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

I. Introduction

Asset price shocks, or bubbles, typically result in large deviations of stock valuations from fundamentals.[1] Do nonfundamental valuations affect corporate invest-

We examine corporate investment spending around the asset price bubble in Japan in the late 1980s and make three contributions to our understanding of how stock valuations affect investment. First, 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 investment cash flow sensitivity is affected more by changes in monetary policy than by shifts in collateral values. Third, asset price shocks primarily affect firms that rely more on bank financing and not necessarily those that use equity financing.

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

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ment during the bubble period? Fischer and Merton (1984) and more recently Stein (1996) have argued that investment responds to nonfundamental changes in stock prices. 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, which suggests that collateral values affect the cost of external funds. In this article, we examine how asset price shocks influence investment and the cost of external financing by studying the asset price bubble in Japan in the late 1980s and the early 1990s.

Japanese stock and land prices rapidly inflated toward 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 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 article 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. Do 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, e.g., 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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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, e.g., De Bondt and Thaler (1985), Summers (1986), and a survey in Shleifer and Summers (1990).

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 Morck et al. 1990; Blanchard et al. 1993; and Chirinko and Schaller 1996). 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 the industry-level investment spending of Japanese

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 (see Myers and Majluf 1984; Bernanke and Gertler 1990; Bernanke, Gertler, and Gilchrist 1996). 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, 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 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. In a similar experiment, Kashyap, Lamont, and Stein (1994) identified periods of collateral shocks accompanied by tight monetary policy in the United States but could not find periods of collateral shocks unrelated to monetary policy. In this regard, the Japanese data provide an unusual opportunity to discriminate between the effects of collateral shocks and monetary policy on the cash flow sensitivity.

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 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 constrained by liquidity when the monetary policy tightened (see Kashyap, Stein, and Wilcox 1993). In addition, asset price deflation could severely exacerbate information and incentive problems in bank-dependent firms that

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firms, while Chirinko and Schaller (2001) find that market valuations have a significant effect on aggregate investment. Examining aggregate investment over a longer period, Dekle, Henderson, and Thomas (2000) conclude that fundamentals matter more than market valuations in explaining investment during 1974–94.

are more vulnerable to fluctuation in collateral values, resulting in a higher cost of external financing (Bernanke et al. 1996).[5]

A key result of the article is that investment of firms that rely more on bank financing *and* hold large amounts of marketable collateral responds more significantly to market valuations. These findings are consistent with the observation that collateral values figure prominently in the lending decisions of Japanese banks. Somewhat paradoxically, we suggest 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.

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 article is organized as follows. Section II provides background information on the development of Japanese asset markets, monetary policies, and corporate financing over the 1981–94 period. This section enables us to identify episodes of asset price shocks and changing monetary policy regimes. Section III describes the data and provides summary statistics over the sample period. Section IV examines how stock market valuations and cash flow affect investment. Section V examines how bank dependence and collateral values affect the investment and liquidity of Japanese firms. Section VI concludes the article.

II.   Asset Valuations in Japan, 1981–94

This section provides background information on asset prices, credit conditions, and aggregate corporate financing during the 1981–94 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 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.[6] The Cusum breakpoints show that the structural shifts in corporate

5. In addition, the banks themselves were affected by adverse asset price shocks, which influenced their lending behavior (see Gibson 1995; Kang and Stulz 2000).
6. See Maskus (1983) for a Cusum technique for panel data.
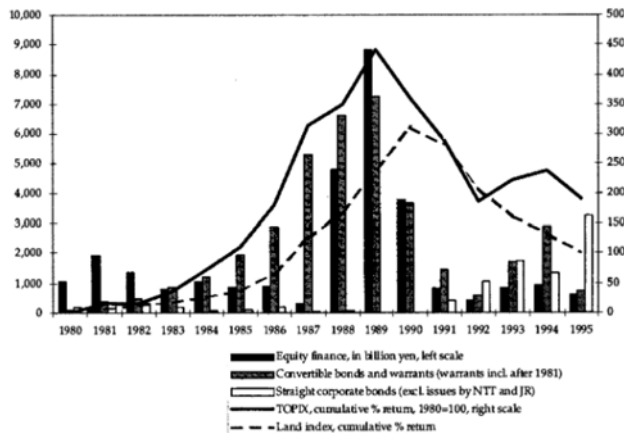
Fig. 1.—Asset valuations and corporate financing. This figure plots cumulative returns on the Tokyo Stock Price Index, cumulative returns on the Land Price Index, and new security issues during the 1980–95 period. The data on new security issues represent aggregate numbers for all stock-exchange-listed 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).

