-level Evidence

A more stringent test can be carried out with individual bank balance sheet and income statement data. If the HK hypothesis were correct, then those banks that lost keiretsu loans would then have excess funds. While under the alternative, banks would actively seek funds to lend to the promising real estate sector. For example if real estate loan demand caused the return on real estate loans to rise relative to keiretsu lending, banks would increase their share of real estate lending at the expense of lending to keiretsus. In this case, banks would be expected to increase their deposit rates (and quantities of borrowed funds) compared to other banks. Regression results are shown in Table 2. Data on 150 banks for the years 1983-90 is used and all regressions are panel fixed effects that include year dummies and two lags of prefectural land inflation, following Hoshi (2001). Sample summary statistics are shown in Table A1. Columns (1) through (3) are estimated with real estate loans to total loans (first difference) as the dependent.

Column (1) is a similar model to that shown in Table 9.1 in Hoshi (2001). Four lags of the keiretsu loan share (first difference) are included on the right hand side. The results are very significant indicating that those banks that lost more keiretsu loans subsequently increased their real estate lending. The estimates suggest that for a 0.01 annual decrease (over 4 years) in a bank's share of keiretsu loans to total loans, its lending to real estate increases by 0.0013. Column (2) includes four lags of the difference between loan and deposit rates to the model in column (1). Those banks that experienced falling margins subsequently increased their real estate lending, a point raised in the literature (e.g. Hoshi and Kashyap 2001; Nagajima and Taguchi 1995; Ueda 1994).

Column (3) provides one test for whether those banks that decreased their keiretsu loans and moved to real estate increased their deposit rates to obtain funds (and decreased their lending rates but there is a more severe selection problem with the lending side so I will not focus on it). If this were the case, it would support the "good opportunities" hypothesis. Therefore column (3) includes the interaction between the four lags of keiretsu loans with the contemporaneous change in deposit rate. Under the null of good opportunities, the coefficients will be negative. There is no support for this hypothesis.

Column (4) shows the estimates from a model with the deposit interest rate as the dependent variable. It is a more direct test than the previous column. On the right hand side are the four lags of the keiretsu loan shares. The results, which are very significant, indicate that those banks that lost keiretsu loans subsequently decreased their deposit rate relative to other banks, suggesting that they had excess funds. In contrast the null of "good opportunities" would predict that they would seek funds by

increasing their deposit rates. In short, the bank-level results do not support the hypothesis that there were good opportunities to be lent to in real estate that rationalized a bank shift away from keiretsus[3].

One potential criticism is that the results in Table 2 do not account for the different types of banks (although fixed effects are included and variables such as keiretsu loans are normalized by each bank's total loans). There may be institutional and size differences between city banks, long-term credit banks, trust banks, and regional banks that are not fully accounted for and the results may be generated by a subset of the banks. For example and as shown in the summary statistics in Table A1, city banks, followed by long-term and trust banks are the largest banks. To account for this possibility, I reran the basic regression in column (1) with dummies for the 5 different bank types (random effects had to be used instead of fixed effects because of the inclusion of bank-type dummies.) The relation between a bank's loss of keiretsu loans and increased lending to real estate is robust. In the interest of brevity, all the robustness checks discussed in the remainder of this section are available on the author's website[4]. I additionally reran the regression restricting to city banks, long-term and trust banks, and regional banks, respectively. The results do not appear to be driven by the larger city, long-term and trust banks, and in fact are stronger among the regional banks (although the degrees of freedom are reduced among the former because there are only 11 city banks and 10 long-term and trust banks.) Finally, I reran the regression separately by bank size, where big banks are defined as those belonging to the upper 85 percentile of the fraction of aggregate real bank assets over the period (23 banks), medium banks are defined as those in the 60 to 85 percentile (37) and small banks accounting for the remaining banks (90). Again the results appear robust to the different bank sizes[5].

To summarize the bank-level evidence so far, I have shown that there is no support for the hypothesis that there were "good opportunities" in the real estate sector. Banks that experienced a decrease in lending to keiretsus did not increase their deposit rates (and quantities of borrowed funds) compared to other banks. The evidence is consistent with the HK hypothesis, as these banks appear to have excess funds and did reduce their deposit rates in an attempt to shrink. However it remains to be answered whether they predominantly increased lending to the real estate market, whether they sought other loans, invested in government bonds, or looked for foreign opportunities.

To answer these questions, I begin by regressing the (change) in the amount of loans to small firms as a share of total loans on the same variables shown in column (1) of Table 2. There is mixed evidence on the sign of the keiretsu loan shares. Nonetheless the sum is negative, indicating that those

[3] Other results (available on author's website, http://www.aub.edu.lb/~nm32/) regressed quantity variables (such as the log first difference of total deposits and "borrowed money") on the four lags of the change in the keiretsu loan share as before. The results confirm that banks that lost keiretsu loans subsequently decreased their deposits as well.

[4] Refer to http://www.aub.edu.lb/~nm32/

[5] In fact, in a regression including the interaction of a bank's total assets with the (lagged) change in keiretsu loan share on the right-hand side, the estimates are insignificant except for the first lag with a positive coefficient. That is, the shift to real estate is stronger among the smaller banks that lost keiretsu loans.

banks that lost more keiretsu loans subsequently increased their lending to small firms. Another option available to banks is to increase their holdings of government bonds. I therefore replace the dependent variable with the change in government bonds in own account to total assets. Again the results are mixed but the sum is overall negative suggesting that those banks that lost keiretsu loans subsequently increased government bond holdings. However the result for both government bonds and lending to small firms is weaker than for real estate lending.

A third option available to a bank facing an exogenous fall in keiretsus' demand for bank loans is to look for foreign opportunities. Unfortunately, the Nikkei NEEDS dataset does not contain data on the amount of a bank's foreign loans or foreign investments. I therefore follow Hoshi (2001) in using the proportion of a bank's branches located overseas as a proxy measure. There is no statistical relationship between the loss of keiretsu loans and a subsequent increase in foreign activity.

Finally I regress loans to sectors other than real estate on the same right-hand side variables for additional robustness checks. The sectors are construction, non-bank financial institutions, agriculture forestry and fishing, individuals & others, local governments, mining, manufacturing, services, transportation & telecommunication, utilities, and wholesale & retail industries, respectively. In fact, only loans to real estate increase when keiretsu loans decrease. The results also confirm that keiretsu loans tended to be towards sectors with "large" firms such as manufacturing, transportation & telecommunication, utilities, and wholesale & retail industries. Loans to these sectors were significantly and positively related to the lags of keiretsu loans. In contrast, there was little or no effect on loans to agriculture forestry & fishing, individuals & others, local governments, mining, and service industries.

2.2.3 Firm-level Evidence

In this section I offer new evidence consistent with the HK hypothesis using firm-level data. It is best to directly examine whether it was a firm choice using firm-level accounting data from the Development Bank of Japan (DBJ) Corporate Finance Data Set on companies listed on the Tokyo, Osaka, and Nagoya stock exchanges[6]. An eligible-to-issue time-varying dummy was created based on the bond issuance criteria (BIC) reported in Table A3. Prior to 1976, there was rationing in the corporate bond market. Beginning in 1976, once a firm met the criteria, it could issue as many bonds as it chose. These criteria applied from October 1976-December 1990[7] for domestic secured

[6] Note that the data was cleaned up for duplicate accounting periods in a given year by taking the average and if there was a missed year by taking the average over the previous and the following year.

[7] For the period from May 1989 to December 1990, a firm with a BB rating or higher could issue bonds if its dividend per share was greater than 5 yen and its ordinary after-tax profit per share was greater than 7 yen, without it having to satisfy the other accounting criteria. Therefore the eligible-to-issue bonds dummy will be excessively conservative during the period from May 1989 to December 1990.

convertible bonds. Convertible bonds were the principle source of public debt financing throughout the 1980s and the criteria also applied to foreign issues of convertible bonds (see Hoshi 1996).

Table 3 reports the number of companies eligible to issue secured convertible bonds for each year from 1976 to 1990. The number steadily increased from a low of 65 companies in 1976 (22% of total listed) to 1374 by 1990 (72% of total listed). Figure 3 plots the average ratio of a firm's bank debt to total bank and bond debt according to whether a firm was fully eligible to issue throughout 1982-1989, eligible for part of the period, or ineligible to issue during 1982-1989. In 1975, both eligible and ineligible firms had a bank debt ratio of approximately 89%. By 1982, this ratio was 68.6% for eligible firms and remained 88.8% for ineligible firms. By 1989, the ratio was 42.6% for eligible firms and 75.7% for ineligible firms. Therefore it appears that firms that became eligible to issue bonds greatly reduced their dependence on bank debt.

More formal results are reported in Table 4, column (1). The dependent variable is the bank debt to total debt for a firm. The estimation is an unbalanced panel fixed effects from 1977 to 1991 for 1291 companies. The ratio of bank debt is regressed on the first lag of the eligible-to-issue dummy and year dummies. The eligibility dummy is significant at the 1% level and suggests that when a firm becomes eligible to issue, its bank debt initially falls by 7 percentage points compared to ineligible firms. Column (2) controls for other variables that a priori may be thought to affect the bank debt ratio such as firm accounting variables (such as leverage, collateral, total assets and all the separate accounting variables used to determine bond issuance eligibility) as well as land inflation in the firm's prefecture. The latter is included to control for the possibility that high land inflation may be a measure of good opportunities in the real estate sector. If so, then firms located in that prefecture would experience a fall in their bank debt if their banks shifted towards the real estate sector. The coefficient remains significant at the 1% level, although it is reduced to 5 percentage points.

Evidence from the DBJ database is also consistent with the figures reported in Table 1 on the flow of funds to the real estate market. Table 5 reports the ratio of a firm's bank debt to total debt for firms in the real estate, real estate & construction, and the manufacturing sector as a comparison. The share of bank debt in 1976 is around 94% for real estate firms and 89% for manufacturing firms. By 1986, the share had declined to 59% for manufacturing firms but only to 85% for real estate firms. Even by 1990 and at the peak of the boom, the major part of the debt of real estate firms was owed to banks (73% and even 66% among the subset of real estate firms fully eligible to issue bonds throughout the 1982-89 period). Therefore it is not possible to make the case that large real estate companies with the ability to borrow in the bond market were fuelling the boom. Bank lending remained the dominant means of financing real estate investment during the 1980s even for relatively large companies. The DBJ database is composed of large companies because they are listed on Japan's major stock

exchanges. The results would be even more pronounced if data were available on financing of smaller real estate companies.

Combining this evidence from the firm side with the bank-level evidence as well as the illustrative evidence and previous literature supports using changes in keiretsu loans as a valid and exogenous shock to analyze the effect of bank credit on land prices. There is no support for the "good opportunities" view of the real estate market that may have created a higher threshold return for banks to lend and decrease their lending to keiretsus. There is no evidence that it was an increase in real estate demand that caused real estate lending to rise. Furthermore, the bank-level evidence shows that those banks that lost their keiretsu customers had excess funds. While they did begin to shrink and pursue other alternatives, their principal substitute was to increase lending to real estate. Therefore the results indicate that the development of the Japanese corporate bond market caused an exogenous fall in demand for bank loans, which then fuelled an increase in bank real estate lending.

