

Article**Financial Anxieties in Japanese Economy**

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Abstract

In this article, financial anxieties over the economy of Japan have been investigated. Some researchers analyzed this anxiety using the level economic variables in TARCH model without showing time series properties. If the time series involved are nonstationary, naive application of time series analysis may yield spurious correlation. So, an attempt has been made to recalculate the anxieties in a more optimum way over the period 1976-2005. Our results are able to capture the anxieties consistent with the economic point of views. Further discussions are given for the difference of financial anxieties between all enterprises and small ones, focusing our attention on the public financial institutions that played the special role for small enterprises.

Keywords: Financial anxieties, unit roots, TARCH

1. Introduction

The relationship between the money supply and economic activity had been relatively stable in the 1970s and 1980s. This relationship had been observed, even during the period of the emergence and busting of the bubble economy, though both were related with a long lag. So, money supply had been one of the important targets in conducting monetary policy in Japan. However, the relationship between money supply and economic activity had become harder to discern since the end of 1990s. The Bank of Japan (2003) and S. Miyagawa and Y. Morita (2004) explicitly reported that the long-run equilibrium relationship between money stock and real economic activity could no longer be detected, though such relationship could be found before 1997. It was the year of 1997 when serious financial problems had come out in the Japanese economy. Several big banks and security companies had failed, including Hokkaido Takushoku Bank and Yamaichi Securities. The Hokkaido Takushoku Bank, well known as TAKUGIN, was the largest regional bank in Hokkaido and Yamaichi Securities Company was fourth largest bank of the Big Four securities firms in Japan. Though several financial institutions had been failing after the burst of the bubble economy in 1990, they were the small sized institutes and tactically

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dealt by insurance deposit. However, the failure of two big financial institutions was quite different from the former bank failures when the significance of their role in the Japanese economy was put into consideration. People's anxieties over the financial system rapidly increased. Further their failure triggered the rapid decline in the share prices of many financial institutions. Japan premium was also imposed in the international market at the same time. As a result both firms and household seem to try to increase the money demand by their precautionary motivation. Therefore, the rise of this motivation seems to break down the cointegration between real money, real GDP and share price, which existed in the pre-1997. These economic developments may be largely influenced by the disturbance in the financial system that occurred reflecting the failures of large financial institutions after 1997. Kimura and Fujita (1999) proposed a new variable to capture these financial shocks as psychological change of people due to financial anxieties. They used the Corporate Financial Position Diffusion Index issued quarterly by Bank of Japan known as TANKAN in order to qualify the unobservable variable over the period 1976Q2 to 1999Q3 without showing the time series properties of the data. However, due to some reasons, their results show some unusual events that cannot be explained in economic views.

In this article, therefore, we have quantified the financial anxieties using the same economic variables for all enterprises used in Kimura and Fujita (1999) as well as for small enterprises but in different ways. Although our main objective is to recalculate the anxiety variable of Kimura and Fujita in a proper statistical framework, we also compare these anxieties with the atmosphere of small enterprises. Why an attempt has been made to recalculate this anxiety variable is as follows.

Kimura and Fujita (1999) considered the observations on two variables DI (financial position) and rate (accumulated change in interest rate on loan) for all enterprises over the period 1976Q2-1999Q3 in TARCh (Threshold Autoregressive Conditional Heteroscedasticity) model to calculate the financial anxieties as follows:

$$\text{Conditional mean: } DI_t = -4.580 + 0.073rate_t - 0.077rate_{t-1} + \varepsilon_t \quad (1)$$

$$(-6.058) (9.749) \quad (-10.563)$$

$$\text{Conditional variance: } h_t^2 = 48.997 + 0.841\varepsilon_{t-1}^2 + 0.730\varepsilon_{t-1}^2 d_{t-1} - 0.678h_{t-1}^2. \quad (2)$$

$$(7.185) (4.021) \quad (2.745) \quad (-6.049)$$

where, $d_t = 1$ for $\varepsilon_t < 0$, $d_t = 0$ for $\varepsilon_t \geq 0$

Financial anxieties quantified by conditional variances of the residual in Equation (1) have been shown in Figure 1 over the period 1962-1999. Figure 1 shows unexpected anxieties during the period 1988 to 1991, which does not bear any economic meaning over that period. It was the period when interest rate was comparatively high and most of the financial institutions were in easy position. Therefore we cannot say that this interval contains financial anxieties.

