Unique Symptoms of Japanese Stagnation: An Equity Market Perspective

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Abstract

This paper documents several unique financial symptoms of Japanese economic stagnation in the 1990s. We find a surprising *fall* in firm-level volatility and turnover in Japanese stocks after the market crash in 1990. These results stand in sharp contrast to the U.S. case, where firm-level volatility generally *increases* after a market crash. Further analysis reveals a parallel sharp reduction in earnings heterogeneity among Japanese firms. Preliminary evidence suggests that the reduction in firm-level volatility may be related to Japanese business group protection. The large decrease in firm-level volatility may impede the equity market's information role, as it has made it more difficult over the past decade for both investors and managers to distinguish high quality from low quality firms.

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The chronic stagnation of the Japanese economy is puzzling in many respects. More than ten years after Japan's stock and real estate market bubble burst, the country is still operating far below its potential productive capacity. It is remarkable that the Japanese economy – second largest in the world – did not grow at all in real terms in 1991-2002. Furthermore, since 1994 Japan has experienced deflation of about 1-2% a year despite the Bank of Japan's "Zero Interest Rate" policy. While the government's aggressive fiscal stimulus packages have led to skyrocketing budget deficits, unemployment has risen to an unprecedented level of 5.5% in recent years.

Several recent studies consider the Japanese relationship-based main bank system, as compared to a more market-oriented system, as a factor contributing to the prolonged stagnation of the Japanese economy (Kang and Stulz (2000), Morck and Nakamura (1999)). Peek and Rosengren (2005) argue that Japanese corporate affiliations (keiretsu) and the main bank system were an effective way to increase credit availability and reduce agency costs when the economy was strong. But, they argue further, during difficult economic circumstances, the same affiliations may impede needed economic restructuring, insofar as they insulate severely troubled firms from the market discipline that otherwise would be imposed by creditors. They find evidence of "ever-greening" (i.e., main banks continue to lend to clients with deteriorating economic health).

This paper follows recent work of Wurgler (2000) by documenting several unique financial symptoms of Japanese economic stagnation from an equity market perspective. As Wurgler pointed out, there is a close relationship between the stock market and business investment. In developed economies, equity markets play an important informational role. Investors use differences in stock prices to help differentiate good from bad firms, and their stock investment decisions directly influence how resources are allocated across firms. Therefore, the behavior of equity markets should offer some useful insights into the causes of Japan's economic decline and stagnation.

Since stocks prices are generally affected by overall market movement, our focus will be on idiosyncratic risk. Numerous papers have found idiosyncratic risk to be related to information efficiency and capital allocation. Recent finance studies

demonstrate that a reduction in firm-level volatility may adversely affect the capital allocation process. Wurgler (2000) presents evidence that countries with stock markets that impound more firm-specific information into individual stock prices exhibit a better allocation of capital. He suggests that efficient secondary market prices can help investors and managers distinguish good investments from bad ones.¹ Durnev, Morck, and Yeung (2001) also find that firms in industries with greater firm-specific return variation exhibit a higher quality of capital budgeting, in that their profitability indices (Tobin's marginal Q ratios) are closer to one (or to a tax-adjusted benchmark). Moreover, macroeconomic models of "cleansing recessions," such as those described by Caballero and Hammour (1994) and Eden and Jovanovic (1994), emphasize the impact of firm-level volatility on resource allocation during recessions. A recession may increase the arrival rate of firm-specific information about management quality and thus promote resource reallocation from low quality to high quality firms.

In this paper, we first document a sharp *reduction* in firm-level volatility immediately following the Japanese market crash in 1990. In contrast, U.S. firm-level volatility moves counter-cyclically (i.e., it *increases* after a market crash or during a recession).² To the extent that Japanese market downturns are accompanied by a *reduction* in firm-level volatility, it makes it more difficult for investors to distinguish low quality from high quality firms, thereby reducing the effectiveness of the cleansing mechanism.

In order to understand the abnormal behavior of idiosyncratic risk in Japan, we further examine the impact of firm performance as well as bankruptcy on firm-level volatility. We find that the fundamental performances of firms are tied more closely together during the post-crash period. We also discover a positive relation between changes in aggregate firm-level volatility and corporate bankruptcies. In addition, we find that idiosyncratic volatility for firms with business group affiliations is less responsive to economic conditions than that of firms without such affiliations.

¹ See also Durnev, Morck, Yeung, and Zarowin (2002).

² Campbell, Lettau, Malkiel, and Xu (2001) were the first to provide a comprehensive study of idiosyncratic risk for U.S. stocks. During the period from 1962 to 1997, they found that all volatility measures (market, industry, and firm) move together counter-cyclically in the U.S. In other words, firm-level volatility tends to *increase* during a recession.

In sum, these preliminary results suggest that the sharp fall in firm-level volatility could be due to the effects of group protection.³

This paper builds on the growing literature exploring the relationship between financial markets and economic growth.⁴ While using methodology developed by Campbell, Lettau, Malkiel, and Xu (2001, CLMX hereafter), we introduce several innovations. First, we broaden the approach by considering volatility behavior as well as trading behavior. Second, we extend the work of CLMX to include analysis of the U.S. market during the 1928-1946 time period.

The remainder of this paper is organized as follows. Section I provides a brief description of the unique features of the Japanese economy, the study period and data sources, and the various specifications for estimating firm-specific volatilities, including a simple market model, the Fama and French (1993) three factor-model, as well as a multi-factor APT model. Section II presents our main empirical results and compares them to findings in the U.S. market. Section III presents additional results that aid in an exploration of the relationship between firm-level volatility and institutional features unique to Japan, such as keiretsu and the main bank system. Section IV provides some discussion of the findings, and Section V offers concluding comments.

I. Background and Methodology

A. A Brief Introduction to “Japanese-Style” Capitalism

The post-WWII Japanese economy was centered on a “main bank” system in which major banks played an important and *quasi*-public-sector role in supplying much needed capital for rebuilding the economy after the devastation and destruction of the war. As a result, banks were heavily protected by the Ministry of Finance

³ Other factors, such as structural changes in the capital market, participation of foreign investors, and changing ownership may have also contributed to the changing volatility during the sample period. But they are beyond the scope of this paper.