3 Shocks to the Supply of Bank Credit: Is There an Effect on Land Prices?

The analysis in Section 2 confirmed that I have an instrument for the supply of real estate loans. This section uses bank loans to keiretsu firms to determine the extent of the effect, if any, of bank credit on asset prices. The Japanese real estate boom during the 1980s provides a unique episode to study this question. Taking advantage of the cross-sectional and time-series variation in Japan's 47 prefectures, this section analyzes the effect of bank credit on land prices.

I begin by briefly reviewing the theory for potential causality of bank credit to asset prices raised in the introduction. In the presence of credit constraints, credit limits are affected by the price of assets used as collateral for loans. However it also matters how much banks are willing to finance projects which require the acquisition of assets. Asset prices can therefore be positively affected by slackened credit limits and increasing available liquidity.

3.1 Empirical Estimation

Data on 150 banks' balance sheets was compiled from the Nikkei NEEDS database. This data was previously used in section 2.2.2 when testing for bank choice against firm choice. The variables of interest in this section include loans disaggregated by sector (e.g. real estate), loans to keiretsu and listed firms, and the location of a bank's headquarters. The individual bank data is then aggregated by prefecture. Refer to Table A2 for sample summary statistics. The maximum sample of the data is from

1976 to 1998. However the effective sample is from 1981 to 1993 because prefecture land prices are available beginning in 1980 and keiretsu loan numbers end in 1993. This is not very constraining because the 1981 to 1993 period is the one of interest to study the real estate boom.

The land price data is available from the annual prefectural land price survey for the 47 prefectures, conducted by the Ministry of Land, Infrastructure and Transport and reported in the Japan Statistical Yearbook. Figure 4 shows land price inflation figures. In Figure 4a, countrywide and the largest 6 city averages are presented (based on semi-annual data from the Japan Real Estate Institute). It is interesting that the country average lagged the increase in land prices in the 6 largest cities. Both series lag the stock market (Nikkei index) that collapsed in 1990 compared to 1992 for land prices. Figure 4b presents prefecture-specific data from the annual July land price survey. Shown are inflation rates for Tokyo, Osaka (the two largest cities) along with rates for Hokkaido and Okinawa (two prefectures geographically at opposite ends of Japan). There is considerable variation across prefectures, which is also confirmed by the summary statistics in Table A2. The inflation rate peaked in Tokyo in the mid-1980s compared to the early 1990s for Okinawa. The annual average real land price inflation over the period 1983 to 1993 is 6.4% Japan-wide, 10.8% for Tokyo, and 11.1% for Osaka.

Finally, data on prefectural demand conditions is obtained from the Japan Statistical Yearbook (various annual issues)[8]. Among the series available are population, job openings and applications, income per capita and so on. These are used to control for demand conditions that may also affect land prices.

In order to explain the Japanese real estate boom, the empirical estimation slices the data in two ways. The first view is to determine if prefectures where banks lost the most keiretsu loans as a share of total loans had the largest increase in land prices. This takes advantage of the cross-sectional variation. The second view is to determine if the timing of keiretsu losses coincides with the subsequent increase in a prefecture's land prices. This takes advantage of the time-series variation in the data. It is worth pointing out that even if bank loans are not limited to the prefecture the bank is headquartered in (and they are not), this would go against finding an effect on prefecture land prices[9].

The cross-sectional regression takes the 1991-81 long difference in the variables across the 47 prefectures,

[8] I would like to acknowledge Mr Akihiko Ito from the Japan Statistical Association who sent me some data missing from the Japan Statistical Yearbook.

[9] Therefore the fact that an effect of bank credit on land prices is later found suggests that the true effect coming from bank loan supplies is stronger. These results are consistent with previous literature, which has found that banks tend to loan to companies located close to them (see Petersen and Rajan 2002). Among their findings is that banks are closer than other lenders (even accounting for the fact that firms may have deposits with them.) They suggest that banks are physically close lenders because the nature of the lending functions they perform is different.

$$\Delta \ln(\text{real land price}_{\text{i,1991-81}}) = \alpha_i + \beta \Delta\left(\frac{\text{keiretsu}}{\text{total loans}}\right)_{i,1991-81} + \gamma X_{i,1991-81} + \varepsilon_i \quad , \qquad (1)$$

where i indexes a prefecture, t indexes a year, and X are demand controls. In addition, land inflation is regressed on the variable of interest, the change in real estate loans, $\Delta\left(\frac{\text{real estate loans}}{\text{total loans}}\right)_{i,1991-81}$, where the latter is instrumented with $\Delta\left(\frac{\text{keiretsu}}{\text{total loans}}\right)_{i,1991-81}$.

The time-series 1981-1993 empirical estimation takes the fixed effects panel form,

$$\Delta \ln(\text{real land price}_{\text{i, t}}) = \alpha_i + \sum_{j=0}^{4} \beta_j \Delta\left(\frac{\text{keiretsu}}{\text{total loans}}\right)_{i,t-j} + \text{year dummies} + \gamma X_{i,t} + \varepsilon_{i,t} \quad , \qquad (2)$$

$$\Delta \ln(\text{real land price}_{\text{i, t}}) = \alpha_i + \beta \Delta\left(\frac{\text{real estate loans}}{\text{total loans}}\right)_{i,t} + \text{year dummies} + \gamma X_{i,t} + \varepsilon_{i,t} \quad , \qquad (3)$$

where i indexes a prefecture, t indexes a year, X are demand controls, and $\Delta\left(\frac{\text{real estate loans}}{\text{total loans}}\right)_{i,t}$ is instrumented with $\Delta\left(\frac{\text{keiretsu}}{\text{total loans}}\right)_{i,t}$ and its four lags[10].

3.2 Results

Table 6 reports the results of the cross-section regression, equation 1. The results are very significant and imply that those prefectures that experienced a loss in keiretsu loans during the 1980s also experienced higher land inflation during that period. For a 0.01 decrease in the share of keiretsu loans to total loans in a prefecture, land inflation increases by 4.7% (column (1)), which is significant at the 1% level. Note that the average share of keiretsu loans is 0.06 during the estimated sample. In column (3) are the IV results when instrumenting for the real estate loan share with the keiretsu loan share.

[10] Note that the variables for keiretsu loans and real estate loans are taken as a proportion of total loans. This is the approach taken by Hoshi (2001). The advantage compared to using growth rates is that the latter can exaggerate the importance of keiretsu loans if a bank starts from a low level. However, the criticism that the captured significant effect of keiretsu loans on real estate loans may stem directly from the construction of the variables is not the case. First, the "total loans" measure used to normalize real estate loans come from summing the 12 components of reported sectoral loans. In contrast, the "total loans" used for keiretsus comes from the total loans measure in a bank's balance sheet. More importantly, no mechanical relation was found when robustness checks were done on other sectoral loans regressed on the keiretsu loans. In fact and as discussed in Section 2.2.2, only loans to real estate increase when keiretsu loans decrease.

The estimate is 20.3% and is significant at the 1% level. This suggests that prefectures whose banks experienced a larger loss in their proportion of keiretsu loans experienced a larger increase in real estate lending which fuelled land inflation[11]. Column (5) repeats the analysis but for "risky" loans instead of real estate loans. Risky loans are defined as the sum of real estate, construction, and non-bank financial institution loans, which were used to proxy for risky loans by Hoshi (2001). As discussed in Section 2.2.1, a large part of non-bank financial institutions were the "jusen", which were housing loan subsidiaries of banks. Similar results are obtained: a 0.01 increase in the instrumented share of risky loans leads to 14.2% higher prefectural land inflation over the period.

It is interesting to contrast the OLS results to the IV results. Column (2) presents the regression of prefectural land inflation on a prefecture's difference in real estate loan share over the 1981-91 period. Because the latter is not instrumented, the estimate of 11.5% higher inflation should be interpreted as a correlation. It is interesting that IV estimation results in almost twice the magnitude with 20.3%. A similar result is found with risky loans. The OLS coefficient is 4.5% compared to the IV coefficient of 14.2%. That the coefficient is larger when using IV underlies the significance of keiretsu loans in identifying real estate lending and the latter's independent effect on land prices. One possibility is that a higher land price also reduces demand for land, which is standard if we ignore the positive effect on net worth coming from the relaxation of credit constraints. This biases the OLS coefficient downwards. Another possibility is that a higher land price increases people's expectation of future increases in land prices (especially in a speculative setting). This leads to an increase in supply of land and construction and mitigates the OLS estimate.

Columns (6) through (8) report robustness results by including long differences of variables to control for demographic and economic differences across prefectures (such as job openings to applications, growth in income per capita, the growth in population, unemployment rate, and CPI excluding rent). The (instrumented) real estate loan share remains significant at the 1% level but is reduced in magnitude from 20.3% to 14.9% higher inflation. Similarly, the coefficient on the risky loan share is reduced but not by much to 13.5%. Apart from a prefecture's population and its job openings to applications ratio, the remaining macroeconomic controls are insignificant. This may be on account of the limited degrees of freedom and potential multicollinearity. Another explanation may be that demand factors were not very responsible for the large increase in land inflation over the period. Hutchison (1994) finds that aggregate demand disturbances were responsible for only a small part of the variation in land prices. To summarize, prefectures whose banks lost keiretsu loans increased their real estate loans (and risky loans more generally). This resulted in 14-20% higher land inflation over the

[11] The regressions were also estimated excluding the Tokyo and Osaka prefectures. This is to counter the criticism that the coefficients might simply be capturing that the two largest prefectures had high land inflation rates (for some other reason) coupled with a larger share of loans to keiretsu firms. However, the results remain significant.

1981-1991 period for a 0.01 increase in a prefecture's instrumented real estate bank loans as a share of total bank loans.

Table 7 reports the results of the within regressions that take advantage of the time-series variation over the period from 1981-1993, equations 2 and 3. The first column reports the simplest regression of the log difference in real prefectural land price regressed on the (first difference of) the keiretsu loan share and its 4 lags, accounting for prefecture fixed effects. The results are very significant and imply that a 0.01 annual decrease (over 5 years) in the share of keiretsu loans to total loans leads to a subsequent 10% increase in a prefecture's land inflation. Column (2) includes year dummies and the significance and magnitude of the keiretsu loan loss is reduced yet remains considerable and causes a 6% increase in land inflation.

Column (3) reports the estimates for equation <ref>eq2</ref> using the uninstrumented real estate loan share. The results confirm the correlation between the increase in land prices and real estate loans (3.3% higher inflation). Column (4) instruments the contemporaneous real estate loan share with the keiretsu loan share and its 4 lags. The coefficient on the real estate loans is much larger and coincides with 27% higher land inflation in a prefecture. However the result is significant only at the 13% level[12]. Columns (5) and (6) repeat the analysis for risky loans. Here a 0.01 increase in the instrumented risky loan share coincides with a 9.5% higher land inflation rate and is significant at the 10% level[13].