It is obviously seen from Equation (2) that comparatively large coefficients of ARCH

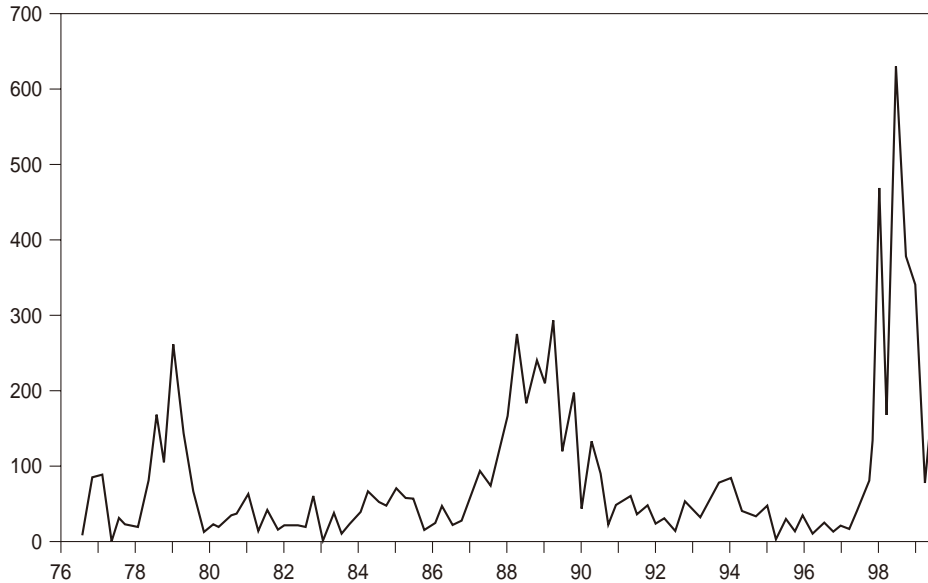


Figure 1. Financial anxieties over 1976-1999 shown by Kimura and Fujita (1999)

effects have been estimated, which would imply a large volatility (anxiety) for positive shock (good financial position). However, it has been argued by Pagan and Schwert (1990), Engle and Ng (1991), Bollerslev, Chou, and Kroner (1992) that a negative shock to financial time series is likely to cause volatility to rise by more than a positive shock of the same magnitude. For this large coefficient, their model cannot explain asymmetric responses of volatility clearly and may show unexpected anxieties for good financial atmosphere (positive shock). Another important thing is that a negative sign is appeared in the estimated coefficient of GARCH effects in their model, which is inconsistent with the non-negativity condition of TARCH model.

They used the level variables for estimating conditional mean equation in TARCH model without checking whether the series are stationary. The most important thing is that it can be shown that the two series, they used, are nonstationary. Using nonstationary variables in their model might introduce spurious regression (Granger and Newbold, 1974) in conditional mean equation (Equation 1) and may be responsible for these contradictory results.

So, we should therefore be very cautious when conducting standard analysis using time series. We also use more observations on the same variables for all enterprises over the period 1976Q2-2005Q1 to increase the precision of the results while for small enterprises the range is 1983Q3-2004Q4.

2. Time Series Properties of the Variables

The time series variables used in this study consist of observations on diffusion index (DI_all) of financial position and changes in interest rate on loans ($crate_all$) of all

Table 1. Unit Root Tests

Variables	lags	DF-GLS	KPSS	PP
<i>DI_all</i>	5	-0.106600	0.237033	-2.649835
<i>crate_all</i>	1	-2.80689***	0.161613	-3.70887***
<i>rate_all</i>	9	0.123617	1.089169***	-2.073389
<i>DI_small</i>	5	-1.68791*	0.508292**	-1.882960
<i>crate_all</i>	8	-2.94269***	0.155260	-2.960707

Note: Rejection of the null hypothesis at 1, 5 and 10 percent level of significance are denoted by ***,** and * respectively.

enterprises from the Corporate Financial Diffusion Index issued by Bank of Japan known as TANKAN. We use quarterly observations over the period of 1976Q2-2005Q1.

