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Financial Constraint, and Investment:
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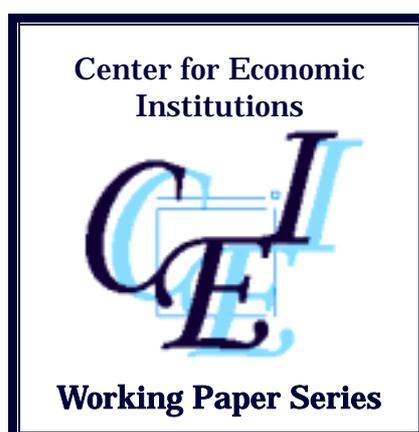
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Asset Price Shocks, Financial Constraints, and Investment: Evidence from Japan

by

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Abstract

This paper examines investment spending of Japanese firms around the "asset price bubble" in the late-1980s and makes three contributions to our understanding of how stock valuations affect investment. First, corporate investment responds significantly to nonfundamental components of stock valuations during asset price shocks; fundamentals matter less. Clearly, the stock market is not a 'sideshow'. Second, the time series variation in the sensitivity of investment to cash flow is affected more by changes in monetary policy than by shifts in collateral values. Finally, asset price shocks primarily affect firms that rely more on bank financing, and not necessarily those that use equity markets for financing. Only the investment of bank-dependent firms responds to nonfundamental valuations. In addition, the cash flow sensitivity of bank-dependent firms with large collateral assets decreases when asset prices become inflated, but increases dramatically when asset prices collapse and monetary policy tightens.

1. Introduction

Asset price shocks, or bubbles, typically result in large deviations of stock valuations from fundamentals.[1] Do nonfundamental valuations affect corporate investment during the bubble period? Fischer and Merton (1984) and more recently Stein (1996) have argued that investment responds to nonfundamental changes in stock prices. That is, firms increase investment spending when stocks are overvalued and they cut back when stocks are undervalued.[2] Firms also typically increase their external financing during periods of asset price inflation suggesting that collateral shocks affect the cost of external funds. In this paper, we examine how asset price shocks influence investment and the cost of external financing by studying the period surrounding the asset price shocks in Japan in the late 1980s and the early 1990s.

Japanese stock and land prices rapidly inflated towards the end of the 1980s (the *asset inflation* period). However, in the early 1990s, both stock and land values collapsed within a short time; coincidentally, the Bank of Japan significantly tightened its monetary policy during 1991 (the *collapse* period). Following the asset price collapse, the Bank of Japan sharply reversed its monetary policy. Although this resulted in easy credit being available from financial institutions, the Japanese economy continued to contract (the

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[1]Recent examples of asset price bubbles include those in the Nordic countries and Japan during the late 1980s and those in several Asian countries around the mid-1990s. Bubbles do not occur frequently but are reasonably common in world history. See Kindleberger (1996) for a history of bubbles through the centuries.

[2]This view presupposes inefficiencies in stock prices. Sufficient evidence exists that points to weaknesses in the efficient markets argument and suggests that stock prices do not always move with fundamentals. See for example DeBondt and Thaler (1985), Summers (1986), and a survey in Shleifer and Summers (1990).

contraction period). We also examine the period prior to the asset inflation period in the first half of the 1980s, which serves as a benchmark (the *pre-asset inflation* period).

This paper has three objectives. First, we examine the relation between stock valuations and firm-level investment spending during asset price shocks. It is well known that stock prices predict investment because fundamental components of prices include information about profitable investment opportunities. However, stock prices may include bubbles, fads, and sentiments that are unrelated to fundamentals. The question is whether nonfundamental stock valuations affect the cost of capital and, therefore, influence a firm's investment decisions. A common view is that when stocks are overpriced, it becomes less costly for firms to access external capital markets, which increases investment spending (see, for example, Fischer and Merton (1984), Morck, Shleifer, and Vishny (1990), Blanchard, Rhee, and Summers (1993), and Stein (1996)). Empirical evidence on the role of the stock market in determining investment spending is, however, mixed.[3] By focusing on the "asset price bubble" in Japan, we have an unusual opportunity to examine the role of stock valuations in determining firm-level investment spending.[4]

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[3] Barro (1990) and Galeotti and Schiantarelli (1994) find that stock valuations significantly affect investment. Other studies find that the incremental predictive content of market valuations for investment is weak when fundamentals are held constant (see Blanchard, Rhee and Summers (1993), Chirinko and Schaller (1996), and Morck, Shleifer and Vishny (1990)). In a recent study, Lamont (2000) finds a positive relation between revision in investment plans and stock returns at the industry level, but not at the aggregate level.

[4] Studies using aggregate Japanese data that examine the asset inflation period in the 1980s also present conflicting results. Ogawa and Kitasaka (1999) find that profitability measures matter more than market valuations in determining industry-level investment spending of Japanese firms, while Chirinko and Schaller (1998) find that market valuations have a significant effect on aggregate investment.

Second, we examine how asset price shocks affect the sensitivity of investment to cash flow. Asset price shocks affect a firm's net worth and consequently the severity of information and moral hazard problems.[5] These in turn affect the sensitivity of investment to cash flow, which is interpreted as a measure of the cost difference between internal and external financing. However, changes in monetary policy could also affect cash flow sensitivity. When monetary policy tightens, interest rates generally increase and overall financial conditions become tight. Consequently, cash flow sensitivity increases. A loose monetary policy would decrease cash flow sensitivity (see Hubbard (1998)).

Since the asset inflation period is characterized by a positive collateral shock and a relatively easy monetary policy, we expect cash flow sensitivity to decline during this period. By similar logic, given the negative collateral shock and the tight monetary policy during the collapse period in 1991, we expect the sensitivities to increase. However, during the contraction period of the early 1990s, low collateral values imply that cash flow sensitivity should remain high while the easy monetary policy suggests that they should decline. A comparison of the sensitivity during the 1991 collapse period (low collateral values and tight monetary policy) with that during the contraction period (low collateral values and easy monetary policy) discriminates between the effect of monetary policy and the effect of collateral shocks on cash flow sensitivities.

Our third objective is to examine if firms that relied on bank loans invested differently from those that relied on equity and/or public debt financing. The late 1980s

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[5] See Myers and Majluf (1984), Bernanke and Gertler (1989), Bernanke, Gertler and Gilchrist (1996).

witnessed banks ramping up lending collateralized by real estate and securities. If banks lent to their borrowers based on inflated collateral values, then did fundamentals matter at all in determining the investments of bank-dependent firms?

Cash flow sensitivities of bank-financed firms are also expected to be more responsive to asset price shocks. If monetary policy was transmitted through the bank-lending channel, then the bank-dependent firms were likely to be more liquidity constrained when the monetary policy tightened in 1991 (see Kashyap, Stein, and Wilcox (1993)). In addition, asset price deflation could severely exacerbate information and incentive problems in bank-dependent firms that are more vulnerable to fluctuation in collateral values, resulting in a higher cost of external financing (Bernanke, Gertler, and Gilchrist (1996)).[6]

A key result of the paper is that, while investment responds to market valuations even after controlling for conventional fundamental measures, the effect is more pronounced for firms that rely more on bank financing *and* hold large amounts of marketable collateral. Many observers of the Japanese banking system suggest that collateral values figure prominently in the lending decisions of Japanese banks. Our results suggest, somewhat paradoxically, that asset price shocks have more pronounced effects on bank-dependent firms with large collateralizable assets than on those that relied on equity and equity-linked debt markets.

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[6] In addition, the banks themselves were affected by adverse asset price shocks, which influenced their lending behavior (see Gibson (1995) and Kang and Stulz (2000)).

Another important result is that the cash flow sensitivity responds significantly to asset price shocks and changes in monetary policy. In general, shifts in monetary policy have a more dominant effect on the variation in the cash flow sensitivity over time. During periods of asset price inflation and easy monetary policy, investment becomes less sensitive to internal cash flow. But when asset prices collapse and monetary policy becomes tight, banks engage in a "flight to quality". Bank-dependent firms that face severe erosion in their collateral values exhibit the largest increase in cash flow sensitivity.

This paper is organized as follows. Section 2 provides background information on the development of Japanese asset markets, monetary policies, and corporate financing over the 1981-1994 period. This section enables us to identify episodes of asset price shocks and changing monetary policy regimes. Section 3 describes the data and provides summary statistics over the sample period. Section 4 examines how stock market valuations and cash flow affect investment. Section 5 examines how bank dependence and collateral values affect the investment and liquidity of Japanese firms. Section 6 concludes the paper.

2. Asset valuations in Japan, 1981-1994

This section provides background information on asset prices, credit conditions, and aggregate corporate financing during the 1981-1994 period. Our objective is to identify episodes of asset price shocks and monetary policy shifts in Japan during the period. However, various breakpoints between the episodes are unknown and we cannot arbitrarily determine them. Since our focus is on the corporate sector, we establish the

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period breakpoints by detecting structural shifts in corporate investment behavior. More specifically, we use the Cusum (Cumulative sum) technique that plots recursively calculated prediction errors of the corporate investment equation and graphically detects regime changes (Appendix A presents the details). The Cusum breakpoints show that the structural shifts in corporate investment behavior coincide closely with shifts in collateral values and monetary policy changes during this period.

