



BANK FOR INTERNATIONAL SETTLEMENTS

BIS Working Papers

No 164

Did investors regard real estate as “safe” during the “Japanese Bubble” in the 1980s?

by I Serdar Dinc* and Patrick M McGuire**

Monetary and Economic Department

November 2004

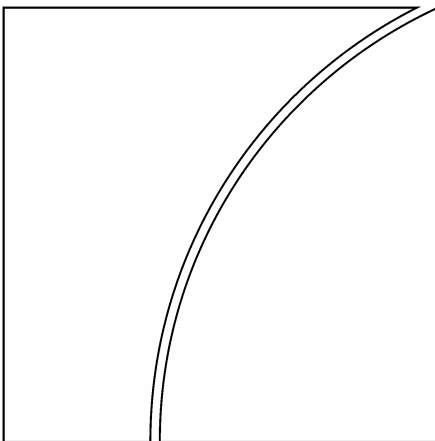
* University of Michigan, Finance Department: dincs@umich.edu

** Bank for International Settlements: patrick.mcguire@bis.org

Abstract

JEL Classification Numbers: G100, G120

Keywords: Japanese land prices



BIS Working Papers are written by members of the Monetary and Economic Department of the Bank for International Settlements, and from time to time by other economists, and are published by the Bank. The views expressed in them are those of their authors and not necessarily the views of the BIS.

Copies of publications are available from:

Bank for International Settlements
Press & Communications
CH-4002 Basel, Switzerland

E-mail: publications@bis.org

Fax: +41 61 280 9100 and +41 61 280 8100

This publication is available on the BIS website (www.bis.org).

© *Bank for International Settlements 2004. All rights reserved. Brief excerpts may be reproduced or translated provided the source is cited.*

ISSN 1020-0959 (print)

ISSN 1682-7678 (online)

Abstract

It is well known that Japanese banks increased their exposure to land assets and the real estate sector in the latter half of the 1980s, and that this became a primary factor in the non-performing loan problem that emerged in the 1990s. What is less clear is whether this increased exposure was the result of active risk taking, and whether banks and other market participants regarded land and real estate assets as “risky” during the period of land price appreciation. To address this issue, we rely on the real estate data contained in corporate balance sheets to extract an estimate of the market sentiment toward land assets during the 1985-89 period. We find that the systematic risk of manufacturing companies increased with their real estate holdings but not with holdings of other balance sheet assets. This result indicates that market participants regarded real estate assets as riskier than the main operations of manufacturing companies during the “bubble period”, even if they may not have foreseen the subsequent crash in real estate prices.

Contents

Abstract	iii
Contents	v
1 Introduction.....	1
2 Background	2
2.1 Bank Exposure to Real Estate	2
2.2 Corporate and Individual Exposure to Real Estate	3
3 Methodology and Data	4
4 Empirical Analysis	6
5 Robustness.....	8
5.1 Alternative Assets	8
5.2 Idiosyncratic and Total Risk	9
5.3 Multi-Factor Risk Measures	9
5.4 Alternative Time Periods	10
6 Conclusion.....	10
7 Appendix.....	22
7.1 Synthesis of the APT and CAPM Models	22
7.2 The “Thin Trading” Bias Problem.....	24
References	28

1 Introduction

The simultaneous rise in land and stock market prices during the second half of the 1980s in Japan has attracted considerable attention in both the popular press and the academic literature.¹ The decade long recession and the non-performing loan problem that followed the land price collapse have made it clear *ex post* that land was a highly risky asset. Policy discussions have focused on the factors that led investors and banks to increase their exposure to land during the 1980s. Yet, policy conclusions hinge on whether investors and banks were *ex ante* aware of the high risks involved in land investments, or were merely over-optimistic about future land price increases. In short, this paper addresses whether investors and bankers really knew about the high risks associated with land and real estate investment during the “bubble” period.

The economic environment in the 1980s was arguably conducive to the rise of moral hazard problems among bank and firm managers. Evidence suggests that the shareholding and regulatory environment in this period provided few sources of discipline to bank managers.² In addition, deregulation of the bond market meant banks faced real competition for the first time. Hoshi and Kashyap (1999) argue that the fall in the value of future profitability that came about with deregulation, and the inability of banks to properly assess investment risk, was a recipe for moral hazard problems.

During this period, banks increased their exposure to land, directly through increased lending to the real estate sector and indirectly through loans that were made to other sectors but collateralized by land. In a banking environment characterized by excess capacity, this increased exposure to land may have reflected active risk taking behavior by bank managers. On the other hand, if the market participants in the 1980s regarded land as “safe”, and if they failed to foresee the eventual collapse in land prices because of a collective forecasting error, then claims that banks actively engaged in risk taking behavior cannot be substantiated. Thus, before investigation of corporate governance problems can meaningfully proceed, a necessary first step is to provide evidence that land was known to be “risky” during the asset appreciation period of the 1980s.

Couched in a simple synthesis of the CAPM and APT asset pricing models, we exploit the real estate asset data on corporate balance sheets to estimate indirectly the contribution of an unobserved real estate “factor” to systematic risk in the 1985-89 period. We find evidence that this unobserved real estate factor was a significant component of systematic risk, but do not find similar results for other asset “factors”, including those that may have been alternative collateral choices. Our results imply that investors did recognize, at least relative to other asset types, the riskiness of land during this period. In particular, we find that a one standard deviation increase in our land sensitivity proxies roughly translates into a 5% increase (from sample means) in a manufacturing firm’s market beta.³

The remainder of the paper proceeds as follows. Section 2 more thoroughly discusses the essential background information on the land exposure of both bank and non-bank entities in Japan. Section 3 describes the empirical methodology and data, while section 4 presents our primary empirical analysis. The robustness of our results is discussed in section 5, and the conclusion follows in section 6.

¹ Ogawa and Suzuki (1998, 2000), Ueda (2000), Hoshi and Kashyap (1999, 2001), Ito and Iwaisako (1995), and Stone and Ziemba (1993) are but a few in a large body of work on this topic.

² Government guarantees reduced the incentives for depositors, the major liability holders, to monitor bank managers. In addition, bank shareholders were often corporations that received loans from, and were partially owned by, the bank itself, and this cross-shareholding relationship potentially diluted the ability of these shareholders to discipline bank managers.

³ We do not claim that land price appreciation caused stock market appreciation (or vice versa), or gave market participants any indication of *when* the land and asset price collapses might occur. Nor does this paper provide evidence for or against the bubble hypothesis. We show that land holdings increased the systematic risk of listed manufacturing companies, which implies that investors saw these holdings as riskier than the generic operations of these firms. The real estate beta we estimate may have been *too small*, indicating that market participants failed to recognize the *full* consequences of land exposure.

2 Background

Despite empirical evidence that links the non-performing loan problem of the 1990s to the lending practices of the 1980s (Tsuru (2001), Ueda (2000)), direct evidence of active risk taking by, and moral hazard problems in, financial institutions has been elusive.⁴ The increased exposure to real estate assets is the most *likely* manifestation of moral hazard problems, but rests on the 1990s perspective that land was risky. Ogawa and Suzuki (2000) provide evidence that land holdings in the 1980s by Japanese corporations “mitigated the probability of default, which enabled the banks to lend a large amount of loans to the firms” (p.2). In addition, simple balance sheet analysis shows the degree to which banks became exposed to real estate assets, both through lending to the real estate sector and through the increased use of land as collateral.

Yet, did these market participants view land as risky before 1991? With the exception of a single six month period (following the first oil crisis), land prices appreciated during the entire post-war period (through 1991). While prices of other physical assets were relatively stable from 1980 on, the growth in land prices remained positive, and accelerated after 1985 (figure 1). An investor holding industrial land in 1980 realized a 60% nominal (38% real) return by 1989, while that on alternative physical assets was near 1% nominal. For the sample of manufacturing firms described below, the average annual growth in the market value of land stocks was around 6% in 1985-1986, but increased to 10% in 1987-88, and to 16% in 1988-89.

2.1 Bank Exposure to Real Estate

Banks' and other financial institutions' exposure to land assets grew on two margins. First, as shown in figure 2, direct lending to the real estate sector increased both absolutely, and relative to other loan categories. The first panel shows that real estate loans increased for all bank types. From 1982 to 1989, real estate loans (as a share of total loans) increased from approximately 5.5% to over 12% for city banks, and from 6% to 11% for regional banks. The share of real estate related loans in the long term credit banks' total loans also increased, while trust banks, which had always lent more heavily, cut back on real estate lending starting in 1987 after warnings from the Ministry of Finance.⁵ At the same time, the share of loans to the manufacturing sector decreased from an average of 26% in 1982 to 16% in 1989, while the share of loans to the construction sector remained relatively stable for all bank types. Consistent with the overall hypothesis that bond market deregulation forced the large city, long term credit, and trust banks to seek out new customers, the share of total loans going to small businesses increased for all three bank types over this period.

Concurrently, loans backed by real estate collateral increased for the major banks during the 1980s. Overall, approximately 44% of all *secured* loans were collateralized by land, while only 8% were collateralized by financial assets. Figure 3 displays the share of total loans backed by various collateral types. The share of loans collateralized by land had always been relatively high for regional banks, hovering around 33%. The share for city banks, however, rose from 17% in 1982 to over 24% in 1989. Since city banks dominated the corporate loan market, this constitutes a significant shift in loan portfolios. Real estate backed loans by the long term credit and trust banks fell in the early 1980s, stabilized during the land price appreciation, and actually increased during the land price collapse of the 1990s, foreshadowing the collapse of the Nippon Credit Bank and the Long Term Credit Bank in later years.

In public statements, Japanese bankers seem to have been well-aware of the high risks involved in real estate loans relative to their other loans before the price reversal, even if they were unlikely to have foreseen the magnitude of the eventual crash. For example, in 1987, more than three years

⁴ Hoshi and Kashyap (1999) argue that the NPL problem is larger than that of the U.S. Savings and Loan crisis, and Corbett (2000) suggests it may be worse than the financial crisis faced by the Nordic countries.

⁵ Tsuru (2001) finds a positive correlation between changes in the share of loans to the real estate sector and land price appreciation, but no correlation for other loan categories, and takes this as evidence that banks shifted their portfolios in response to rising land values. Dinc (2003) provides evidence that the presence of large shareholders (of banks), or those best able to monitor, *restrained* bank managers from real estate lending during the 1985-89 period, but that the ability of these shareholders to do so depended on the degree of bank ownership by other firms within the same Keiretsu group. Also see Horiuchi and Shimizu (2001) for the role of *Amakudari* in regulator monitoring of banks.

before real estate prices started their eventual decline, Kenichi Komiya, the then president of Mitsui Bank as well as the president of the Federation of Bankers Association of Japan, publicly stated that “the association recognized the importance of limiting the amount of money lent to finance land purchases. The association recommended its members [to] tighten up their lending procedures and...carefully investigate the uses to which the land in question is to be put.”⁶

2.2 Corporate and Individual Exposure to Real Estate

Although the relationship between bank health, the non-performing loan problem, and banks' exposure to land has received considerable attention, the land price collapse had severe consequences for individual investors and corporations as well. Japanese tax law provides incentives for individual investors to hold real estate assets since inherited land is valued at well below market price, while other assets are valued at full market price. In addition, relative to the U.S., average property taxes were quite low, at .39%, and interest expenses deductible, making investment in land with borrowed money attractive to investors seeking to lower ordinary and estate taxes (Stone and Ziemba (1993)). Noguchi and Poterba (1994) report that the average house price to average annual income ratio is 7.4 for Japan, while only 3.2 for the U.S., implying that Japanese households spend about twice as much on owner occupied housing. Iwaisako (2003) finds that over 60% of the sample population over the age of 40 owned real estate in 1987, and this share rises to over 80% for cohorts over the age of 60.⁷

The Japanese corporate sector was also heavily exposed to real estate assets. Reflecting the boom in real estate prices, the number of listed real estate firms increased from 21 in 1980 to 39 in 1990, with the largest increase occurring between 1985 and 1989 when land price increases accelerated. In addition, the number of listed construction companies increased from 132 in 1980 to 160 in 1990. This increase, however, likely understates the effect of the real estate boom on business creation, as many of the real estate development and leasing companies that emerged were unlisted small and medium sized firms. To illustrate the extent to which corporations were exposed, Ziemba and Schwartz (1991) calculate the P/E ratios of large Japanese companies for the 1980s, and find a more substantial drop when land is factored out than when other asset types are removed.⁸

For listed firms as a whole, land exposure increased dramatically in the second half of the 1980s, both because of the appreciation in land prices, and because of large real estate investments. Corporations were already the major purchasers of real estate assets throughout the 1970s. Yet, corporate investment in land assets increased substantially during the land price appreciation of the 1980s; net land purchases by corporate entities between 1985-89 totaled 28 trillion yen, dwarfing their 3 trillion yen investment between 1980 and 1985 (Cutts (1990), Stone and Ziemba (1993)). These real estate purchases were often used to house employees at subsidized rental rates, although there is growing evidence that land intensive manufacturing firms may have enjoyed lower financing costs.⁹ Land comprised roughly 30% of the market value of total assets for listed *manufacturing* firms in the 1980s, a much larger share than any other tangible asset.