Time series can be characterized in many ways. In checking the time series properties, we focus on the presence or absence of unit roots or stochastic trends in each variable used in this article. In order to form a statistically adequate model, the variable should first be checked as to whether they can be considered stationary. The tests carried out are the asymptotically most powerful DF-GLS test for the null of unit root of Elliott, Rothenberg, and Stock (1996), the Kwiatkowski et al. (1992) LM test for the null of stationarity (KPSS) as well as the PP test of Phillips and Perron (1988) for the null of unit root. A common strategy is to present results of both ADF/PP and KPSS tests, and show that the results are consistent (e.g., that the former reject the null while the latter fails to do so, or vice -versa). The lag length is selected by the Akaike Information Criteria (AIC). The results are shown in Table.1.

For *DI_all* both the DF-GLS and PP tests are unable to reject the null hypothesis of unit root while KPSS test contradicts with this result by accepting the null of stationarity. However, there is no strong evidence against the nonstationarity of *DI_all* we consider this variable as nonstationary process. *crate_all* is appeared as stationary process while *rate_all* is nonstationary according to all the test procedures shown in Table 1. Therefore, we use first difference form of *DI_all* in regressing this variable on *crate_all*. It is worthwhile to note that Kimura and Fujita (1999) used both nonstationary variables *DI_all* and *rate_all* in the regression model, which may be treated as spurious regression.

3. Quantifying the Financial Anxieties

In the previous section, we have seen that *DI_all* is integrated of order one, I (1), and *crate_all* is stationary and hence we are now in a position to apply the first difference form of *DI_all* in a TARARCH model to calculate conditional variance for quantifying the financial anxieties. We use the following model for conditional mean:

Table 2. Engle's test for the presence of ARCH effects

Lags	Test statistic	Critical value	p-value
10	44.1625	18.3070	0.0000
15	43.0023	24.98	0.00002
20	43.1152	31.4104	0.0020

Table 3. Estimation of TARARCH model (1976Q3-2005Q1)

	Coefficient	Std. Error	z-Statistic	Prob.
β_0	0.053084	.236598	0.224364	0.8225
β_1	-0.0000344	0.008962	-0.038433	0.9693
β_2	-0.026407	0.009873	-2.674603	0.0075
Variance Equation				
α_0	1.240864	0.879154	1.411429	0.1581
α_1	0.058104	0.117175	0.495876	0.6200
γ	0.256846	0.145875	1.760722	0.0783
β	0.573227	0.196519	2.916904	0.0035

$$\Delta DI_all_t = \beta_0 + \beta_1 crate_all_t + \beta_2 crate_all_{t-1} + \varepsilon_t; \quad \varepsilon_t \sim N(0, h_t^2) \quad (3)$$

where Δ is a difference operator, DI_all is the diffusion index of financial position, $crate_all$ is the change in interest rates on loans for all enterprises and ε_t is an error term, which shows the influence of irregular or unexpected factors other than change in interest rates on loan. The financial anxieties can be captured as the variance of this error terms.

Before applying the TARARCH model on the conditional variance of this error term, we should check whether the ARCH effects are present on it. To do so, we have used Engle's ARCH test proposed by Engle and Robert (1982) for the presence of ARCH effects. This test is most often used as a post estimation lack-of-fit test applied to the fitted innovations (i.e., residuals). Under the null hypothesis of that a time series is a random sequence of the Gaussian disturbances (i.e., no ARCH effects exist), this test statistic is asymptotically distributed as Chi-square with m (number of lags) degrees of freedom. Table-2 comprises the test results for up to 10, 15 and 20 lags respectively at 5% level of significance.

Engle's test shows significance evidence in support of ARCH effects. Now we can apply the required TARARCH model.