investment behavior coincide closely with shifts in collateral values and monetary policy changes during this period.

A. Pre-asset Inflation Period (1981–86)

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 fig. 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]

B. Asset Inflation Period (1987–90)

The following 4 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

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.
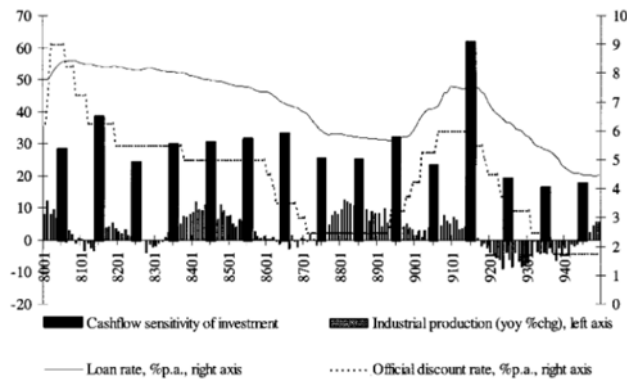
Fig. 2.—Interest rates and estimated investment-cash-flow sensitivities. The loan rate is the average interest rate on long-term loan contracts for all banks. Loan rates and the official discount rate (both on the right axis) are obtained from the Bank of Japan. Industrial production is from the Ministry of International Trade and Industry (MITI). The estimated investment-cash-flow sensitivities (rescaled on the left axis) are the coefficient on the cash-flow variable in the following fixed industry effects regression estimated separately for each year: $I_t/K_{t-1} = a + bq_{t-1} + gCF_t/K_{t-1} + u_t$, 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.

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 exist in the academic literature (see, e.g., Ueda 1990; French and Poterba 1991; Kindleberger 1996; Allen 1997; Allen and Gale 2000).

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% in 1986 to 2.5% 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]

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 U.S. 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 increased liquidity in the economy.

The data on aggregate new issues of equity, convertible/warrant debt, and straight corporate debt over the period from 1980 to 1994 suggest 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. 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).[9]

C. 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% in June 1989 to almost 6% by August 1990 and (ii) imposed limits on commercial bank lending to real estate related projects (*souryo-kisei*) during 1990–91. 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% in one year from its peak. Similarly, the land price index declined by more than half during the 1991–94 period (see fig. 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.

D. Contraction Period (1992–94)

The deflation in asset values that began in the early 1990s caused the Japanese economy to contract significantly during the 1992–94 period. As figure 2 shows, the growth in industrial production turned negative starting in late 1991 and continued to contract until late 1994. Since the economy showed a brief recovery in 1995, we define the contraction period until 1994. Cusum analysis also shows a structural shift in 1995. To stimulate domestic demand and to help financial institutions, the Bank of Japan reversed its monetary policy yet again in late 1991. The official discount rate was gradually lowered to 1.75% toward the end of 1994 (and further to 0.5% in 1995). While adverse collateral shocks were experienced during both the collapse and the contraction periods, a distinguishing feature of the 1992–94 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.

9. Loughran and Ritter (1995) examine equity issuances and subsequent returns for U.S. firms and suggest that their results are consistent with firms issuing equity when it is overpriced.