2.1. Pre-asset inflation period (1981-1986)

Between 1981 and 1986, both the Tokyo Stock Price Index (TOPIX) and the land price index (based on land prices in Japan's six largest cities) increased *gradually* (see Figure 1). At the same time, the Bank of Japan maintained an easy but relatively stable monetary policy. This pre-asset inflation period serves as a benchmark that allows a comparison between investment policies of firms during the asset inflation period of the late 1980s and the asset price deflation period of the early 1990s.[7]

2.2. Asset inflation period (1987-1990)

The following four years witnessed a rapid heating up of the Japanese asset markets. For example, the TOPIX increased from 1,324 in early 1987 to 2,569 at the beginning of 1990. Similarly, the land price index rose rapidly during the late 1980s. The business press has extensively referred to this period as a "speculative bubble". Similar references

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[7] We define the pre-asset inflation period as starting from 1981 because it appears that Japan's monetary policy became easy and relatively more stable around 1981.

exist in the academic literature (see, for example, Ueda (1990), French and Poterba (1991), Allen (1996), Allen and Gale (2000), and Kindleberger (1996)).

The beginning of the asset inflation period coincided with the Bank of Japan adopting an easier monetary policy. As Figure 2 shows, the official discount rate fell from 5 percent in 1986 to 2.5 percent in February 1987. It is widely believed that the easy credit policies adopted by the Bank of Japan in the mid-1980s created excess liquidity in the Japanese economy during the asset inflation period.[8]

The data on aggregate new issues of equity, convertible/warrant debt, and straight corporate debt over the period from 1980 to 1994 suggests a strong correlation between aggregate stock market valuations and issuances of equity or equity-linked securities. As shown in Figure 1, both equity and equity-linked securities issues increased dramatically during the asset inflation period.[9] These data are consistent with a decline in the cost premium on external financing during periods of asset price inflation (see Myers and Majluf (1984)).[10]

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[8] The sequence of events started with the Plaza Accord (1985) in which the G5 countries agreed on a stronger yen to correct for the US trade deficit. The central banks' intervention in foreign exchange markets appreciated the yen rapidly. Responding to the strengthening yen and seeking to prevent deflationary effects in the domestic economy, the Bank of Japan lowered interest rates and intervened in the foreign exchange market (to buy dollars and sell yen) that increased the money supply in the economy.

[9] Firms listed on the Tokyo Stock Exchange issued an aggregate of 301.3 billion yen in equity during 1987. The equity issues by these firms increased more than 15 times to 4,782.3 billion yen in 1988 and further to 8,848.6 billion yen in 1989. As stock prices collapsed, equity issues declined to 3,792.4 billion yen in 1990 and dropped to a mere 419.9 billion yen in 1992. Equity-linked bonds such as convertible bonds and warrants also followed a similar pattern. The source of this information is the Tokyo Stock Exchange Fact Book for various years.

[10] Loughran and Ritter (1995) examine equity issuances and subsequent returns for US firms and suggest that their results are consistent with firms issuing equity when it is overpriced.

2.3.   Asset price collapse period (1991)

Concerned with the overheating in the asset markets, the Bank of Japan (i) increased the official discount rate in several steps from 2.5 percent in June 1989 to almost 6 percent by August 1990 and (ii) imposed limits on commercial bank lending to real estate related projects (*souryo-kisei*) during 1990-1991. The introduction of capital adequacy requirements by the Bank of International Settlement (BIS), which took effect at the beginning of March 1991, perhaps also caused an inward shift in bank loan supply. Industrial production growth in Figure 2 suggests that real economic activity continued to increase during most of 1991, which also contributed to tighter credit market conditions during the period. The monetary tightening coincided with a rapid fall in both stock and real estate prices. The Tokyo Stock Price Index fell almost 40 percent in one year from its peak. Similarly, the land price index declined by more than half during the 1991-1994 period (see Figure 1). Kindleberger (1996) describes this period as one in which there was a "revulsion" against commodities and securities, causing banks to reduce lending against the collateral value of such assets.

2.4 Contraction period (1992-1994)

The deflation in asset values that began in the early 1990s caused the Japanese economy to contract significantly during the 1992-1994 period. As Figure 2 shows, the growth in industrial production turned negative starting in late 1991 and continued to contract until late 1994.[11] To stimulate domestic demand and to help financial

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[11] Since the economy showed a brief recovery in 1995, we define the contraction period until 1994. See also the result of the Cusum analysis in the appendix.

institutions, the Bank of Japan reversed its monetary policy yet again in late 1991. The official discount rate was gradually lowered to 1.75 percent towards the end of 1994 (and further to 0.5 percent in 1995). While adverse collateral shocks were experienced during both the collapse and the contraction periods, a distinguishing feature of the 1992-1994 period was its easy monetary policy, in sharp contrast to 1991. The decreasing level of the bank loan rate after 1991 reflects the loosening credit condition due to the easy monetary policy as well as to the weak demand for loans from corporations.

3. Data

The sample consists of Japanese firms listed on the Tokyo Stock Exchange at the beginning of 1978. Most data come from the Nikkei Corporate Financial Database (Nikkei). Stock prices are taken from the Pacific-Basin Capital Markets Research Center (PACAP) database.[12] We exclude firms in the financial services or utility industries. We also exclude firm-years in which a firm either merged or was spun-off, as data for the years surrounding the restructuring are not comparable.

Table 1 provides summary statistics of investment, Tobin's q, and cash flows for the sample firms during the 1980-1994 period. Tobin's q is estimated as the ratio of the market value of assets to their replacement values. Appendix B summarizes the estimation procedure for the q ratio (see also Hoshi and Kashyap (1990)). The time series variation in the annual cross-sectional average of Tobin's q ratio mirrors the aggregate

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[12] While the Nikkei database is free from survivorship bias, the PACAP is not. However, as Kang and Stulz (2000) argue, this is essentially not an issue because only 69 firms were delisted out of about 1400 to 1600 firms over the 1981-1994 period.

trend in stock prices over the observation period. The q ratio increased from 1.16 in the early 1980s to 1.56 at the end of the asset inflation period; it then declined to 1.18 in 1994 as asset prices collapsed in the early 1990s. However, the shifts in the q ratio were more gradual relative to the rapid increase in stock prices, as land prices also inflated the replacement value of capital stock in the denominator of q.

Investment spending, or I/K, is measured as the change in tangible fixed assets plus depreciation divided by the replacement value of the capital stock at the beginning of the year. The replacement value of the capital stock is estimated by using the algorithm described by Hoshi and Kashyap (1990) and Hoshi, Kashyap and Scharfstein (1993). Internally generated cash flow, or CF/K, equals "net income before extraordinary items and depreciation" divided by the replacement value of capital stock at the beginning of the year.

Studies examining corporate investment in Japan sometimes include land in capital stock and investment (Hayashi and Inoue (1991), Hoshi and Kashyap (1990), Hoshi, Kashyap, and Scharfstein (1991)) and sometimes do not (Gibson (1995), Ogawa and Kitasaka (1999) and Kiyotaki and West (1996)). In particular, studies that use either industry-level or aggregate data tend to exclude land, as the data typically do not allow a distinction between land used for production from that held as investments. The firm-level data used in this study permit a distinction between productive land and non-productive land. Because decisions about investing in productive land are made jointly with those about investing in other productive assets considering their relative prices, we include purchases of productive land in investment and its replacement value in capital

stock. Land held for investment purposes is excluded from capital stock and investment.[13]

For comparison, Table 1 reports the mean and median values of I/K and CF/K, with and without land, for each year. As a mechanical matter, both I/K and CF/K with land drop during the asset inflation period because a surge in land prices increases the replacement value of K. If we disregard land in K, both investment and cash flows increase during the 1987-1990 period.

4. Empirical results: market valuation, cash flow, and investment

In the absence of capital market frictions, the q-theory of investment implies that investment is a function of Tobin's q ratio (see Hayashi (1982)). Empirical studies, however, suggest that financial variables also play an important role in determining investments. Beginning with Fazzari, Hubbard and Petersen (1988), a common approach has been to specify investment expenditures as a function of both Tobin's q ratio and internal cash flow. A positive coefficient on cash flow in the investment regression suggests that financial constraints are binding. Furthermore, asymmetric information and agency models also predict that more financially constrained firms exhibit a greater sensitivity of investment to cash flow.

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[13] In addition, stock market valuation of a firm reflects the market's assessment of how land is employed in the firm's production technology. This makes it difficult to estimate a q ratio without land by subtracting replacement value of the land from both the numerator and the denominator of q. For example, warehouse companies in Japan typically own a lot of land, which is complementary to other assets for their business operations. In the late 1980s, even though land values were inflated, stock prices of warehouse companies did not increase correspondingly, suggesting that land is integral to warehouse operations and cannot be sold without shutting down the business.

An extensive empirical literature on corporate investment documents that firms *a priori* classified as financially constrained show greater sensitivity to cash flow. Several recent papers, however, argue over the interpretation of cash flow sensitivity as a measure of the cost wedge between internal and external financing (see a review in Hubbard (1998)). These papers argue that if cash flow is correlated with expected investment opportunities, cash flow may turn out to be a significant explanatory variable in the investment regression. To some extent, Gilchrist and Himmelberg (1995) mitigate these concerns by showing that, for firms with limited access to capital markets, investment is 'excessively' sensitive to cash flow even after controlling for the predictive content of cash flow for investment opportunities. On the other hand, Kaplan and Zingales (1997) show that when firms are classified using a different set of criteria, those that appear financially constrained do not necessarily have higher cash flow sensitivities.[14]

The panel analysis in this study allows us to avoid the problems that hinder cross-sectional work, since the change in stock valuations and the shifts in monetary policy during the observation period can be taken as exogenous factors in this study. The interpretation of our key results focuses on the variation in asset valuations and shifts in monetary policy over different periods. Hence, free from the sorting problems described above, we can reasonably assume a substantial change in the cost of external financing

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[14] Also see a response by Fazzari, Hubbard, and Petersen (2000) and Hubbard (1998) for a survey of the issues.

during different periods. This allows us to examine how cash flow sensitivities vary in response to asset price shocks and changes in monetary policy.