⁴ King and Levine (1993), Levine (1998), Levine and Zervos (1998), Beck, Levine, and Loayza (1999), Demirguc-Kunt and Maksimovic (1998) demonstrate that firms in financially developed countries grow faster. Rajan and Zingales (1998) show that industries that are externally financed grow faster in financially developed countries. Jayaratne and Strahan (1996) discover that economic growth increases in states that have less stringent intrastate banking restrictions.

through the so-called “convoy system,” which essentially guaranteed that no bank would fail.

Banks not only made loans to large industrial groups (keiretsu), but also owned up to 10% (5% after 1977) of client firms (many of them in the keiretsu group). When client firms experienced economic difficulties, main banks often sent directors to monitor their activities, a capability that was found to be effective (Aoki, Patrick, and Sheard, 1994). Main banks also provided much-needed liquidity for financially distressed firms, thus reducing the cost of financial distress (Hoshi, Kashyap, and Scharfstein, 1990). In addition, since bankruptcy procedures in Japan were quite time-consuming and expensive, and once filed, conferred immediate control to court-appointed trustees, corporate managers had a strong incentive not to resort to them. As a result, as shown later, there were very few cases of bankruptcies of large, publicly traded firms in Japan.

While the Japanese model appeared to function well through the high-growth period, one can argue that it was not able to meet the challenges of the changing environment in the 1990s. Instead, the system created an excuse for maintaining the status quo rather than implementing timely reforms. After the collapse of the bubble, many corporations faced financial problems, such as high leverage resulting from overly optimistic expansion plans during the bubble period, decreased collateral value owing to the decline in land values, and decline in revenues due to economic slowdown. However, corporate managers did not address these issues quickly.⁵

Financial regulators were also slow to reveal the problem of non-performing loans. Rather than addressing the issue, they chose to use “easy” criteria for classifying non-performing loans in their published statistics, delaying immediate and necessary reforms.⁶ Since banks were not directly writing off the non-performing

⁵ Nissan Motor, for example, asked for help from its main bank (Industrial Bank of Japan) over several years until at the end, in 1999, the French automaker Renault bought a substantial share of Nissan and sent a CEO to initiate a drastic restructuring, at which time analysts widely agreed that Nissan was actually insolvent.

⁶ Although the banking problem had been well recognized since the early 1990s, it was not publicly acknowledged until the first failure of a major bank (Hokkaido Takushoku Bank) in November 1997. In late 1998, two more major banks (Long-Term Credit Bank and Nippon Credit Bank) ultimately failed and were nationalized. In March 1999, 15 major banks reluctantly received injections of tax money totaling 7.45 trillion yen. The bad loan problem has not improved much since then, as the

loans, troubled borrowers were not forced to go bankrupt. Even firms widely recognized to be in serious financial distress for more than five years (e.g., large construction companies and some retail operations) are still receiving support from banks. The practice of lifetime employment in large corporations is another element that has made it difficult for firms to go bankrupt.

B. Study Period and Data Sources

To understand how these unique Japanese institutional features affect the functioning of Japan's equity market, we conduct a detailed analysis of the dynamics of Japanese stock prices during the period from 1975 to 1999. The 25-year study period (1975-1999) covers a full economic cycle—from recovery after the oil crisis, through the economic boom, and then to the prolonged recession. The so-called “bubble period” started around 1985 with a rapid run-up of the stock market, and the market peaked on the last trading day of 1989 (see Figure 1). While a thorough account of Japanese economic history during this sample period is beyond the scope of this paper, we note that after the post-World War II high-growth period (1956-1973), when the average annual GDP growth rate was 9.2%, Japan entered a lower growth period, triggered by the oil crises. The average annual GDP growth rate during the period from 1974 to 1990 was 3.8%. Our sample period starts in 1975, which is around the beginning of this medium-growth period. In the latter period of our sample (1991-1999), Japan's growth rate dropped further to an average of 1.3%. This low- or no-growth period corresponds with the aftermath of the bursting of the market bubble.

In an effort to provide better summary statistics over these different periods, we divide the entire sample period into five 5-year periods. The first two periods (1975-1979 and 1980-1984) are before the bubble; the third (1985-1989) is the bubble period; and the last two periods (1990-1994 and 1995-1999) correspond to the post-crash era.

In order to examine all stocks listed on the First and Second Sections of the Tokyo Stock Exchange (TSE), we draw on data from several different sources.

economy went into another round of recession. In May 2003, another large bank (Resona Bank) asked for a 2 trillion yen tax money injection and was nationalized.

Monthly data on individual stock returns and volume and annual financial statements (for book value of equity) are from the PACAP Japan database. Short-term interest rates are from updates of the database presented in Hamao (1991). GDP and industrial production data are from the Japanese Ministry of Economy, Trade, and Industry. The Nomura Research Institute and Tokyo Shoko Research provide bankruptcy data. The numbers of stocks in each sub-period are 1174 (1975-1979), 1275 (1980-1984), 1368 (1985-1989), 1521 (1990-1994), and 1607 (1995-1999).

C. Model Specification

Our analysis of the dynamics of Japanese stock prices focuses on idiosyncratic risk, given its relevance to information efficiency and capital allocation as described above. We use idiosyncratic volatility to measure idiosyncratic risk directly. Unlike total volatility, uncovering idiosyncratic volatility may require the use of an asset pricing model.

As a start, we use the popular market model to decompose the total return into systematic and idiosyncratic components. That is, we run the following model,

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{m,i}(R_{M,t} - R_{f,t}) + \varepsilon_{i,t}, \quad (1)$$

where $R_{i,t}$, $R_{M,t}$, $R_{f,t}$ are the individual stock return, the value-weighted market return, and the risk-free rate, respectively. We measure idiosyncratic volatility using the root mean square of residuals, $\varepsilon_{i,t}$.

CLMX have proposed a simple estimation procedure based on daily data for computing total aggregate idiosyncratic volatility that avoids tedious estimation of betas. Since our study uses monthly stock returns, we follow a modified approach developed by Xu and Malkiel (2003). Specifically, the total aggregate volatility σ_{TV}^2 is calculated by value weighting an individual stock's total volatility $\sigma_{i,TV}^2$. The aggregate idiosyncratic volatility σ_{IV}^2 is then computed as the difference between the total aggregate volatility and the market volatility. Since volatilities in general are unobservable, we apply rolling statistics as used in Xu and Malkiel (2003) to estimate them efficiently. The optimal weights are suggested by Foster and Nelson (1999).