The land price and stock market collapse in the early 1990s had a severe impact on the financial health of individuals, firms, and banks.¹⁰ From 1991 to 2001, industrial land prices fell by 22%, commercial land prices by 54%, and residential land prices by 41%. Iwaisako (2003) reports that total

⁶ Kyodo News International, 27 October 1987.

⁷ Real estate assets comprised roughly 50% of total individual wealth in 1987 for Iwaisako's (2003) sample as a whole, whereas equity ownership comprised less than 5% of total wealth. The share of real estate assets in total wealth reached 50% for those aged 35-39, and increased to over 70% for those in their mid 50s.

⁸ As an example, Nippon Steel had a P/E ratio of 101.5 in 1988, but only 83.3 once land is removed.

⁹ Ogawa and Suzuki (1998, 2000).

¹⁰ Using aggregate stock market measures (such as the Nikkei 225 or the Topix indices), it has been well documented that stock prices over the relevant period were more volatile than land prices, and that (a) there was little co-integration between stock indices and land prices (Hamao and Hoshi (1991), Stone and Ziemba (1992)), and (b) movements in stock prices tended to lead movements in land prices by at least one year (Canaway (1990), Ito and Iwaisako (1995)). For example, Ito and Iwaisako (1995) show that the simple correlation between current period excess land returns (over the call rate) and excess stock returns is only .05, but increases to .35 when t -2 period excess returns are used.

wealth of individuals decreased nearly 50% from 1990 to 1999, while financial wealth (wealth composed of stocks, mutual funds, and other financial assets) actually increased by 5 to 10%. He reports that the decline in total wealth is explained almost exclusively by the fall in real estate value over this period. For corporate Japan, the fall in land prices led to a decrease in collateral value which increased the cost of capital for firms, and simultaneously halved the collateral value already on bank balance sheets. As a result, many banks were forced to call in loans that firms were often unable to repay. In addition, many real estate development companies and the Jusen lending institutions (many of which were affiliates of the large City banks) went bankrupt when land prices failed to recover quickly, leaving banks and individual investors with ties to these industries without recourse.

3 Methodology and Data

Our aim is to analyze the risk to investors associated with real estate investment in the 1985-89 period. If real estate holdings were frequently traded in the market, or if there were Real Estate Investment Trusts (REITs), one could estimate the market beta for real estate directly. Unfortunately, no such security existed in Japan during the period of interest. Hence, we study securities whose return is likely to be partially affected by the return on real estate assets. Towards that aim, the analysis below focuses on listed manufacturing firms whose stock return is presumed to be partially determined by their land holdings. Since the market return to their land holdings is not observed as frequently as their stock return, we first use the stock price to estimate the market beta for each firm and then study the effects of their land holdings on their beta.¹¹

This analysis is couched in a simple synthesis of the APT and CAPM asset pricing models, as outlined in the appendix. This synthesis yields a decomposition of the market beta of a particular security into the weighted sum of factor “sensitivity” parameters (but offers no guidance on what the underlying factors actually are). The weights on these parameters are the unobserved betas of the factors, and can be estimated with appropriate measures of the factor sensitivities. Using listed firms as our universe of securities, our strategy is to proxy for the sensitivity parameters using variables from the firm’s balance sheet. In particular, we assume that the real estate sensitivity parameters are well measured by the ratio of the value of land and real estate holdings to total firm value.

Whether this is a good assumption will depend on the asset composition of the firm. Firm value is the sum of the market value of all assets (both tangible and intangible, realized and unrealized). Construction and real estate development firms own relatively little land, but their business operations are strongly tied to the real estate market. In addition, their intangible assets (e.g. brand recognition, good will) are likely highly correlated with developments in the real estate market, and should also be reflected in the stock price. Thus, the ratio of physical land (owned by the firm) to the firm’s market value is likely to underestimate the sensitivity of the firm’s stock return to the real estate factor.

Manufacturing firms, on the other hand, own considerable tracts of land, and their operations are generally not directly tied to the real estate market. Thus, the sensitivity of their stock price to the real estate factor is likely well proxied by this ratio. It is still possible that manufacturing firms are exposed to real estate through cross-shareholding with firms tied to the construction or real estate markets, and the use of the land/firm value ratio as a proxy will not capture this additional sensitivity. However, the value of these cross-shareholdings is small relative to the stock of land.

In the first step, each firm’s market beta is estimated separately for each year using

$$R_{i,t}^f = \alpha_i + \beta_i^M RM_t^f + \epsilon_{i,t}, \quad (1)$$

¹¹ Using the same methodology, Saunders et al. (1990) study whether managerial shareholding is associated with higher risk taking by banks. See, also, Chen, Steiner, and Whyte (1998, 2001), Beason (1998), May (1995), and Lewis, Rogalski, and Seward (2002).

where t indexes weeks, $RI_{i,t}^f$ is firm i 's annualized excess return in week t , RM_t^f is the annualized excess market return in week t , and $\epsilon_{i,t}$ is a white noise error term.¹² This generates a yearly series for each firm of $\hat{\beta}_i^M$, the estimates of β_i^M , which are then stacked to form the dependent variable in a second regression equation,

$$\hat{\beta}_{i,t}^M = \alpha_i + \beta^C X_{i,t} + \beta_{RE}^M LAND_{i,t} + \epsilon_{i,t}^* \quad (2)$$

where t indexes years, $X_{i,t}$ is a vector of firm and year control regressors, $LAND_{i,t}$ is our proxy for firm i 's sensitivity to real estate, $\epsilon_{i,t}^*$ is a white noise error term, and β^C and β_{RE}^M are to be estimated.¹³

The main variable of interest is $LAND_{i,t}$. A positive coefficient on this variable would indicate that the exposure to real estate is positively correlated with the systematic risk of the firm. To the extent that this correlation is stronger than that of other assets, such a result would be consistent with investors recognizing and pricing the riskiness of land. Note, however, that this says nothing about whether land risk was *accurately priced*. Investors may still have underestimated the riskiness of real estate, but a positive coefficient on the $LAND_{i,t}$ measure in equation 2 will imply that investors knew that real estate was on average riskier than investing in manufacturing companies. Different measures of $LAND_{i,t}$ are used for robustness, and further checks are provided by using (as dependent variables) the standard deviations of the regression residuals from equation 1 (an estimate of the firm's idiosyncratic risk), as well as the standard deviations of raw stock returns (an estimate of total firm risk).

The firm balance sheet data is taken from the financial database of the Development Bank of Japan, which contains detailed accounting data for all non-financial listed firms. This balance sheet data is supplemented with weekly stock price data from Datastream. The annualized weekly yield on the three month Japanese government bond is used as the risk free rate, while the weekly Nikkei 225 index is used to calculate the market return. Requiring that all data be available for manufacturing firms over the 1985-96 time period, and that firms be continuously listed from 1983-1996, leaves a sample of 576 manufacturing firms.

The use of the book value of assets, as listed on Japanese corporate balance sheets, is likely to be problematic in this analysis. Japanese law permitted firms to record physical assets at historical cost, which has led to a large discrepancy between their book and market values. Thus, to the extent possible, the book values of all assets have been converted to market value. For each firm, the market value of each physical asset is calculated using a perpetual inventory method similar to that in Hayashi and Inoue (1991), with asset specific price series and depreciation rates.¹⁴ In particular, the construction of the market value of land involves a LIFO recursion using land prices from the Japan Real Estate Institute, and is similar to the procedure used by Hoshi et al. (1990).¹⁵ The market value of total assets, denoted TA , is the sum of the market values of all physical assets plus financial assets. For the latter, the book value is taken as the market value under the assumption that the rate of financial asset turnover is high.

¹² We use the stock price index for each firm instead of the stock price itself in calculating excess firm returns because the former is adjusted for stock splits and inter-period dividend payments.

¹³ The constant term, α_i , contains a firm specific component, a result of the inclusion of the market portfolio as a factor in the APT equation (see appendix). Because our panel covers a very short time span, our estimates are driven by variation in the cross section of firm returns, which tend to be washed out in fixed effects models. As described below, a variety of firm specific controls as well as industry and year dummies are included in each regression.

¹⁴ Non-land physical assets include buildings, structures, machines, transportation equipment, and tools.

¹⁵ This land price index is the most common series used in econometric work on Japan. The institute generates indices for industrial, commercial, the highest priced lots, and for all land in the six largest cities and the country as a whole from 1955. The data is appraisal based, where simple averages of three sets of ten lots in each city covered in the survey are used to construct the index. Land is separated into high, medium, and low grades, reflecting location, yield, and other factors, and lots are randomly selected from these three classes. Ideally, one should use the land price index that corresponds to the actual geographic location of each *plant* in each firm. However, the firms in our sample are large, with multiple plants in numerous geographic areas. Even with data on the location of the headquarters of each firm, this correction could overestimate the value of land, as many firms have their headquarters in Tokyo or Osaka, but base their operations elsewhere. Since we have no data on actual factory location, and because we restrict our sample to manufacturing firms, we follow the standard in the investment/Q literature on Japan and use the national industrial price index as our price series.

4 Empirical Analysis

This section presents the primary results from the estimation of equation 2. The dependent variable, β_t^M , is calculated with *current* period weekly return data, whereas all independent variables are *beginning of period* values constructed from the balance sheet data contained in the DBJ database. Each OLS regression presented below contains a full set of industry and year dummies, and a dummy variable that equals one if the firm had a non-twelve month accounting period.¹⁶ All reported *t* statistics and standard errors are heteroskedasticity consistent, and calculated with an estimated variance/covariance matrix adjusted for clustering by firm.¹⁷

Although the results are robust to a wide range of control variables, only those with control variables used elsewhere in the literature are presented. The log of gross sales, $\ln(\text{Sales})$, is a control for firm size, EBITDA over sales, Prof/SL , is a measure of profitability, and total debt over market capitalization plus total debt, Leverage , controls for leverage effects.¹⁸

Several measures are used as proxies for sensitivity to the unobserved real estate factor, $\text{LAND}_{i,t}$ in equation 2. Simply including the stock of land as a regressor is problematic because of the heterogeneity in firm size. If land is risky, larger firms can hold more land than smaller firms without adversely affecting their risk premium. Thus, we focus on measures of asset composition. BLand/BTA , defined as the book value of land over the book value of total assets, is an obvious choice, but may be problematic because of the large discrepancy between the market and book values.¹⁹

Table 1 presents sample statistics for the variables used in the empirical analysis. Since many listed firms acquired their land in the pre-war era, there is an enormous discrepancy between the observed book value of land (BLand) and the unobserved market value (Land). The mean and median of BLand/BTA are around 4% throughout the sample period, while those for Land/TA are roughly five times larger, at 19%. The figures also contain evidence on the extraordinary growth in land prices *relative to other asset prices*. The last six rows of the table contain the ratio of the market value of land, buildings, and machinery to their corresponding book values. While the above mentioned accounting issues applied to all of these assets, the discrepancy between the book and market value of non-land physical assets is far smaller than that for land. The market value of land is roughly 7 times its book value on average, while the market values of machines and buildings are less than twice their book values. This is partially explained by the fact that land is not a depreciable asset.