We begin our analysis by estimating the "baseline" investment regression for each period. The dependent variable is the I/K ratio, and the regressors are Tobin's q ratio and the CF/K ratio. We also decompose the q ratio into fundamental and residual components and examine whether investment responds to the residual component of stock valuations during asset price shocks.

Table 2 reports results from the baseline regressions and Table 3 reports those from the regressions with the decomposed q ratio. All of the regressions include fixed industry and year effects. According to the investment-q theory, exogenous shocks to a firm's profit function could result in the regressor(s) becoming correlated with the error terms (see Hayashi and Inoue (1991)). The resulting endogeneity of both q and cash flow biases the OLS estimates, while GMM mitigates this endogeneity bias and provides heteroskedastic-consistent estimates when appropriate instruments are used.[15] Alongside our GMM estimates, in Table 2, we also present the OLS estimates of the investment regression.

4.1. Market valuations and investment spending

In this section, we discuss the estimated coefficient on the q ratio. Discussion of the cash flow sensitivity is deferred to the next section. With the exception of the OLS result

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[15] If the error term is serially correlated, the endogenous variables used as instruments must be lagged more than the order of the serial correlation. To test whether the instruments (and jointly the model) are valid, a Chi-squared test is conducted using Hansen's J-statistic.

for 1991, the baseline results in Table 2 show that investment is positively and significantly related to the q ratio. The estimated coefficients on the q ratio decline significantly during the asset-inflation period compared with those during the 1981-1986 period. The decline perhaps results from the greater divergence of stock prices from the fundamentals during the late 1980s and the early 1990s.[16] Hoshi and Kashyap (1990) similarly find that the investment-q relation becomes weaker during the asset inflation period.[17]

A more interesting question, however, is whether stock valuations importantly affect investment spending during periods of asset price shocks when one expects large deviations of stock valuations from fundamentals. To address this question, we decompose the q ratio into two parts – a fundamental component and a residual component – and then examine how investment responds to these components of the q ratio.

Previous research that attempts to decompose the q ratio into fundamental and nonfundamental components points to several alternative approaches. Several studies construct the fundamental q by discounting ex-post profits or dividends (see Blanchard, Rhee, and Summers (1993) and Galeotti and Schiantarelli (1994)). The problem with the Japanese data is that dividends by Japanese firms are typically tied to the par value of

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[16] The errors-in-variable problem in stock prices is not an issue in our paper because our focus is precisely on understanding how market valuations, including any stock-misvaluations, affect the investment spending of firms.

[17] Hoshi and Kashyap (1990) attribute the weakening of the relation to an increase in "adjustment costs" during this period because of a lack of management strategies during the bubble.

equity, show very little variation, and are generally uninformative about future investment opportunities. In another approach, Cummins, Hassett, and Oliner (1999) and Bond and Cummins (2000) estimate the fundamental q by discounting analysts' earnings forecasts. However, Amir, Lev, and Sougiannis (1999) argue that earnings forecasts themselves are affected by stock prices. At a practical level, therefore, it is likely that earnings forecast will be affected by inflation in asset values during a bubble period. Finally, several studies estimate proxies for the marginal q using a vector autoregression approach to model the process of fundamental variables and relate this to the marginal q (see Gilchrist and Himmelberg (1995)). Because we observe several structural shifts in a relatively short period in the sample, we find that the autoregression technique to calculate forward-looking fundamental variables is difficult to implement.

Given these restrictions, our strategy is to project the observed q ratio on different sets of variables that previous research has commonly used to describe the fundamentals of the firm. A key issue here is our choice of proxies for the fundamentals. The most commonly used proxy for the fundamentals is sales growth (see Morck, Shleifer and Vishny (1990) and Shin and Stulz (1998)). The results that we report in the tables are based on decomposition obtained by annual cross-sectional regressions of the q ratio on contemporaneous and lagged sales growth, squared sales growth and industry dummies.[18] The fitted values from this regression are proxies for the fundamental component of stock valuations (q^f), while the residual components are proxies for the residual values ($q^r=q-$

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[18] In an alternative specification, we estimate this regression without the industry dummies. Although the R^2s are lower without these dummies, the results are qualitatively identical.

q^f). The caveat is that the residual component of q includes not only stock market misvaluations but also *other fundamental components* not captured in q^f.

A plot of the adjusted R^2 from annual regressions in Figure 3 shows that, as stock prices started to rise in the mid-1980s, the explanatory power of the fundamental variables for the q ratio dropped sharply. This finding is consistent with the widely held belief and previous empirical evidence that fundamental measures cannot account for stock market valuations during the asset inflation period. For example, French and Poterba (1991) show that changes in the required returns or growth expectations could not account for changes in Japanese stock valuations during this period. Similarly, Conroy, Harris and Park (1998) find that market valuations were less sensitive to earnings fundamentals during the asset inflation period. Studies using aggregate time series data similarly find bubbles in Japanese asset prices during the late 1980s (see Ito and Iwaisako (1996)). The R^2s during the early 1990s are equally low since asset prices rapidly fell during these years and fundamental measures once again cannot account for market valuations.

Table 3 reports regressions relating investment to q^f, q^r, and cash flow. During the asset price shocks from 1987 to 1994, investment responds only to the residual component of stock valuations. No relation exists between investment and fundamental valuations. By contrast, results from the pre-asset inflation period (1981-1986) show that both q^f and q^r are positive and significant. Our results are consistent with those reported by Chirinko and Schaller (1998) who use an alternative methodology to address a similar

issue.[19] Their results, based on aggregate time series data, similarly suggest that the asset price shock in Japan during the late 1980s significantly affected Japanese corporate investment spending during the period. Clearly, the stock market is *not* a 'sideshow'.

While the way we decompose the q ratio may affect the magnitude of estimated sensitivities of investment to fundamental and residual valuations, we are interested in relative changes in the sensitivities between the benchmark period (1981-1986) and subsequent periods of asset price shocks. If the sensitivities change between the periods, we can reasonably interpret these changes in investment behavior as structural shifts in response to market valuations.

We test the robustness of our results with different proxies for the fundamentals. The other candidates suggested in the literature include earnings, cash flows, working capital ratios, and dividends – all of which are considered to have some forward looking information about the fundamentals of a firm. As an alternative to the sales growth terms, we employ (i) contemporaneous, lagged and one-period ahead earnings, (ii) this set of earnings variables with that of sales growth terms, (iii) the contemporaneous and lagged working capital together with the sales growth terms, (iv) cash flow measures in addition to the sales terms, and (v) the dividend payout ratio with the sales growth terms. Industry dummies are included in all cases. While the results that use different proxies are not presented in a table here, they are qualitatively identical to those we report in Table 3.

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[19] Chirinko and Schaller's Euler equation methodology circumvents the decomposition of q into fundamental and nonfundamental valuations.

4.2. Cash flow and investment spending

We now turn to results regarding changes in cash flow sensitivity during periods of asset price shocks and different monetary policy regimes. As Tables 2 and 3 show, cash flow sensitivity varies substantially with changes in asset values and shifts in monetary policy regimes.[20]

During the 1987-1990 period, the cash flow sensitivities initially declined as asset prices inflated and monetary policy became relatively easy (the sensitivity slightly decreased from 1981-1986 to 1987-1990 with a p-value of 0.093 for the GMM estimates in Table 3).[21] The sensitivities then substantially increased when asset prices collapsed and monetary policy became tight during 1991 (from 0.26 during 1987-1990 to 0.41 in 1991 with p-value=0.064). Overall, these results suggest that asset price shocks and changes in monetary policy significantly affect liquidity constraints faced by Japanese firms.

The predictions on how cash flow sensitivities would change during the contraction period of 1992-1994 are ambiguous. Although both the 1991 and the 1992-1994 periods saw collapses in asset values, the monetary policy was easy in the latter period. The results in the last columns of Table 2 and 3 show that investment is substantially less

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[20]To address concerns that cash flow may have predictive content for investment opportunities, we also examine whether the cash flow sensitivities change when cash flow is one of the instruments for q^f. The results (not reported in a table) show that the investment cash flow sensitivities are similar to our findings in Table 3, with the exception of 1991 when they were larger. Overall inferences about the shifts in cash flow sensitivity are unaffected.

[21]A modified-Welch t-test is used to test the equality of the regression parameters when variances are unequal.

sensitive to cash flows during the contraction period of 1992-1994 than during 1991, which suggests that monetary policy has a more dominant effect than collateral shocks on cash flow sensitivities (the sensitivity declines from 0.43 in 1991 to 0.23 in 1992-1994 with p-value=0.037 for the GMM estimates in Table 3).

The cash flow sensitivities during 1992-1994 are even smaller than those during the asset inflation period of 1987-1990. We conjecture that contraction in the Japanese economy (in addition to an easy monetary policy) perhaps explains the decline in cash flow sensitivity below its level in 1987-1990.

5. Bank-dependence, investment, and liquidity

5.1 Bank-dependence and collateral holdings

Is the investment of bank-financed firms more responsive to asset price shocks and monetary policy changes? This is a relevant question because "banks like most economic agents get caught up in the euphoria of budding economic expansions and expand credit rapidly to finance the increase in economic activity, particularly in areas subject to the greatest increase in demand and consequently in prices, e.g., stock market and real estate" (Kaufman (1998).

Japanese banks have traditionally emphasized collateral, particularly securities and fixed assets such as land and developed real estate, rather than future cash flows in their lending decisions.[22] In addition, the deregulation of public debt markets in the 1980s and the relaxation of bond issuance criteria dramatically changed the mix of bank and public

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[22] See Ballon and Tomita (1988) and Shibata (1995).

debt financing for large firms. The issuance criteria gave large firms increasingly better access to public debt markets.[23] Figure 4, which plots the loan-to-assets ratio for large and small firms, confirms that bank lending to large firms declined relatively steeply during the late 1980s.