The market model may be misspecified if we fail to measure the market return properly or if other risk factors exist, as suggested by the APT model. Chan, Hamao,

and Lakonishok (1991) and Daniel, Titman, and Wei (2000) document that size and book-to-market ratio are significant determinants of the cross-section of Japanese stock returns. Therefore, we also use the three-factor model of Fama and French (1993) to decompose the total return as,

$$R_{i,t} - R_{f,t} = \alpha_i + \beta_{m,i}(R_{M,t} - R_{f,t}) + \beta_{SMB,i}R_{SMB,t} + \beta_{HML,i}R_{HML,t} + \varepsilon_{i,t}, \quad (2)$$

where $R_{SMB,t}$, $R_{HML,t}$, are the return proxies for the size variable and the book-to-market variable, respectively. These return proxies are constructed following Fama and French (1993). In particular, at the beginning of each year, stocks are sorted into two groups according to their market capitalization. $R_{SMB,t}$ is the average return difference between these two groups of stocks. Within each group, stocks are sorted again into three groups according to their book-to-market measure. $R_{HML,t}$ is simply the average return of stocks in the two high book-to-market portfolios minus the average return of stocks in the two low book-to-market portfolios. Finally, idiosyncratic volatility is computed as the root mean square of residuals, $\varepsilon_{i,t}$.

The above analysis hinges on accurate specification of the return model. Since idiosyncratic volatility is unobservable, its estimation is model dependent. Even with the Fama and French's three-factor model, it is still possible that our measurement of idiosyncratic volatility includes other missed factors. Therefore, we extend our analysis by examining the correlation structure. When firms become similar, the pair-wise correlation should increase. This simple statistic is not only model-free but also consistent with the behavior of idiosyncratic volatility. In order to obtain time-varying estimates of average pair-wise correlation, we use rolling past returns.

Trading volume might also help us to understand the unique behavior of the Japanese equity market. Many theoretical models suggest that trading volume is related to differences in opinion or asymmetric information. Recent empirical work by Cremers and Mei (2003) shows a close relationship between idiosyncratic volatility and turnover in the U.S. data. There could be less trading activity if all firms become similar. Thus, trading volume provides an alternative means for studying Japanese firm volatility during the recession years.

A final important issue in measuring idiosyncratic volatility and turnover is the correct identification of the number of factors in both returns and trading volume. In past studies, this crucial parameter has often been assumed, rather than determined by the data.⁷ This paper introduces a formal statistical procedure that can consistently extract factors from observed data. This procedure is developed by Xu (2001) under the assumption that both N and T converge to infinity. This approach allows heteroskedasticity in both the time and cross-section dimensions, thus rendering them more general than the results of Connor and Korajczyk (1993) who assume homoskedasticity over time. This extension is of empirical relevance because it fully exploits the advantage of a large panel data set. In addition, our empirical study employs an approximate factor structure for both returns and trading volume.

II. The Distinct Behavior of Japanese Idiosyncratic Volatility

A. Summary Statistics

We first plot aggregate returns and trading volume of the Tokyo Stock Exchange. As Figure 1 illustrates, the market experienced a rapid run-up after 1985, and it peaked in December 1989. This period, now widely known as the “bubble period,” was followed by a rapid decline of the market and a consequent series of ups and downs. For simplicity, we call the 1990-1994 period “the crash period” and the 1995-1999 period “the post-crash period.” In the 1990s, the index value stayed between $\frac{1}{2}$ to $\frac{2}{3}$ of its peak and there was a sharp fall in trading volume.

[Insert Figure 1 approximately here]

Table 1 provides summary statistics of the data. The first column in Table 1 provides the mean and standard deviation of the value-weighted market return (R_M). The mean market return is positive in the first three periods, with a high 2.8% per month return in the 1985-1989 (“the bubble”) period. In the last two periods, however, the market on average earned negative returns. Market volatility, calculated as the standard deviation of market return, shows a rising trend.

⁷ Brown and Weinstein (1983) emphasize the importance of obtaining correct estimates on the number of factors. They point out that the common practice of using an over-estimate can cause spurious rejection of asset pricing models. They note: “...the rejection of the five and seven factor versions is to be expected if the three factor version is correct.”

[Insert Table 1 approximately here]

The next two columns of Table 1 provide the results of the market model estimation for individual stocks. We first notice a significant reduction in the cross-sectional variation of firm betas, $\beta_{i,CAPM}$, from 0.447 to 0.321 from the bubble period (1985-89) to the crash period (1990-94). We also note a remarkable change in the R^2 of the market model. On average it is 13% and 10% in the earlier, pre-bubble periods (1975-79, 1980-84); increases to 17% during the bubble period (1985-89); jumps dramatically to 51% in the period immediately following the market peak (1990-94); and then decreases somewhat (38%) in the last period (1995-1999). Such a startling difference in R^2 s over such a short period of time suggests that there was a profound change in the market structure.

One might suspect that the market bubble caused stocks to move in the same direction, as investors in general may have expected similar returns even on stocks with different characteristics. But the further increase in the explanatory power of the value-weighted index *after* the burst of the bubble indicates that Japanese stocks started to move together with the whole market, even when the market started to decline and the economy moved into recession. In those years, individual stocks lost much of their contribution of idiosyncratic risk to total risk. This is in contrast to results obtained in the U.S. as reported by CLMX, who find that firm-level volatility is *higher* in NBER-dated recessions.

The fourth column in Table 1 shows the cross-sectional distribution of the idiosyncratic component of volatility ($\sigma_{i,IV}$), as measured by the mean square of residuals. We note a slightly increased mean idiosyncratic volatility of 0.106 in the bubble period (1985-89), followed by a sharp fall to 0.080 in the crash period (1990-94). This is a 25% decrease, which is also statistically significant, as shown in Table 2 later. Idiosyncratic volatility recovers to 0.093 in the last period.

The difference is more dramatic if we use market volatility (standard deviation of R_M) as a benchmark. In the first three pre-crash periods, idiosyncratic volatility is about three times market volatility. However, in the latter two periods after the crash, idiosyncratic volatility is about the same as market volatility. In

addition, we observe more than a 50% decrease in the variation of $\sigma_{i,IV}$ in the crash period (1990-94), dropping from 0.039 to 0.024.

Total volatility ($\sigma_{i,TV}$) reported in the fifth column is the return volatility of individual stocks measured over each period. While total volatility changed little from the bubble to the post-crash periods, we notice a 25% drop in the variation of $\sigma_{i,TV}$ in the crash period (1990-94), falling from 0.038 to 0.029.