Table 2 presents the first set of empirical results based on estimation of equation 2. The first column contains only the control variables as regressors, and shows a positive and significant relationship between beta and the leverage and size regressors, but a negative relationship between beta and profitability. In other words, the systematic risk of manufacturing firms increases with their size and leverage but decreases with their profitability.

In the second column, BLand/BTA , the book value of land over the book value of total assets, is included as a proxy for the firm's sensitivity to the real estate factor. In the 1985-89 period, this enters *negatively* (but is insignificant), suggesting at most a weak, negative correlation between risk and land exposure. For the 1990-96 period (results not presented), BLand/BTA is again negative, but now significant. This is somewhat counterintuitive, as land prices collapsed after 1990, and suggests not only that investors did *not* recognize the riskiness of land during the asset appreciation period, but that firms with more land during the *land price collapse* were viewed as less risky. Hence, the negative coefficient on the BLand/BTA variable more likely illustrates the severe measurement error caused by using historical rather than market prices in valuing land held by these companies.

¹⁶ Our results are robust to the exclusion of this variable.

¹⁷ This relaxes the assumption that observations across years are independent within each firm.

¹⁸ We also experimented with numerous corporate governance variables that have been the subject of other studies (eg ownership structure, corporate affiliation) to ensure that claims we make about our variables of interest are robust. For brevity, these have been excluded.

¹⁹ Conceptually, if the measurement error in the book value of land and that in total assets has a common source, then the ratio may be an accurate measure of land intensity. However, because all fixed assets are carried at historical cost, book total assets contains measurement error beyond that introduced by the book value of land.

Consistent with this hypothesis, the pattern is reversed in the third column where *Land/TA* is used in place of *BLand/BTA*. The coefficient on *Land/TA* is positive and significant, while the signs of the coefficients on the control regressors are similar. Although interpretation of the size of the coefficient on *Land/TA* is difficult because we do not have a corresponding model of investor risk aversion, the results suggest that a one standard deviation increase in *Land/TA* leads to an increase in the firm's beta coefficient of $.3204 * .119 = .038$, or roughly a 5% increase from the sample mean. This is nearly *double* the effect of a one standard deviation increase in the leverage ratio.

There are several potential measurement error issues to consider. In constructing the market value of total assets, it is assumed that the book and market value of financial assets are equal. This is not necessarily restrictive since, on average, 40% of financial assets are cash and short term securities. However, if there is a large divergence between the market and book value because of the unmeasured market value of royalties, patents, brand name recognition, and research and development capital, then normalization by our measure of total assets may be problematic.

To investigate this possibility, the remaining columns of the table include alternative proxies for the sensitivity to the real estate factor. If capital markets are efficient, investors should capitalize all assets regardless of how they are recorded on the balance sheet. This implies that firm value perfectly reflects these intangible assets, and is a potentially better normalization variable.²⁰ The third column presents the results using *Land/FV* defined as the market value of land normalized by firm value (market capitalization plus gross debt). It enters significantly at the 10% level, but the coefficient has dropped from .32 to .11, and now implies that a one standard deviation increase in the land proxy translates into a 2.05% increase in beta (from sample mean). Whether this weaker result is because the original *Land/TA* measure overstates the land-risk relationship, or because *Land/FV* introduces *more* measurement error is difficult to determine.

In support of the previous results, however, the remaining columns repeat these regressions using alternative sensitivity proxies (defined below) for $LAND_{i,t}$ in equation 2. Financial assets were used as collateral in only 8% of secured loans during the relevant period. However, firms with a substantial stock of reserve cash and other liquid assets may be considered better able to weather adverse shocks, implying a negative correlation between financial assets and firm risk (confirmed below). This variation in financial assets across firms could generate a positive coefficient on the real estate sensitivity proxy when total assets (which includes financial assets) is the variable used to normalize land. Thus, a better measure may be *Land/FA*, defined as the market value of land over the market value of fixed assets. As shown in the fifth column, the coefficient on *Land/FA* is roughly double that on *Land/FV* in the preceding regression, and is significant at the 1% level. As with *Land/TA*, a one standard deviation increase in *Land/FA* is correlated with roughly a 5% increase in beta.

Similarly, because of the problems with all these asset measures, gross sales is often used as a proxy for firm size (total assets) in empirical work based on Japanese data. Land normalized by gross sales, *Land/SL*, enters positively and is highly significant in the sixth column, and has a slightly larger effect on the dependent variable; a one standard deviation increase leads to a 5.5% increase in beta.

It is possible that land is highly correlated with other real estate assets that may be risky, while land itself is not. The last column contains the results where *Real/TA*, defined as the market value of land *plus* the market value of buildings and structures over the market value of total assets, is used as the sensitivity proxy. The coefficient on *Real/TA* is smaller and (slightly) less significant than that on the original *Land/TA* regressor, suggesting a negative correlation between buildings and structures and the firm's market beta. This is consistent with the use of physical structures as collateral assets, and suggests that the earlier estimates were not driven by correlation between land and other real estate assets. We address this issue thoroughly in the next section.²¹

²⁰ This is the fundamental assumption behind using stock price data to back out estimates of R&D capital, the benefits of IT technology, and other "intangibles" using U.S. data. See Hall (1993), Hall (2001), and Brynjolfsson and Yang (1999) for discussion and applications. Note, however, that the possible existence of an asset price "bubble" in Japan in the second half of the 1980s may mean that normalization by firm value will introduce non-fundamental components into the regressor. We cannot address this issue directly, making it unclear as to whether this is a better measure.

²¹ The denominator of *Leverage* also contains the firm's market capitalization, thus possibly introducing measurement error through the leverage ratio. All regressions presented in table 2 were run using the coverage ratio in place of *Prof/SL* and *Leverage*, where $\ln(\text{Cov Rat})$ is defined as the log of one plus the ratio of interest expenses over EBITDA. Like *Leverage*, firms with higher debt (and thus higher interest payments) and lower cash flow should be viewed as more risky, and the

Taken together, the results from table 2 are consistent with the hypothesis that market participants knew land to be risky in the 1985-89 period. Our real estate sensitivity proxies are always positive and significant, implying that the beta on the real estate factor is positive and significant. The next section further establishes this primary result by incorporating other asset “factors” into the empirical framework.

5 Robustness

This section explores several alternative specifications to ensure that the results presented above are robust. We first consider exposure to alternative assets, including those that could have been used as collateral assets. Second, cross-shareholding relationships in Japan may have implied that investors could not diversify away idiosyncratic risk. Thus, we examine the correlation between measures of idiosyncratic (and total) risk and our various proxies of sensitivity to the real estate assets. Third, we test our results using market beta’s calculated from a multi-factor CAPM equation. Fourth, we consider alternative time periods. Finally, a well known problem in the estimation of market betas is the “non-synchronous trading bias”. a discussion of this issue, as well as results based on corrected risk measures, is presented in appendix 7.2.

5.1 Alternative Assets

It is possible that the proxy for real estate sensitivity is correlated with components of systematic risk which result from exposure to other, uncontrolled for factors. In particular, land holdings may proxy for new investment, as land was typically used as collateral in obtaining loans from banks. If new investments increase the systematic risk of a firm, the results presented in the previous section may be capturing the riskiness of new investment, and not the risk associated with land per se. To address this issue, we study the factors related to non-land real estate assets, assets tied to the operation of the firm, and financial assets, and then proxy for the sensitivity to these factors using ratios similar to those used for land. As reported in table 1, land comprised about 40% of the market value of fixed assets, machines and tools about 35%, and buildings and structures about 24%, implying that exposure to these latter asset types was considerable.

The results of these experiments are presented in tables 3-5. In the first column of table 3, systematic risk is regressed on the control variables and on a proxy for the sensitivity to the return on non-land real estate assets, $Bldg/TA$, defined as the market value of buildings and structures over the market value of total assets. This regressor enters negatively, but with standard errors roughly 40 times larger than the estimated coefficient. In the third column where buildings and structures are normalized by firm value, the coefficient is positive, but even more imprecisely estimated. Similar results follow in regressions where fixed assets or sales are used to normalize the numerator. For each of these regressions, we also include the corresponding $LAND_{i,t}$ proxy, which is the market value of land over the corresponding denominator. In all cases, these regressors enters positively and significantly, and, in addition, the coefficients on the non-land real estate regressors are everywhere insignificant when the land regressor is included.

This experiment is repeated using machines and tools in table 4, and using financial assets in table 5. The results for machines and tools are similar to those for buildings and structures discussed above, but those for financial assets warrant further comment. In the first column of table 5, Fin/TA , defined as financial assets (assumed equal to book value) over the market value of total assets, enters negatively and significantly, evidence that those firms with a larger share of financial assets have lower systematic risk. This proxy becomes insignificant when $Land/TA$ is included as a regressor, implying a negative correlation between Fin/TA and $Land/TA$. Since both land and financial assets are relatively large shares of total assets, the inclusion of both regressors may introduce near multicollinearity.

coefficient on $\ln(Cov\ Rat)$ is expected to be positive. In all cases, this regressor enters positively, and is generally significant, although the size of the regressor is smaller than when the leverage ratio is used. The measures of land intensity are virtually unchanged, and these results have been omitted for brevity.

However, these regressions were repeated in the remaining columns of the table after normalizing all assets by firm value, fixed assets, and gross sales, and similar results are obtained.²²

5.2 Idiosyncratic and Total Risk

The above analysis rested on the decomposition of beta that falls out of a synthesis of the CAPM and APT models. However, it is often of interest to examine the components of idiosyncratic and total risk, particularly if agents cannot easily diversify their portfolios. Idiosyncratic risk should be irrelevant if investors maintain a well diversified portfolio. However, unlike in the U.S., a significant portion of shares in Japan were held by financial institutions and other corporations. In particular, banks held shares in many large companies as part of their main bank relationships. Because these banks could not adjust their portfolios easily without affecting these relationships, they would have been exposed to exposed to idiosyncratic risk as well.²³

Similarly, many large manufacturing firms in Japan maintain close ties with supplier firms as part of a vertical Keiretsu chain (e.g. Toyota, Matsushita). It is argued that the cross-shareholding in these vertical chains helps to mitigate holdup problems inherent in subcontracting relationships. These shareholder connections may imply that the value to the firm (or bank) of holding shares may extend beyond that asset's contribution to the firm's portfolio. These agents may choose not to diversify away idiosyncratic risk because the information/stability benefits of maintaining the shareholding tie outweigh the financial costs of holding volatile shares. Thus, idiosyncratic risk measures are potentially important in our analysis.

The summary statistics for both the idiosyncratic and total risk measures are presented in table 6, while table 7 presents the results from regressions where these measures are regressed on the independent variables discussed in the previous section. All the land measures have positive and, with the exception of land normalized by firm value (*Land/FV*), statistically significant coefficients. These results indicate that real estate exposure is also a significant component of idiosyncratic and total risk.

5.3 Multi-Factor Risk Measures

The systematic risk measure from the single-factor CAPM theoretically contains all risk priced by the market. It is possible that the correlation between the real estate sensitivity proxies and systematic risk are driven by the interest rate component of the dependent variable. The systematic risk measures used in this section are based on the multi-factor market model that includes the long term interest rate and the yen/dollar exchange rate as factors (as well as the market return), and the resulting beta is a measure of systematic risk which is independent of interest or exchange rate exposure.

Table 8 presents the results using this alternative measure and our four proxies for sensitivity to the real estate portfolio. Relative to the results in table 2, the coefficients on our proxies are all larger and (generally) more statistically significant. Based on these estimates, the effect of a marginal increase in land intensity on systematic risk is roughly equivalent to the effect of a marginal increase in the leverage ratio, a smaller effect in relative terms than that documented above, but arguably more precisely estimated. The real estate sensitivity proxies perform less consistently when idiosyncratic and total risk (estimated with the multi factor model) are used as dependent variables. These regressions support those results presented thus far, but the coefficients of interest are less often significant and somewhat more volatile across model specifications. These regressions have been omitted for brevity.

²² Transportation equipment is a small fraction of fixed assets for manufacturing firms. We experimented with this individually, and included this with machines and tools, but with no quantitative or qualitative effect on the results.