As large firms migrated to other sources of funding during the late 1980s, banks lent more to small firms with which they had no previous close ties. This lending was largely based more on collateral values of real estate and security holdings, and less on fundamental valuations (see Bank of Japan (1996)). Both Hoshi and Kashyap (1999) and Ogawa and Kitasaka (2000) document that Japanese banks substantially increased their real estate related lending during the asset inflation period. In addition, Ogawa and Kitasaka show that the rate of change in land prices positively affected loans to small firms during this period.

Asset price shocks significantly affect the value of collateral such as securities and land held for investment purposes by firms. In particular, these marketable collateral assets are unrelated to firms' productive activities. If banks lend to firms based more on marketable collateral, then (i) do fundamentals matter in determining the investment spending of bank-dependent firms, and (ii) do shocks to collateral values affect financial constraints of bank-dependent firms? To examine these questions, we split the sample in

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[23] The bond issuance criteria, called the *Tekisai Kijun* (Bond Issuance Criteria), typically favored large companies, and size was a key determinant of a firm's ability to issue public debt (see Hoshi, Kashyap, and Scharfstein (1993) and Anderson and Makhija (1999)). Although these criteria were substantially loosened during the 1980s, some restrictions were in effect until 1990 (when the accounting criteria were dropped and replaced by a single rating criterion).

each period by bank-dependence and beginning-of-the-year holdings of marketable

collateral. The four sample splits are: (i) firms with above median ratios of collateral

assets to total assets (high collateral) and above median ratios of loans to assets (bank-

dependent), (ii) low collateral and bank-dependent firms, (iii) high collateral and less

bank-dependent firms, and (iv) low collateral and less bank-dependent firms.

Table 4 shows that collateral is an important factor in determining the investment

spending of bank-dependent firms, but not for less bank-dependent firms. Investment of

bank-dependent firms with high collateral is responsive only to the residual valuations

during the 1987-1990 period; fundamentals do not matter.[24] For bank-dependent firms

with low collateral, investment is generally insensitive to both residual and fundamental

valuations during periods of asset price shocks (with the exception of 1992-1994). In

contrast, investment spending of less bank-dependent firms is sensitive *only to*

fundamental valuations during the asset inflation period, regardless of the amount of

collateral.

The results on cash flow sensitivities for different sample splits show that the

sensitivities of bank-dependent firms with high collateral assets are more responsive to

fluctuations in collateral values. When asset prices inflated in the late 1980s, the cash

flow sensitivities for bank-dependent firms with high collateral dropped significantly (the

estimated coefficient for these firms declined from 0.42 during 1981-1986 to 0.21 during

1987-1990 with a p-value for the difference of 0.001). But, when asset prices collapsed

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[24] The correlation between investment and the residual q exists since the collateral value is possibly
reflected in the residual valuation.

and monetary policy tightened in 1991, it is only in these firms that the cash flow sensitivity increased significantly (the coefficient on cash flow increased more than three times from 0.21 in 1987-1990 to 0.69 in 1991 with a p=0.002). In contrast, the cash flow sensitivities in other sample splits are fairly stable throughout the 1980s, even during the asset price collapse of 1991.

The results for the 1992-1994 period confirm our pervious finding that the effect of the monetary policy dominates that of the negative collateral shock. Cash flow sensitivities for all four groups of firms drop significantly relative to their values during 1991 (p<0.048). Bank-dependent firms with low collateral have the lowest sensitivity of investment to cash flow during the 1992-1994 period. This is consistent with banks being more willing to lend to companies that are least affected by the declining value of collateral assets (*flight to quality*).[25]

As discussed earlier, while bank lending during the late 1980s was based more on collateral values, it was also directed more towards small firms. To examine the robustness of our results, we do additional splits of the sample based on bank-dependence and size, and then examine the investment regression for each group separately. Specifically, we examine the following four splits: (i) firms that have above median book value of assets (large) and above median loan-to-asset ratio (bank-dependent), (ii) large

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[25] In a related study, Kang and Stulz (2000) examine the investment of Japanese firms during the early 1990s and find that more bank-dependent firms invested less during the asset price deflation than during 1990, the peak of the bubble.

and less-bank-dependent firms, (iii) small and bank-dependent firms, and (iv) small and less-bank-dependent firms.

The results in Table 5 show that the investment spending of bank-dependent firms – regardless of size – is more sensitive to residual valuations during the asset inflation and deflation periods; again, fundamentals do not matter. By contrast, residual valuations do not matter in determining the investment of less bank-dependent firms during the entire asset shock period from 1987 to 1994. Overall, these results confirm that bank dependence has an independent and important effect on the sensitivity of investment to stock valuations during the asset inflation period.

The results on cash flow sensitivities across different sample splits and periods are consistent with small firms facing higher costs in accessing external credit – small firms generally exhibit larger cash flow sensitivity than large firms.[26] During 1991, the asset price collapse and monetary tightening dramatically increased the external finance premium only for small bank-dependent firms; their cash flow sensitivity increased from 0.34 in 1987-1990 to 0.70 in 1991 (p=0.013). In comparison, the cash flow sensitivities for large bank-dependent firms show no significant change in 1991. These results again imply that the negative collateral shock and tight monetary policy in 1991 adversely

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[26] In addition, large firms that continued to rely on bank loans witnessed significant declines in their cash flow sensitivity during the asset inflation period (from 0.33 in 1981-1986 to 0.21 in 1987-1990 with a p-value for the difference of 0.023). Moreover, there are no significant differences in cash flow sensitivity between bank-dependent and less bank-dependent firms in the same size category for all periods (except for the large firms in 1992-1994).

affected small bank-dependent firms in particular. This result underscores the lack of alternative sources of financing for these firms.

5.2 Bank loans and stock valuations

In response to the above results, a natural question is whether new bank loans themselves are affected by residual valuations during the asset inflation period. To examine this question, we regress new loans on fundamental and residual valuations for sample splits based on bank-dependence. These regressions control for firm size and include fixed industry and year effects. The results reported in Table 6 show that new loans to bank-dependent firms are sensitive only to residual valuations. By contrast, new loans to *less* bank-dependent firms are sensitive only to *fundamentals* during the asset inflation period. We also performed further sample splits by size. While these results are not reported in the paper, they show that new loans to small bank-dependent firms are significantly more sensitive to residual valuations during the asset inflation period. When we split the sample by the amount of marketable collateral, we find that new loans to bank-dependent firms with large collateral are significantly related to residual valuations.

6. Concluding remarks

Fisher and Merton (1984) and Stein (1996) argue that investment responds to nonfundamental changes in stock prices – firms increase investment spending when stocks are overpriced and cut back when stocks are under priced. It is commonly suggested that asset price shocks affect the cost of external financing and, consequently, real investment.

We present three key findings. First, investment during asset price shocks is significantly more responsive to nonfundamentals, or residual stock valuations; fundamentals matter less. Second, while the cash flow sensitivity during the asset inflation period was relatively low, it increased dramatically when the monetary policy tightened and asset prices collapsed in 1991. Thus, both collateral values and monetary policy appear important in explaining the variation in the cost of external financing. However, when the monetary policy was substantially relaxed during 1992-1994, cash flow sensitivities declined even though collateral values continued to remain low. These results suggest that the time-series variations in cash flow sensitivities are attributable more to changes in monetary policy than to shifts in collateral values.

Third, somewhat paradoxically, asset price shocks significantly affect firms that depend on bank loans but not necessarily those that depended on public debt and equity markets for financing. Japanese banks have traditionally extended loans against inflated collateral during the asset price inflation period. Consistently, we find that only the bank-dependent firms with large collateral holdings show a significant relation between investment and residual market valuations. More broadly, the results imply that when banks make lending decisions based on collateral values, capital allocations by firms are affected by factors other than fundamentals.

Moreover, these bank-dependent firms show significantly smaller cash flow sensitivity during the asset inflation period compared with other firms. However, when asset prices collapsed and the monetary policy tightened in 1991, these firms (and small bank-dependent ones) showed the most dramatic increase in their cash flow sensitivity.

The result suggests that collapse of asset prices and tight monetary policies severely hit

bank-dependent firms with weak balance sheets.

Appendix A

Modified Cusum test

We employ the Cusum (Cumulative sum) method proposed by Brown, Durbin and Evans (1975) to identify regime shifts when breakpoints are unknown. Harvey (1990, pp. 150-160), provides a brief description of the Cusum method. Although the method was originally developed for time series data, we use an approach by Maskus (1983) that extends the method for panel data. The advantage of his method is that the standard Cusum technique used for univariate time series data can be applied to the panel data. Thus, the standard significance bounds can be applied.