Table 1 also presents summary statistics for turnover. Average turnover $\overline{\eta_i}$ of stocks was high (0.056) until the collapse of the bubble (1989) and then decreased significantly to 0.027 afterwards. In addition, there is also a significant drop in the variation of $\overline{\eta_i}$, changing from 0.039 in the bubble period to 0.022 in the crash period. The simultaneous fall in $\sigma_{i,IV}$, the variation of $\sigma_{i,TV}$, and the variation of $\overline{\eta_i}$ all suggest a much stronger presence of the market factor in both stock returns and trading volume during the crash period.

To further investigate the significant shift in the characteristics of Japanese firms during the bubble-burst period, we performed simple mean tests for levels and F tests for variances for each sub-period in comparison with the crash period (1990-1994). The results of these tests are presented in Table 2. First, as evidenced by the low variation in beta (second column in Table 2), differences among systematic risk of individual firms appear to have dropped significantly. At the same time, both the level of aggregate idiosyncratic volatility and the differences in idiosyncratic volatilities among different firms have decreased significantly over this period.

[Insert Table 2 approximately here]

The summary statistics provide a strong indication of the differences in the behavior of different volatility components over time. Figure 2 shows the 12-month moving average of both the monthly market volatility and the monthly aggregated idiosyncratic volatility. Through this visual presentation, we can detect a trend of increasing market volatility (the solid line) with a large jump at the time of the crash in 1990-1991. Consistent with the summary statistics presented in Table 1, volatility

increased during the bubble period as compared to previous years, and remained higher during the period of market decline in the 1990s.

[Insert Figure 2 approximately here]

While market-wide volatility in Japan appears to have increased after 1985, we also see a decreasing trend in the behavior of idiosyncratic volatility.⁸ There is, however, a noticeable jump in the last two years, when the Japanese financial system experienced unprecedented stress and reorganization (e.g., major bank failures and government bailouts). Aggregate trading volume was also higher during the boom period, but since then has decreased to the lowest level in the entire sample. These figures are shown in Figure 1 in monthly frequency.

B. Correlation Structure

The unique behavior of the different components of volatility has important implications for the Japanese economy that will be discussed in the next section. In this section we check the robustness of our results from different perspectives.

Given the strong evidence of a decreasing trend in idiosyncratic volatility and increasing market volatility, we can further examine the issue from the perspective of the explanatory power of the market model, which is the R^2 measure.⁹ Apparently, a dispersion between market volatility and idiosyncratic volatility implies an increase in the R^2 for the market model. In Figure 3a, we show the dynamics of average R^2 statistics from the market model. R^2 s for both returns and turnover are reported. At time t , the return R^2 is computed based on estimating the market model using the previous 24 months of monthly data. In order to obtain a corresponding R^2 measure for turnover, trading volume of individual stocks is regressed on the value-weighted aggregate trading volume. We can see the return R^2 s were generally low (around 10%). They showed a sudden turnaround after 1990 and peaked during 1994-1995. The level declined somewhat in the most recent years, but still remained much higher

⁸ In comparison to the U.S. experience U.S. 1928 to 1946, rising market volatility after the stock market crash in the U.S. was accompanied by a simultaneous *rise* in idiosyncratic volatility. In comparison, rising market volatility in Japan was accompanied by *falling* firm-level volatility, possibly due to corporate bailouts and lack of reorganization.

⁹ $R^2 = 1 - (\text{idiosyncratic volatility}) / (\text{total volatility})$. Recently, there is an increasing application of average R^2 as a measure of market information inefficiency (see Morck, Yeung, and Yu, 2000; Durnev, Morck, Yeung, and Zarowin, 2002; and Wurgler, 2000). Higher R^2 implies that the market is less informationally efficient.

than the level of the 1970s and 1980s. The turnover R^2 s follow a similar pattern¹⁰ except their reaction to the crash was a little slower than that of the return R^2 s.

[Insert Figures 3a and 3b approximately here]

Perhaps it is more interesting to examine the changing volatility issue from the correlation perspective. If market volatility reflects the average covariance among individual stock returns, the observed phenomenon of decreasing idiosyncratic volatility could only happen when the average correlation increases. We present correlations among individual stock excess returns and volume in Figure 3b. At any time t , we compute the average of pair-wise correlations using the previous 24 months of monthly data. As the figure shows, we find a clear pattern in the evolution of return and volume correlations: approximately 0.10 for returns and 0.05 for volume in the 1970s and 1980s. But in the 1990s, after the collapse of the bubble, the correlations increase significantly, to as high as 0.50 for returns, and 0.20 for volume.

As discussed previously, both declining idiosyncratic volatility and rising correlation may suggest an important shift in the dynamics of Japanese stock prices. Faced with stocks that were virtually indistinguishable from each other, investors may have treated more and more companies like “lemons,” thus preventing a reallocation of much needed resources to good firms after the market crash. The resulting relative scarcity of capital for competitive Japanese firms may have increased their vulnerability to economy-wide risk, which would result in higher overall market volatility. As Figure 2 suggests, Japanese investors have faced rising aggregate market risk in the 1990s.

C. The Multi-Factor Model for Both Returns and Turnover

We now further confirm the above results by explicitly applying multi-factor models to both returns and turnover data (duo-factor model) for TSE securities from 1975 to 1999. Table 3 provides the results of the analysis across a number of factors in excess return and turnover, including incremental R^2 from the k -th factor of the return and turnover for models for 1 to 10 factors. The first principal component of

¹⁰ Note that there might be a downward trend in aggregate trading volume from 1987 to 1991 (see Figure 1). This trend will not likely to bias our R^2 estimates since we use small windows of volume data in estimation. In the presence of a time trend, the R^2 estimate will be biased upwards. Instead, there was a downward trend in R^2 s during the sub-period.

returns explains 14% and 11% of the normalized excess returns in the 1975-1979 and 1980-1984 periods, which increases to 18% during the bubble period, followed by dramatic increases to 52% (1990-1994) and 39% (1995-1999) in the post-bubble periods. These findings indicate that during a period of market decline, excess returns are largely driven by a single systematic factor, and are consistent with our previous results showing rising market risk during the post-bubble period.¹¹

[Insert Table 3 approximately here]

The last column of Table 3 shows the average R^2 of regressing individual stock returns and turnover on their corresponding systematic factors for each period. In the first period, a three-factor model explains on average 25% of variation of stock returns and a four-factor model explains 31% of variation of turnovers. These R^2 s go up slightly for the 1985-1989 period, suggesting a small rise in commonality in time-series variations of both stock returns and volumes. However, we find a significant increase in average R^2 s in the 1990-1994 and 1995-1999 periods for both returns and turnovers. This indicates that during the post-bubble period, there is a sharp decrease in contribution of idiosyncratic risk in stock returns and trading volume, further confirming our previous results.