Finally, demand controls are included in the regressions reported in columns (7) through (12). As in the cross-section regressions, prefecture-level controls are included (job openings to applications, growth in income per capita, the growth in population, unemployment rate, CPI excluding rent, as well as the second lags of house rent and the ratio of rent to residential land price). Also included are Japan-wide macro controls (changes in unemployment rate, stock market, and population.). Many of these variables enter with the expected sign. For example, a larger growth in a prefecture's population contributes to higher land inflation. A prefecture experiencing an increase in its job openings to applications ratio also has higher land inflation etc. What is important though is that the loss in keiretsu loans are robust in significance, a 0.01 annual decrease in the share (over 5 years) contributes to approximately 6% higher land inflation. Note that this estimate is similar to that found in column (2) which only included year dummies. Also the result is similar whether we look at column (7) or (8). Column (7) reports a random effects model because some of the prefecture controls are time-independent and therefore do not allow for fixed effects. Also omitted are the year dummies because the Japan-level controls are time-varying.

[12] It is worth mentioning that the Hausman test for all these models favors random effects over fixed effects (for example the Chi-squared value is 0.27 for the model in column (4)). Random effects is more efficient and the coefficient is estimated to be 18.6 and significant at the 1.2% level. However, fixed effects are reported for ease of understanding the time dimension of the keiretsu shock.

[13] Again the random effects model is favored and results in an almost identical coefficient estimate of 9.3, which is significant at the 1% level.

Columns (9) and (10) reestimate the IV regression for real estate loans reported in column (4) but now with demand controls. The magnitude is reduced from before to 15.7-17.3% higher inflation. The coefficient of 17.3% from the fixed effects model is now not significant (in column (4) it was only at the 13% level). Nonetheless the associated random effects model coefficient is 20.9% and significant at the 5% level (the Hausman test chi-squared is 1.26 favoring the random effects model). Finally columns (11) and (12) reestimate the IV regression reported in column (6) for instrumented risky loans with demand controls. The coefficient of 7.9% from the fixed effect model is only significant at the 16% level, while the random effects coefficient on the same model is 9.5% (similar to that reported in column (6)) and significant at the 1.3% level.

What can therefore be learned from the panel regressions is that the timing of the keiretsu losses coincides with the subsequent increase in land prices in a prefecture during the period from 1981 to 1993. A 0.01 instrumented increase in a prefecture's real estate loan share corresponds to a 15%-27% higher land inflation rate (and is particularly significant for the Hausman preferred random effects model). More generally, a 0.01 instrumented increase in a prefecture's risky loan share (loans to real estate, construction and non-bank financial institutions) leads to a 6%-9.5% higher land inflation rate.

To get a better sense of how large the implied effect is, it is worth comparing estimates with actual figures for Japan during the period from 1983 to 1993. The average over Japan's 47 prefectures of the share of keiretsu loans was 0.06, of real estates loans was 0.08, and of "risky" loans was 0.21. As for changes in these shares, the average for keiretsu loans was -0.002, for real estate loans was 0.002, and "risky" loans was 0.007. At the same time, the average (real) land inflation rate in Japan was 0.064 (6.4%). A simple calculation combining the coefficient estimates from model 7.3 (i.e. the one reported in Table 7, column (3)) and these average figures, implies that the average increase in real estate loans of 0.002 would lead to inflation increase of 0.008. But this model is not appropriate because it does not instrument for real estate lending with keiretsu loans. When using the IV coefficients from model 7.4, the implied inflation rate coming from real estate lending is 0.0618, almost identical to the actual figure in Japan. A similar figure of 0.0617 is derived from risky lending from Model 7.6. Looking specifically at Tokyo, where the average actual inflation rate was 0.108, the implied rate from model 7.4 is higher at 0.166. Overall these results suggest a large but not unrealistic effect of bank credit on land prices.

Figure 5 shows the time-variation in the Japan-wide average land inflation rate and the predicted rates based on the uninstrumented real estate loans (model 7.3) and on the instrumented real estate loans (model 7.4). As calculated above, the average land inflation over the time period 1983-1993 predicted by the instrumented real estate loans regression is similar to the actual one. What is interesting is to look specifically at the time series and to note the ability of the exogenous real estate lending by banks to predict well the actual land inflation rate (this is also the case for risky loans). The predicted component tends to lead the actual rate during the 1980s boom. As expected by the

underlying hypothesis, this shock was most relevant during the mid to late 1980s. Note that the predicted land inflation coming from the uninstrumented real estate lending does not do a good job at capturing the actual path of land inflation. Its effect is small.

In short, the analysis has shown that shocks to the supply of credit fuel land prices. The effect is considerably but not unrealistically large. The main result can be seen in two slices of the data. First, prefectures whose banks lost keiretsu loans increased their real estate loans and this led to 14-20% significantly higher land inflation compared to other prefectures (for a 0.01 increase in a prefecture's instrumented real estate bank loans as a share of total bank loans). Second, the timing of the keiretsu loan loss coincides with the increase in land prices at the prefecture level.

4 Conclusion

The history of the Japanese financial system runs contrary to popular opinion about its uniqueness in its emphasis on banks. This has been a relatively recent phenomenon. The history of the system evolved as an outcome of regulatory changes which in turn were endogenous to macroeconomic shocks. Among the more important shocks to the Japanese economy were World War II and the oil shocks in the 1970s (see Hoshi and Kashyap 2001). It is interesting that from the Meiji restoration to the 1930s, firms (including MSEs) received most of their funding through the capital market in the form of bonds and stocks. For example, this share reached 70% in 1935 (Ueda 1994). The government's motivation to restrict competition was a result of the 1930s and war. It was at this time that the government took control of the allocation of credit and used the banks to implement its preference towards funding the military. During the Japanese miracle period from the 1950s to the early 1970s, the government's priority shifted away from military to industry. As a result, the system did not revert to the prewar emphasis on capital markets. The savings restrictions on households guaranteed the flow of funds to the banks which in turn channeled them to large industrial companies -- mostly keiretsus.

Japan liberalized its financial system in the 1980s. As part of this deregulation, large and known firms reduced their borrowing from banks. In the first part of this paper I test the Hoshi and Kashyap hypothesis, i.e. the idea that the development of the Japanese corporate bond market caused an exogenous fall in demand for bank loans, which then fuelled an increase in bank real estate lending. I find evidence consistent with the HK hypothesis using firm-level and bank-level data. There is no support for the alternative "good opportunities" hypothesis, which is that real estate had (or was perceived to have) good opportunities, rationalizing a shift of bank lending towards the real estate sector during the 1980s. There is no evidence that it was an increase in real estate demand that caused real estate lending to rise. Therefore it was a choice by keiretsu firms to move away from banks. One

question remains however and it is why did banks shift their lending to real estate? Faced with a decrease in demand for bank loans from keiretsus, they could look for other types of loans, invest in government bonds, look for foreign opportunities, or choose to reduce deposit rates and shrink. I evaluate each of these competing alternatives and find none to be a major explanation. While banks that lost their keiretsu customers had excess funds, did begin to shrink and pursue other alternatives, their principal substitute was to increase lending to real estate. Hoshi and Kashyap (2001) argue that this is on account of the incomplete and slow financial deregulation that ensured that household savings continued to be directed to banks at the same time as a policy of interest rate controls was maintained and government assumed banks' credit risk. Ueda (1994) contends that banks actively competed for real estate-related loans because credit analysis was considered easy as it consisted of forecasting future land prices. The latter had not fallen throughout the postwar period suggesting that banks wrongly perceived low volatility in real estate.

Therefore the HK hypothesis can be applied to help answer the question motivating this paper. What is the effect, if any, of bank credit on asset prices? The Japanese real estate boom during the 1980s provides the appropriate setting and some answers to this ongoing debate. I use a bank's keiretsu loan loss as an instrument for the supply of real estate loans. First, in the beginning of the paper this shock is shown to be exogenous and not a result of movements in land prices and demand. Second, it is highly correlated with banks' subsequent lending shift to real estate. Taking advantage of both the cross-sectional and time-series variation in Japan's 47 prefectures' land prices, this paper explains the Japanese real estate boom. Shocks to the supply of bank credit fuel land prices. First, a 0.01 increase in a prefecture's instrumented real estate loans as a share of total loans causes 14-20% higher land inflation over the 1981-1991 period. Second, the timing of keiretsu loan losses coincides with subsequent land inflation in a prefecture. For example, from 1983 to 1993 the average predicted land price inflation coming from IV real estate lending is close to the Japan-wide average land price inflation during this period of 6.4 percent annually.

That the supply of credit can have such a large impact on asset prices has implications for both monetary policy and regulatory policy. If there were no imperfections in credit markets, banks' willingness to offer loans would have no impact on asset prices. But in the presence of credit constraints and in the short run, a shock like incomplete financial deregulation can amplify its effect on asset prices. This can be true even if financial liberalization eases credit market imperfections in the long run. I elaborate on this point in Appendix 1, which is based on an extension of the Kiyotaki and Moore (1997) model. The idea behind this paper can be captured by shocks to lending limits, not originating in shocks to productivity as in the original Kiyotaki and Moore framework. Because durable assets play a dual role: they are both factors of production and collateral for loans, credit limits are

affected by the price of these assets[14]. However, allowing for shocks to lending implies that asset prices (and asset holdings) are also affected by shocks to credit limits. It therefore matters for asset valuations how willing banks are to finance projects which involve the purchase of assets such as land. A credit cycle is created when banks ease binding credit limits independent of firms' net worth, allowing them to borrow more, invest more in the asset and in the process increase the price of the asset.

The main contribution of this paper is in identifying the role of bank credit in fuelling real estate prices, using an instrument for the supply of real estate loans. I am then able to apply the analysis to disaggregated data, which is also new to the best of my knowledge. Ito and Iwaisako (1996) find a role for bank loans in explaining land price inflation, but their analysis is on aggregate data using a VAR approach. More recently and in a paper on bank lending and property prices in Hong Kong using aggregate data, Gerlach and Peng (2005) find instead that the direction of influence goes from property prices and demand to bank credit. A paper by Peek and Rosengren (2000) that studied an exogenous (originating in Japan) negative loan supply shock's effect on 3 US states is closest to mine. They find that the real decline in Japanese bank lending contributed to a substantial decline in new construction projects in the US.

What lessons for monetary and regulatory policy are to be drawn? As mentioned earlier and if credit markets were perfect, then there would be no effect of bank credit on real asset prices. The latter would only depend on the discounted flow of future income deriving from the asset. In reality however, credit markets are imperfect and even a move towards financial liberalization can in the short run amplify the effect of credit on asset prices. This is especially true in the case of Japan that underwent incomplete and slow financial deregulation over two decades. The resulting "over-banking" problem (as dubbed by Hoshi and Kashyap) that has characterized the Japanese banking system is gradually being resolved as banks begin to merge and shrink. If the process of liberalization had been more complete and faster, the wrong incentives would not have materialized to cause banks to shift lending disproportionately to real estate. Ito (2004) calls for the supervisory regime to have been strengthened in Japan in the 1980s to ensure stricter prudential guidelines (on real estate lending) when the regulatory regime began to allow for more competition. With the benefit of hindsight, such a move can be well justified. That said, central banks continue to struggle with appropriate policy when there is asset price inflation and little goods inflation. More research is needed but the results of this paper suggest that banks can actively contribute to asset inflation.

[14] It is for this reason that a positive productivity shock causes the constrained borrowers to demand more credit and invest more. In contrast, the first-best allocation is not affected and the only outcome is that agents increase their consumption.