²³ It is often argued that large banks give implicit guarantees to help firms that enter financial distress, and that the shareholding tie helps reduce problems of asymmetric information. Alternatively, bank shareholding may be a vehicle by which banks extract rents from client firms. Either of these imply that banks may choose not to divest shares of risky firms as part of a portfolio management strategy in the way a neutral investor would. See Aoki and Patrick (1994) and Hoshi and Kashyap (2001) for descriptions of relationship banking in Japan.

5.4 Alternative Time Periods

A positive correlation between systematic risk and the real estate factor was documented above for the 1985-89 period. Ideally, these results should be compared with estimates from the period prior to the acceleration in land price increases (i.e. 1980-84). This will help establish, for example, whether or not market participants had always viewed land as risky, or whether this awareness developed after the growth in land prices accelerated in 1985. Unfortunately, the weekly risk free rate used to construct the market beta is unavailable before 1985. However, the 3 month euroyen rate, a short term interest rate which moves almost perfectly with the risk free rate after 1985, is available for the 1980-84 period.

Table 9 repeats the regressions from table 2, but focuses on the 1980-84 and 1990-96 time periods. The dependent variable is constructed using the three month euroyen rate as the risk free rate. As shown in the top half of the table, none of the land sensitivity proxies are statistically significant in the 1980-84 period, suggesting that market participants did not view land as riskier than the firms main operations prior to the acceleration in the growth of land prices. In regressions in which other asset sensitivity variables are included (as in Tables 3, 4 and 5), the land sensitivity proxies are again generally not significant during this earlier period. The results using the euroyen rate for the 1985-89 period are virtually identical to those presented in table 2, and have been omitted for brevity. Further results are presented in Table 10, where idiosyncratic risk and total risk (calculated using the three month euroyen rate as the risk free rate) are the dependent variables. Interestingly, the results imply a positive (and mildly significant) relationship between idiosyncratic risk and the land sensitivity proxy in the 1980-84 period. Together, these results imply that while exposure to land assets did not generally lead to higher systematic risk in the first half of the 1980s, it nonetheless had consequences for investors through idiosyncratic risk.

Both Tables 9 and 10 include similar regressions for the 1990s, a period in which land prices fell considerably. In such an environment, it is not surprising that firms more intensely exposed to land assets would be perceived as more risky. The coefficients on the land sensitivity proxies in the 1990-96 period in table 9 (and those in Table 10 as well) are everywhere positive and statistically significant.

6 Conclusion

This paper has documented a strong positive correlation between manufacturing firm's exposure to land assets and measures of systematic firm risk during the 1985-89 period. Couched in theory that synthesizes the CAPM and the APT models, our results can be interpreted as estimates of the beta coefficient on an unobserved real estate factor. The consistently positive and significant coefficients on our real estate sensitivity proxies suggest that real estate was a significant contributor to systematic market risk during the asset appreciation period. Moreover, we are unable to establish similar results for other asset types. To the extent that shareholders of manufacturing firms were a diverse group of market participants, our results imply that investors did appreciate, at least to some extent, the riskiness of land prior to the asset market collapse. This calls into question claims made during the 1990s that it was impossible to know that land was risky.

The results presented here do not imply that the investors should have foreseen the timing of subsequent crash in land prices. The beta's of the unobserved land factors that we estimate may have been too small, implying that investors did not fully internalize the riskiness of these assets. However, they do indicate that investors were aware of higher risks of land investments *relative to* the main operations of manufacturing companies, and have implications for studies of the Japanese financial environment in the 1980s and after. The non-performing loan problem that surfaced in the 1990s was a direct result of the financial sector's excessive exposure to real estate in the late 1980s. Whether this exposure was the result of bad judgement on the part of bank managers, or symptomatic of much larger corporate governance failures that arose when banks faced competition from the bond market, is an open, but important, question.

Table 1
Sample Statistics

Table presents sample statistics for 576 manufacturing firms that were continuously listed from 1983 to 1996. β_i^M is the firm beta coefficient, $\ln(\text{Sales})$ is the log of real sales, Prof//SL is operating profit over gross sales, Leverage is total debt over total debt plus market capitalization, Land/FA , Land/TA , Land/FV and Land/SL are the market value of land divided by the market value of physical assets, the market value of total assets, the market capitalization plus total debt, and gross sales, respectively. Bldg/FA , Mach/FA , Bldg/TA , Mach/TA , Fin/FV and Fin/TA are corresponding variables with the market value of buildings and structures, machines and tools, and financial assets in the numerator. BLand/BTA is the book value of land over the book value of total assets. MLand/BLand is the ratio of the market value of land to the book value of land, MBldg/BBldg is the ratio of the market to the book value of buildings and structures, and MMach/BMach is the ratio of the market value to the book value of machines and tools.

Variable	Period	Mean	Std Dev	10th Pctile	Median	90th Pctile
β_i^M	85-89	0.750	0.527	0.078	0.774	1.361
	90-96	0.948	0.377	0.472	0.947	1.424
$\ln(\text{Sales})$	85-89	18.206	1.181	16.803	18.039	19.845
	90-96	18.442	1.202	17.040	18.317	20.083
Prof//SL	85-89	0.051	0.051	0.007	0.045	0.104
	90-96	0.039	0.053	0.005	0.035	0.088
Leverage	85-89	0.151	0.112	0.029	0.127	0.304
	90-96	0.197	0.127	0.044	0.178	0.374
BLand/BTA	85-89	0.047	0.033	0.013	0.041	0.084
	90-96	0.057	0.041	0.016	0.049	0.105
Land/TA	85-89	0.193	0.119	0.065	0.170	0.350
	90-96	0.199	0.123	0.068	0.175	0.367
Land/FV	85-89	0.140	0.139	0.034	0.103	0.276
	90-96	0.188	0.175	0.049	0.144	0.377
Land/FA	85-89	0.412	0.174	0.195	0.401	0.643
	90-96	0.412	0.171	0.200	0.396	0.644
Land/SL	85-90	0.273	0.282	0.069	0.199	0.538
	90-96	0.331	0.440	0.084	0.233	0.661
Real/TA	85-89	0.293	0.126	0.147	0.277	0.462
	90-96	0.309	0.130	0.159	0.292	0.492
Fin/TA	85-89	0.549	0.141	0.366	0.552	0.730
	90-96	0.534	0.144	0.347	0.537	0.718
Fin/FV	85-89	0.351	0.113	0.218	0.343	0.491
	90-96	0.444	0.123	0.299	0.436	0.603
Bldg/TA	85-89	0.100	0.038	0.057	0.096	0.146
	90-96	0.109	0.043	0.062	0.104	0.157
Bldg/FV	85-89	0.067	0.036	0.029	0.061	0.113
	90-96	0.096	0.048	0.043	0.088	0.153
Mach/TA	85-89	0.156	0.083	0.056	0.148	0.267
	90-96	0.156	0.083	0.055	0.145	0.272
Mach/FV	85-89	0.067	0.036	0.029	0.061	0.113
	90-96	0.096	0.048	0.043	0.088	0.153
MLand/BLand	85-89	7.292	8.443	1.835	5.225	13.145
	90-96	6.335	8.142	1.750	4.416	11.347
MBldg/BBldg	85-89	1.692	0.358	1.331	1.641	2.108
	90-96	1.529	0.282	1.261	1.496	1.822
MMach/BMach	85-89	1.985	0.586	1.420	1.894	2.653
	90-96	2.095	0.766	1.423	1.937	2.885

Table 2

Systematic Risk and Land Sensitivity

Table presents results for OLS regressions on 576 manufacturing firms that were continuously listed from 1983 to 1996. The dependent variable is β_i^M , the market beta from the single-factor CAPM model estimated with weekly stock price data. $\ln(\text{Sales})$ is the log of real sales, Prof/SL is operating profit over gross sales, Leverage is total debt over total debt plus market capitalization. BLand/BTA is the book value of land over the book value of total assets. Land/TA , Land/FA , Land/FV and Land/SL are defined as the market value of land over the market value of total assets, the market value of fixed assets, market capitalization plus gross debt, and gross sales, respectively. Real/TA is the market value of land plus buildings and structures over the market value of total assets. All regressors are end of period $t-1$ values. All regressions include unreported year and industry dummies, and a dummy that equals one if the firm has a change in its accounting period. The heteroskedasticity consistent standard errors (in parentheses) have been adjusted for clustering by firm. One, Two and three asterisks denote statistical significance at the 10%, 5% and 1% levels respectively.

Period 1985-89							
Dependent Variable: Systematic Risk β_i^M							
Constant	-.6708 (.1663)***	-.6565 (.1677)***	-.8317 (.1686)***	-.7148 (.1689)***	-.8509 (.1689)***	-.8155 (.1721)***	-.8522 (.1707)***
$\ln(\text{Sales})$	.0689 (.0084)***	.0687 (.0085)***	.073 (.0084)***	.0699 (.0085)***	.0733 (.0083)***	.0752 (.0086)***	.0722 (.0083)***
Leverage	.1964 (.0902)**	.1968 (.0902)**	.1774 (.0904)**	.1761 (.0904)*	.1831 (.0905)**	.1504 (.0929)	.1795 (.0899)**
Prof/SL	-.2173 (.2086)	-.2137 (.2093)	-.0677 (.2144)	-.1667 (.2141)	-.1261 (.2168)	-.1563 (.2142)	-.078 (.2132)
BLand/BTA		-.1694 (.284)					
Land/TA			.3204 (.0873)***				
Land/FV				.1107 (.0597)*			
Land/FA					.2053 (.061)***		
Land/SL						.1466 (.0472)***	
Real/TA							.3031 (.0842)***
R^2	.17	.17	.174	.171	.174	.175	.174

Table 3

Systematic Risk and Buildings/Structures

Table presents results for OLS regressions on 576 manufacturing firms that were continuously listed from 1983 to 1996. The dependent variable is β_i^M , the market beta from the single-factor CAPM model. $\ln(\text{Sales})$ is the log of real sales, Prof/SL is operating profit over gross sales, Leverage is total debt over total debt plus market capitalization, Bldg/TA , Bldg/FV , Bldg/FA , and Bldg/SL is the market value of buildings and structures over the market value of total assets, over market capitalization plus gross debt, over the market value of fixed assets, and over gross sales, respectively. LAND is the corresponding ratio of the market value of land over each of the above. All regressors are end of period $t-1$ values, and all regressions include unreported year and industry dummies, and a dummy that equals one if the firm changes its accounting period. The heteroskedasticity consistent standard errors (in parentheses) have been adjusted for clustering by firm. One, Two and three asterisks denote statistical significance at the 10%, 5% and 1% levels respectively.

Period: 1985-89								
Dependent Variable: Systematic Risk β_i^M								
Constant	-.6701 (.1673)***	-.8407 (.1705)***	-.6709 (.1669)	-.7121 (.1687)***	-.597 (.1668)***	-.7953 (.1755)***	-.7429 (.1682)***	-.8362 (.1719)***
$\ln(\text{Sales})$	.0689 (.0085)***	.0729 (.0084)***	.0689 (.0085)	.0705 (.0085)***	.0686 (.0083)***	.0726 (.0083)***	.0714 (.0085)***	.0758 (.0086)***
Leverage	.1963 (.0901)**	.1776 (.0902)**	.1962 (.0916)**	.1839 (.092)**	.184 (.0901)**	.1799 (.0903)**	.1517 (.0937)	.1329 (.0953)
Prof/SL	-.2173 (.2087)	-.0671 (.2143)	-.2171 (.2116)	-.174 (.2156)	-.1298 (.2117)	-.1031 (.2178)	-.2952 (.2132)	-.2016 (.2185)
Bldg/TA	-.0069 (.2719)	.0808 (.2764)						
Bldg/FV			.0026 (.2567)	-.1515 (.2731)				
Bldg/FA					-.2836 (.1171)**	-.1161 (.1282)		
Bldg/SL							.3368 (.1396)**	.1679 (.1475)
LAND		.323 (.0873)***		.1224 (.063)*		.1764 (.0668)***		.1312 (.0482)***
R ²	.17	.174	.17	.171	.172	.174	.172	.175

Table 4

Systematic Risk and Machines/Tools

Table presents results for OLS regressions on 576 manufacturing firms that were continuously listed from 1983 to 1996. The dependent variable is β_i^M , the market beta from the single-factor CAPM model. $\ln(\text{Sales})$ is the log of real sales, Prof/SL is operating profit over gross sales, Leverage is total debt over total debt plus market capitalization, Mach/TA , Mach/FV , Mach/FA , and Mach/SL is the market value of machines and tools over the market value of total assets, over market capitalization plus gross debt, over the market value of fixed assets, and over gross sales, respectively. LAND is the /it corresponding ratio of the market value of land over each of the above. All regressors are end of period $t-1$ values, and all regressions include unreported year and industry dummies, and a dummy that equals one if the firm changes its accounting period. The heteroskedasticity consistent standard errors (in parentheses) have been adjusted for clustering by firm. One, Two and three asterisks denote statistical significance at the 10%, 5% and 1% levels respectively.