D. Industries, Liquidity, and Idiosyncratic Volatility

It is often noted in the public press that some politically well-connected firms/industries in Japan are protected even though they are not competitive and efficient. The press often cites retail, real estate, construction, and commercial banking as examples of such industries. We therefore examine if the level of idiosyncratic volatility is related to particular industries. We find that before 1990, retail and banks (which are often referred to as “protected”) show a substantially low level of idiosyncratic volatility compared to the aggregate idiosyncratic volatility, whereas other industries, such as chemicals and materials manufacturing, have higher-than-aggregate idiosyncratic volatility. On the other hand, we note that after 1990 the idiosyncratic volatilities of different industries became closer to the

¹¹ Table 4 also reports the number of factors in excess returns and turnover, determined by using a loss function suggested by Xu (2001). Our results show that there are 3 factors in excess returns in Japan, except for the 1990-94 period where there are 4 factors. The number of factors in excess returns remains relatively stable, whereas for turnover, it varies between 3 and 6. However, our main interest here is to derive measures of idiosyncratic volatility.

aggregate level. This suggests that the reduced level of idiosyncratic volatility in the 1990s is a market-wide phenomenon, and not necessarily attributable to specific industries.

The reduction in idiosyncratic volatilities could also be due to a decrease in the liquidity of shares. Therefore, we grouped the stocks into three (low, medium, and high) portfolios according to their liquidity as measured by trading volume. There is, however, no apparent difference in the downward trend in the idiosyncratic volatilities in the 1990s.¹²

In summary, by examining the Japanese stock market over different time periods (pre-bubble, bubble and post-crash), we have documented different levels of total and idiosyncratic volatility over time. Total volatility increased after the burst of the bubble, but, at the same time, idiosyncratic components significantly decreased. This stands in sharp contrast with the post-1962 U.S. market where market-level volatility does not show significant change over time, although firm-level volatility increases over time, especially during recessions (CLMX).

III. The Relationship between Idiosyncratic Risk and Institutional Features Unique to Japan

We have so far documented decreased firm-level volatility in Japan. We have also shown that the decrease in firm-level volatility was not limited to certain industries; it is a rather common phenomenon for the entire market. In this section, we discuss how these findings relate to Japanese firm performance and to business group association.¹³

A. Increasing Homogeneity of Economic Performance among Japanese Firms

¹² The results for industries and liquidity sorted portfolios are available from the authors upon request.

¹³ Besides the factors analyzed in this section, there have been several changes in the Japanese market in general. These include internationalization and deregulation (most notably, the 1980 amendment of the Foreign Exchange Control Law and the financial “Big Ban” deregulation that started in 1996) that may have made changes in the level of trading activities of domestic and foreign investors. We examined the impact of changes in trading volumes by different class of investors (institutional, individual and foreign) on volatility, but no significant relations were found. Hamao and Mei (2001) also find that trading by foreign investors do not increase market volatility more than trading by domestic investors.

It is possible that the falling firm-level volatility in Japanese stock returns documented above is related to changes in the underlying performance of Japanese firms. To address this issue, Figures 4a and 4b report the average 10-year pair-wise return on asset (ROA) correlations and cross-sectional standard deviation of ROAs over the sample period.¹⁴ Since Japanese corporations report earnings on an annual basis, we are limited to annual ROA figures. The most striking result shown in Figure 4a is the 300% increase (from 0.05 to 0.23) in the average 10-year ROA correlations for all firms in the economy. This suggests that in the 1990s, the fortunes of Japanese firms were tied much more tightly together and their fundamental economic performance moved in closer steps as compared to the pre-crash period. Since stock returns are related to firm performance through earnings and dividends, the dramatic rise in ROA correlations appears to be an important driver to rising return correlations and falling idiosyncratic volatility.

We also divide our sample into (1) firms that belong to the six major keiretsu groups (Fuji, Mitsui, Mitsubishi, Daiichi-Kangyo, Sumitomo, and Sanwa), and firms that do not; and (2) firms that have a main bank affiliation, and firms that do not. The classification is based on 1998 data in *Kigyo Keiretsu Soran* (1999), published by Toyo Keizai Shinpo Sha. As Figure 4a illustrates, group affiliated firms (keiretsu and main bank (MB)) have higher ROA correlations in the post-bubble period, suggesting that the fundamental performances of group firms were also more closely tied together during this period. Figure 4b, which presents the standard deviations of ROA for both non-keiretsu and keiretsu firms, shows that the standard deviations of ROA for non-keiretsu firms tend to be higher than those for keiretsu firms. Thus, there is less variation in firm performance among keiretsu firms.

[Insert Figures 4a and 4b approximately here]

B. The Impact of Business Group Affiliation on Idiosyncratic Risk

We next turn our attention to differences in the behavior of idiosyncratic volatility of keiretsu and non-keiretsu firms, and firms with and without main banks. Our purpose is to examine whether these unique Japanese institutional features play a role in determining the firm-level components of volatility and volume.

¹⁴ We use ROA rather than return on equity (ROE) since leverage may differ across firms.

We compute idiosyncratic components of return volatility and volume of individual firms, and average them across firms within each category (keiretsu firms and non-keiretsu firms; firms with main banks and firms without main banks) to obtain aggregate idiosyncratic components.¹⁵ We then regress the difference in aggregate idiosyncratic components between non-keiretsu firms and keiretsu firms on the monthly growth rate of industrial production (IP). We include an intercept to control for differences in idiosyncratic components due to industrial composition.

[Insert Table 4 approximately here]

Table 4 reports regression results for the difference in idiosyncratic components of return volatility and volume between non-keiretsu firms and keiretsu firms (Panel A), and between firms with main banks and firms without main banks (Panel B). We report results for before the collapse of the bubble (high- and medium-economic growth periods), and the post-bubble (low-growth period). Noting that there is a reversal in the pattern of idiosyncratic risk around 1997, we report results for the 1990-1996 period.