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Appendix 1

Extending the Kiyotaki and Moore Framework: Shocks to Lending Limits

The Kiyotaki and Moore Model

It is possible to analyze the effect of shocks to bank credit in the credit cycles framework presented in Kiyotaki and Moore (1997), hereafter KM[15]. They impose a Hart-Moore limited commitment condition. Therefore "farmers" ("gatherers" are the unconstrained other group) face an endogenous credit limit given by :

$$Rb_t \leq q_{t+1}k_t, \qquad (4)$$

where q is the relative price of land to traded "fruit", R is the gross interest rate, b is debt, and k is the asset (landholdings) . This constraint will bind in equilibrium and farmers will borrow up to the limit. It can be shown that farmers' aggregate landholdings and borrowing will equal, respectively:

$$K_t = \frac{1}{q_t - \frac{1}{R}q_{t+1}}\left[(a + q_t)K_{t-1} - RB_{t-1}\right] \quad , \qquad (5)$$

$$B_t = \frac{1}{R}q_{t+1}K_t \quad , \qquad (6)$$

where the term in square brackets of the land equation is the farmers' net worth and the term in the denominator is the user cost of holding land (u), the gap between the purchase price of land and the amount that a farmer can borrow against each unit of land. Shocks to productivity in KM are captured by shocks to a.

The farmers' landholdings equation implies there will be an upward sloping demand for capital. For example, if present and future land prices, q_t and q_{t+1}, increase by 1 % (implying that u_t also increases by 1 %), then farmers' demand for K_t would also increase (conditional on $R B_{t-1} > a K_{t-1}$). The intuition is that farmers' net worth is increasing more than proportionately with q_t because of the leverage effect of outstanding debt.

The aggregate productivity will be endogenous in such a credit-constrained economy. KM focus on shocks to productivity affecting credit-constrained farmers' net worth, which lead to shocks to their

[15] Among the empirical support for the KM view is a recent paper by Gelos and Werner (2002) which studies the effect of financial deregulation in Mexico on firm investment. They find that cash flow is correlated with investment and that the value of a firm's real estate has a large effect on investment. After liberalization in 1989, real estate as collateral has become even more important in Mexico.

asset demand leading to shocks to asset prices that in turn affect the amount of lending to these firms. Linearizing around the steady state[16], it can be shown that for a temporary increase in productivity by Δa at time t:

$$\hat{q}_t \cong \frac{1}{\eta}\Delta \quad , \tag{7}$$

$$\hat{K}_t \cong \frac{1}{1+\frac{1}{\eta}}\left(1+\frac{R}{R-1}\frac{1}{\eta}\right)\Delta \quad , \tag{8}$$

where $\eta>0$ is the elasticity of the residual supply of land to the farmers with respect to the user cost at the steady state. If $\eta=0$ there is an inelastic supply and the shock does not persist into the future. The dynamic interaction between credit limits and asset prices can be important in amplifying the initial shock. The multiplier in the $\hat{K}_t$ equation is greater than one. If there were no dynamic multiplier (suppose that q_{t+1} was artificially pegged at q^*), the effect from the static multiplier will be smaller:

$$\hat{q}_t \cong \frac{R-1}{R}\frac{1}{\eta}\Delta \quad , \tag{9}$$

$$\hat{K}_t \cong \Delta \quad . \tag{10}$$

Shocks to Lending Limits

The spirit of this paper can be captured by shocks to lending limits, not originating in shocks to productivity as in KM. This view is also highlighted by Ito and Iwaisako (1996). Using aggregate Japanese data they find that, first, the aggregate growth of bank loans to real estate has high explanatory power for land returns (in a VAR framework). Second, they find comovement between stock and land prices, with stock returns leading land returns empirically. Finally, they suggest that it was an irrational bubble, though the initial shock may have been a shock to fundamentals. They suggest a hypothesis that emphasizes the KM relationship between the collateral value of land and the cash flow of credit-constrained firms but where the KM productivity shock is not the full story. Because of liquidity constraints, it matters how much banks are also willing to finance projects that require the acquisition of land.

One way to capture such a shock is mentioned in KM. If the economy experiences an unanticipated one-time reduction in the value of its debt obligations at time t such that:

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[16] define $\hat{X} = \frac{X_t - X^*}{X^*}$.

$$E[RB_t] = E[q_{t+1}K_t] = q^*K^*, \tag{11}$$

$$\text{but actual } RB_t = \left[1 - \Delta\frac{R-1}{R}\right]q^*K^*, \tag{12}$$

then the results will be the same for $\hat{q}_t$ and $\hat{K}_t$ as before. Intuitively, a reduction in the value of their debt obligations of only (R-1)/R percent is needed to have the same effect as a one percent productivity shock because farmers' outstanding debt to tradable output in steady state is equal to $RB^*/aK^* = R/(R-1)$.

An alternative shock can be an ex ante shock to borrowing limits. Suppose there is a one-time shock to collaterizable land at time t so that:

$$RB_t = (q_{t+1} + \Delta)k_t, \tag{13}$$

where I have assumed that the borrowing constraint continues to bind. Therefore the path of K will be:

$$K_t = \frac{1}{q_t - \frac{q_{t+1}+\Delta}{R}}\left[a + q_t - q^*\right]K^*, \tag{14}$$

$$K_{t+1} = \frac{1}{q_{t+1} - \frac{q_{t+2}}{R}}[a - \Delta]K_t, \tag{15}$$

$$K_{t+s} = \frac{1}{q_{t+s} - \frac{q_{t+s+1}}{R}}aK_{t+s-1}, \quad \text{for } s \geq 2. \tag{16}$$

The dynamics are more complicated. Suppose the static multiplier is isolated. This implies that:

$$\hat{q}_t \cong \frac{R-1}{R}\frac{1}{\eta}\left(\frac{1}{aR-\Delta}\right)\Delta \quad , \tag{17}$$

$$\hat{K}_t \cong \frac{1}{aR-\Delta}\Delta \quad , \tag{18}$$

which is similar to the static result above except for the term $1/(aR - \Delta)$. Therefore $\hat{q}_t$ and $\hat{K}_t$ are no longer unambiguously positive for a positive shock Δ. This is because a one-time shock to borrowing limits implies that the debt repayment will be higher in the following period. For there to be a positive

effect on land prices and landholdings, it must be that a $>\Delta/R$ or the marginal product of farmers' land (the tradable part of output) exceed the additional debt taken at time t for each unit of land.

Simulations

To get a sense of the order of magnitude of the various shocks, consider a 1 percent increase in productivity in period t, $\Delta=0.01$. I use the same parameter values employed by KM when they simulate a more complicated quarterly model: $R=1.01$ (a 4 percent annual interest rate), $a=1$ (normalization), and $\eta=0.1$.

Allowing for dynamic effects implies that on impact, the land price increases by 10 percent and landholdings by 92 percent. While these are very large magnitudes, there is almost no persistence and the peak is on impact. After a quarter, the land price increase is only 0.9 percent and landholdings increase 8 percent. After two quarters, the land price increase is only 0.08 percent and landholdings increase 0.7 percent. With a land elasticity of 100 percent, $\eta=1$, there will be a more persistent effect on landholdings (period t, t+1, t+2: 51 %, 26 %, and 13 % respectively) and a reduced effect on land prices (period t, t+1, t+2: 1 %, 0.5 %, and 0.25 %). If the static effect is isolated, land prices increase by only 0.1 percent (compared to 10 percent with dynamics) and landholdings increase by only 1 percent. This confirms that the dynamic multiplier accounts for the large increase at impact.

If this shock is interpreted as a one-time reduction in the value of debt obligations, then it will only need to decrease by $\Delta(R-1)/R=0.01$ percent. The resulting effect will be identical to a 1 percent increase in productivity, because of the leverage effect discussed above. As interest rates in the economy fall, then the debt reduction necessary to obtain the same effect on land prices and landholdings will be even smaller.

If the shock is to borrowing limits, so that at time t farmers take on additional debt of 1 percent, then the static effect will be the same as the static multiplier for an increase in productivity of 1 percent. This is because the parameters are such that the extra term has no effect, $1/(aR-\Delta)=1$. So that allowing for additional debt of 1 percent implies that land prices increase by 0.1 percent. What is different from the productivity shock is that allowing for dynamics does not change the initial impact much and the later dynamics are close to zero and negative. This is on account of the one-time nature of the shock because the debt has to be repaid in the following period.

All these simulations result in a large (too large) effect at the time of the shock and very little persistence. Therefore to obtain persistent cycles and decrease the contemporaneous response, KM impose two additional assumptions. First, they introduce a reproducible and depreciating asset (trees) which reduces the leverage effect and makes investment positive, reinforcing persistence. Second, they introduce lumpy investment which causes further persistence and can lead to endogenous cycles

because it uncouples farmers' aggregate borrowing from their aggregate landholdings. In such a model, they find that a one percent increase in productivity (and setting some additional parameters for investment and lumpiness) implies that the land price increases by 0.37 %, landholdings by 0.1 %, and debt by 0.13 % at time t. The land price increase reaches a maximum at impact, compared to landholdings and debt which peak after seven quarters at 0.37 % and 0.55 % respectively.

In short, in the KM model durable assets play a dual role: they are factors of production, but are also used as collateral for loans, so that credit limits are affected by the price of these assets. I have also shown that allowing for shocks to lending implies that asset prices (and asset holdings) are affected by shocks to credit limits.

Appendix 2

Financial Regulation and Deregulation in Japan

Banks and Households

The Japanese economy was characterized by interest rate controls (TIRAL), which were effective from 1947 until 1992. While these were controls on deposit rates, they were accompanied by loan rate restrictions to ensure that long-term credit banks earned profits. Certain implications of interest rate controls on banks' profitability have been highlighted by Hoshi and Kashyap (2001) and Kitagawa and Kurosawa (1994). Hoshi and Kashyap argue that the increase in fraction of assets lent out by banks reflects their attempting to make up through volume the reduction in margins they received on loans during the period of deregulation. Kitagawa and Kurosawa echo this view that the objective of banks was not profit but scale. However they also suggest that the two may have been equivalent in Japan at the time. For example, because of the policy of ensured profit margins, as profit margins fell banks increased scale. Another policy was the discount window guidance given by the Bank of Japan at a lower rate than the interbank call market. The discount rate at which the Bank of Japan lent funds to banks was essentially a subsidy proportional to a bank's size. Aside from these incentives, there is the possibility that banks were in fact not profit maximizing but directly maximizing scale due to social status, a branch manager's promotion ambitions and so on.

The Japanese banking system was also characterized by regulation limiting bank entry, branch growth restrictions, regional segmentation, and bank segmentation from non-banks. For example, Ueda (1994) notes that opening a new branch required permission from the Ministry of Finance. He argues that long-term and trust banks were more severely affected by the loss of manufacturing firms because of their low branch to loan figure.

In addition to restrictions on banking activity, households had limited savings options. Household savings did eventually shift to insurance and pensions companies, albeit slowly because of slow deregulation (Hoshi and Kashyap 2001; Kitagawa and Kurosawa 1994). The share of household funds at banks fell from 60-80 % in 1960s and 1970s to 40-50 % in late 1980s. From 1980-86, 72 % of the increase in savings was deposited at insurance companies and the rest at banks (Kitagawa and Kurosawa 1994). So although, as a share of GDP, deposits at banks did continue to increase during the 1980s, the overall increase in savings was even larger. The Big Bang in 1998 further deregulated the foreign exchange law and allowed residents to directly open accounts in foreign institutions abroad. This led to a large capital outflow (Cargill et al. 2000).