Period: 1985-89								
Dependent Variable: Systematic Risk β_i^M								
Constant	-.6763 (.166)***	-.8311 (.1686)***	-.684 (.166)***	-.7361 (.1687)***	-.6976 (.1641)***	-.9109 (.1838)***	-.6684 (.1663)***	-.8062 (.1719)***
$\ln(\text{Sales})$	.0696 (.0085)***	.0725 (.0084)***	.0704 (.0085)***	.0719 (.0086)***	.0728 (.0084)***	.0724 (.0083)***	.0683 (.0084)***	.0744 (.0086)***
Leverage	.1973 (.0902)**	.1763 (.0901)**	.2106 (.0904)**	.1918 (.0907)**	.1935 (.0903)**	.1794 (.0903)**	.1551 (.0933)*	.1227 (.0948)
Prof/SL	-.2223 (.2097)	-.0602 (.2144)	-.2377 (.2114)	-.187 (.2163)	-.1952 (.2138)	-.1018 (.2176)	-.2523 (.2065)	-.185 (.213)
Mach/TA	-.0591 (.1227)	.046 (.1211)						
Mach/FV			-.1264 (.1293)	-.159 (.1296)				
Mach/FA					-.1679 (.0659)**	.1207 (.1259)		
Mach/SL							.1574 (.0832)*	.1147 (.083)
LAND		.3279 (.0869)***		.1225 (.0621)**		.2957 (.1167)**		.139 (.0469)***
R ²	.17	.174	.17	.171	.172	.174	.171	.175

Table 5

Systematic Risk and Financial Assets

Table presents results for OLS regressions on 576 manufacturing firms that were continuously listed from 1983 to 1996. The dependent variable is β_i^M , the market beta from the single-factor CAPM model. $\ln(\text{Sales})$ is the log of real sales, Prof/SL is operating profit over gross sales, Leverage is total debt over total debt plus market capitalization, Fin/TA , Fin/FV , Fin/FA , and Fin/SL is the market value of buildings and structures over the market value of total assets, over market capitalization plus gross debt, over the market value of fixed assets, and over gross sales, respectively. LAND is the corresponding ratio of the market value of land over each of the above. All regressors are end of period $t-1$ values, and all regressions include unreported year and industry dummies, and a dummy that equals one if the firm changes its accounting period. The heteroskedasticity consistent standard errors (in parentheses) have been adjusted for clustering by firm. One, Two and three asterisks denote statistical significance at the 10%, 5% and 1% levels respectively.

Period: 1985-89								
Dependent Variable: Systematic Risk β_i^M								
Constant	-.5664 (.1679)***	-.7917 (.1927)***	-.6136 (.1658)***	-.6552 (.1696)***	-.6202 (.1652)***	-.7898 (.1688)***	-.6804 (.1699)***	-.8103 (.1747)***
$\ln(\text{Sales})$	.0686 (.0084)***	.0725 (.0085)***	.0709 (.0082)***	.0718 (.0083)***	.0675 (.0084)***	.0717 (.0083)***	.0693 (.0086)***	.075 (.0087)***
Leverage	.1814 (.0894)**	.1764 (.0902)**	.2635 (.091)***	.2432 (.0918)***	.1906 (.0892)**	.1792 (.0898)**	.1926 (.0918)**	.1524 (.0942)
Prof/SL	-.1001 (.2107)	-.06 (.2141)	-.284 (.2157)	-.2361 (.2222)	-.093 (.2075)	-.0249 (.2123)	-.2311 (.2163)	-.1476 (.22)
Fin/TA	-.2144 (.694)***	-.0449 (.1027)						
Fin/FV			-.2556 (.0961)***	-.2485 (.0968)***				
Fin/FA					-.0286 (.009)***	-.0252 (.0089)***		
Fin/SL							.0074 (.0216)	-.0045 (.0211)
LAND		.2843 (.127)**		.1008 (.0595)*		.1865 (.0612)***		.1474 (.0476)***
R ²	.173	.174	.173	.173	.173	.176	.17	.175

Table 6

Risk Measure Sample Statistics

Each risk measure is calculated separately by year for each of 576 manufacturing firms using the firm-specific listing dates, and roughly 52 weekly market observations. The yield on the three month Japanese government bond is used as the risk free rate and the weekly Nikkei 225 index is used to calculate market returns. The yield on the 10 year Japanese government bond and the weekly Yen/Dollar exchange rate are included as additional regressors in the multi-factor model. δ_i^{tot} is the standard deviation of raw excess returns, δ_i^0 is the standard deviation of the residuals from the single-factor CAPM model, β_i^{MF} is the market beta from the multi-factor CAPM model, and δ_i^{MF} is the standard deviation of the residuals from the multi-factor CAPM model.

Risk	Period	Mean	Std. Dev.	10th Pctile	Med.	90th Pctile
δ_i^{tot}	85-89	2.576	0.831	1.723	2.419	3.607
	90-96	2.652	0.979	1.616	2.451	3.919
δ_i^0	85-89	2.395	0.828	1.558	2.226	3.452
	90-96	2.108	0.831	1.280	1.935	3.130
β_i^{MF}	85-89	0.758	0.567	0.071	0.768	1.425
	90-96	0.956	0.398	0.458	0.950	1.465
δ_i^{MF}	85-89	2.333	0.803	1.522	2.173	3.357
	90-96	2.066	0.817	1.254	1.896	3.071

Table 7

Idiosyncratic and Total Risk and Real Estate

Table presents results for IV regressions on 576 manufacturing firms that were continuously listed from 1983 to 1996. The dependent variables are β_i^M , the market beta from the single-factor CAPM model estimated with weekly stock price data, δ_i^0 , the annual standard deviation of the residuals from this model, and δ_i^{tot} , the annual standard deviation of the raw excess returns. $\ln(\text{Sales})$ is the log of real sales, Prof/SL is operating profit over gross sales, Leverage is total debt over total debt plus market capitalization, Land/FV is the market value of land over firm value (market capitalization plus gross debt), Land/FA is the market value of land over the market value of fixed assets, and Land/SL is the market value of land over gross sales, Real/TA is the market value of real estate (land plus buildings and structures) over the market value of total assets. All regressions are end of period $t-1$ values, and all regressions include unreported year and industry dummies, and a dummy that equals one if the firm changes its accounting period. The heteroskedasticity consistent standard errors (in parentheses) have been adjusted for clustering by firm. One, Two and three asterisks denote statistical significance at the 10%, 5% and 1% levels respectively.

	Period: 1985-89							
	Idiosyncratic Risk: δ_i^0				Total Risk: δ_i^{tot}			
Constant	6.331 (.3032)***	6.4617 (.3016)***	6.2904 (.3107)***	6.3031 (.3054)***	5.7223 (.3011)***	5.8999 (.3003)***	5.6845 (.3067)***	5.6896 (.3049)***
$\ln(\text{Sales})$	-.2235 (.0154)***	-.2268 (.0154)***	-.2226 (.0154)***	-.224 (.0153)***	-.188 (.0151)***	-.1926 (.0152)***	-.1873 (.0151)***	-.1888 (.0151)***
Leverage	.3678 (.1548)**	.3783 (.1569)**	.3712 (.1549)**	.3687 (.1549)**	.3903 (.1539)**	.4032 (.1564)***	.3964 (.1543)***	.3922 (.1537)**
Prof/SL	-1.2737 (.4446)***	-1.3921 (.4473)***	-1.3145 (.4364)***	-1.2758 (.4445)***	-1.1776 (.431)***	-1.3377 (.436)***	-1.2436 (.4202)***	-1.1851 (.4327)***
Land/TA	.2886 (.1477)*				.4002 (.1488)***			
Land/FV		.0358 (.102)				.0588 (.1048)		
Land/FA			.2114 (.1123)*				.2722 (.1116)**	
Real/TA				.2887 (.1493)*				.3905 (.1489)***
R ²	.2	.199	.2	.2	.182	.179	.182	.182

Table 8:

Firm Risk and land Sensitivity, Multi-Factor Model

Table presents results for IV regressions on 576 manufacturing firms that were continuously listed from 1983 to 1996. The dependent variables are β_i^{MF} the market beta from the multi-factor CAPM model estimated with weekly stock price data, and δ_i^{MF} , the annual standard deviation of the residuals from this model. $\ln(\text{Sales})$ is the log of real sales, Prof/SL is operating profit over gross sales, Leverage is total debt over total debt plus market capitalization, Land/FV is the market value of land over market capitalization plus gross debt, Land/FA is the market value of land over the market value of fixed assets, Land/SL is the market value of land over gross sales and Real/TA is the market value of real estate (land plus buildings and structures) over the market value of total assets. All regressions are end of period $t-1$ values, and all regressors include unreported year and industry dummies, and a dummy that equals one if the firm changes its accounting period. The heteroskedasticity consistent standard errors (in parentheses) have been adjusted for clustering by firm. One, Two and three asterisks denote statistical significance at the 10%, 5% and 1% levels respectively.

	Period: 1985-89							
	Systematic: β_i^{MF}				Idiosyncratic: δ_i^{MF}			
Constant	-.839 (.194)***	-.7093 (.1935)***	-.8651 (.1941)***	-.8557 (.1976)***	6.2467 (.2902)***	6.3779 (.2895)***	6.2 (.297)***	6.217 (.2924)***
$\ln(\text{Sales})$	.0711 (.0097)***	.0677 (.0098)***	.0716 (.0097)***	.0701 (.0097)***	-.2213 (.0147)***	-.2247 (.0148)***	-.2203 (.0147)***	-.2218 (.0146)***
Leverage	.2732 (.1008)***	.2674 (.1015)***	.2797 (.1009)***	.2763 (.1005)***	.3505 (.1497)**	.3595 (.1517)***	.3537 (.1498)**	.3515 (.1497)**
Prof/SL	.0699 (.2201)	-.0373 (.2208)	.0021 (.2229)	.0517 (.2192)	-1.2272 (.4313)***	-1.3452 (.4335)***	-1.2671 (.4226)***	-1.2288 (.4313)***
Land/TA	.3806 (.1007)***				.2986 (.1445)**			
Land/FV		.1545 (.0699)**				.0471 (.0988)		
Land/FA			.2475 (.0698)***				.2241 (.1091)**	
Real/TA				.3472 (.0958)***				.3001 (.146)**
R ²	.162	.159	.162	.161	.201	.199	.201	.201

Table 9

Systematic Risk and Land Sensitivity, Alternative Time Periods

Table presents results for OLS regressions on 536 manufacturing firms that were continuously listed from 1989 to 1996. The dependent variable is β_i^M , the market beta from the single-factor CAPM model estimated with weekly stock price data and the three month euroyen rate (as the risk free rate). $\ln(\text{Sales})$ is the log of real sales, Prof/SL is operating profit over gross sales and Leverage is total debt over total debt plus market capitalization or BLand/BTA is the book value of land over the book value of total assets. Land/TA , Land/FA , Land/FV and Land/SL are defined as the market value of land over the market value of total assets, the market value of fixed assets, market capitalization plus gross debt, and gross sales, respectively. Real/TA is the market value of land plus buildings and structures over the market value of total assets. All regressors are end of period $t-1$ values, and all regressions include unreported year and industry dummies, and a dummy that equals one if the firm has a change in its accounting period. The heteroskedasticity consistent standard errors (in parentheses) have been adjusted for clustering by firm. One, Two and three asterisks denote statistical significance at the 10%, 5% and 1% levels respectively.