Let x_t denote a N×K matrix of dependent variables, and y_t a N dimensional column vector of the independent variable for year t, where N is the number of cross sectional observations and K is the number of dependent variables. We stack the annual observation over t years and obtain

$$Y_t = X_t \beta + V_t, \qquad t = 1, ..., T \tag{A1}$$

where $Y_t = (y_1, y_2, ... y_t)'$, $X_t = (x_1, x_2, ... x_t)'$, $\beta = (\beta_1, \beta_2, ... \beta_t)'$ and $V_t = (v_1, v_2, ... v_t)'$. V_t is a vector of identically and independently distributed error terms where $EV_t = 0$ and each error terms has a common variance σ^2. T is the number of years contained in the panel data. Let b_t be the OLS estimator using t years of data: $b_t = (X_t'X_t)^{-1}X_t'Y_t$. Then consider the recursive residual for the model as

$$u_t = y_t - x_t b_{t-1} \tag{A2}$$

where b_{t-1} is the OLS estimator using data for periods t=1,…t-1. The residual is updated annually by simultaneously adding all N observations from the successive cross-section data. Under the distributional assumptions of V_t, it follows that $E(u_t) = 0$ and

$$E(u_t u_t') = \sigma^2 (I_N + x_t (X'_{t-1} X_{t-1})^{-1} x'_t),$$

where I_N is an identity matrix of dimension N. The residuals are standardized such that

$$w_t = P_t^{-1} u_t \tag{A3}$$

where

$$P_t P_t' = I_N + x_t (X'_{t-1} X_{t-1})^{-1} x'_t.$$

The standardized error w_t is aggregated across cross-section observations for period t:

$$\widetilde{w}_t = \frac{1}{N} \sum_{i=1}^{N} w_{t,i} \tag{A4}$$

where $w_{t,i}$ is the ith cross-section element in w_t. The Cusum test is based on the cumulative sum of residuals

$$W_t = \sum_{j=2}^{t} \frac{\widetilde{w}_t}{\hat{\sigma}} \qquad (A5)$$

where

$$\hat{\sigma}^2 = \frac{1}{(NT-1)} \sum_{t=1}^{T} (w_t - \overline{w})'(w_t - \overline{w}),$$

and

$$\overline{w} = \frac{1}{NT} \sum_{t=1}^{T} \sum_{i=1}^{N} w_{t,i} .$$

The Cusum of Squares statistics uses

$$S_t = \sum_{j=2}^{t} (\widetilde{w}_j)^2 / \sum_{j=2}^{T} (\widetilde{w}_j)^2 . \qquad (A6)$$

The test is helpful in detecting shifts in the regression coefficients if their changes are haphazard (see Brown, Durbin and Evans (1975)).

We conduct the experiment for the investment equation in which the dependent variable is I/K and the independent variables are the q ratio, CF/K and industry dummies. The Cusum plot in panel A of Figure 5 indicates changes in the directions of structural shifts in 1987, 1991, and 1994, which is suggested by the reversal of the plot in those years. Also the plot shows a large downward drift in 1995. Although the Cusum plot is not formally significant, it shows that the course of instability has changed in these years. Harvey (1990, p.155) notes that, although a Cusum plot may not be significant, "[t]his is quite likely to be the case, even if there is a genuine structural break in the data," and further remarks that "plots contain more information than can be summarized in a single test statistic." To complement the analysis, we examine the Cusum of Squares plot in panel B of Figure 5. We do not detect any significant patterns in the plot, however.

Based on the Cusum plot, we determine that the *asset inflation period* starts from 1987 and ends in 1990. Thus, the *pre-asset inflation period* is defined until 1986. Although the Cusum plot does not detect any turning point until 1994, we single out 1991 as the period of tight credit. This is not only because the episode of monetary policy indicates tight credit conditions in 1991 compared with adjacent years, but also year-by-year regressions show a much larger cash flow coefficient for this year. Finally, the large downward drift of Cusum in 1995 could reflect changes in investment behavior because of the economic recovery that started in late 1994. We therefore exclude 1995 and define the *contraction period* from 1992 to 1994.

Appendix B

Estimation of Tobin's q

This appendix describes our estimation method for Tobin's q ratios. For the most part, we follow the procedure described in the appendix to Hoshi and Kashyap (1990). Tobin's q ratio is defined as the market value of assets divided by the replacement value of assets.

The replacement value of assets is the sum of the replacement value of depreciable tangible assets, the replacement value of land, and the replacement value of other assets. We describe the construction of each of these replacement values below.

(i)   *The replacement value of depreciable tangible assets* at the end of year t (RK_t) is calculated using the following recursive equation:

$$RK_t = \left\{ RK_{t-1} \times \frac{p_t^K}{p_{t-1}^K} + I_t \right\} (1 - \delta) \qquad (B1)$$

where,

- I_t is the gross investment and is given by $I_t = K_t - K_{t-1} + \gamma Dep_t$
- p_k is the wholesale price index of machinery and equipment
- δ is the economic depreciation estimated as the time-series average (over the observation period beginning 1975 or later and ending 1994 or earlier) of the ratio of depreciation (Dep_t) to the sum of tangible fixed assets, intangible assets, financial assets, and depreciation. When firms use a straight-line method of depreciation, we estimate the depreciation rate as $\delta = 1-0.1^L$ where L is the average life of capital and 0.1 is the ratio of the salvage value of capital to the acquisition value following Japanese tax law. The average life of capital is the time-series average of the ratio of (depreciable fixed assets + intangible assets + financial assets + depreciation)/ (depreciation) during the observation period for each firm.
- γ is defined as the fraction of depreciation attributable to depreciable tangible fixed assets. This ensures that our depreciation numbers exclude depreciation of intangible or financial assets, if any.

(ii)   *The replacement value of land*: Our estimates of replacement values of land follow the method suggested by Hoshi, Kashyap, and Scharfstein (1993). Let A_t and BVL_t be the area of land and its corresponding book value reported under the "condition of facilities" in the annual report. Then, the replacement value of land (RL_t) is calculated as follows:

if $\{A_t/A_{t-1} \leq 1\}$ or $\{A_t/A_{t-1} > 1$ and $BVL_t-BVL_{t-1} \leq 0\}$, then

$RL_t = RL_{t-1}(p_{Lt}/p_{Lt-1})(A_t/A_{t-1})$ (B2)

else

if $\{A_t/A_{t-1}>1 \text{ and } BVL_t-BVL_{t-1}>0\}$, then

$RL_t = RL_{t-1}(p_{Lt}/p_{Lt-1}) + (BVL_t-BVL_{t-1})$.

Here, p_{Lt} is the land price index for year t based on the commercial land price index of six major cities determined by the Japan Real Estate Research Institute. To estimate the initial replacement value for the iterative algorithm, we multiply the book value with the market-to-book ratio calculated from aggregate figures for both depreciable tangible fixed assets and land. Hayashi and Inoue (1991) use a similar method for land. The aggregate market value is taken from the National Accounts Statistics published by the Economic Planning Agency and the book value from the Corporate Statistics Annual published by the Ministry of Finance. Both sets of statistics cover all non-financial corporations, both publicly traded and non-traded firms, although there is a slight difference in coverage due to different sampling methods. The market-to-book ratios for 1975 for net tangible fixed assets and land are 2.22 and 5.96, respectively.

(iii)   *The replacement value of other assets* is assumed equal to their book value.

Tobin's q is the ratio of the sum of the market value of equity and the market value of liabilities divided by the replacement value of assets.

(i)   The market value of equity at year t is the stock price multiplied by the number of shares outstanding on the last business day of the last month of the accounting year. The data for calculating the market value of equity is obtained from the PACAP tape.

(ii)   Following Hoshi and Kashyap (1990), we estimate the market value of interest-bearing debt by dividing the interest expense by the average interest rate. We assume market values of all non-interest-bearing liabilities are equal to their book values. Thus, our measure of market value of liabilities is a sum of the estimated market value of interest-bearing debt and the book value of the rest of the liabilities. The average interest rate is the weighted average of: (a) the average short-term (long-term) interest rates on loans and discounts for short term (long-term) borrowings, (b) the three-month Gensaki rate for debt maturing within one year, and (c) ten-year government bond yield for bonds and convertible bonds maturing in more than one year. Because this method overestimates the market value of debt – it treats interest expense as a perpetuity – we estimate an alternative q ratio in which the market value of liabilities is assumed to be equal to the book value. Since the q ratios estimated using these two alternative methods have a correlation coefficient of more than 0.97, we use the q ratio with the market value of liabilities.

While we do not adjust for taxes in the q ratio, we believe this is not a serious concern for two reasons. First, Hoshi and Kashyap (1990) show that the correlation between the tax-adjusted and non-adjusted ratio is about 0.98. Second, tax adjustment of the q ratio is based on industry-level tax rates. Since we include industry dummies in the reported regressions, we control for at least some of the cross-sectional variation in tax-adjustment.

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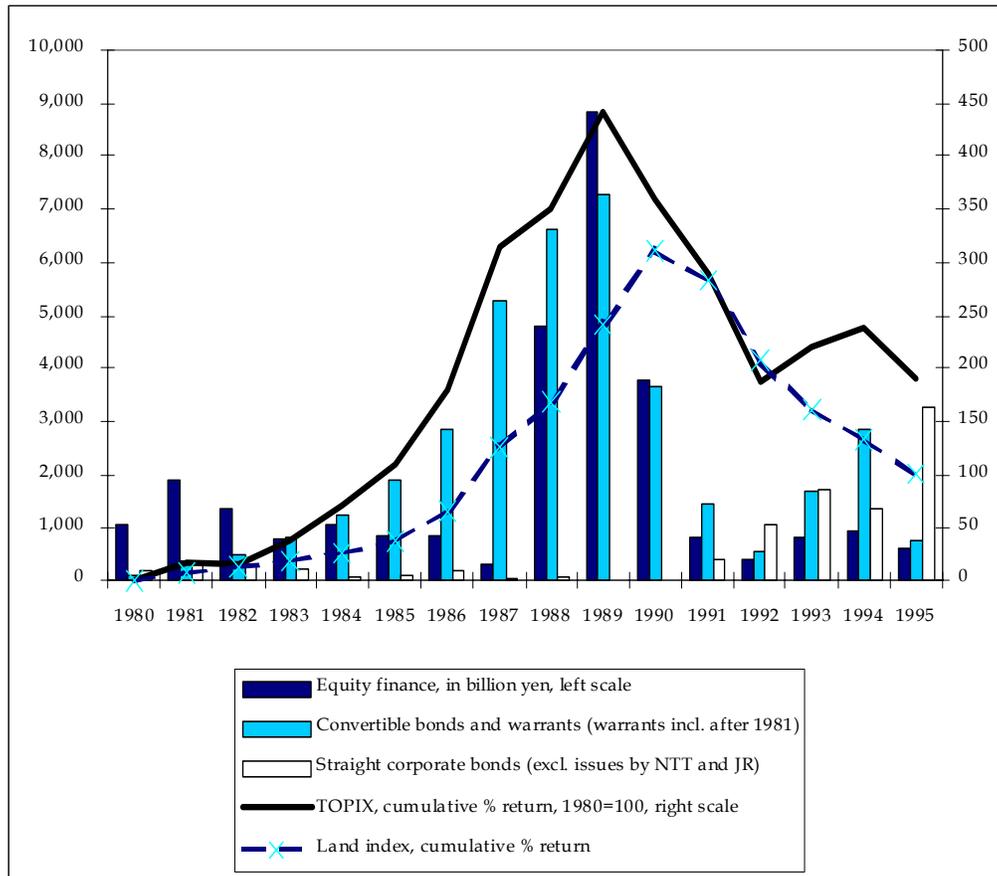
Figure 1. Asset valuations and corporate financing