III.   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.[10] 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 1980–94 period. Tobin's q is estimated as the ratio of the market value of assets to their replacement values.[11] The time series variation in the annual cross-sectional average of Tobin's q ratio mirrors the aggregate 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 (Hoshi and Kashyap 1990; Hayashi and Inoue 1991; Hoshi, Kashyap, and Scharfstein 1991) and sometimes do not (Gibson 1995; Kiyotaki and West 1996; and Ogawa and Kitasaka 1999). 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 nonproductive 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

10. 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 1,400–1,600 firms over the 1981–94 period.
11. For the most part, we follow the procedure described in the appendix to Hoshi and Kashyap (1990). The details are available from the authors.

TABLE 1   Summary Statistics: Investment, *q*, and Cash Flows of Japanese Firms

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	16.1	.064	.105	.139	.262
	(1.09)	(14.0)	(.046)	(.078)	(.113)	(.216)
1981	1.22	11.8	.079	.131	.141	.270
	(1.14)	(10.8)	(.056)	(.093)	(.110)	(.222)
1982	1.16	4.8	.081	.130	.137	.265
	(1.09)	(4.7)	(.055)	(.096)	(.106)	(.218)
1983	1.21	1.5	.078	.128	.122	.241
	(1.12)	(1.9)	(.048)	(.087)	(.099)	(.205)
1984	1.38	4.4	.072	.121	.127	.256
	(1.18)	(4.0)	(.044)	(.083)	(.104)	(.223)
1985	1.39	7.6	.089	.154	.138	.280
	(1.24)	(6.5)	(.051)	(.095)	(.110)	(.244)
1986	1.45	2.2	.085	.151	.127	.272
	(1.28)	(2.1)	(.057)	(.120)	(.104)	(.246)
1987	1.44	3.4	.068	.134	.108	.271
	(1.26)	(2.4)	(.045)	(.095)	(.090)	(.253)
1988	1.52	6.3	.062	.140	.110	.326
	(1.37)	(4.7)	(.036)	(.097)	(.088)	(.292)
1989	1.54	14.7	.067	.183	.109	.394
	(1.41)	(8.6)	(.041)	(.138)	(.086)	(.328)
1990	1.56	13.1	.067	.211	.105	.418
	(1.41)	(7.3)	(.043)	(.160)	(.082)	(.346)
1991	1.28	11.9	.074	.263	.096	.434
	(1.20)	(8.8)	(.045)	(.197)	(.073)	(.354)
1992	1.10	3.2	.067	.230	.089	.383
	(1.04)	(2.7)	(.047)	(.181)	(.069)	(.315)
1993	1.14	2.9	.065	.188	.078	.293
	(1.08)	(3.4)	(.037)	(.119)	(.066)	(.260)
1994	1.18	4.2	.050	.132	.076	.252
	(1.11)	(5.1)	(.027)	(.074)	(.068)	(.219)

Not e.—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.

stock. Land held for investment purposes is excluded from capital stock and investment.[12]

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 1987–90 period.

IV. 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.

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.[13]

Because we are able to compare different monetary and collateral regimes

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12. 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, which suggests that land is integral to warehouse operations and cannot be sold without shutting down the business.

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

over time with our data, we can 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 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 generalized method of moments (GMM) mitigates this endogeneity bias and provides heteroskedastic-consistent estimates when appropriate instruments are used.[14] Alongside our GMM estimates, in table 2, we also present the OLS estimates of the investment regression.

A.   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 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 1981–86 period. The decline results perhaps from the greater divergence of stock prices from the fundamentals during the late 1980s and the early 1990s.[15] Hoshi and Kashyap (1990) similarly find that the investment-q relation becomes weaker during the asset inflation period.[16]

A more interesting question, however, is whether stock valuations importantly affect investment spending during periods of asset price shocks when

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14. 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.

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

16. 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.