Firms

Corporate finance regulation was also extensive. There were restrictive bond issuance criteria (BIC) in place which were based on accounting criteria initially (refer to Appendix Table 3). Only in 1990 were the accounting criteria removed and the criteria limited to a firm's rating (of BB or higher). In 1979, only two firms satistifed the BIC for domestic issues of unsecured straight bonds and unsecured convertible bonds (Matsushita Electric and Toyota Motors). By 1989, about 300 companies were eligible to issue unsecured straight bonds and 500 companies to issue unsecured convertible bonds (Hoshi et al. 1993 based on Nomura Securities).

The relaxation of the foreign exchange law in 1980 allowed firms to issue bonds in foreign markets without explicit government approval. This triggered the easing of the domestic BIC. Prior to 1980, only Japanese banks were allowed to manage firms' collateral as trustees for the bondholders. This led to high fees charged by banks. Banks were also members of the bond issuance committee. The foreign exchange law revision in 1980 coupled with the increase in the supply of goverment bonds due to increased government financing needs after the oil shocks in the late 1970s helped relax domestic controls on bond finance. For example, total funds raised in overseas markets in 1981 exceeded 1.4 trillion Yen, almost three times the 1975-79 average of 560 million Yen. As a fraction of all securities issued by Japanese corporations, overseas issues rose from under 20% prior to 1980 to almost 50% by 1985 (cited in Weinstein and Yafeh 1998).

Table 1
Flow of Funds to the Real Estate Market (trillions of yen)
June 1991

	Domestic Banks	Insurance Companies	Credit Unions & Depository	Foreign Banks	Non - Banks	Capital Market	Total to Real Estate
Direct Financing	59	3	5.5	0.6	50 - 55	residual (maximum 2)	120
Indirect lending activities through non-bank financial institutions	72	15	0.6	6.3			

Source: Taken from Figure 5.6 in Cargill, Hutchison and Ito (1997), who obtained the data from the Ministry of Finance

Table 2
Bank Regressions: Testing The Hoshi-Kashyap Hypothesis
1983-1990

	(1)[a]	(2)	(3)	(4)
	Dependent variable: first difference of: Real estate loans to total loans			Dependent variable: first difference of: Deposit interest rate
Regressors				
Prefecture land inflation, lag 1[b]	0.0086***	0.0086***	0.0078***	-0.0024***
	(0.0016)	(0.0016)	(0.0016)	(0.0006)
Prefecture land inflation, lag 2	-0.0013	-0.0008	-0.0005	0.0015**
	(0.0017)	(0.0017)	(0.0017)	(0.0006)
Year 1983	-0.0025**	-0.0024*	-0.0023	-0.0095***
	(0.0012)	(0.0012)	(0.0015)	(0.0004)
Year 1984	-0.0034***	-0.0015	-0.0038***	-0.0062***
	(0.0011)	(0.0013)	(0.0013)	(0.0004)
Year 1985	-0.0017	-0.0017	-0.0022*	-0.0049***
	(0.0012)	(0.0013)	(0.0013)	(0.0004)
Year 1986	0.0016	0.0026*	0.0014	-0.0056***
	(0.0012)	(0.0013)	(0.0013)	(0.0004)
Year 1987	0.0035***	0.0037***	0.0029*	-0.0113***
	(0.0012)	(0.0012)	(0.0017)	(0.0004)
Year 1988	-0.0004	0.0000	-0.0004	-0.0079***
	(0.0011)	(0.0012)	(0.0015)	(0.0004)
Year 1989	0.0008	0.0007	0.0010	-0.0058***
	(0.0011)	(0.0012)	(0.0013)	(0.0004)
Keiretsu loan share, first diff, lag 1	-0.0163*	-0.0111	-0.0060	0.0019
	(0.0088)	(0.0093)	(0.0100)	(0.0033)
Keiretsu loan share, first diff, lag 2	-0.0464***	-0.0401***	-0.0253**	0.0222***
	(0.0110)	(0.0117)	(0.0126)	(0.0041)
Keiretsu loan share, first diff, lag 3	-0.0358***	-0.0365***	-0.0272*	0.0115***
	(0.0114)	(0.0121)	(0.0146)	(0.0043)
Keiretsu loan share, first diff, lag 4	-0.0341***	-0.0329***	0.0139	0.0247***
	(0.0109)	(0.0112)	(0.0160)	(0.0041)
Interest on loans - Interest on deposits to total assets (first diff, lag 1)		-0.1348		
		(0.1159)		
Interest on loans - Interest on deposits to total assets (first diff, lag 2)		-0.3510***		
		(0.1235)		
Interest on loans - Interest on deposits to total assets (first diff, lag 3)		0.1011		
		(0.1276)		
Interest on loans - Interest on deposits to total assets (first diff, lag 4)		-0.2551**		
		(0.1245)		
Deposit rate (first diff)			0.1373	
			(0.1037)	
Loan rate (first diff)			-0.1193	
			(0.0812)	
Deposit rate (first diff) * Keiretsu loan share (first diff, lag 1)			0.8638	
			(1.5868)	
Deposit rate (first diff) * Keiretsu loan share (first diff, lag 2)			1.7107	
			(1.1723)	
Deposit rate (first diff) * Keiretsu loan share (first diff, lag 3)			2.0725	
			(1.4613)	
Deposit rate (first diff) * Keiretsu loan share (first diff, lag 4)			-1.6570	
			(1.3753)	
Loan rate (first diff) * Keiretsu loan share (first diff, lag 1)			0.2324	
			(2.0113)	
Loan rate (first diff) * Keiretsu loan share (first diff, lag 2)			-0.3579	
			(1.0428)	
Loan rate (first diff) * Keiretsu loan share (first diff, lag 3)			-0.1702	
			(1.9285)	
Loan rate (first diff) * Keiretsu loan share (first diff, lag 4)			3.7731*	
			(2.0532)	
Constant	0.0034***	0.0032***	0.0043***	0.0053***
	(0.0009)	(0.0009)	(0.0011)	(0.0003)
Observations	1200	1200	1200	1200
Number of Banks	150	150	150	150
R-squared	0.11	0.12	0.13	0.49

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

[a] Column (1) is similar model to that in Hoshi (2001) Table 9 column 1

[b] Prefecture land inflation refers to the land inflation in the prefecture (among 47 prefectures) in which a bank is headquartered.

Note:

This table presents results from fixed effects regressions. Standard errors are reported in parentheses.

Table 3
Bond Issuance Eligibility for Domestic Secured Convertible Bonds

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Number of companies eligible	65	378	422	496	559	616	671	675	727	799	819	855	1084	1247	1374
As a share of total companies (in %)	21.5	25.0	27.3	31.8	35.5	38.6	41.3	41.1	43.9	47.9	49.0	51.7	63.4	68.2	71.7

Source: The figures come from author's calculations based on the accounting criteria effective in Japan from October 1976-December 1990. These criteria are given in Table A3. The underlying accounting data comes from the Development Bank of Japan Corporate Finance Data Set for listed Japanese companies. Therefore "total companies" refers to the entire sample of companies with accounting data available in a given year. Note that convertible bonds were the principle source of public debt financing during the 1980s and these criteria were also applied to foreign issues of convertible bonds (refer to Hoshi, 1996).

Table 4
Firm Regressions: Testing The Hoshi-Kashyap Hypothesis
1977-1991

Dependent variable: Bank loans as a Share of a Firm's Total Debt	(1)	(2)
Regressors		
Eligible to issue bonds dummy (BIC), first lag	-0.0732***	-0.0499***
	(0.0056)	(0.0079)
Year 1977	0.2871***	
	(0.0203)	
Year 1978	0.2533***	
	(0.0098)	
Year 1979	0.2345***	
	(0.0096)	
Year 1980	0.2292***	
	(0.0094)	
Year 1981	0.2484***	
	(0.0092)	
Year 1982	0.2431***	0.2298***
	(0.0090)	(0.0123)
Year 1983	0.2276***	0.2198***
	(0.0090)	(0.0120)
Year 1984	0.1967***	0.1871***
	(0.0089)	(0.0113)
Year 1985	0.1761***	0.1681***
	(0.0087)	(0.0113)
Year 1986	0.1391***	0.1438***
	(0.0085)	(0.0126)
Year 1987	0.0786***	0.0968***
	(0.0082)	(0.0116)
Year 1988	0.0506***	0.0671***
	(0.0081)	(0.0100)
Year 1989	0.0238***	0.0378***
	(0.0077)	(0.0089)
Year 1990	0.0059	0.0050
	(0.0073)	(0.0081)
Prefecture land inflation		-0.0044
		(0.0146)
Prefecture land inflation, first lag		-0.0312**
		(0.0135)
Leverage (ratio of debt to assets), first lag		-0.4056***
		(0.0547)
Collateral (financial investments to assets), first lag		0.3339***
		(0.1002)
Total assets, first lag		7.72×10^{-11}***
		(1.87×10^{-11})
Variables used to determine bond issuance criteria from 1976-1990		
Net worth, first lag		-2.13×10^{-10}**
		(8.28×10^{-11})
Dividend per share, first lag		-0.0002
		(0.0002)
Net worth to assets, first lag		-0.3454***
		(0.0660)
Net worth to paid-in-capital, first lag		0.0005
		(0.0058)
Business profits to assets, first lag		-1.0428***
		(0.1136)
Ordinary after tax profit per share, first lag		0.0001*
		(0.0000)
Constant	0.5758***	0.8055***
	(0.0072)	(0.0416)
Observations	9269	6273
Number of firms from DBJ database	1291	1138
R-squared	0.27	0.27

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.
Note:
This table presents results from fixed effects regressions using a panel of firms from the Development Bank of Japan Corporate Finance Data Set. Standard errors are reported in parentheses. The estimates are over the period 1977-1991 because the bond issuance accounting criteria were valid from October 1976 to December 1990. The other control variables are taken from the Development Bank of Japan Corporate Finance Data Set, except for prefecture land inflation which comes from the Statistical Yearbook of Japan and refers to the land inflation in the prefecture in which a firm is headquartered.

Table 5
Ratio of firms' bank debt to total debt

	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990
Real Estate	93.8	89.1	89.1	89.0	89.2	89.3	87.6	88.3	79.9	84.7	84.8	80.3	67.9	71.6	72.6
Real Estate & Construction	94.0	91.2	90.2	88.5	87.8	89.7	88.4	89.2	85.4	87.3	78.5	68.9	63.1	67.8	68.6
Manufacturing	88.5	84.7	80.0	75.9	75.5	77.4	74.8	72.0	66.6	62.3	59.3	54.4	51.5	50.4	49.1
Among Firms Eligible to Issue Bonds Througout 1982-1989															
Real Estate	92.3	92.9	89.8	89.2	85.9	84.3	82.3	84.2	74.2	81.6	76.2	72.5	59.8	64.1	66.1
Real Estate & Construction	91.7	90.6	88.1	86.3	84.3	85.9	83.4	85.0	79.4	84.6	70.1	57.6	51.8	56.5	55.8
Manufacturing	84.9	79.2	71.4	66.3	66.3	67.9	64.0	61.2	53.3	50.0	46.8	39.7	37.0	37.2	36.2

Source: Author's calculations using the Development Bank of Japan Corporate Finance Dataset for listed non-financial companies by classifying companies according to which sector they belonged. A firm's total debt is calculated as the sum of outstanding short-term bank loans (DBJ code K1960) + long-term bank loans (K2350) + total outstanding bonds composed of straight bonds (K6850), convertible bonds (K6890), and warrant bonds (K6930). A firm's bank debt ratio is then calculated as the ratio of its short-term and long-term bank loans to its total debt. Refer to Table 3 for information on companies eligible to issue bonds (domestic secured convertible) during the period.