This figure plots cumulative returns on the Tokyo Stock Price Index, cumulative returns on the Land Price Index, and new security issues during the 1980-1995 period. The data on new security issues represent aggregate numbers for all stock-exchange-listed firms and are obtained from the Tokyo Stock Exchange Fact Book. The Land price index is based on urban land prices of Japan's six largest cities (the index is produced by the Japan Real Estate Institute).
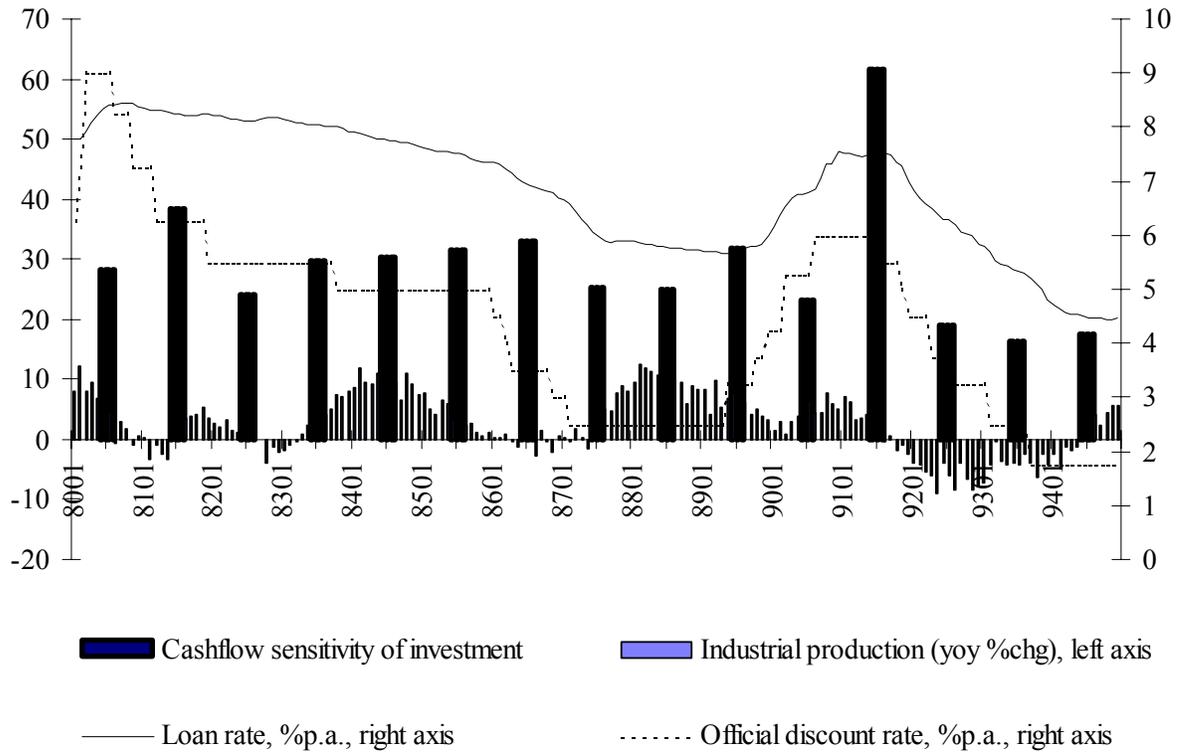
Figure 2. Interest rates and estimated investment-cash flow sensitivities

Loan rate is the average interest rate on long-term loan contracts for all banks. Loan rates and the official discount rate (both on right axis) are obtained from the Bank of Japan. Industrial production is from MITI. The estimated investment-cash flow sensitivities (rescaled on left axis) are the coefficient on the cash flow variable in the following fixed industry effects regression estimated separately for each year: $I_t/K_{t-1} = \alpha + \beta q_{t-1} + \gamma CF_t/K_{t-1} + u_t$, where I/K is investment in plant, property and equipment divided by the beginning-of-period capital stock, q is Tobin's q ratio, and CF/K is internally generated cash flow divided by the beginning-of-period capital stock. The sample includes all firms, excluding those in financial services and public utilities that were listed on the Tokyo Stock Exchange in 1980. The sensitivity is rescaled by a factor of 100 on the left axis.
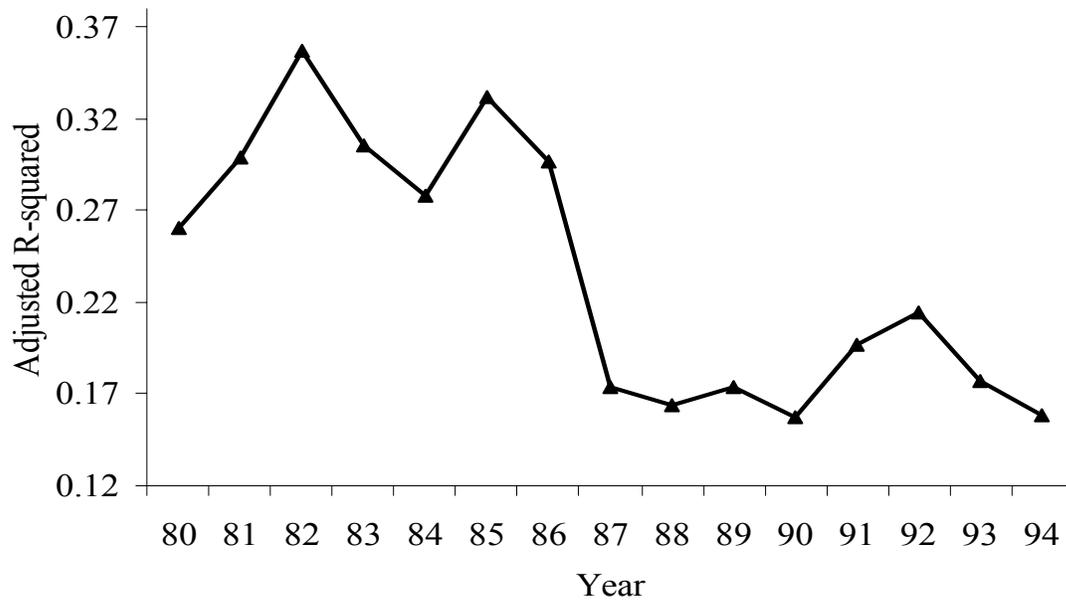
Figure 3. The explanatory power of the fundamental variables in the q ratio

This figure shows adjusted R^2s from the annual regressions of Tobin's q ratio: $q_{t-1} = a_0 + a_1 Sg_t + a_2 Sg_{t-1} + a_3 Sg_t^2 + a_4 Sg_{t-1}^2 + $(industry dummies). Variable q_{t-1} is Tobin's q ratio at the beginning of year t, Sg_t is sales growth in year t, and a_i (i=0,..,4) are coefficients. The sample includes all firms, excluding those in financial services and public utilities, listed on the Tokyo Stock Exchange in 1980.
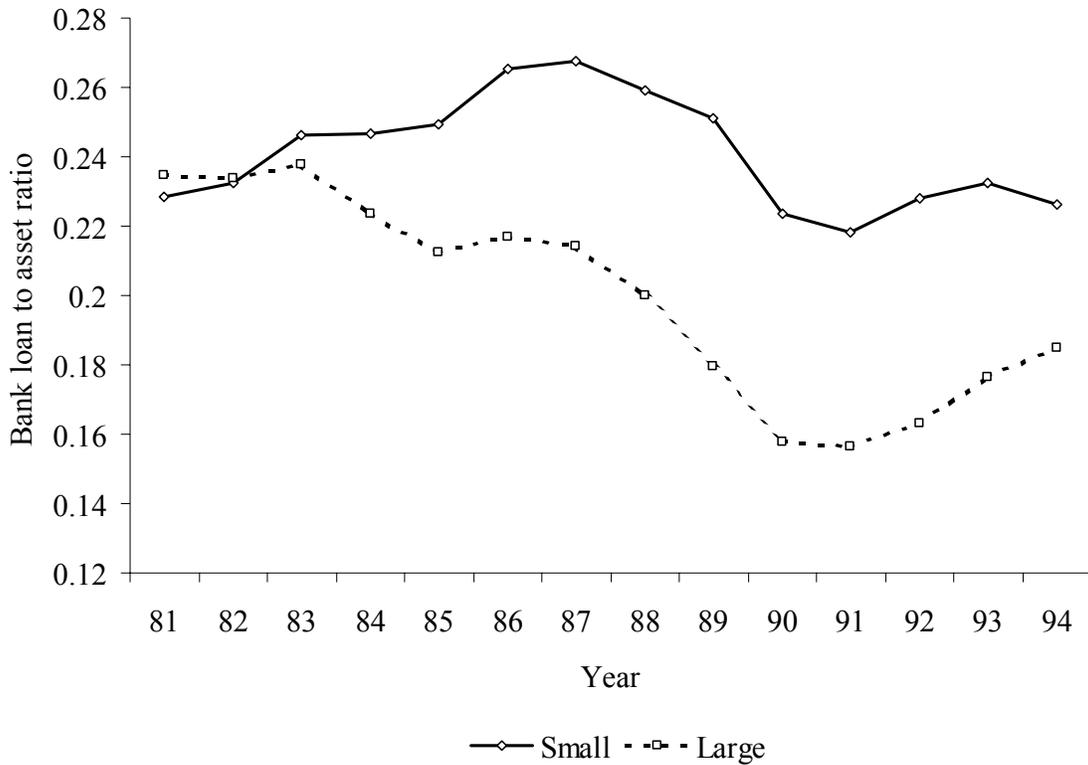
Figure 4. Average bank loan-to-assets ratio for small and large firms, 1981-1994

This figure plots the ratio of loans to total assets for small and large firms. Small firms are those that have book values of assets below the median for the sample each year. Large firms have book value of assets above the median value. The sample includes firms that are listed on the Tokyo Stock Exchange in 1980 and covers all industries except financial services and public utilities.