TABLE 2   **Regressions of Investment on Tobin's q and Cash Flow**

	1981–86		1987–90		1991		1992–94	
	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM
q_{t-1}	.028	.019	.011	.006	.009	.010	.014	.016
	(11.7)***	(4.43)***	(5.0)***	(2.1)**	(1.6)	(1.4)	(3.2)***	(2.6)***
CF/K_{t-1}	.315	.319	.263	.274	.617	.439	.174	.243
	(33.4)***	(15.3)***	(19.4)***	(9.6)***	(14.6)***	(4.1)***	(11.8)***	(6.1)***
N	6,892	6,519	4,158	3,799	1,137	923	3,472	2,982
J-statistic [df]		52.4 [34]		24.1 [22]		4.1 [4]		20.4 [16]
(p-value)		(.02)		(.34)		(.40)		(.20)
Adjusted R^2	.29		.15		.18		.06	

Not e.—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 1, 2, and 3 years. The J-statistic is used to test the set of overidentifying restrictions and is asymptotically distributed as $x^2_{(m-p)}$, where m is the number of instruments and p is the number of parameters. N is the number of observations.
  * Significant at the 10% level.
  ** Significant at the 5% level.
  *** Significant at the 1% level.

TABLE 3   **Regressions of Investment on Fundamental *q*, Residual *q*, and Cash Flow**

	1981–86		1987–90		1991		1992–94	
	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM
$q^f_{t\ 1}$	.059	.061	.016	.007	.092	.137	.019	.030
	(9.6)***	(5.0)***	(1.5)	(.4)	(.8)	(1.2)	(.8)	(1.1)
$q^r_{t\ 1}$	.024	.014	.009	.007	.011	.010	.013	.016
	(9.5)***	(3.5)***	(4.0)***	(2.5)**	(1.9)*	(1.5)	(3.1)***	(2.5)**
$CF_t/K_{t\ 1}$	.307	.302	.266	.260	.657	.425	.170	.225
	(31.5)***	(15.8)***	(19.3)***	(10.2)***	(14.1)***	(4.0)***	(11.6)***	(5.9)***
N	6,769	6,371	3,989	3,721	1,054	906	3,387	2,778
J-statistic [df]		85.3 [51]		37.1 [33]		4.8 [6]		37.9 [24]
(*p*-value)		(.00)		(.29)		(.57)		(.04)
Adjusted R^2	.30		.15		.18		.06	

Not e.—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 $q^f_{\ 1}$ 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 1, 2, and 3 years. The *J*-statistic is used to test the set of overidentifying restrictions and is asymptotically distributed as $x^2_{(m\ p)}$, where *m* is the number of instruments and *p* is the number of parameters. *N* is the number of observations.

  * Significant at the 10% level.

  ** Significant at the 5% level.

  *** Significant at the 1% level.

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 et al. 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 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 forecasts 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 et al. 1990; and Shin and Stulz 1998). The results that we report in the tables are based on the decomposition obtained by annual cross-sectional regressions of the q ratio on contemporaneous and lagged sales growth, squared sales growth, and industry dummies.[17] 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 ($q^r \text{ p } q \quad q^f$). 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 Japan's asset inflation period. For example, French and Poterba (1991) show that changes in the required returns or growth expectations could not account for changes

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17. 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.
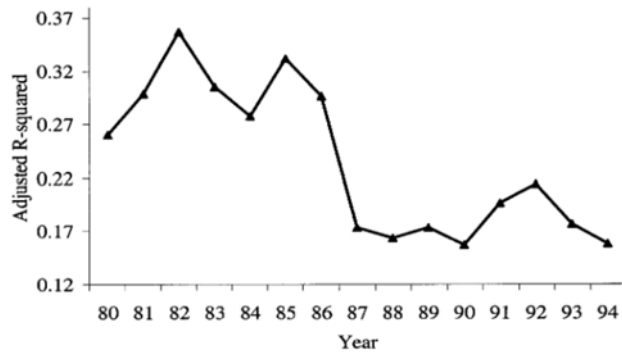
Fig. 3.—The explanatory power of the fundamental variables in the q ratio. This figure shows adjusted R^2s from the annual regressions of Tobin's q ratio: $q_{t\ 1} = a_0 + a_1 Sg_t + a_2 Sg_{t\ 1} + a_3 Sg_t^2 + a_4 Sg_{t\ 1}^2$ (industry dummies). Variable $q_{t\ 1}$ is Tobin's q ratio at the beginning 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.