Table 6
The Effect of Bank Credit on Land Prices: The Prefecture Cross-Sectional View

Dependent variable: Log difference in real prefectural land price between 1991 and 1981	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
All regressors are the difference between 1991 and 1981 [a] :								
Keiretsu loan share	-4.6568***					-3.4475***		
	(0.7352)					(0.9895)		
Real estate loan share		11.4852***	20.3016***				14.8649***	
		(2.1672)	(4.6123)				(4.8989)	
"Risky" loan share (loans to real estate & construction & non-bank financial institutions.)				4.4586**	14.2489***			13.5435*
				(1.6632)	(5.0130)			(7.5214)
Macro controls [c]								
Prefecture population, in logs						3.6120***	0.8910	3.8869*
						(0.9883)	(1.3197)	(2.1875)
Prefecture unemployment rate						-0.1376	0.0878	0.0019
						(0.1940)	(0.2183)	(0.3484)
Prefecture income per capita, in logs						-0.0994	1.1116	-2.9717
						(0.7785)	(0.9088)	(3.1228)
Prefecture job openings to applications						-0.2670*	-0.2694	-0.0069
						(0.1415)	(0.1740)	(0.3522)
Prefecture CPI excluding rent, in logs						0.3925	4.0841	-3.1615
						(3.3966)	(2.7428)	(8.1607)
Instrumenting for real estate or "risk" loan share with keiretsu loan share?			Yes		Yes		Yes	Yes
Constant	0.8961***	0.7439***	0.5197***	0.6749***	-0.1180	1.0232	-0.5199	1.8371
	(0.0547)	(0.0641)	(0.1180)	(0.1252)	(0.4103)	(0.7128)	(0.7229)	(2.0110)
Number of prefectures	47	47	47	47	47	47	47	47
R-squared	0.35	0.38	0.16	0.17	R-sq < 0 [b]	0.57	0.46	R-sq < 0 [c]

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

[a] Except for Prefecture population and unemployment which are the difference between 1990 and 1980 due to data availability.

[b] Note that in 2SLS the R-squared can sometimes be negative, even when a constant is included.

[c] The controls are compiled from the Japan Statistical Yearbook, various issues.

Note:

Robust standard errors are reported in parentheses and they are clustered by prefecture.

Table 7
The Effect of Bank Credit on Land Prices: The Time-Series View
Prefecture Fixed Effects 1981-1993

Dependent variable: Log difference in real prefectural land price, annual	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Regressors									
Keiretsu loan share, first difference	-3.3154***	-1.8019***					-1.1640**	-1.6448**	
	(0.6597)	(0.6186)					(0.5821)	(0.6716)	
Keiretsu loan share, first difference, lag 1	-3.3996***	-1.3002*					-1.0870*	-1.1346	
	(0.7626)	(0.7270)					(0.6145)	(0.7686)	
Keiretsu loan share, first difference, lag 2	-2.4380***	-1.3379*					-1.3945**	-1.5180*	
	(0.7841)	(0.7532)					(0.5907)	(0.7913)	
Keiretsu loan share, first difference, lag 3	-0.9592	-1.0184					-1.1142*	-1.2089	
	(0.7700)	(0.7347)					(0.5826)	(0.7718)	
Keiretsu loan share, first difference, lag 4	-0.1979	-0.5232					-0.7107	-0.5973	
	(0.6594)	(0.6168)					(0.5457)	(0.6527)	
Real estate loan share, first difference			3.3498**	27.0575					15.6876**
			(1.3651)	(18.0139)					(6.5623)
"Risky" loan share (loans to real estate & construction & non-bank financial institutions.)					1.6221**	9.4662*			
					(0.7119)	(5.0734)			
Year dummies?		Yes	Yes	Yes	Yes	Yes		Yes	
Japan-wide macro controls									
Japanese unemployment, first difference							-0.0883		-0.0251
							(0.0687)		(0.0824)
Nikkei stock market, in logs, first difference							0.0344		-0.1139
							(0.0656)		(0.0889)
Japan population, in logs, first difference							12.8641*		11.5327
							(7.2285)		(7.9958)
Prefecture-level controls									
Population, in logs, 1990-80 difference							0.4116**		0.1872
							(0.1694)		(0.2135)
Unemployment rate, 19990-80 difference							-0.0056		0.0226
							(0.0342)		(0.0380)
Income per capita, in logs, first difference							-0.0715	0.1178	0.3970
							(0.3550)	(0.3699)	(0.4334)
Job openings to applications, first difference							0.3025***	0.1216	0.2591***
							(0.0641)	(0.0764)	(0.0738)
CPI excluding rent, in logs, first difference							1.6192*	1.2422	3.6304***
							(0.8577)	(1.5712)	(1.1620)
House rent, in logs, first difference, lag 2							0.5511***	0.5271***	0.5152***
							(0.1197)	(0.1258)	(0.1350)
House rent to residential land price, lag 2							0.0082**	0.0147*	0.0061*
							(0.0032)	(0.0078)	(0.0034)
Instrumenting for real estate or "risk" loan share with keiretsu loan share and its lags?				Yes		Yes			Yes
Constant	0.0434***	-0.1385***	-0.1418***	-0.1898***	-0.1361***	-0.1412***	-0.1212***	-0.2166***	-0.1718***
	(0.0108)	(0.0247)	(0.0243)	(0.0473)	(0.0242)	(0.0269)	(0.0432)	(0.0603)	(0.0565)
Observations	611	611	611	611	611	611	562	562	562
R-squared	0.05	0.28	0.27	0.14	0.27	0.11	0.26	0.32	0.17

***, **, and * denote significance at the 1%, 5%, and 10% levels, respectively.

Note:

Standard errors are reported in parentheses.

Regressions reported in columns 7,9, and 11 were estimated using random effects and no year dummies because the Japan-wide macro controls serve as an alternative time control while the prefectural-level population and ur prefecture fixed effects.

Table A1
Sample Statistics: 1981 - 1991, across banks

Panel of 150 banks	Mean 1981 - 1991	Mean 1981	Mean 1991	Std. Dev.	Minimum	Maximum
Keiretsu loans, as share of total	0.0690	0.1246	0.0399	0.1714	0.0000	1.76495[a]
First difference	-0.0076	0.0012	0.0029	0.0426	-0.4997	0.3238
Real estate loans, as share of total	0.0853	0.0632	0.0973	0.0528	0.0000	0.3487
First difference	0.0032	0.0009	-0.0136	0.0112	-0.0474	0.0933
Real growth rate of real estate loans	0.1058	0.0262	0.0160	0.1180	-0.2921	0.8605
(Interest on loans & discounts - Interest on deposits) / total assets	0.0089	0.0052	0.0069	0.0066	-0.0187	0.0397
Net interest income / total assets	0.0180	0.0100	0.0149	0.0064	-0.0028	0.0309
Interest income on loans / total loans	0.0623	0.0411	0.0731	0.0117	0.0000	0.1081
Interest income on deposits / total deposits	0.0387	0.0269	0.0506	0.0109	0.0008	0.1005
First difference	0.0028	0.0075	0.0162	0.0095	-0.0327	0.0577
Amount of loans to small borrowers / total loans	0.8597	0.9382	0.8627	0.2239	0.0000	2.2019
Government bonds in own account / total assets	0.0499	0.0539	0.0511	0.0228	0.0073	0.1496
Foreign branches / total branches	0.0145	0.0118	0.0187	0.0594	0.0000	0.6190
Total assets , in million Yen	3755744	1954148	6067036	8365080	54409	66600000
Total assets, real terms	39894	23291	60309	87065	648	676736
Total loans, in million Yen	1860464	886473	3224307	4025695	29878	35900000
Sectoral shares:						
Risky loans (real estate & construction & non-banks financial institutions)	0.2209	0.1723	0.2539	0.0727	0.0000	0.5172
First difference	0.0078	0.0045	-0.0137	0.0167	-0.0717	0.1476
Loans to Agriculture, Forestry and Fishery	0.0102	0.0117	0.0084	0.0091	0.0000	0.0472
Loans to Individuals & Others	0.1699	0.1673	0.2000	0.0501	0.0664	0.3995
Loans to Local Governments	0.0142	0.0162	0.0096	0.0187	0.0000	0.1099
Loans to Mining	0.0039	0.0043	0.0032	0.0037	0.0000	0.0329
Loans to Manufacturing	0.1975	0.2394	0.1571	0.0722	0.0371	0.4148
Loans to Services	0.1175	0.0890	0.1401	0.0403	0.0000	0.3540
Loans to Transportation & Telecommunication	0.0272	0.0262	0.0261	0.0173	0.0045	0.1658
Loans to Utilities	0.0099	0.0103	0.0073	0.0178	0.0000	0.1553
Loans to Wholesale & Retail Industries	0.2288	0.2632	0.1944	0.0580	0.0632	0.4099

By bank type	City	Long-term	Trust	Regional 1	Regional 2
Number of Banks	11	3	7	64	65
Fraction of Aggregate Bank Assets over period 1981-1991	0.505	0.106	0.086	0.222	0.081
Means					
Keiretsu loans, as share of total	0.1536	0.2601	0.6503	0.0447	0.0071
First difference	-0.0132	-0.0203	-0.1129	-0.0016	-0.0006
Real estate loans, as share of total	0.0784	0.1019	0.1603	0.0660	0.0965
First difference	0.0048	0.0082	0.0031	0.0022	0.0036
Real growth rate of real estate loans	0.1593	0.1059	0.0849	0.1011	0.1035
(Interest on loans & discounts - Interest on deposits) / total assets	-0.0013	0.0241	0.0001	0.0067	0.0130
Net interest income / total assets	0.0088	0.0063	0.0035	0.0186	0.0211
Interest income on loans / total loans	0.0646	0.0673	0.0656	0.0593	0.0643
Interest income on deposits / total deposits	0.0504	0.0647	0.0545	0.0361	0.0363
First difference	0.0038	0.0050	0.0045	0.0027	0.0026
Amount of loans to small borrowers / total loans	0.4968	0.3090	1.0199	0.8257	0.9627
Government bonds in own account / total assets	0.0264	0.0585	0.0606	0.0622	0.0403
Foreign branches / total branches	0.0940	0.2092	0.0641	0.0010	0.0001
Total assets , in million Yen	25900000	19900000	6992002	1947628	700784
Total assets, real terms	274548	211306	73818	20741	7478
Total loans, in million Yen	12000000	11300000	2643197	1055507	420130
Sectoral shares:					
Risky loans (real estate & construction & non-banks financial institutions)	0.1951	0.2589	0.3414	0.1927	0.2383
First difference	0.0089	0.0275	0.0200	0.0077	0.0055
Loans to Agriculture, Forestry and Fishery	0.0037	0.0030	0.0018	0.0133	0.0095
Loans to Individuals & Others	0.1540	0.1826	0.1311	0.1470	0.1987
Loans to Local Governments	0.0093	0.0001	0.0008	0.0264	0.0052
Loans to Mining	0.0060	0.0060	0.0035	0.0038	0.0036
Loans to Manufacturing	0.2471	0.2177	0.1811	0.2229	0.1649
Loans to Services	0.1011	0.0916	0.1093	0.1110	0.1288
Loans to Transportation & Telecommunication	0.0328	0.0613	0.0635	0.0229	0.0250
Loans to Utilities	0.0155	0.0836	0.0599	0.0086	0.0013
Loans to Wholesale & Retail Industries	0.2354	0.0952	0.1077	0.2513	0.2247

Source: Nikkei NEEDS database. The keiretsu loans were provided by Takeo Hoshi, who compiled them from Keizai Chosakai, *Kin'yu Kikan no Toyushi* (Investment and Loans by Financial Institutions), various issues.