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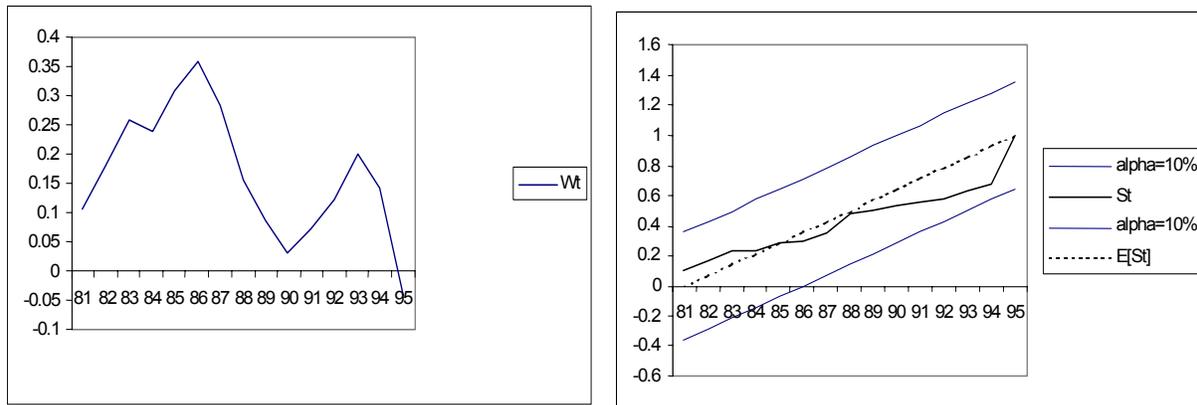
A. Cusum (W_t) B. Cusum of squares (S_t)

Figure 5. Cusum and Cusum of Squares recursions of investment equation with q ratio and cash flow

These plots are based on a modified Cusum method for panel data proposed by Maskus (1983) and are calculated from recursive residuals of the following investment equation: $I_t/K_{t-1}=\alpha+(Industry\ dummies)+\beta q_{t-1}+\gamma CF_t/K_{t-1}+u_t$, where I/K is investment divided by the beginning-of-period capital stock, q is Tobin's q ratio, and CF/K is cash flow divided by the beginning-of-period capital stock. The sample includes all firms, excluding those in financial services and public utilities that were listed on the Tokyo Stock Exchange in 1980. The 10% significance line is indicated by alpha=10%, and the expected value of Cusum of Squares is shown by $E[S_t]$. Significance bounds for Cusum plots are not included since they lie beyond the vertical scale of the panels.

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Table 1
Summary statistics: Investment, q and cash flows of Japanese firms

This table presents means and medians (in parentheses) of the Tobin's q ratio, sales growth, cash flow to capital stock ratio (CF/K), and investment to capital stock ratio (I/K) of sample firms. The sample includes all firms that were listed on the Tokyo Stock Exchange in 1980, except firms in the financial services and public utility industries. Capital stock is measured at the beginning of the year.

Year	Tobin's q ratio	Sales growth (%)	I/K (with land)	I/K (without land)	CF/K (with land)	CF/K (without land)
1980	1.16 (1.09)	16.1 (14.0)	0.064 (0.046)	0.105 (0.078)	0.139 (0.113)	0.262 (0.216)
1981	1.22 (1.14)	11.8 (10.8)	0.079 (0.056)	0.131 (0.093)	0.141 (0.110)	0.270 (0.222)
1982	1.16 (1.09)	4.8 (4.7)	0.081 (0.055)	0.130 (0.096)	0.137 (0.106)	0.265 (0.218)
1983	1.21 (1.12)	1.5 (1.9)	0.078 (0.048)	0.128 (0.087)	0.122 (0.099)	0.241 (0.205)
1984	1.38 (1.18)	4.4 (4.0)	0.072 (0.044)	0.121 (0.083)	0.127 (0.104)	0.256 (0.223)
1985	1.39 (1.24)	7.6 (6.5)	0.089 (0.051)	0.154 (0.095)	0.138 (0.110)	0.280 (0.244)
1986	1.45 (1.28)	2.2 (2.1)	0.085 (0.057)	0.151 (0.120)	0.127 (0.104)	0.272 (0.246)
1987	1.44 (1.26)	-3.4 (-2.4)	0.068 (0.045)	0.134 (0.095)	0.108 (0.090)	0.271 (0.253)
1988	1.52 (1.37)	6.3 (4.7)	0.062 (0.036)	0.140 (0.097)	0.110 (0.088)	0.326 (0.292)
1989	1.54 (1.41)	14.7 (8.6)	0.067 (0.041)	0.183 (0.138)	0.109 (0.086)	0.394 (0.328)
1990	1.56 (1.41)	13.1 (7.3)	0.067 (0.043)	0.211 (0.160)	0.105 (0.082)	0.418 (0.346)
1991	1.28 (1.20)	11.9 (8.8)	0.074 (0.045)	0.263 (0.197)	0.096 (0.073)	0.434 (0.354)
1992	1.10 (1.04)	3.2 (2.7)	0.067 (0.047)	0.230 (0.181)	0.089 (0.069)	0.383 (0.315)
1993	1.14 (1.08)	-2.9 (-3.4)	0.065 (0.037)	0.188 (0.119)	0.078 (0.066)	0.293 (0.260)
1994	1.18 (1.11)	-4.2 (-5.1)	0.050 (0.027)	0.132 (0.074)	0.076 (0.068)	0.252 (0.219)

Table 2
Regressions of investment on Tobin's q and cash flow

This table presents results of regressions in which the dependent variable is the investment divided by beginning-of-period capital stock at replacement cost. The independent variables are the overall q ratio and cash flow divided by the beginning-of-period capital stock. The t-values are reported in parentheses. GMM reports the asymptotic t-values. All regressions include industry dummies, year dummies, and a constant. Instruments employed for GMM estimations are industry and year dummy variables, a constant, and independent variables lagged by one, two and three years. The J-statistic is used to test the set of over-identifying restrictions and is asymptotically distributed as $\chi^2_{(m-p)}$, where m is the number of instruments and p is the number of parameters. ***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level. N is the number of observations.

	1981-1986		1987-1990		1991		1992-1994	
	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM
q_{t-1}	0.028 (11.7)***	0.019 (4.43)***	0.011 (5.0)***	0.006 (2.1)**	-0.009 (-1.6)	0.010 (1.4)	0.014 (3.2)***	0.016 (2.6)***
CF_t/K_{t-1}	0.315 (33.4)***	0.319 (15.3)***	0.263 (19.4)***	0.274 (9.6)***	0.617 (14.6)***	0.439 (4.1)***	0.174 (11.8)***	0.243 (6.1)***
N	6892	6519	4158	3799	1137	923	3472	2982
J-stat[d.f.] (p-value)		52.4 [34] (0.02)		24.1 [22] (0.34)		4.1 [4] (0.40)		20.4 [16] (0.20)
Adj. R^2	0.29		0.15		0.18		0.06	

Table 3
Regressions of investment on fundamental q, residual q, and cash flow

This table presents results of regressions in which the dependent variable is the investment divided by the beginning-of-period capital stock at replacement cost. The independent variables are fundamental stock valuation (q^f), residual valuations (q^r), and cash flow divided by beginning-of-period capital stock. The q^f_{t-1} is the component of q ratio at the beginning of year t that is explained by sales growth and squared sales growth in years t and t-1 and industry dummies. The q^r is the difference of q and the fitted component q^f. The t-values are reported in parentheses. GMM reports the asymptotic t-values. All regressions include industry dummies, year dummies, and a constant. Instruments employed for GMM estimations are industry and year dummy variables, a constant, and independent variables lagged by one, two and three years. The J-statistic is used to test the set of over-identifying restrictions and is asymptotically distributed as $\chi^2_{(m-p)}$, where m is the number of instruments and p is the number of parameters. ***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level. N is the number of observations.