The TARARCH model with asymmetric variance property for the conditional variance of the innovations is

$$h_t^2 = \alpha_0 + \alpha_1 \varepsilon_{t-1}^2 + \beta h_{t-1}^2 + \gamma \varepsilon_{t-1}^2 I_{t-1} \quad (4)$$

where $I_{t-1} = 1$ if $\varepsilon_{t-1} < 0$

= 0 otherwise

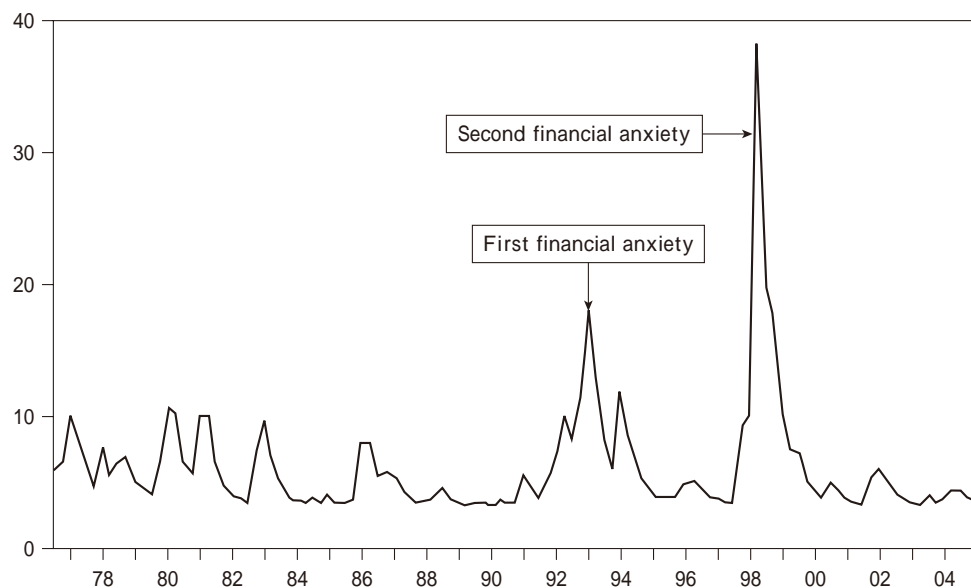


Figure 2. Financial anxieties over the period 1976-2005

In this model, for TARCH effect, the asymmetry term $\gamma > 0$ and the condition for non-negativity will be $\alpha_0 \geq 0$, $\alpha_1 \geq 0$, $\beta \geq 0$ and $\alpha_1 + \gamma \geq 0$. The conditional variance h_t^2 is subject to an impact α_1 from good news ($\varepsilon_{t-1} \geq 0$), while an impact $(\alpha_1 + \gamma)$ from bad news ($\varepsilon_{t-1} < 0$). This kind of asymmetric property corresponds to the situation such that the psychological change of people due to the financial anxieties increases the precautionary demand and that an easy financial position does not rise the precautionary demand.

Estimation results are shown in Table 3. The sign of all parameters seem to be reasonable in economic sense. Since a rise of DT_all_t implies easy financial position and a decrease of $crate_t$ means that of interest rate, $\beta_1 + \beta_2$ should take a negative value. The parameter γ of $\varepsilon_{t-1}^2 I_{t-1}$ takes a positive value and hence the conditional variance is shown to exhibit asymmetric property, though the significance levels of some parameters are not sufficient. Figure 2 depicts the behavior of h_{t-1}^2 as a variable of financial anxieties.

Anxieties variable denoted by $DV_t (= h_t^2)$ is seen to rise at first from 1992 to 1994 (the first financial anxiety in Japan), when small credit unions and cooperative failed because of an increase in the nonperformed loan caused by the rapid decline of stock and land prices after the bust of the bubble. The Japanese economy began to show the modest recovery in late 1995, when real GDP began to increase and the official estimation of NPLs decreased¹⁾. The Ministry of Finance had issued a report entitled “Reorganizing the Japanese Financial system (kinyu shisutemu no kinoukaifuku nituite)” in June 1995, in which they showed diehard attitude to tackle with the NPLs problems by officially disclosing the magnitude of bad loans totaled 40 trillion yen (about 4 percent of the loans held by depository institutions).