[a] Because the data source for keiretsu loans is different from that for total loans, the keiretsu loan "share" for some banks (particularly Trust banks in early 1980s) exceeds one.

Table A2
Sample Statistics: 1981 - 1991, across prefectures

Panel of 47 Prefectures	Mean			Std. Dev.	Minimum	Maximum
	1981 - 1991	1981	1991			
Japanwide						
Real land price index, average 6 largest cities	0.5548	0.3170	1.0239	0.2629	0.3170	1.0239
First difference	0.1085	0.0208	0.0074	0.0940	0.0074	0.2465
Real land price index, average all	0.8199	0.6841	1.0974	0.1289	0.6841	1.0974
First difference	0.0450	0.0221	0.0768	0.0346	0.0003	0.1077
Prefecture specific						
Real land price at the prefecture	1.4095	0.6257	2.4329	3.2744	0.0660	30.7996
First difference	0.1015	0.0807	0.0687	0.1812	-2.2563	2.3458
Keiretsu loans, as share of total in prefecture	0.0507	0.0658	0.0358	0.0472	0.0011	0.3711
First difference	-0.0026	0.0014	0.0018	0.0149	-0.1587	0.1529
Real estate loans, as share of total in prefecture	0.0708	0.0542	0.0796	0.0269	0.0238	0.1744
First difference	0.0023	0.0000	-0.0124	0.0074	-0.0300	0.0295
Real growth rate of real estate loans	0.0997	0.0182	0.0229	0.0879	-0.1232	0.4700
Risky loans (real estate & construction & non-banks financial institutions)	0.2007	0.1544	0.2354	0.0442	0.1143	0.3729
First difference	0.0076	0.0029	-0.0132	0.0125	-0.0624	0.0633
Number of banks headquartered in prefecture	3.1915	3.1915	3.1915	3.0462	1.0000	20.0000
Proportion of major banks in prefecture (city & long-term & trust banks)	0.0331	0.0331	0.0331	0.1248	0.0000	0.7500
Proportion of regional banks in prefecture (regional 1 & regional 2 banks)	0.9669	0.9669	0.9669	0.1248	0.2500	1.0000
Proportion of long-term & trust banks in prefecture	0.0112	0.0112	0.0112	0.0657	0.0000	0.4500
Prefecture Macroeconomic controls						
Population (in 1000s), in logs	7.5742	7.5396	7.5802	0.7155	6.4232	9.3806
Unemployment rate, in %	3.1454	2.4579	2.9663	1.0995	1.6281	7.7758
Job openings to applications	0.8756	0.6616	1.3663	0.4820	0.1314	2.4415
Income per capita (in 1000 yen), in logs	7.6421	7.4020	7.9021	0.2194	7.1624	8.4011
CPI excluding rent	4.4899	4.4072	4.5862	0.0530	4.3747	4.6592
House rent to residential land price	6.0427	6.4906	5.6299	2.7795	0.6457	14.8566

Source: Nikkei NEEDS database for bank data. The keiretsu loans were provided by Takeo Hoshi, who compiled them from Keizai Chosakai, *Kin'yu Kikan no Toyushi* (Investment and Loans by Financial Institutions), various issues. Japan-wide land prices are from the semi-annual Japan Real Estate Institute and prefecture land prices are from the annual July 1st Prefectural Land Price Survey. Prefectural macroeconomic controls are taken from the Japan Statistical Yearbook, various issues.
Note: Prefecture population and unemployment are provided for 1980 and 1990 because 1981 and 1991 are not available.

Table A3
Bond Issuance Criteria for Domestic Secured Convertible Bonds

Effective October 1976 - July 1987

A firm with net worth greater than 10 billion yen can issue if:

1. Dividend per share in the most recent accounting period exceeds 5 yen and
2. Ordinary after-tax profit per share in the most recent accounting period is greater than 7 yen and
3. One of the following 3 conditions is met:
    a. Net worth ratio is greater than or equal to 0.15
    b. Net worth / paid-in-capital is greater than or equal to 1.2
    c. Business profits / total assets is greater than or equal to 0.04

A firm with net worth greater than 6 billion yen but less than 10 billion yen can issue if:

1. Dividend per share in the most recent accounting period exceeds 5 yen and
2. Ordinary after-tax profit per share in the most recent accounting period is greater than 7 yen and
3. Two of the following 3 conditions are met:
    a. Net worth ratio is greater than or equal to 0.2
    b. Net worth / paid-in-capital is greater than or equal to 1.5
    c. Business profits / total assets is greater than or equal to 0.05

Effective July 1987 - December 1990

A firm with net worth greater than 10 billion yen can issue if:

1. Dividend per share in the most recent accounting period exceeds 5 yen and
2. Ordinary after-tax profit per share in the most recent accounting period is greater than 7 yen and
3. One of the following 3 conditions is met:
    a. Net worth ratio is greater than or equal to 0.1
    b. Net worth / paid-in-capital is greater than or equal to 1.2
    c. Business profits / total assets is greater than or equal to 0.05

A firm with net worth greater than 6 billion yen but less than 10 billion yen can issue if:

1. Dividend per share in the most recent accounting period exceeds 5 yen and
2. Ordinary after-tax profit per share in the most recent accounting period is greater than 7 yen and
3. Two of the following 3 conditions are met:
    a. Net worth ratio is greater than or equal to 0.12
    b. Net worth / paid-in-capital is greater than or equal to 1.5
    c. Business profits / total assets is greater than or equal to 0.06

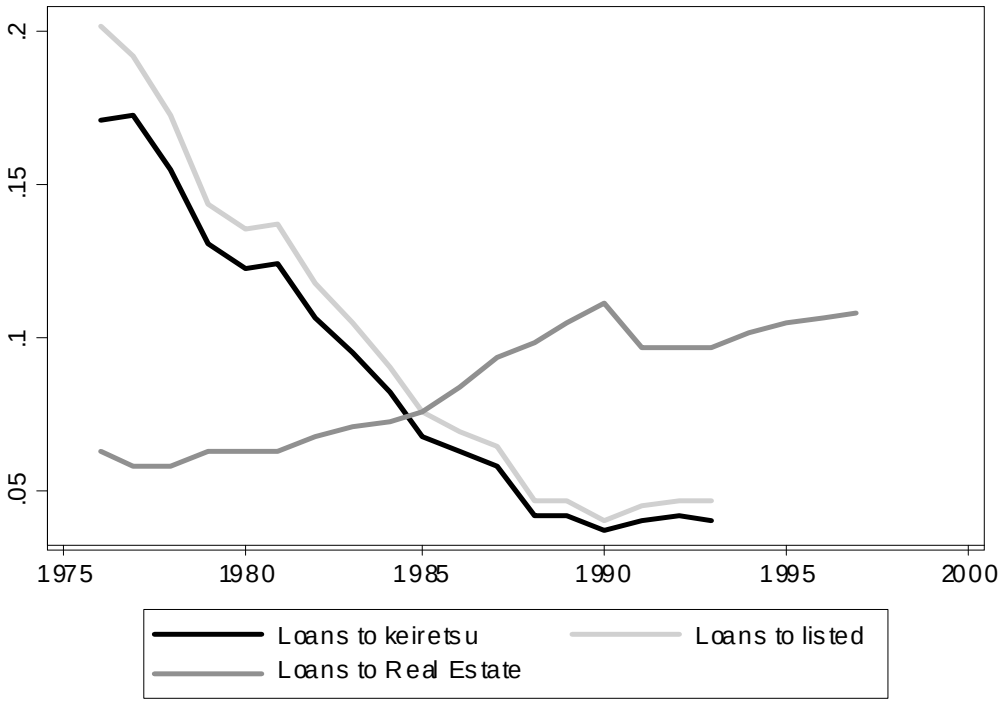
A firm with net worth greater than 3 billion yen but less than 6 billion yen can issue if:

1. Dividend per share in the most recent accounting period exceeds 5 yen and
2. Ordinary after-tax profit per share in the most recent accounting period is greater than 7 yen and
3. Two of the following 3 conditions are met:
    a. Net worth ratio is greater than or equal to 0.15
    b. Net worth / paid-in-capital is greater than or equal to 2.0
    c. Business profits / total assets is greater than or equal to 0.07

Note:
This table reports the criteria effective from 1976 to 1990 based on accounting figures and as reported in Hoshi, Kashyap and Scharfstein (1993). Note that criteria based on a firm's ratings became effective May 1989 whereby a firm wih a BB rating or higher could issue bonds if its dividend per share were greater than 5 yen and its ordinary after-tax profit per share were greater than 7 yen. After December 1990, the accounting criteria ceased to be in effect and only the rating criteria were applicable. Therefore for the period May 1989-December 1990, the eligible-to-issue firms tabulated in Table 2 and based on only the accounting criteria are biased downwards.