in Japanese stock valuations during this period. Similarly, Conroy, Harris, and Park (1998) find that market valuations were less sensitive to earnings fundamentals during Japan's 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 could not 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 (1981–86) show that both q^f and q^r are positive and significant. Our results are consistent with those reported by Chirinko and Schaller (2001), who use an alternative methodology to address a similar issue.[18] 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.

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

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

period (1981–86) 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) the earnings variables with the 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.

B.   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.

During the 1987–90 period, the cash-flow sensitivities initially declined as asset prices inflated and monetary policy became relatively easy (the sensitivity decreased during the 1987–90 period compared with the earlier period with the p-value p .093 for the GMM estimates in table 3).[19] The sensitivities substantially increased when asset prices collapsed and monetary policy became tight during 1991 (from 0.26 during 1987–90 to 0.43 in 1991 with the p-value p .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 1992–94 are ambiguous. Although both the 1991 and the 1992–94 periods saw collapses in asset values, the monetary policy was easy in the latter period. The results in the last columns of tables 2 and 3 show that investment is substantially less sensitive to cash flows during the contraction period of 1992–94 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 1992–94 with the p-value p .037 for the GMM estimates in table 3).

If collateral shocks were important in determining cash-flow sensitivities, then a prediction would be that cash-flow sensitivities during the contraction

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

period of 1992–94 would be higher than those during the asset inflation period of 1987–90. The results show that the sensitivities during these two periods are statistically indistinguishable (the sensitivity is 0.26 in 1987–90 and 0.23 in 1992–94 with the *p*-value p .224 for the GMM estimates in table 3), suggesting that the effects of the easy monetary policy dominate those of the collateral shock on estimated cash-flow sensitivities.

One may argue that the decline in cash-flow sensitivities during 1992–94 reflects a downward estimation bias in the cash-flow sensitivity caused by more firms reporting very low or negative cash flows during the contraction period. According to Fazzari et al. (2000), the presence of firms with low or negative cash flows biases the estimated cash-flow sensitivity downward because some positive levels of investment are still needed to keep production technically feasible even when the cash flows are negative.

To examine if this censored regression bias affects the decline in cash-flow sensitivity in the 1992–94 period, we reestimate the models after excluding observations with negative cash flows.[20] While the estimated cash-flow sensitivities increase when we exclude negative cash-flow observations, the time series variation in the sensitivities remains virtually unaffected.[21] Overall, our conclusions about the changes in cash-flow sensitivities across time periods are robust to whether we include or exclude negative cash-flow observations. Thus, the decline in cash-flow sensitivity during 1992–94 cannot be attributed to more observations with negative cash flows.

We also address concerns that cash flow may have predictive content for investment opportunities by examining whether the cash-flow sensitivities change when cash flow is one of the instruments for q^i. The results (not reported in a table) show that the investment cash-flow sensitivities are similar to our findings in table 3. Overall inferences about the shifts in cash-flow sensitivity are unaffected.

V. Bank Dependence and Collateral Holdings

Are the investments 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, p. 5).

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20. The sample size is fairly stable over time. Despite the contraction in the Japanese economy during the 1992–94 period, only 16 out of about 1,600 firms delisted from the Tokyo Stock Exchange during this time. The fraction of firms reporting negative cash flow is 5.9% during 1981–86, 3.8% during 1987–90, 2.5% in 1991, and 6.8% during 1992–94.