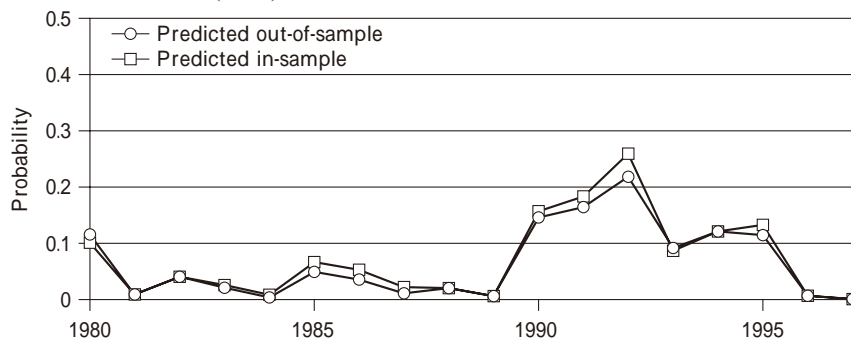
Furthermore MOF had strongly pledged the complete deposit guarantee by March

2001, the reform of the Deposit Insurance Corporation and Prompt Corrective Act, which had been already implemented with a success in the United States in 1991 after the financial crisis in the end of 1980s. As a result the financial anxieties had been dispelled in 1995.

However, the economy sharply decline in 1997 when Prime Minister Ryutaro Hashimoto had declared the rise of the consumption tax from 3 to 5 percent and the end of temporary income tax cut. Hokkaido Takushoku, one of the biggest banks and Yamaichi, one of the Big Four securities had failed in November 1997 (the second financial anxiety in Japan). Japan Premium, which is the additional rate Japanese banks have to pay for raising funds in the international money market, jumped by around 100 basis points. People feel that no financial institute is immune from failure when government took a very negative view to use public funds to help affected banks. People anxieties tremendously increased, as indicated in the rise of DV in 1998.

Then DV rapidly decrease after 1999. The decline can be seen as follows. The Bank of Japan had adopted an aggressive monetary easing policy to reduce the inter-bank money rate to a low level in February 1999. Thanks to this so-called zero interest policy, the uncollateralized overnight call rate was lowered to 0.01 percent and further declined to 0.001 percent when the BOJ had took the so-called quantitative easy policy in March 2001. The Japanese government also decided to inject the public fund to the banking sector; the amounts are 1.8 trillion yen in 1998, 7.8 trillion yen in 1999. The Japan premium which made it difficult for banks to raise funds had disappeared in the international market in 1999. Both efforts of the BOJ and the government had succeeded in dispelling the financial anxiety. Thus, DV rapidly decrease after 1999 when the BOJ began to take an aggressive policy and the government decided to inject public fund to stabilize the financial system.

- 1) Hutchison and McDill (1999) also estimated the financial crisis by using the probit model and got the similar results as ours. Their results indicate that the likelihood of a banking problem sharply rose in 1991, reached at a peak in 1992, and sharply declined after 1993, while it was very small (below 10 percent) until 1990. The following Figure is taken exactly as in Hutchison and McDill (1999).



4. Comparison of Our Results with Kimura and Fujita

Kimura and Fujita (1999) can be treated as a pioneer of quantifying the financial anxieties in Japanese economy using *DI_all* and *rate_all* variables in TARARCH model. Recently some researchers are using this concept in their articles such as H. Hayakawa and E. Maeda (2000). Figure 1 shows the financial anxieties derived by Kimura and Fujita (1999) over the period 1976-1999. This figure shows some contradictory results, which are not consistent with economic condition over that period. During the period of 1988 to 1991 when interest rate was comparatively high and most financial institutions were in easy position, Figure 1 indicates considerably big values of anxiety variable. In contrast with our results no such anxieties appear over this period (Figure 2). A mild financial anxieties during the period 1992 to 1994 and it is the period of 1997 to 1999 when financial anxieties broke out over the economy have been identified well by our results. The first one appears after the bust of bubble of the economy and the later is responsible for the failure of big financial institutions in 1997. Although, the later case (big anxieties) have been produced in Figure 1.

From statistical point of views TARARCH model is only applicable in a situation when the conditional variance shows asymmetric property. In such cases magnitude of the impact of bad news will be larger than that of the impact of good news. Our estimation results support this statement. Kimura and Fujita calculated comparatively large coefficient of ARCH effect in their model (Eq. 2) and this coefficient caused anxieties for good news over the period 1988-1991, when all financial institutions were in easy position. That is, their model cannot explain asymmetric behaviors properly. Also a negative sign is appeared in estimating the coefficient of GARCH effects in their model, which is inconsistent with the non-negativity conditions of TARARCH model.