Dependent Variable: Systematic Risk β_i^M					
Period 1980-84					
Constant	-3.6009 (.2324)***	-3.555 (.2315)***	-3.5295 (.2338)***	-3.6371 (.229)***	-3.5688 (.2381)***
$\ln(\text{Sales})$	.2177 (.012)***	.2167 (.0121)***	.2164 (.0121)***	.2196 (.0121)***	.217 (.012)***
Leverage	-.0819 (.0936)	-.0775 (.0938)	-.0802 (.0932)	-.1004 (.0941)	-.0803 (.0937)
Prof/SL	1.7225 (.3517)***	1.674 (.3439)***	1.6636 (.3475)***	1.7175 (.3412)***	1.6937 (.3477)***
Land/TA	.0635 (.1383)				
Land/FV		-.0327 (.0755)			
Land/FA			-.0646 (.0912)		
Land/SL				.0972 (.071)	
Real/TA					-.0066 (.133)
R ²	.252	.252	.252	.253	.252
Period 1990-96					
Constant	1.651 (.1466)***	1.7681 (.1454)***	1.6957 (.1499)***	1.7388 (.1471)***	1.6269 (.148)***
$\ln(\text{Sales})$	-.0335 (.0074)***	-.037 (.0075)***	-.0351 (.0075)***	-.0348 (.0076)***	-.0343 (.0074)***
Leverage	.5532 (.0835)***	.5508 (.085)***	.5605 (.0855)***	.5638 (.0849)***	.5553 (.0832)***
Prof/SL	-1.2029 (.2095)***	-1.2162 (.2096)***	-1.2952 (.2128)***	-1.2278 (.2151)***	-1.1828 (.2083)***
Land/TA	.3164 (.0885)***				
Land/FV		.1715 (.0731)**			
Land/FA			.1464 (.0627)**		
Land/SL				.0747 (.0323)**	
Real/TA					.3168 (.0854)***
R ²	.214	.211	.209	.21	.215

Table 10

Idiosyncratic and Total Risk, Alternative Time Periods

Table presents results for OLS regressions on 536 manufacturing firms that were continuously listed from 1983 to 1996. The dependent variables are β_i^M , the market beta from the single-factor CAPM model estimated with weekly stock price data, δ_i^0 , the annual standard deviation of the residuals from this model, and δ_i^{tot} , the annual standard deviation of the raw excess returns. All three were estimated using the three month euroyen rate (as the risk free rate). $\ln(\text{Sales})$ is the log of real sales, Prof/SL is operating profit over gross sales, Leverage is total debt over total debt plus market capitalization, and Land/TA is the market value of land over the market value of total assets. All regressors are end of period $t-1$ values, and all regressions include unreported year and industry dummies, and a dummy that equals one if the firm changes its accounting period. The heteroskedasticity consistent standard errors (in parentheses) have been adjusted for clustering by firm. One, Two and three asterisks denote statistical significance at the 10%, 5% and 1% levels respectively.

Risk Type:	Idiosyncratic			Total		
	δ_i^0			δ_i^{tot}		
Period	1980-85	1985-89	1990-96	1980-85	1985-89	1990-96
Constant	6.0488 (.3326)***	6.494 (.3193)***	8.1212 (.2572)***	4.9591 (.351)***	5.8628 (.3169)***	8.8475 (.2483)***
$\ln(\text{Sales})$	-.2357 (.0169)***	-.2308 (.0162)***	-.3039 (.0133)***	-.1765 (.0178)***	-.1946 (.0158)***	-.2903 (.0126)***
Leverage	.58 (.135)***	.3874 (.1597)***	.6231 (.2273)***	.5398 (.1395)***	.4249 (.1586)***	.9921 (.2096)***
Prof/SL	-1.6725 (.52)***	-1.6718 (.4175)***	-2.5217 (.4425)***	-1.2988 (.5161)***	-1.5313 (.4032)***	-3.1455 (.4711)***
Land/TA	.3701 (.218)*	.2552 (.1512)*	.4586 (.1416)***	.3627 (.2241)***	.361 (.1526)***	.7338 (.1286)***
R ²	.22	.215	.458	.192	.195	.586
Ob: Num:	2682	2771	3778	2682	2771	3778

Figure 1 : Price and stock market indices

Figure displays the industrial land price index from the Japan Real Estate Institute, the wholesale price index for building and construction materials, the wholesale price index for general machinery and the Nikkei 225 stock market index (1995 = base year).

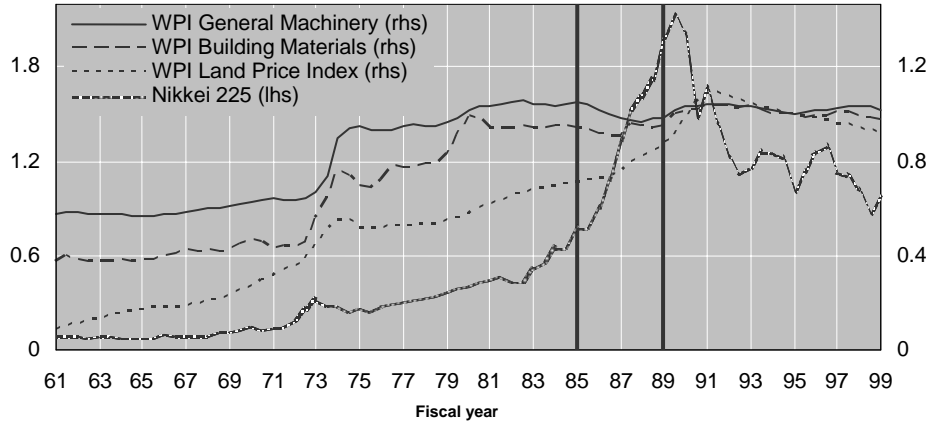
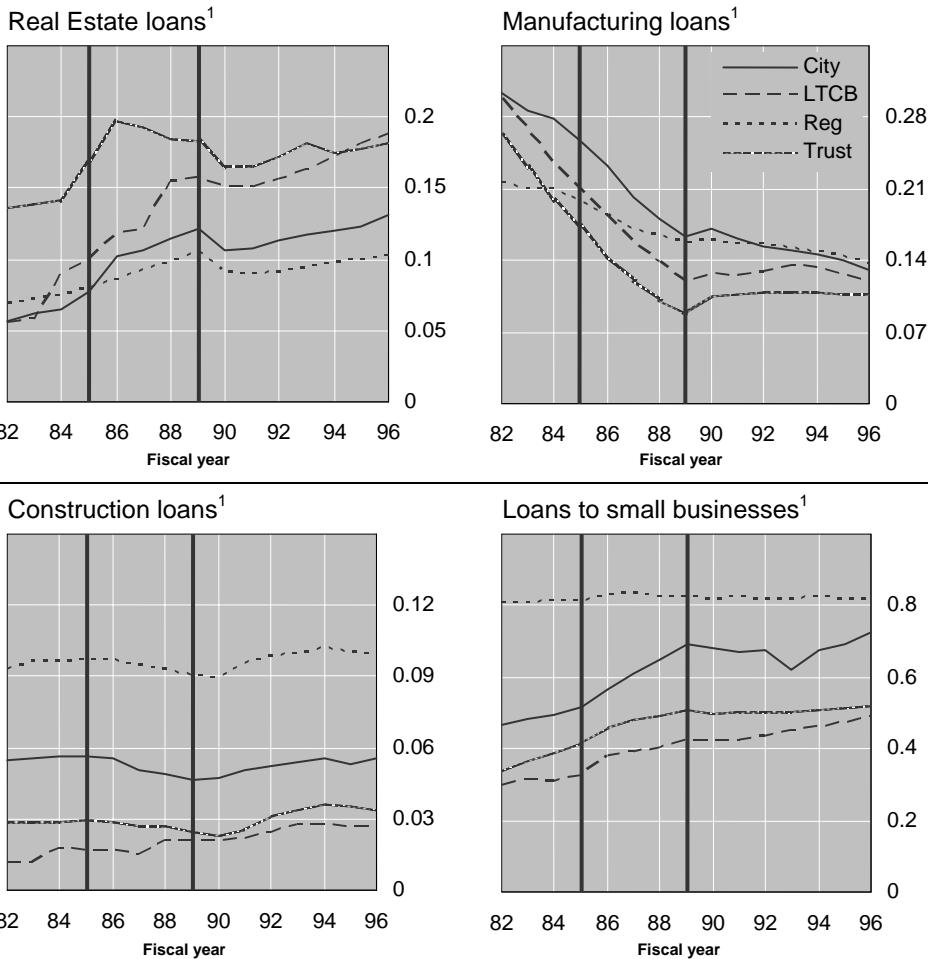


Figure 2 : Breakdown of loans by sector

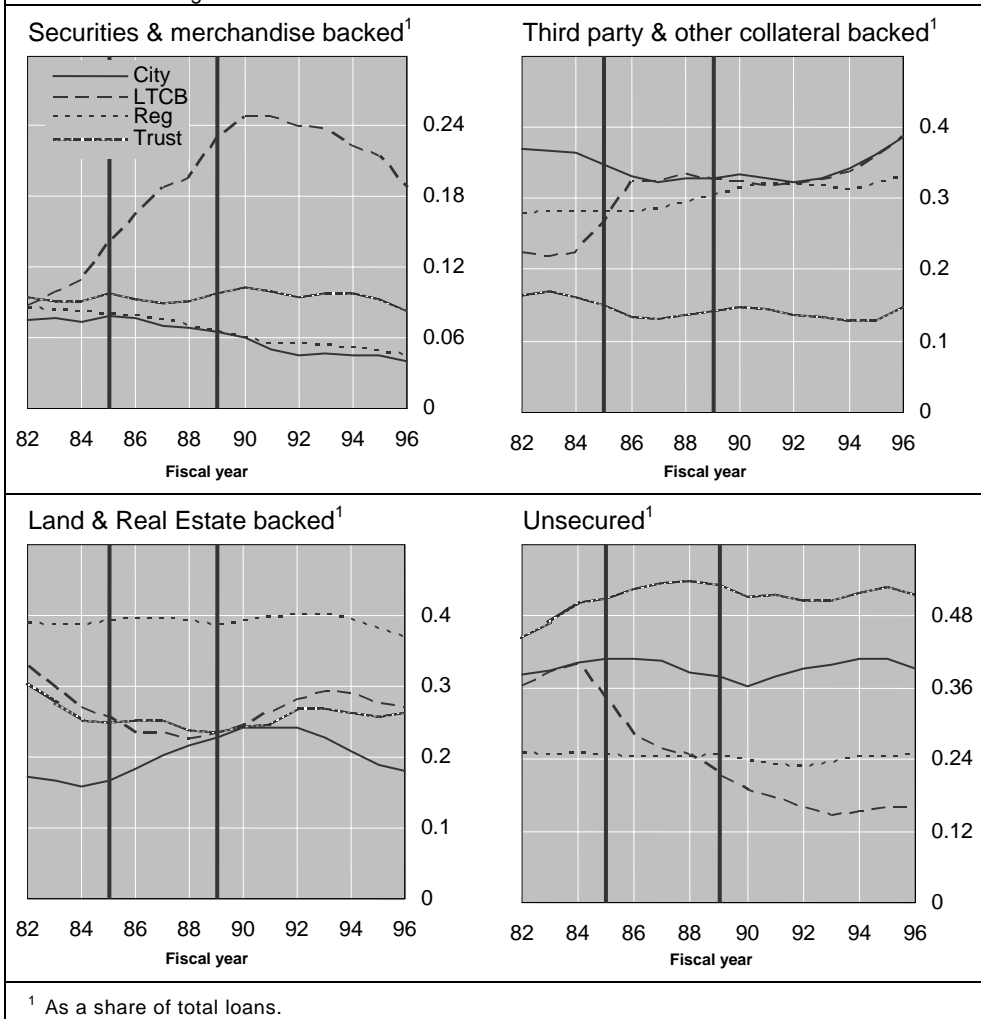
Figure displays the share of total loans to various sectors by bank type. "City" represents the 13 City banks, "Trust" the 6 trust banks, "LTCB" the 3 long term credit banks, and "Reg" the 63 regional banks. The mean for each bank type is presented for each loan category, and is calculated using balance sheet data contained in the NIKKEI Zaimu database.