Figure 1. Keiretsu Loans, Loans to Listed Firms, and Loans to Real Estate Sector

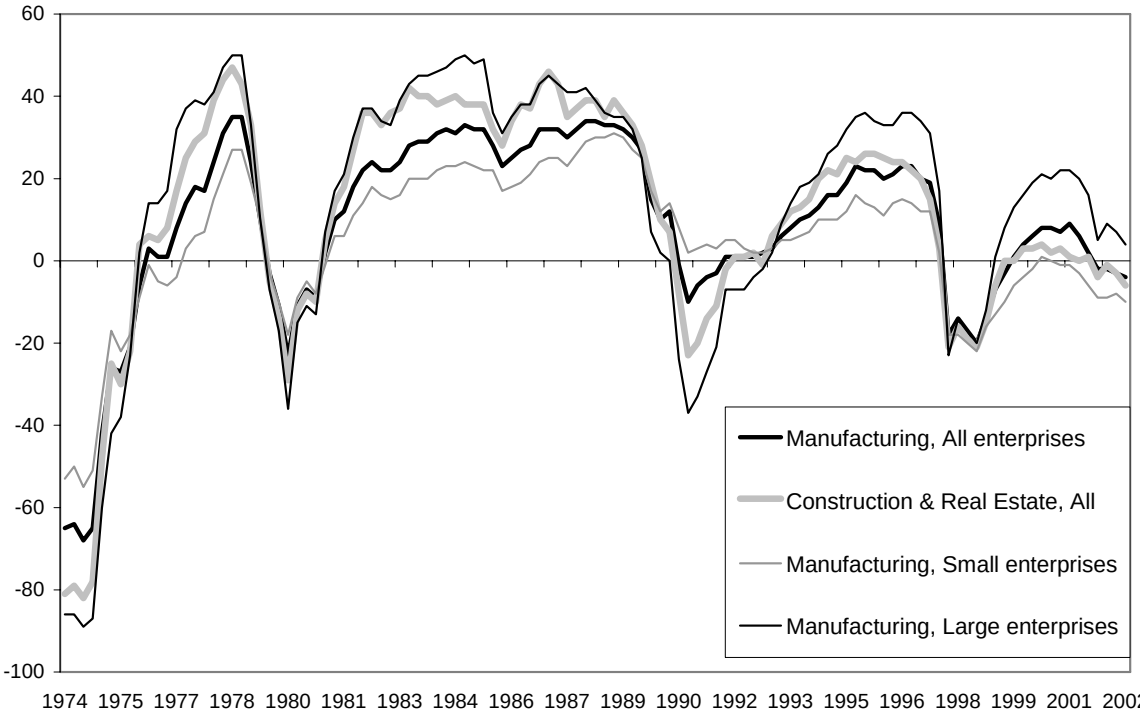
(as a share of total loans, all banks, average)



Source: The keiretsu loans and loans to listed firms were provided by Takeo Hoshi, who compiled them from Keizai Chosakai, *Kin'yu Kikan no Toyushi* (Investment and Loans by Financial Institutions), various issues.
The real estate loans and the total loans come from the Nikkei NEEDS database.

Figure 2. Tankan Survey: Perception by enterprises of financial institutions' lending attitudes

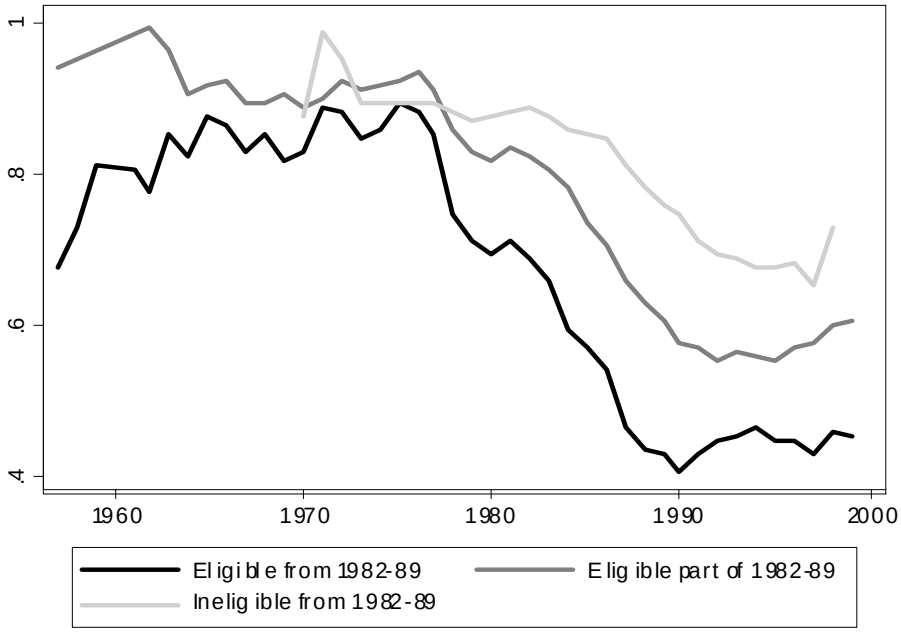
(A higher number indicates perception of more relaxed conditions)



Source: Bank of Japan, Research and Statistics Department, http://www.boj.or.jp/en

Note: For judgement questions, the percentage share of the raw number of responding enterprises for each of the three choices is calculated. The diffusion index (DI) is calculated as following: DI = percentage share of enterprises responding for choice 1minus percentage share of enterprises responding for choice 3. The choices for lending attitude were 1) Accommodative Choice 2) Not so severe and 3) Severe. Therefore if all the surveyed enterprises perceived the lending attitude to be accomodative, the index would be equal to 100 and vice versa.

Figure 3. Ratio of firms' bank debt to total debt



Source: Author's calculations using the Development Bank of Japan Corporate Finance Dataset by classifying whether a firm was eligible to issue during the period from 1982-1989. Eligible-to-issue bonds criteria are shown in Table A3.
Note: The calculations are based on all companies with accounting data available for each year during 1982-1989 (resulting in 371 companies). See Tables 3 and 5 for details.

Figure 4. Inflation

Figure 4a. Land price inflation and the Nikkei stock market index

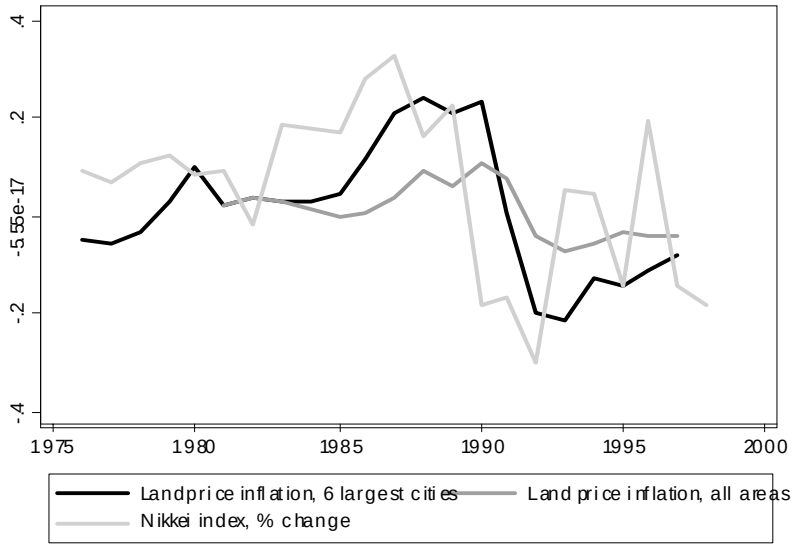
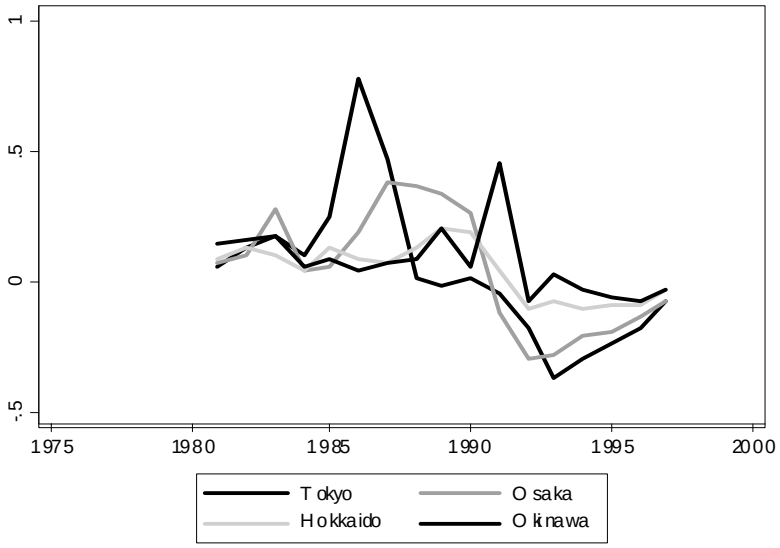
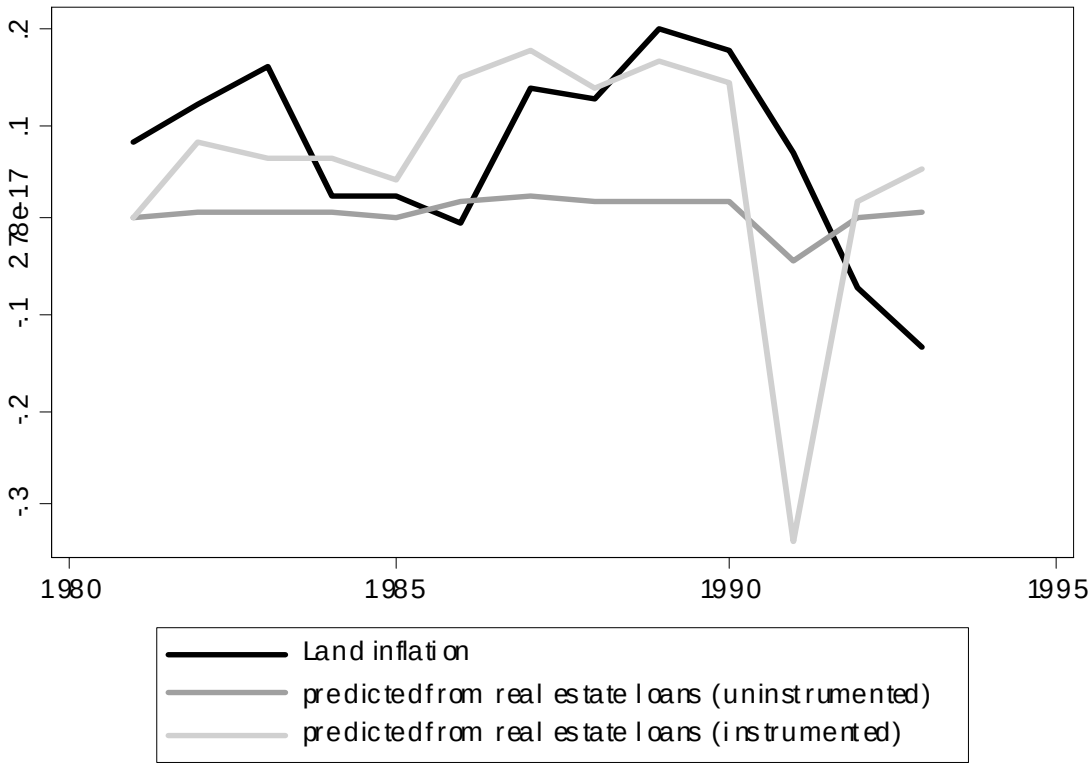


Figure 4b. Prefecture-level land price inflation (selected prefectures)



Source: Nikkei stock market index from Bank of Japan, http://www.boj.or.jp/en
Land prices, all areas and 6 largest cities are from the Japan Statistical Yearbook's Table 17-12
Index of Urban Land Prices (1960-2003), which in turn are from the Japan Real Estate Institute (as of end-March).
Prefecture land prices are from the Japan Statistical Yearbook, various issues, which come from the annual July 1st Prefectural Land Price Survey carried out by the Land and Water Bureau, Ministry of Land, Infrastructure and Transport. The weighted average over 6 categories of land is taken: residential site, prospective housing land, commercial site, quasi-industrial site, industrial site, and housing land within urbanization control area.
Land price indices are divided by the GDP deflator to obtain real land prices, then the inflation rate is calculated as the annual log difference.

Figure 5. The Japan Average Actual Land Inflation Rate and the Predicted Rate



Source: Land inflation is the average over the 47 prefectures of the prefectural real land price inflation. The predicted inflation rate comes from Model 7.3 for the uninstrumented real estate loans and from Model 7.4 for the keiretsu-share instrumented real estate loans (refer to columns 3 and 4 in Table 7).