Using nonstationary variable in their model may be responsible for these contradictory results. Because we have seen that the variables *DI_all* and *rate_all*, which have been used in Kimura and Fujita (1999), are nonstationary (Table 1). So far as we know there is no evidence to apply nonstationary variables in TARARCH model. Recently published text books (such as Hamilton, 1994) and different manuals of statistical software (such as MatLab, version 7.0, 2004) indicate to apply stationary series in the ARCH type models. Granger and Newbold (1974) state that if the time series involved are nonstationary, naive application of regression analysis may yield nonsense results. One should therefore be very cautious when conducting standard analysis using time series.

Whereas, the magnitude and non-negativity conditions in estimating our TARARCH model is valid in statistical sense and our estimation can exhibit the financial anxieties explicitly over the economy, which is consistent with economic views.

5. Financial Anxieties for Small Enterprises

Because any TARCh analysis has some tentative nature, it is important to examine several alternative frameworks and check robustness in some detail. We use another set of Diffusion index variables for small enterprises. *DI_small* and *crate_small* denotes the financial position and change in interest rate on loan for small enterprises respectively over the period 1983Q3-2004Q4. Unit roots tests in Table 1 shows that at 5% level of significance *DI_small* is nonstationary while *crate_small* is stationary process. Then we have used the first difference form of *DI_small* and the level *crate_small* in the same TARCh model used above (in Equation 3 and 4), and have quantified the financial anxieties. Estimation results are shown in Table 4 and financial anxieties for both cases (small and all enterprises) are depicted in Figure 3 for comparison.

Parameter estimation and statistical inference of TARCh model for small enterprises are almost same as the TARCh model for all enterprises. Sign of all parameters are consistent with statistical and economic point of views and also the magnitude of the impact of bad news is larger than the impact of good news, which implies asymmetric variance property.

Figure 3 shows anxieties due to small enterprises over 1983Q3-2004Q4 and all enterprises over the period 1976Q3-2005Q1. Over the common period, both show a little amount of anxieties from 1992 to 1994 and a big amount of anxieties after 1997, which reduce rapidly after 1999. Although the pattern of anxieties is similar for both cases, the magnitude due to small enterprises is somewhat lower than that of all enterprises for its sensitivity. The reason for this is that the public financial institution expanded the loan to the small enterprises in response to the credit crunch at the private bank.

The private banks contracted their lending as shown in Figure 4, because they have to raise the capital-asset ratio to meet the international standard, imposed by Bank for International Settlement, so called capital adequacy standards. On the contrary, the People's Finance Corporation (Kokumin Seikatsu Kin-yu Koko) and the Japan Finance Corporation for Small Business (Chusho Kigyo Kin-yu Koko) had taken the aggressive lending policy in 1998, which are shown in Figure 5. The credit crunch at the private banks is shown in Figure 4. The policy, which the government took, can be thought as a kind of social policy, not as economic policy in the meaning that the government helped the small business by the public funds. We also have the same reason to explain the difference of anxieties between all enterprises and small enterprises from 1992 to 1994, though we do not show the figures.

Table 4. Estimation of TARCh model for small enterprises (1983Q2-2004Q4)

	Coefficient	Std. Error	z-Statistic	Prob.
β_0	0.242461	0.209155	1.159238	0.2464
β_1	0.016253	0.010879	1.494036	0.1352
β_2	-0.025446	0.009836	-2.587094	0.0097
Variance Equation				
α_0	1.695004	0.877359	1.931938	0.0534
α_1	0.062633	0.169156	0.370254	0.7112
γ	0.282733	0.312626	0.904381	0.3658
β	0.384934	0.259662	1.482442	0.1382