21. The estimated cash-flow sensitivities with (without) negative cash-flow observations are 0.30 (0.32) for 1981–86, 0.26 (0.29) for 1987–90, 0.43 (0.43) for 1991, and 0.23 (0.32) for 1992–94.

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 (see Ballon and Tomita 1988; Shibata 1995). 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 debt financing for large firms. The issuance criteria gave large firms increasingly better access to public debt markets, and bank lending to large firms declined steeply during the late 1980s (see Hoshi et al. 1993).[22]

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 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 in less bank-dependent firms. Investment of bank-dependent firms with high collateral is responsive only to the residual valuations during the 1987–90 period; fundamentals do not matter.[23] For bank-dependent firms with low collateral, investment is insensitive to residual valuations. In contrast, investment spending of less bank-

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22. The bond issuance criteria, called the *Tekisai Kijun,* typically favored large companies, and size was a key determinant of a firm's ability to issue public debt (see Hosh et al. 1993; 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).

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

TABLE 4 **Investment, Bank Dependence, Financial Assets, and Land Holdings**

| | Ratio of Financial Assets and Investment Land Holdings to Total Assets | | | | | | | |
| | 1981–86 | | 1987–90 | | 1991 | | 1992–94 | |
Loan Ratio	High	Low	High	Low	High	Low	High	Low
High:								
$q^f_{t\,1}$	.050	.041	.019	.028	.001	.281	.002	.044
	(6.1)***	(2.3)**	(1.0)	(.8)	(.0)	(2.3)**	(.0)	(1.6)
$q^r_{t\,1}$	.005	.024	.015	.001	.002	.022	.018	.043
	(.9)	(2.9)***	(3.6)***	(.2)	(.3)	(1.3)	(1.5)	(3.6)***
$CF_t/K_{t\,1}$	.421	.328	.213	.348	.690	.379	.231	.122
	(8.4)***	(10.0)***	(4.7)***	(7.8)***	(4.4)***	(2.7)***	(2.5)**	(5.6)***
N	1,268	1,890	756	1,099	212	241	673	738
J-statistic [df]	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)	(.83)	(.32)	(.11)	(.48)	(.32)	(.15)	(.75)	(.06)
Low:								
$q^f_{t\,1}$	.059	.043	.036	.033	.024	.059	.014	.103
	(3.4)***	(2.2)**	(1.8)*	(1.7)*	(.9)	(3.1)***	(.4)	(2.8)***
$q^r_{t\,1}$	.017	.005	.004	.005	.005	.002	!.001	!.001
	(3.5)***	(.7)	(1.4)	(.9)	(.7)	(.3)	(.0)	(.1)
$CF_t/K_{t\,1}$	.272	.305	.345	.288	.443	.362	.202	.216
	(11.2)***	(10.6)***	(10.0)***	(6.9)***	(3.3)***	(5.2)***	(7.0)***	(4.2)***
N	1,892	1,321	1,081	785	242	211	753	673
J-stat [df]	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)	(.06)	(.02)	(.34)	(.39)	(.50)	(.39)	(.13)	(.25)

Not e.—This table shows GMM regression results for subsamples stratified by the median loan-to-asset ratio and the median asset holdings ratio, 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 1, 2, and 3 years. The J-statistic is used to test the set of overidentifying restrictions and is asymptotically distributed as $x^2_{(m\ p)}$, where m is the number of instruments and p is the number of parameters. The asymptotic t-values are reported in parentheses. N is the number of observations.

  * Significant at the 10% level.
  ** Significant at the 5% level.
  *** Significant at the 1% level.

dependent firms is sensitive to fundamental valuations *only* 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 1981–86 to 0.21 during 1987–90 with the *p*-value p .001). But, when asset prices collapsed 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 1987–90 to 0.69 in 1991 with the *p*-value p .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 1992–94 period confirm our previous 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 ! .048). Bank-dependent firms with low collateral have the lowest sensitivity of investment to cash flow during the 1992–94 period. This is consistent with banks being more willing to lend to companies that are least affected by the declining value of collateral assets (the flight to quality).[24]

As discussed earlier, while bank lending during the late 1980s was based more on collateral values, it was also directed more toward 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 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 Japan's 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

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24. 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.