¹ As a share of total loans.

Figure 3: Breakdown of loans by collateral type

Figure displays the ratio of collateral backed loans in total loans by collateral and bank type. “City” represents the 13 City banks, “Trust” the 6 trust banks, “LTCB” the 3 long term credit banks, and “Reg” the 63 regional banks. The mean for each bank type is presented for each loan category, and is calculated using balance sheet data contained in the NIKKEI Zaimu database.



7 Appendix

7.1 Synthesis of the APT and CAPM Models

A simple synthesis of the APT and CAPM asset pricing models yields regression equation 2 in the main text.²⁴ Investors will require a higher return to hold securities that are highly correlated with the market portfolio, but be willing to accept a lower return for those securities that pay off when the return on the market portfolio is low. Thus, a security’s beta coefficient (β_i^M) can be interpreted as a measure of its *systematic* risk, or risk which cannot be eliminated through portfolio diversification. Under the standard single-factor CAPM model, the following is the expected return on security i at any time t

²⁴ See Sharpe (1984), Jarrow and Rudd (1985), Shanken (1985), and Wei (1988) for discussion of the synthesis of the APT and CAPM models. For less technical treatment, see Sharpe, Alexander, and Bailey (1999).

$$E[r_i] = r^f + (r^m - r^f)\beta_i^M \quad (3)$$

where r^f is the risk free return, r^m is the market return, and β_i^M is security i 's market beta. Time subscripts have been dropped for ease of exposition.

Unlike the CAPM, the APT model postulates that expected security returns are a linear function of k (unspecified) factors, and is described by

$$E[r_i] = b_{i,0} + \sum_{j=1}^k b_{i,j}F_j$$

where the $b_{i,j}$'s are the sensitivity of security i to factor F_j . Ross (1976) showed that given enough securities, investors will eliminate arbitrage opportunities, and the expected return of security i will be approximately equal to a linear function of the sensitivity parameters,

$$E[r_i] \approx \lambda_0 + \sum_{j=1}^k \lambda_j b_{i,j}$$

where the λ_j 's are constants common across all securities.²⁵ In general, the λ 's are unknown, but values can be assigned using reasonable assumptions on the size and scope of the asset market. First, by definition, the risk free security will be insensitive to the factors, implying that $\lambda_0 = r^f$. Second, a large asset market will contain a sufficient number of securities such that at least one security (or portfolio of securities) will exist with unit sensitivity to factor j , and zero sensitivity to all other factors (the so called "pure j factor security"). If the return on the pure security for factor j is d_j , then $\lambda_j = d_j - r^f$, and the above can be written as

$$E[r_i] = r^f + \sum_{j=1}^k (d_j - r^f)b_{i,j} \quad (4)$$

The CAPM model is not inconsistent with the APT model in that equations 3 and 4 can simultaneously describe the state of the world if the assumptions underlying both models are satisfied. When both hold, simple manipulation of covariance formulas implies that

$$\beta_i^M = \sum_{j=1}^k b_{i,j} \frac{Cov(F_j, r^M)}{\sigma_M^2} + \frac{Cov(\varepsilon_i, r^M)}{\sigma_M^2}$$

where σ_M^2 is the variance of the return on the market portfolio, and ε_i is an expectations error from the APT equation. Each security's market beta is a linear function of the covariance between each factor and the return on the market portfolio, and the covariance between the error term from the APT equation and the return on the market portfolio. Note that $\frac{Cov(F_j, r^M)}{\sigma_M^2}$ is simply the beta of a portfolio of factor j , is constant across securities, and is, by definition, the contribution of factor j to systematic risk. Since it is assumed that the APT model is well specified, the covariance between the market return, r^M , and ε_i is zero, and the above can be written as

$$\beta_i^M = \sum_{j=1}^k b_{i,j}\beta_{F_j}^M \quad (5)$$

The APT theory provides no guidance on what the factors should actually be. It merely says that given some important factors, and given that the CAPM holds, the above decomposition of each security's market beta is possible. We assume that the APT equation contains (at least) two primary factors: the

²⁵ The relationship holds with strict equality in the limit as the number of securities available increases. It is assumed that the deviation from equality for the case of Japan is negligible.

market portfolio and an unobservable “real estate factor” (other factors are included in the empirical analysis for robustness).²⁶ Further, we assume that the relationship between the true sensitivity to the real estate factor and the observed proxy can be described by

$$b_{i,RE} = a + c * RE_i + v_i \quad (6)$$

where a and c are constant across securities, RE_i is the real estate proxy, and v_i is a white noise error term which is uncorrelated with ε_i .²⁷ Combining equations 5 and 6 and simplifying yields

$$\beta_i^M = \alpha_i + \beta^C X_i + \tilde{\beta}_{RE}^M RE_i + \varepsilon_i^* \quad (7)$$

$$\alpha_i = \frac{b_{i,M}}{\sigma_M^2} + a\beta_{RE}^M$$

$$\tilde{\beta}_{RE}^M = c\beta_{RE}^M$$

$$\varepsilon_i^* = \varepsilon_i + v_i\beta_{RE}^M$$

where X_i is a matrix of control regressors (additional factors in the APT), β^C is the coefficient vector for these controls, $b_{i,M}$ is the sensitivity of security i to the market portfolio from the APT equation, and RE_i is our proxy for security i 's sensitivity to the real estate portfolio. The constant c , which cannot be separately identified, can be thought of as simply a renormalization of our proxy variables. Since the error term and the proxy are correlated, the estimate of $\tilde{\beta}_{RE}^M$ will be biased. However, the resulting attenuation inconsistency will bias this coefficient toward zero, and away from finding that real estate exposure was a determinant of systematic risk.

7.2 The “Thin Trading” Bias Problem

A well known empirical problem in calculating systematic risk is “nonsynchronous trading bias”, or the “thin trading problem”. If some stocks are traded infrequently, then the actual return from $t-1$ to t will differ from the measured return (based on the last closing price). In this case, the observed return, $RI_{i,t}$, *actually* measures the return from $t-s_{i,t-1}$ to $t-s_{i,t}$ where $s_{i,t}$ is the time from the posting of the last trade of security i until the measurement date t (i.e. security i 's “non-trading” time). Theoretically, the measurement error in $RI_{i,t}$ is correlated with the market index, RM_t , which is simply the weighted average of returns across all securities. Thus, when $RI_{i,t}$ is used in the standard OLS estimation of β_i^M , the measurement error leads to an additional source of correlation between the error term and the regressor, and further biases the coefficients.

Assuming that the *true* instantaneous returns on securities are normally distributed, Scholes and Williams (1977) identify the direction of the thin trading bias, and propose computationally convenient, yet consistent, estimators that require only that the $s_{i,t}$'s be identically and independently distributed across both firms and time. Their consistent estimate of the market beta is defined as

$$\beta_i^{sw} = \frac{b_i^- + b_i + b_i^+}{(1+2\rho)}$$

²⁶ The inclusion of the market portfolio in the APT equation has a different interpretation than when included in the CAPM model. It is an equilibrium condition in the CAPM, but merely a factor in the APT.

²⁷ The constant c is assumed greater than zero.

and is composed of coefficients from *three separate* OLS regressions and a correlation coefficient. First, b_i is the coefficient on RM_t^{rf} in equation 1. b_i^- and b_i^+ are the same, except RM_{t-1}^{rf} and RM_{t+1}^{rf} are used in place of RM_t^{rf} . The correlation coefficient ρ is calculated as the sample equivalent of

$$\rho = \frac{COV(RM_t^{rf}, RM_{t-1}^{rf})}{std(RM_t^{rf}) std(RM_{t-1}^{rf})}$$

Another widely used correction procedure was proposed by Dimson (1979), and involves estimating the following equation:

$$RI_{i,t}^{rf} = \beta_i^-(RM_{t-1}^{rf}) + \beta_i^0(RM_t^{rf}) + \beta_i^+(RM_{t+1}^{rf}) + \varepsilon_t$$

The consistent estimate of the firm's market beta is calculated as

$$\beta_i^D = \beta_i^- + \beta_i^0 + \beta_i^+$$

The magnitude of the bias problem depends on the data used. Because the size of the individual $s_{i,t}$'s grows relative to the length of the measurement period as measurement occurs more frequently, estimates based on corrected betas are typically provided for robustness in studies where daily return data is used.²⁸ Scholes and Williams (1977) note that the problem is much less severe in monthly return data. This paper uses *weekly* return data, possibly implying that thin trading is not a problem. Unfortunately, this cannot be tested since transaction specific data (or even data on weekly trading volume) is unavailable. However, Japanese stock markets have been described as "inactive" (relative to U.S. markets) because of the extensive of cross-shareholding, particularly before the period of deregulation. For this reason, these corrections in the calculation of the market beta may be important.

Table 11 presents the sample statistics for these corrected market beta measures for the two periods of interest, and table 12 presents the correlation matrices of all eight risk measures used in this study. The main regressions are re-estimated in table 13 using these corrected measures. Despite a seemingly low correlation between the CAPM beta and these corrected measures, our primary proxies of (*Land/FA* and *Land/FV*) remain positive and significant in these alternative specifications.

Table 11
Adjusted Market Betas Sample Statistics

β_i^{SW} is the market beta calculated using the Scholles-Williams correction, and β_i^D is that using the Dimson correction procedures. Each risk measure is calculated separately by year for each of 576 manufacturing firms using the firm-specific listing dates, and roughly 52 weekly market observations. The yield on the three month Japanese government bond is used as the risk free rate, and the weekly Nikkei 225 index is used to calculate market returns.

Risk	Period	Mean	Std. Dev.	10th Pctile	Med.	90th Pctile
β_i^{SW}	85-89	0.788	0.881	0.191	0.797	1.708
	90-96	1.104	0.564	0.465	1.068	1.782
β_i^D	85-89	0.764	0.743	0.154	0.798	1.612
	90-96	1.080	0.481	0.501	1.063	1.687

²⁸ These correction procedures have received mixed reviews. Using U.S. stock market data, Scholes and Williams (1977) find that their consistent estimate of beta is larger than the OLS estimate for infrequently traded portfolios, and smaller for frequently traded portfolios. However, Fowler, Rorke and Jog (1980) and McInish and Wood (1984) offer evidence that neither the Dimson nor the Scholes-Williams estimators are adequate. The problem is in finding a benchmark to which estimates of the market beta can be compared. The thin trading bias might exist, but absent data on the exact trading dates for each security, it is difficult to determine whether or not these correction techniques are important. Bartholdy and Riding (1994) get around this by calculating beta using *synchronous* price data for New Zealand securities (argued to be relatively infrequently traded). Other correction procedures have been proposed by Fowler and Rorke (1983), Cohen et al. (1983), and Marsh (1979), but are not pursued here because of data limitations.

Table 12

Risk Measure Correlation Matrices

Entry $(i; j)$ of the table displays the correlation coefficient between the risk measures in row i and column j for 576 manufacturing firms. Each risk measure is calculated separately for each firm in each year using the firm-specific listing dates, and roughly 52 weekly market observations. The yield on the three month Japanese government bond is used as the risk free rate, the weekly Nikkei 225 index is used to calculate market returns. In the multi-factor regression model, the yield on the 10 year Japanese government bond is used as the long term interest rate, and the weekly yen/dollar exchange rate is used to calculate the exchange rate index.