The results for the 1977-1989 period in Panel A show a generally positive relation between IP growth and the difference in idiosyncratic components; an increase in IP growth tends to increase the difference of firm-level volatility between non-keiretsu and keiretsu firms. A higher growth rate of the IP implies higher firm-level volatility and volume of non-keiretsu firms compared to keiretsu firms. This means that, in this sub-period, when economic growth is at a high rate, there tends to be greater disparity of stock performance among non-keiretsu firms. Less disparity among the performance of stocks of keiretsu firms during the high-growth period implies the presence of resource sharing among these firms, whereas independent firms who do not share resources experience a higher degree of disparity in volatility. Panel B shows that the same results hold for firms without main banks versus firms with main banks, and all coefficients are significant.

When we run the same regressions for the 1990-1996 period, the sign of the coefficients flips to negative, and they are all significant except for one case. In this

¹⁵ We have also used other single- and multi-factor models to compute idiosyncratic components. The results are quite similar and available from the authors upon request.

sub-period, a decrease in IP growth tends to increase the difference of firm-level components between non-keiretsu and keiretsu firms (Panel A) and between firms without main banks and firms with main banks (Panel B). The lower the IP growth, the higher the firm-level components of non-keiretsu firms (firms without main banks) compared to keiretsu firms (firms with main banks). Firms generally suffer from financial difficulties in this period and the lower the IP growth, the severer the problem. Our finding shows that the lower IP growth is associated with higher idiosyncratic volatility of non-keiretsu firms (or firms without main bank) compared to that of keiretsu firms (or firms with main bank) in the post-bubble period.¹⁶ That is, in this sub-period when the rate of economic growth is low, there tends to be greater disparity of stock performance among non-keiretsu firms and firms without main banks, compared to their counterparts. These findings suggest that keiretsu firms and firms with main banks are less sensitive to negative economic conditions compared to independent firms.

C. Diminishing Sensitivity to Leverage

The overly optimistic expansions and easy lending during the bubble period left many Japanese firms with high leverage after the burst of the bubble. Those firms with heavy burden of debt are likely to perform poorly. In general, idiosyncratic volatilities are high for firms with high leverage due to high defaulting and restructuring risks. However, as mentioned in Section IA, close banking and keiretsu relationships might have created an excuse for managers to maintain the status quo rather than implementing timely restructuring. If this is indeed the case, any possible association between leverage and idiosyncratic volatility should be weaker in the post-bubble period.

We test this hypothesis by performing cross-sectional regression between firms' idiosyncratic volatilities and leverage. Since volatilities are positive, we use the natural log of the idiosyncratic volatility as the dependent variable in the cross-section regressions. As before, individual idiosyncratic volatility is computed from the residuals of the CAPM model using current and previous 12 months returns.

¹⁶ This is consistent with Xu and Malkiel (2003) who report a positive (negative) relation between forecasted earnings growth and idiosyncratic volatility for high (low) growth periods.

Independent variables include $\log[(\text{market value of equity})/(\text{book value of long-term debt})]$, return on assets, and one-month lagged log idiosyncratic volatility. The first independent variable measures (the inverse of) a firm's leverage, and the second variable represents a firm's financial performance. The lagged idiosyncratic volatility is added to account for high persistence in volatilities. This cross-section regression is run monthly over the sample period the coefficients are averaged, and t-statistics are computed as in Fama and MacBeth (1973).

[Insert Table 5 approximately here]

As Table 5 illustrates, the inverse of leverage measure has statistically negative average coefficients for all specifications, indicating that higher leveraged firms have higher idiosyncratic volatility. The table also reports coefficients for the bubble period (1985-89) and the period immediately following the burst of the bubble (1990-94). Both periods also show statistically significant negative relations between the inverse of leverage and firm-level volatility, but we note that the average coefficients are smaller in the post-bubble period than in the bubble period. This implies that the impact of leverage is less pronounced after the collapse of the bubble. After the crash of the stock market, when higher leveraged firms should be experiencing more acute problems, firm-level volatility is actually less sensitive to leverage, consistent with the group protection.¹⁷

D. Relationship between Bankruptcy and Idiosyncratic Risk

Protection among keiretsu and main bank affiliated firms may be associated with a lack of “creative destruction” in the Japanese economy. Figure 5 compares bankruptcies of all firms in the economy and those of TSE firms. As the figure reveals, the number of bankruptcies for firms listed on the TSE is much smaller than the number for the entire economy. This is in sharp contrast to the U.S. experience, where in 2000 (2001), there were 176 (257) bankruptcy filings of publicly traded companies.¹⁸ Bankruptcies of listed firms in Japan are particularly low since such firms are considered to have social and economic importance, and all parties involved (banks, other businesses, and regulators) deem them to be “too large to fail.”

¹⁷ Unfortunately, when we test the difference in mean coefficients between the two sample periods, assuming the independence of coefficients, the t-test does not show significance.

¹⁸ See <http://www.bankruptcydata.com/>

[Insert Figure 5 approximately here]

The Japanese stock market mirrored this period of procrastination. Since immediate restructuring of corporations and banks was not forthcoming, investors may have expected a prolonged period of corporate “bailouts and rescues” where cash flows from good firms are diverted to save weak firms in the same business group and to converge economic risk. Thus, we should observe a convergence of stock market returns and a reduction in firm-level volatility. This implies a positive relation between number of bankruptcies and idiosyncratic risk, and a negative relation between number of bankruptcies and market co-movement.¹⁹

IV. Discussion

The above analysis has demonstrated that a lack of corporate bankruptcy and the presence of group protection may have contributed to a reduction in idiosyncratic volatility (or increase in equity price co-movement) thus impeding the information role of the Japanese equity market. This impediment may have had important and longstanding consequences.