TABLE 5   **Investment, Bank Dependence, and Size**

Loan Ratio	1981–86		1987–90		1991		1992–94	
	Small	Large	Small	Large	Small	Large	Small	Large
High:								
q^f_{t-1}	.079	.029	.052	.008	.017	.023	.044	.030
	(4.0)***	(1.5)	(1.3)	(.2)	(.7)	(1.2)	(1.1)	(1.1)
q^r_{t-1}	.016	.015	.012	.017	.001	.025	.030	.041
	(2.3)**	(1.7)*	(1.9)*	(2.3)**	(.1)	(1.8)*	(2.3)**	(3.8)***
CF_t/K_{t-1}	.352	.326	.346	.205	.696	.255	.160	.011
	(9.7)***	(7.7)***	(7.3)***	(4.8)***	(4.7)***	(1.0)	(2.5)**	(.4)
N	1,606	1,552	1,060	795	242	211	742	630
J-statistic [df]	54.4 [51]	58.7 [51]	35.4 [33]	31.6 [33]	11.6 [8]	14.45 [9]	35.1 [25]	27.7 [25]
(p-value)	(.34)	(.21)	(.35)	(.53)	(.17)	(.11)	(.09)	(.32)
Low:								
q^f_{t-1}	.039	.051	.058	.018	.005	.276	.003	.007
	(1.9)*	(3.5)***	(2.6)**	(1.3)	(.5)	(3.1)***	(.1)	(.2)
q^r_{t-1}	.004	.012	.003	!.001	.007	.001	.004	.006
	(.5)	(2.6)***	(.5)	(.1)	(.5)	(.1)	(.4)	(1.4)
CF_t/K_{t-1}	.336	.277	.329	.256	.553	.404	.202	.179
	(11.5)***	(11.6)***	(7.0)***	(9.4)***	(4.9)***	(6.3)***	(3.5)***	(10.2)***
N	1,553	1,660	784	1,082	200	253	631	775
J-statistic [df]	65.5 [51]	62.1 [54]	35.1 [37]	38.8 [33]	8.78 [9]	8.09 [8]	24.8 [25]	27.2 [25]
(p-value)	(.08)	(.21)	(.56)	(.22)	(.46)	(.43)	(.47)	(.34)

Not e.—This table shows GMM regression results for subsamples stratified by the median loan-to-asset ratio and median 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 1, 2, and 3 years. The J-statistic is used to test the set of over-identifying restrictions and is asymptotically distributed as $x^2_{(m-p)}$, where m is the number of instruments and p is the number of parameters. N is the number of observations.

* Significant at the 10% level.

** Significant at the 5% level.

*** Significant at the 1% level.

credit—small firms generally exhibit larger cash flow sensitivity than do large firms.[25] 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 1987–90 to 0.70 in 1991 (p p .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 affected small bank-dependent firms in particular. This result underscores that there was a lack of alternative sources of financing for these firms.

VI.   Concluding Remarks

Fischer 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 underpriced. It is commonly suggested that asset price shocks affect the cost of external financing and, consequently, real investments.

We study the investment spending around the asset price bubble in Japan in the late 1980s and the early 1990s and present three key findings. First, investment during asset price shocks is significantly more responsive to non-fundamentals 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. 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 subsequently relaxed, 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, 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 more variation in cash-flow

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25. 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 1981–86 to 0.21 in 1987–90 with a p-value for the difference p .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 1992–94).

sensitivity during asset price shocks. In particular, when asset prices collapsed and the monetary policy tightened, these firms (and small bank-dependent ones) showed the most dramatic increase in their cash-flow sensitivity. The result suggests that the collapse of asset prices and tight monetary policies severely hit bank-dependent firms with weak balance sheets.

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