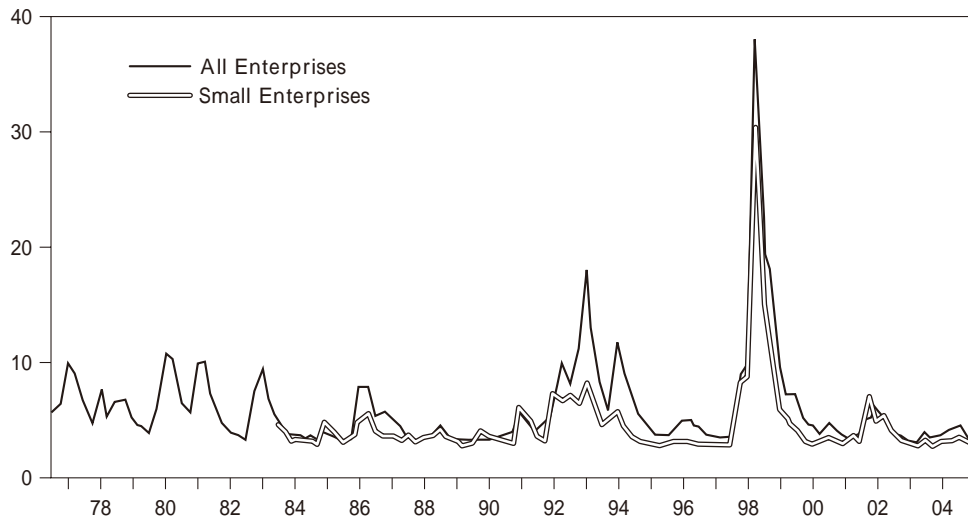
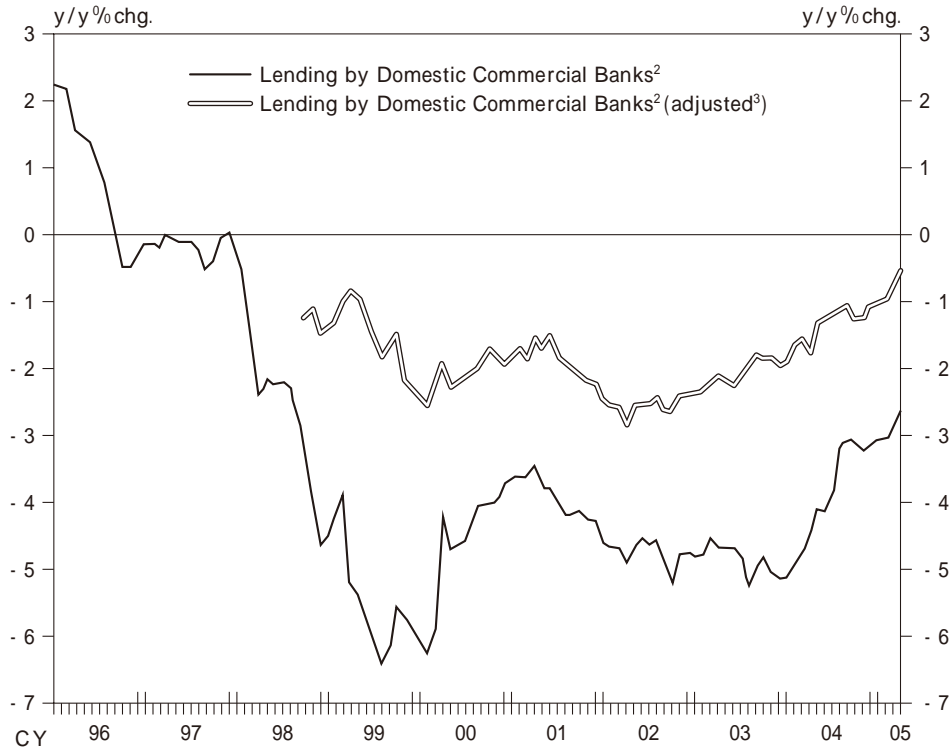