	1981-1986		1987-1990		1991		1992-1994	
	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM
q^f_{t-1}	0.059 (9.6)***	0.061 (5.0)***	0.016 (1.5)	0.007 (0.4)	-0.092 (-0.8)	0.137 (1.2)	0.019 (0.8)	-0.030 (-1.1)
q^r_{t-1}	0.024 (9.5)***	0.014 (3.5)***	0.009 (4.0)***	0.007 (2.5)**	-0.011 (-1.9)*	0.010 (1.5)	0.013 (3.1)***	0.016 (2.5)**
CF_t/K_{t-1}	0.307 (31.5)***	0.302 (15.8)***	0.266 (19.3)***	0.260 (10.2)***	0.657 (14.1)***	0.425 (4.0)***	0.170 (11.6)***	0.225 (5.9)***
N	6769	6371	3989	3721	1054	906	3387	2778
J-stat [d.f.] (p-value)		85.3 [51] (0.00)		37.1 [33] (0.29)		4.8 [6] (0.57)		37.9 [24] (0.04)
Adjusted R²	0.30		0.15		0.18		0.06	

Table 4
Investment, bank dependence, financial assets, and land holdings

This table shows GMM regression results for sub-samples stratified by loan-to-asset ratio and asset holdings, which are the sum of book values of securities, long-term deposits and investment land holdings divided by book assets. The dependent variable is the investment dividend by beginning-of-year capital stock at replacement cost. The independent variables are fundamental stock valuation (q^f), residual valuations (q^r), and cash flow divided by beginning-of-year capital stock. The q^f is the component of q ratio at the beginning of year t that is explained by sales growth and squared sales growth in years t and t-1 and industry dummies. The q^r is the difference of q and the fitted component q^f. All regressions include industry dummies, year dummies, and a constant. Instruments employed for the estimations are industry and year dummy variables, a constant, and independent variables lagged by one, two and three years. The J-statistic is used to test the set of over-identifying restrictions and is asymptotically distributed as $\chi^2_{(m-p)}$, where m is the number of instruments and p is the number of parameters. The asymptotic t-values are reported in parentheses. [***]Significant at the 1% level. [**]Significant at the 5% level. [*]Significant at the 10% level. N is the number of observations.

		1981-1986		1987-1990		1991		1992-1994	
		Financial assets and investment land holdings to total assets ratio							
Loan ratio		High	Low	High	Low	High	Low	High	Low
High	q^f_{t-1}	0.050	0.041	-0.019	-0.028	0.001	0.281	-0.002	0.044
		(6.1)[***]	(2.3)[**]	(-1.0)	(-0.8)	(0.0)	(2.3)[**]	(-0.0)	(1.6)
	q^r_{t-1}	0.005	0.024	0.015	0.001	0.002	0.022	0.018	0.043
		(0.9)	(2.9)[***]	(3.6)[***]	(0.2)	(0.3)	(1.3)	(1.5)	(3.6)[***]
	CF_t/K_{t-1}	0.421	0.328	0.213	0.348	0.690	0.379	0.231	0.122
		(8.4)[***]	(10.0)[***]	(4.7)[***]	(7.8)[***]	(4.4)[***]	(2.7)[***]	(2.5)[**]	(5.6)[***]
	N	1268	1890	756	1099	212	241	673	738
	J-Stat [d.f.]	42.4 [52]	55.3 [51]	44.5 [34]	33.7 [34]	10.38 [9]	12.0 [8]	19.1 [24]	37.1 [57]
	(p-value)	(0.83)	(0.32)	(0.11)	(0.48)	(0.32)	(0.15)	(0.75)	(0.06)
Low	q^f_{t-1}	0.059	0.043	0.036	0.033	0.024	-0.059	0.014	-0.103
		(3.4)[***]	(2.2)[**]	(1.8)[*]	(1.7)[*]	(0.9)	(-3.1)[***]	(0.4)	(-2.8)[***]
	q^r_{t-1}	0.017	-0.005	0.004	-0.005	0.005	0.002	<0.001	<0.001
		(3.5)[***]	(-0.7)	(1.4)	(-0.9)	(0.7)	(0.3)	(0.0)	(0.1)
	CF_t/K_{t-1}	0.272	0.305	0.345	0.288	0.443	0.362	0.202	0.216
		(11.2)[***]	(10.6)[***]	(10.0)[***]	(6.9)[***]	(3.3)[***]	(5.2)[***]	(7.0)[***]	(4.2)[***]
	N	1892	1321	1081	785	242	211	753	673
	J-Stat [d.f.]	67.7 [51]	74.8 [51]	35.7 [33]	36.8 [35]	7.4 [8]	11.6 [11]	34.1 [26]	31.4 [27]
	(p-value)	(0.06)	(0.02)	(0.34)	(0.39)	(0.50)	(0.39)	(0.13)	(0.25)

Table 5
Investment, bank dependence and size

This table shows GMM regression results for sub-samples stratified by the loan-to-asset ratio and firm size at their median values for each year. The dependent variable is the investment divided by beginning-of-period capital stock at replacement cost. The independent variables are fundamental stock valuation (q^f), residual valuations (q^r), and cash flow divided by beginning-of-year capital stock. The q^f_{t-1} is the component of q ratio at the beginning of year t that is explained by sales growth and squared sales growth in years t and t-1 and industry dummies. The q^r is the difference of q and the fitted component q^f. The asymptotic t-values are reported in parentheses. All regressions include industry dummies, year dummies, and a constant. Instruments employed for the estimations are industry and year dummy variables, a constant, and independent variables lagged by one, two and three years. The J-statistic is used to test the set of over-identifying restrictions and is asymptotically distributed as $\chi^2_{(m-p)}$, where m is the number of instruments and p is the number of parameters. [***]Significant at the 1% level. [**]Significant at the 5% level. [*]Significant at the 10% level. N is the number of observations.

		1981-1986		1987-1990		1991		1992-1994	
Loan ratio		Small	Large	Small	Large	Small	Large	Small	Large
High	q^f_{t-1}	0.079 (4.0)[***]	0.029 (1.5)	-0.052 (-1.3)	0.008 (0.2)	-0.017 (-0.7)	0.023 (1.2)	-0.044 (-1.1)	0.030 (1.1)
	q^r_{t-1}	0.016 (2.3)[**]	0.015 (1.7)[*]	0.012 (1.9)[*]	0.017 (2.3)[**]	0.001 (0.1)	0.025 (1.8)[*]	0.030 (2.3)[**]	0.041 (3.8)[***]
	CF_t/K_{t-1}	0.352 (9.7)[***]	0.326 (7.7)[***]	0.346 (7.3)[***]	0.205 (4.8)[***]	0.696 (4.7)[***]	0.255 (1.0)	0.160 (2.5)[**]	0.011 (0.4)
	N	1606	1552	1060	795	242	211	742	630
	J-Stat[d.f.] (p-value)	54.4 [51] (0.34)	58.7 [51] (0.21)	35.4 [33] (0.35)	31.6 [33] (0.53)	11.6 [8] (0.17)	14.45 [9] (0.11)	35.1 [25] (0.09)	27.7 [25] (0.32)
Low	q^f_{t-1}	0.039 (1.9)[*]	0.051 (3.5)[***]	0.058 (2.6)[**]	0.018 (1.3)	0.005 (0.5)	-0.276 (-3.1)[***]	-0.003 (-0.1)	-0.007 (-0.2)
	q^r_{t-1}	0.004 (0.5)	0.012 (2.6)[***]	0.003 (0.5)	<0.001 (0.1)	0.007 (0.5)	-0.001 (-0.1)	0.004 (0.4)	0.006 (1.4)
	CF_t/K_{t-1}	0.336 (11.5)[***]	0.277 (11.6)[***]	0.329 (7.0)[***]	0.256 (9.4)[***]	0.553 (4.9)[***]	0.404 (6.3)[***]	0.202 (3.5)[***]	0.179 (10.2)[***]
	N	1553	1660	784	1082	200	253	631	775
	J-Stat[d.f.] (p-value)	65.5 [51] (0.08)	62.1 [54] (0.21)	35.1 [37] (0.56)	38.8 [33] (0.22)	8.78 [9] (0.46)	8.09 [8] (0.43)	24.8 [25] (0.47)	27.2 [25] (0.34)

Table 6
Loans and bank dependence

This table presents results from regressions relating increase in loans to fundamental and residual valuations. Panel A reports results for firms that have loan-to-asset ratios above the median for the sample each year, while Panel B reports results for firms with loan-to-asset ratios below the median. The dependent variable is the net increase in loans divided by the beginning-of-period capital stock at replacement cost. The independent variables are fundamental stock valuation (q^f), residual valuations (q^r), and size. The q^f is the component of the q ratio that is explained by sales growth variables and industry dummies. The q^r is the difference of q and the fitted component q^f. Size is the log of book value of total assets at the beginning of year. The t-values are reported in parentheses. All investment regressions include both industry dummies and year dummies. *N* is the number of observations. ***Significant at the 1% level. **Significant at the 5% level. *Significant at the 10% level.

	1981-1986	1987-1990	1991	1992-1994
Panel A: Above median loans to assets ratio				
q^f_{t-1}	0.348 (3.6)***	-0.041 (-0.1)	-5.511 (-1.7)*	1.072 (2.3)**
q^r_{t-1}	0.137 (3.0)***	0.297 (3.5)***	0.195 (1.2)	0.137 (1.3)
Log Size$_{t-1}$	0.032 (2.7)***	0.163 (4.0)***	-0.030 (-0.3)	-0.013 (-0.4)
Constant	-0.929 (-3.2)***	-1.675 (-2.1)**	14.170 (1.8)*	-0.590 (-0.8)
N	3369	1992	522	1660
Adj. R²	0.04	0.07	0.06	0.04
Panel B: Below median loans to assets ratio				
q^f_{t-1}	-0.013 (-0.4)	0.251 (2.0)**	-0.531 (-1.1)	0.109 (0.8)
q^r_{t-1}	-0.006 (-0.5)	-0.009 (-0.4)	0.027 (1.1)	-0.034 (-1.4)
Log Size$_{t-1}$	0.014 (2.7)***	0.021 (1.5)	0.035 (2.6)***	0.036 (4.3)***
Constant	-0.121 (-0.7)	-0.488 (-0.6)	0.038 (0.1)	-0.754 (-2.4)**
N	3401	1998	532	1671
Adj. R²	0.01	0.02	0.00	0.01