Numerous theoretical and empirical studies have demonstrated that equity markets help improve the capital allocation process, and thus contribute to economic growth. One theory is that efficient secondary market prices help investors separate good from bad investments through a mechanism like Tobin’s Q. Another is that lenders and intermediaries use book-to-market ratios computed from stock prices to screen out bad credits (Altman, 2002). Recent empirical work by Wurgler (2000) demonstrates that equity markets actually do improve the allocation of capital. Using a sample of 65 countries, he shows that countries with stock markets that impound more firm-specific information into individual stock prices – in other words, those that have a smaller R^2 – do exhibit a better allocation of capital, “...which appears to be particularly useful for limiting investment in declining industries.” Durnev, Morck, and Yeung (2001) also find that firms in industries in which firm-specific

¹⁹ To confirm the above hypothesis, we regress changes in firm-level volatility on the number of corporate bankruptcies of TSE listed firms and the annual growth rate of GDP. For the full sample period, we find a weak positive relation between changes in firm-level volatility and corporate bankruptcies; the higher number of bankruptcies is related to higher idiosyncratic volatility. These results are available from the authors upon request.

return variation is larger exhibit a higher quality of capital budgeting, in that their profitability indices (marginal Q ratios) are closer to one.

The results of these studies suggest that equity markets play an active role in the allocation of capital itself. While misallocation of capital by major banks and keiretsu may cause an increase in Japanese equity price co-movement, this in turn may lead to further misallocation of capital by firms and investors. As discussed in section III, large equity price co-movement makes it difficult for investors to distinguish good from bad firms. As a result, some healthy firms will find it difficult to get financing and stay competitive. This in turn will lead to more “rescues and bailouts” by business groups, which will trigger further reductions in firm-level volatility, thus leading to a vicious cycle in the capital formation process.

We conjecture that this vicious cycle of capital misallocation may help explain the long stagnation of the Japanese economy. Fundamentally, the strength of an economy can be measured by whether it allocates its scarce capital efficiently. Capital should be invested in firms that are expected to have high returns, and withdrawn from firms with poorer prospects. To the extent that the Japanese economy continues to misallocate large amounts of scarce capital, its recovery will remain illusive, despite its large capital endowment. While Japanese corporations and government recently have taken steps to address the issue of corporate reorganization, our results indicate that firm-level volatility in Japan is still too low (and R^2 is too high) compared to other developed countries, indicating that Japan’s corporate restructuring may still have a long way to go.²⁰

V. Conclusion

This paper documents several unique symptoms of the Japanese equity market. We find an abnormal *reduction* in firm-level volatility after the Japanese stock market crash. We discover a significant drop in the variation of systematic risk across firms and a sharp increase in Japanese equity co-movement. These results

²⁰ At the end of 1999, the average R^2 of the Japanese market was 0.25, still much higher than that of the U.S. (about 0.08 over the 1993-1998 period) and its own pre-crash historical level.

stand in sharp contrast to the U.S. case, where firm-level volatility generally *increases* after a market crash or during a recession.

In order to understand the abnormal behavior of idiosyncratic risk in Japan, we examine the impact of firm fundamentals as well as bankruptcy on firm-level volatility. We find that firm fortunes were tied together more tightly during the post-crash period. We discover a positive correlation between changes in aggregate firm-level volatility and corporate bankruptcies. In addition, we find that idiosyncratic volatility for firms with business group affiliations is less responsive to economic conditions than that of firms without such affiliations. These results suggest that the sharp fall in firm-level volatility could be due to group protection.

To obtain a more accurate measure of idiosyncratic risk, this paper offers a number of methodological innovations. First, we have introduced volume into our asset pricing studies. Because of the close relationship between idiosyncratic risk and idiosyncratic volume, examining the time-variation of idiosyncratic volume allows us to better understand firm-level volatility in the Japanese equity market. Second, as a robustness check, we employ the duo-factor model of Lo and Wang (2000), which provides an alternative measure of firm-level volatility and trading volume in a multi-factor setting. Third, we use a recently developed consistent statistic by Xu (2001) to determine the number of factors in the duo-factor model. This could provide a more accurate measure of idiosyncratic volatility in a multifactor model.

This paper raises several interesting questions for future research. First, while our results indicate an increase in Japanese equity co-movement and a potential negative impact on its capital allocation, it would be interesting to examine whether this increase actually leads to reduced efficiency in Japanese firm capital budgeting. Second, there were other structural changes, such as liberalization of the capital market, participation of foreign investors, and changing ownership, during the sample period. It might be interesting to examine explicitly their impact on Japanese stock volatility. Lastly, our results indicate that a reduction in idiosyncratic volatility is accompanied by rising overall market volatility in Japan. It would be useful to examine whether changes in idiosyncratic risk have affected asset pricing.

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Table 1: Summary Statistics

This table shows some of the summary statistics for Japanese equity markets over different episodes. Except for “ R_M ”, which is based on the value-weighted market index return, all statistics are computed based on the statistics of individual stocks in the specified period. In particular, $\sigma_{i,IV}$ is the root mean squared residuals from the same CAPM that computes $\beta_{i,CAPM}$ and R^2_{CAPM} . $\sigma_{i,TV}$ is the return volatility of individual stocks. $\overline{\eta_i}$ denotes the average turnover over time of individual stocks.

	R_M	$\beta_{i,CAPM}$	R^2_{CAPM}	$\sigma_{i,IV}$	$\sigma_{i,TV}$	$\overline{\eta_i}$
1975-79						
Mean	0.016	0.999	0.132	0.090	0.096	0.050
S.D.	0.033	0.580	0.095	0.036	0.037	0.049
1980-84						
Mean	0.013	0.996	0.103	0.087	0.091	0.040
S.D.	0.026	0.653	0.083	0.040	0.041	0.040
1985-89						
Mean	0.027	1.024	0.172	0.106	0.115	0.056
S.D.	0.041	0.447	0.113	0.039	0.038	0.039
1990-94						
Mean	-0.004	1.011	0.513	0.080	0.117	0.027
S.D.	0.083	0.321	0.168	0.024	0.029	0.022
1995-99						
Mean	-0.004	1.006	0.387	0.093	0.122	0.027
S.D.	0.075	0.519	0.188	0.039	0.049	0.024

Table 2: Test of Significance for the Difference between the 1990-1994 Period and Other Periods

This table provides the significant test of selected statistics of 1990-1994 against other time periods. This comparison period has 1521 stocks. Test statistics for the hypothesis of equal standard deviation are computed based on an F test, while those of equal mean are based on a t test. In particular, $\sigma_{i,IV}$ is the root mean squared residuals from the same CAPM that computes $\beta_{i,CAPM}$ and R^2_{CAPM} . $\overline{\eta_i}$ denotes the average turnover over time of individual stocks.