	β_i^M	β_i^{SW}	1985-89		δ_i^0	δ_i^{MF}	δ_i^{tot}
			β_i^D	β_i^{MF}			
β_i^M	1.00						
β_i^{SW}	0.49	1.00					
β_i^D	0.6	0.94	1.00				
β_i^{MF}	0.94	0.38	0.47	1.00			
δ_i^0	0.01	-0.03	-0.02	0.02	1.00		
δ_i^{MF}	0.01	-0.02	-0.02	0.02	0.99	1.00	
δ_i^{tot}	0.17	0.05	0.07	0.17	0.98	0.97	1.00

	β_i^M	β_i^{SW}	1990-96		δ_i^0	δ_i^{MF}	δ_i^{tot}
			β_i^D	β_i^{MF}			
β_i^M	1.00						
β_i^{SW}	0.54	1.00					
β_i^D	0.68	0.95	1.00				
β_i^{MF}	0.98	0.49	0.64	1.00			
δ_i^0	0.22	0.32	0.35	0.22	1.00		
δ_i^{MF}	0.22	0.32	0.35	0.22	0.99	1.00	
δ_i^{tot}	0.53	0.43	0.51	0.52	0.91	0.91	1.00

Table 13

Adjusted Systematic Risk and Real Estate

Table presents results for OLS regressions on 576 manufacturing firms that were continuously listed from 1983 to 1996. The dependent variables are the market betas corrected for thin-trading bias using the Scholes-Williams (1977) and Dimson (1979) procedures described in the appendix. $\ln(\text{Sales})$ is the log of real sales, Prof/SL is operating profit over gross sales, Leverage is total debt over total debt plus market capitalization, BLand/BTA is the book value of land over the book value of total assets, Land/TA is the market value of land over the market value of total assets, Land/FV is the market value of land over market capitalization plus total debt, and Real/TA is the market value of buildings plus land over the market value of total assets. All regressors are end of period $t-1$ values. All regressions include unreported year and industry dummies, and a dummy that equals one if the firm changes its accounting period. The heteroskedasticity consistent standard errors (in parentheses) have been adjusted for clustering by firm. One, Two and three asterisks denote statistical significance at the 10%, 5% and 1% levels respectively.

Systematic Risk:	Period: 1985-89			Dimson		
	Scholes/Williams β_i^{SW}			β_i^D		
Constant	.3257 (.2746)	.4028 (.277)	.3404 (.2805)	.0882 (.2681)	.237 (.2701)	.0834 (.2767)
$\ln(\text{Sales})$	.0181 (.014)	.016 (.0141)	.0168 (.014)	.0285 (.0135)**	.0245 (.0137)*	.0268 (.0137)**
Leverage	.2465* (.1338)*	.2319* (.1338)*	.2514* (.1345)*	.3009** (.1419)**	.282* (.1454)*	.3067** (.1423)**
Prof/SL	-1.3322 (.3988)***	-1.3889 (.3924)***	-1.3671 (.3967)***	-1.1158 (.3691)***	-1.231 (.3623)***	-1.1535 (.3684)***
Land/TA	.2907 (.1407)**			.5077 (.1557)***		
Land/FV		.1732** (.0879)**			.2671** (.1297)**	
Real/TA			.2195 (.1445)			.4341* (.1519)*
R ²	.145	.144	.144	.135	.133	.134

References

- Aoki, M., and H. Patrick (eds.) (1994): *The Japanese Main Bank System: Its Relevance for Developing and Transforming Economies*. Oxford University Press, Oxford.
- Barthholdy, J., and A. Riding (1994): "Thin Trading and the estimation of betas: The efficacy of alternative techniques," *The Journal of Financial Research*, XVII(2), 241–254.
- Beason, D. (1998): "Keiretsu affiliation and share price volatility in Japan," *Pacific-Basin Finance Journal*, 6, 27–43.
- Brynjolfsson, E., and S. Yang (1999): "The Intangible costs and benefits of computer investments: Evidence from the financial markets," MIT Working Paper.
- Canaway, H. (1990): "Land Prices in Japan: No Cause for Alarm," Baring Securities, Tokyo.
- Chen, C. R., T. L. Steiner, and A. M. Whyte (1998): "Risk-Taking Behaviour and Management Ownership in Depository Institutions," *The Journal of Financial Research*, XXI(1), 1–16.
- (2001): "Risk Taking Behaviour and Managerial Ownership in the United States life insurance industry," *Applied Financial Economics*, 11, 165–171.
- Corbett, J. (2000): "Japan's Banking Crisis in International Perspective," in *Finance, Governance, and Competitiveness in Japan*, ed. by M. Aoki, and G. Saxonhouse, pp. 139–175. Oxford University Press, Oxford.
- Cowen, K. G., S. Maier, R. Schwartz, and D. Whitcomb (1983): "Estimating and adjusting for the intervaling-effect bias in beta," *Management Science*, 30, 135–148.
- Cutts, R. L. (1990): "Power from the Ground Up: Japan's Land Bubble," *Harvard Business Review*, May-June(3), 164–72.
- Dimson, E. (1979): "Risk Measurement when shares are subject to infrequent trading," *Journal of Financial Economics*, 6, 197–226.
- Dinc, I. S. (2003): "Monitoring the Monitors: The Corporate Governance in Japanese Banks and Their Real Estate Lending in the 1980s," Working Paper, Department of Finance, University of Michigan Business School.
- Fowler, D., and C. H. Rorke (1983): "Risk measurement when shares are subject to infrequent trading: Comment," *Journal of Financial Economics*, 12, 289–94.
- Fowler, D., C. H. Rorke, and V. Jog (1980): "A bias-correcting procedure for beta estimation in the presence of thin trading," *Journal of Financial Research*, 12, 12–32.
- Hall, B. H. (1993): "The Stock Market's Valuation of R&D Investment during the 1980's," *The American Economic Review*, 83(2), 259–64.
- Hall, R. E. (2001): "The Stock Market and Capital Accumulation," *The American Economic Review*, 91(5), 1185–1202.
- Hamao, Y., and T. Hoshi (1991): "Stock and Land Prices in Japan," mimeo, Columbia University.
- Hayashi, F., and T. Inoue (1991): "The Relation Between Firm Growth and Q with Multiple Capital Goods: Theory and Evidence from Panel Data on Japanese Firms," *Econometrica*, 59(3), 731–53.
- Horiuchi, A., and K. Shimizu (2001): "Did Amakudari undermine the effectiveness of regulator monitoring in Japan?," *Journal of Banking and Finance*, 25(3), 573–96.
- Hoshi, T., and A. Kashyap (1999): "The Japanese Banking Crisis: Where Did It Come From and How Will It End?," NBER Working Paper Series: Working Paper #7250.
- (2001): *Corporate Financing and Governance in Japan: The Road to the Future*. The MIT Press, Cambridge, Massachusetts.
- Hoshi, T., A. Kashyap, and D. Scharfstein (1990): "The Role of Banks in Reducing the Costs of Financial Distress in Japan," *Journal of Financial Economics*, 27, 33–60.
- Ito, T., and T. Iwaisako (1995): "Explaining Asset Bubbles in Japan," NBER Working Paper No. 5358.
- Iwaisako, T. (2003): "Household Portfolios in Japan," NBER Working Paper No. 9647.

- Jarrow, R., and A. Rudd (1985): "A comparison of the APT and CAPM: A Note," *Journal of Banking and Finance*, 7(2), 295–303.
- Lewis, C. M., R. J. Rogalski, and J. K. Seward (2002): "Risk Changes around convertible debt offerings," *Journal of Corporate Finance*, 8, 67–80.
- Marsh, P. (1979): "Equity rights issues and the efficiency of the UK stock market," *Journal of Finance*, 34, 839–862.
- May, D. O. (1995): "Do managerial Motives influence firm risk reduction strategies?," *The Journal of Finance*, 50(4), 1291–1308.
- McInish, T., and R. Wood (1984): "Nonsynchronous trading and beta estimation," in *Proceedings. Western Finance Association*.
- Noguchi, Y., and J. Porterba (eds.) (1994): *Housing Markets in the United States and Japan*. The University of Chicago Press.
- Ogawa, K., and K. Suzuki (1998): "Land Value and Corporate Investment: Evidence from Japanese Panel Data," *Journal of the Japanese and International Economies*, 12(3), 232–49.
- (2000): "Demand for Bank Loans and Investment under Borrowing Constraints: A Panel Study of Japanese Firm Data," *Journal of the Japanese and International Economies*, 14, 1–21.
- Ross, S. A. (1976): "The Arbitrage Theory of Capital Asset Pricing," *Journal of Economic Theory*, 13(3), 341–360.
- Saunders, A., E. Strock, and N. G. Travlos (1990): "Ownership Structure, Deregulation, and Bank Risk Taking," *The Journal of Finance*, XLV(2), 643–654.
- Scholes, M., and J. Williams (1977): "Estimating Betas from nonsynchronous data," *Journal of Financial Economics*, 5, 309–327.
- Shanken, J. (1985): "Multi-beta CAPM or Equilibrium-APT?: A Reply," *Journal of Finance*, 40(4), 1189–1196.
- Sharpe, W. (1984): "Factor Models, CAPMs, and the ABT," *Journal of Portfolio Management*, 11(1), 21–25.
- Sharpe, W. F., G. J. Alexander, and J. V. Bailey (1999): *Investments (International Edition)*. Prentice Hall, Inc. New Jersey.
- Stone, D., and W. Ziemba (1992): "Relationships between Land and Stock Prices in Japan," mimeo, University of British Columbia, Vancouver.
- (1993): "Land and Stock Prices in Japan," *The Journal of Economic Perspectives*, 7(3), 149–165.
- Tsuru, K. (2001): "The Choice of lending patterns by Japanese banks during he 1980's and 1990's: The causes and consequences of a real estate lending boom," *Bank of Japan Institute for Monetary and Economic Studies, Discussion Paper, No. 2001-E-8*.
- Ueda, K. (2000): "Causes of Japan's Banking Problems in the 1990's," in *Crisis and changes in the Japanese Financial System*, ed. by T. Hoshi, and H. Patrick. Kluwer Academic Pub.
- Wei, K. J. (1988): "An Asset-Pricing Theory Unifying the CAPM and APT," *Journal of Finance*, 43(4), 881–892.
- Ziemba, W., and S. L. Schwartz (1991): *Invest Japan*. Chicago: Probus Publishing.

Previous volumes in this series

No	Title	Author
163 November 2004	CDO rating methodology: Some thoughts on model risk and its implications	Ingo Fender and John Kiff
162 September 2004	Recent fiscal policy in selected industrial countries	David E Lebow
161 September 2004	The monetisation of Japan's government debt	David E Lebow
160 August 2004	An empirical comparison of credit spreads between the bond market and the credit default swap market	Haibin Zhu
159 July 2004	The term structure of credit spreads in project finance	Marco Sorge and Blaise Gadanecz
158 July 2004	Market distress and vanishing liquidity: anatomy and policy options	Claudio Borio
157 July 2004	Securing sustainable price stability: should credit come back from the wilderness?	Claudio Borio and Philip Lowe
156 July 2004	Deposit Insurance and Bank Intermediation in the Long Run	Robert Cull, Lemma Senbet and Marco Sorge
155 June 2004	Monetary policy and asset price bubbles: calibrating the monetary policy trade-offs	Andrew Filardo
154 June 2004	Monetary and real shocks, the business cycle and the value of the euro	Renato Filosa
153 June 2004	Macroeconomic implication of rising household debt	Guy Debelle
152 March 2004	Back to the future? Assessing the deflation record	Claudio Borio and Andrew J Filardo
151 March 2004	Bank ties and bond market access: evidence on investment-cash flow sensitivity in Japan	Patrick M McGuire
150 March 2004	Bank lending and commercial property cycles: dome cross-country evidence	E Philip Davis and Haibin Zhu
149 March 2004	Monetary policy rules in emerging market economies: issues and evidence	M S Mohanty and Marc Klau
148 March 2004	The 2001 US recession: what did recession prediction models tell us?	Andrew J Filardo
147 February 2004	Whither monetary and financial stability? The implications of evolving policy regimes	Claudio Borio and William R. White
146 January 2004	Consumer credit scoring: do situational circumstances matter?	R B Avery, P S Calem & G B Canner
145 January 2004	Are changes in financial structure extending safety nets?	William R White
144 October 2003	Transparency versus constructive ambiguity in foreign exchange intervention	Priscilla Chiu

All volumes are available on request from the BIS and are also on our website www.bis.org.