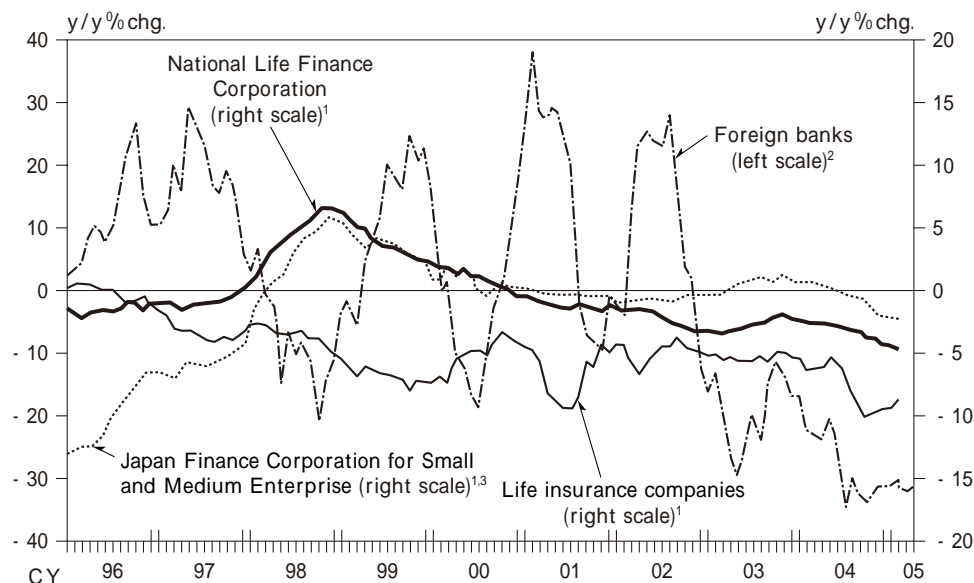
Figure 3. Financial anxieties according to all and small enterprises

**Notes**

1. Percent changes in average amounts outstanding from a year earlier.
2. "Domestic commercial banks" refers to city banks, regional banks, regional banks II.
3. Adjusted to exclude
 - (a) fluctuations due to the liquidation of loans,
 - (b) fluctuations in the yen value of foreign currency-denominated loans due to changes in exchange rates,
 - (c) fluctuations due to loan write-offs,
 - (d) the transfer of loans to the former Japan National Railways Settlement Corporation to the General Account, and
 - (e) the transfer of loans to the former Housing Loan Administration Corporation to the Resolution and Collection Corporation.

Source: Bank of Japan, "Principal Figures of Financial Institutions."

Figure 4. Lending by domestic commercial banks



Notes: 1. Data are based on amounts outstanding at end of period. 2. Data are based on average amounts outstanding. 3. Figures from July 2004 are adjusted to exclude the effects from the succession of the credit insurance accounts of the former Japan Small and Medium Enterprise Corporation.

Source: Bank of Japan, "Financial and Economic Statistics Monthly"; Japan Finance Corporation for Small and Medium Enterprise, "Gyomu Gaikyo (Business Outline)."

Figure 5. Lending by other financial institutions

6. Conclusion

We have examined the time series properties of two economic variables, financial position and cumulative change in interest rate on loan of all enterprises, used in the article of Kimura and Fujita (1999) to quantify the financial anxieties over the Japanese economy. It has been investigated that both variables contain unit roots and hence we have recalculated the financial anxieties under a valid statistical framework. We used first difference form of nonstationary 'financial position' and level form of stationary 'change in interest rate' variables in TARCh model over the period 1976-2005 and have quantified the conditional variances of the residual as financial anxieties. We have also calculated the anxieties due to small enterprises. Over the economy, both cases (all as well as small enterprises) have identified a mild financial anxiety from 1992 to 1994 and a lot of financial anxieties after 1997, which rapidly disappeared after 1999. The first one appears after the bust of bubble of the economy and the later is responsible for the failure of big financial institutions in 1997, which are explained in the previous sections in this article.

In contrast, Kimura and Fujita have shown unexpected anxieties during the period 1988 to 1991, which does not bear any economic meaning over that period. It was the period when interest rate was comparatively high and most of the financial institutions were in stable position. They calculated comparatively large coefficient of ARCH effect in

the model and this coefficient caused anxieties for good news over that period. That is, their model cannot explain asymmetric properties properly. Also a negative sign is appeared in estimating the coefficient of GARCH effects in their model, which is inconsistent with the non-negativity condition of TARCH model. Using nonstationary variable in their model may be responsible for these contradictory results. Whereas the magnitude and non-negativity conditions in estimating our TARCH model is valid in statistical sense and our estimation can exhibit the financial anxieties explicitly over the economy, which is consistent with economic views.

These financial anxieties may have caused both firms and household to increase the precautionary demand for money especially in 1998. Although our earlier paper (Miyagawa and Morita (2004)) considered the money demand function, financial anxieties used there was the same as Kimura's one. In this paper, we have reconstructed financial anxieties and by using these new financial anxieties we analyzed the money demand function and the result is being prepared for publication.

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