	No.	$\beta_{i,CAPM}$	R^2_{CAPM}	$\sigma_{i,IV}$	$\sigma_{i,IV}$	$\overline{\eta_i}$	$\overline{\eta_i}$
	Obs.	S.D.	Mean	Mean	S.D.	Mean	S.D.
1975-79							
Statistic	1174	3.268	-69.56	8.498	2.165	16.28	5.171
P-value		0.000	0.000	0.000	0.000	0.000	0.000
1980-84							
Statistic	1275	4.152	-79.29	5.037	2.710	11.36	3.505
P-value		0.000	0.000	0.000	0.000	0.000	0.000
1985-89							
Statistic	1352	1.942	-62.91	20.87	2.648	24.94	3.288
P-value		0.000	0.000	0.000	0.000	0.000	0.000
1995-99							
Statistic	1606	2.624	-19.71	10.86	2.668	-0.167	1.220
P-value		0.000	0.000	0.000	0.000	0.566	0.000

Table 3: Test of Number of Factors in the Excess Return and Turnover Models for Balanced Panels

This table reports the average incremental coefficient of determination from regressing individual stock returns (or turnover) on each statistical factor extracted using the “MEC” approach of Xu (2001). The number of factors is determined based on the test statistics suggested by Xu (2001).

Period	ΔR^2_1	ΔR^2_2	ΔR^2_3	ΔR^2_4	ΔR^2_5	ΔR^2_6	ΔR^2_7	ΔR^2_8	ΔR^2_9	ΔR^2_{10}	# factors	$R^2_{1,...,10}$
Stock return												
1975-79	0.135	0.060	0.052	0.044	0.028	0.026	0.024	0.022	0.021	0.021	3	0.247
1980-84	0.107	0.066	0.048	0.035	0.031	0.028	0.027	0.025	0.023	0.022	3	0.222
1985-89	0.176	0.095	0.042	0.034	0.031	0.025	0.023	0.021	0.020	0.019	3	0.313
1990-94	0.515	0.049	0.030	0.024	0.022	0.018	0.014	0.014	0.013	0.013	4	0.619
1995-99	0.389	0.048	0.030	0.026	0.026	0.025	0.020	0.019	0.019	0.018	3	0.467
Turnover												
1975-79	0.123	0.076	0.057	0.048	0.039	0.031	0.031	0.027	0.025	0.024	4	0.305
1980-84	0.101	0.062	0.052	0.042	0.040	0.035	0.033	0.030	0.028	0.026	3	0.215
1985-89	0.103	0.067	0.055	0.053	0.044	0.036	0.035	0.029	0.027	0.026	5	0.322
1990-94	0.208	0.074	0.061	0.058	0.038	0.037	0.031	0.028	0.025	0.022	6	0.476
1995-99	0.137	0.117	0.053	0.045	0.041	0.035	0.031	0.028	0.026	0.024	5	0.391

Table 4: Regression of Difference of Equity Market Characteristics on IP growth (1977-1996)

The first line provides parameter estimates. The second line gives the t-statistics.

	1977-1989 Sample			1990-1996 Sample		
	Constant	IP	Adj. R ²	Constant	IP	Adj. R ²
A: Keiretsu						
Diff. Idio. Risk (nonKeiretsu-Keiretsu)	0.000	0.002	-0.004	0.000	0.000	-0.014
(CAPM)	-1.960	0.527		2.955	-0.138	
Diff. Idio. Risk (nonKeiretsu-Keiretsu)	-0.001	0.002	-0.005	-0.001	-0.008	0.087
(Xu)	-2.796	0.405		-9.438	-2.790	
Diff. Idio. Volume (nonKeiretsu-Keiretsu)	-0.002	0.012	0.030	0.000	-0.005	0.103
(CAPM)	-7.151	2.481		0.637	-3.023	
Diff. Idio. Volume (nonKeiretsu-Keiretsu)	-0.003	0.014	0.030	0.000	-0.005	0.090
(Xu)	-7.545	2.470		0.177	-2.825	
B. Main Banks						
Diff. Idio. Risk (nonMain Bank-Main Bank)	-0.003	0.019	0.102	-0.002	-0.006	0.163
(CAPM)	-10.16	4.460		-22.43	-3.846	
Diff. Idio. Risk (nonMain Bank-Main Bank)	-0.003	0.019	0.092	-0.003	-0.013	0.094
(Xu)	-9.046	4.229		-17.58	-2.894	
Diff. Idio. Volume (nonMain Bank-Main Bank)	-0.003	0.011	0.033	-0.001	-0.006	0.127
(CAPM)	-12.23	2.587		-11.95	-3.365	
Diff. Idio. Volume (nonMain Bank-Main Bank)	-0.004	0.012	0.036	-0.001	-0.008	0.165
(Xu)	-13.55	2.700		-11.85	-3.879	

Table 5: Leverage and Firm Performance and Idiosyncratic Volatility

This table provides time-series average coefficients and t-statistics from monthly cross-section regression. The dependent variable of the cross-section regression is the natural log of the idiosyncratic volatility, which is computed from the CAPM residuals using current and past 12 months returns. The independent variables are: $\log[(\text{market value of equity})/(\text{book value of long-term debt})]$, return on assets, and one-month lagged log idiosyncratic volatility. This cross-section regression is run monthly over the sample period, the coefficients are then averaged, and t-statistics are computed. The first row of each specification reports average coefficients and the second row t-statistics.

		Const	Eq/LTD	ROA	Vid(t-1)	Average R ²
1977-99						
Model 1		-0.368	-0.003		0.927	0.863
		-27.71	-4.66		291.6	
Model 2		-0.377		-0.232	0.926	0.863
		-29.13		-8.09	298.2	
Model 3		-0.373	-0.002	-0.255	0.926	0.864
		-28.24	-2.75	-7.97	290.5	
1985-89						
Model 1		-0.418	-0.004		0.912	0.844
		-16.05	-2.84		135.4	
Model 2		-0.435		-0.134	0.911	0.843
		-16.23		-2.55	132.7	
Model 3		-0.421	-0.003	-0.185	0.912	0.844
		-16.08	-2.34	-2.81	134.6	
1990-94						
Model 1		-0.4000	-0.002		0.923	0.857
		-11.20	-2.01		89.82	
Model 2		-0.408		-0.135	0.922	0.856
		-11.93		-2.45	94.00	
Model 3		-0.404	-0.002	-0.157	0.922	0.857
		-11.41	-1.73	-2.34	89.57	