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Review of Fluctuations in Land and Stock Prices in the Japanese Economy

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Abstracts

This paper attempts to shed light on whether innovations in stock and land prices have contributed to fluctuations in the Japanese economy. From a simple VAR model, the results suggest that land and stock prices are related to movements in real GDP, CPI, and the interest rate. Specifically, we find that shocks to the stock price have more immediate impact on real GDP. Shocks to the land price, which are strongly correlated to the stock market as a risk factor, have significant impacts on CPI even under the zero interest rate commitment. After the bubble burst, both prices were not found to have a significant interaction with interest rate.

KRF Classification : B031003
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Ⅰ. Introduction

A notable feature of the Japanese economy in the last two decades is the large fluctuations in asset prices. The asset price boom occurred in the late 1980s, followed by the collapse in the

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1990s. Stone and Ziemba (1993) reported that the land price index increased from 2.4% in 1985 to 21.7% in 1988 for all types of land and exceeded the previous high of 10% in 1980. Meanwhile, the Japanese stock market was valued at about 4 trillion dollars, which was approximately 44% of the world's equity market capitalization at its peak in December 1989. However, from December 1989 to August 1992, the stock value and subsequently the land value fell by a similar amount due to previous increases. The stagnation in output in the first half of the 1990s and the deflation in prices in the mid-1990s caused the Japanese economy to shrink. The economy fell into a state of low growth, falling prices, and chronic banking crisis for more than a decade, which Hayashi and Prescott (2002) named as the lost decade.

The stock and land prices are of particular interest in the Japanese economy because they play an active role in the aggregate economic activity. Kwon (1998) argued that land has served as a primary collateral in the investment financing of Japanese corporations. Ito and Harada (2000) showed that the stock price reflects the Japanese structural problems such as the bank failures, and verified that it Granger-causes the Japan premium, but the reverse does not hold. However, previous studies have mainly focused on verifying a set of models to explain the asset price fluctuations and analyzing the sources of these fluctuations. Ueda (2000) concluded that the main cause of the banking crisis was the speculative real estate-related lending of the 1980s, which turned bad when (urban) land prices plummeted in the 1990s. Shiratsuka (2005) found that financial instability is closely related to large fluctuations in the asset prices. Nakajima (2008) found that a stochastic growth model with habit persistence, capital adjustment, and adaptive expectations about future productivity growth can reproduce the aggregate land price.[1]

Azeez, Yonezawa, and Herath (2006) found that land price was a significant risk factor affecting Japanese bank stock returns by providing estimated coefficients from a multifactor APT model.

The objective of this paper is to understand how the fluctuations in the land and stock prices have interacted with the aggregate economy in the Japanese economy last two decades. Using Japanese data for 113 quarters, this paper attempts to examine a set of structural shocks to interest rate, real GDP, CPI, the land price, and the stock price. Specifically, this paper focuses on how long impact each price factor has been persistent on interest rate, real GDP, and CPI which describe the Japanese (aggregate) economy. Following other research, we employ a simple VAR model with five different systems to provide variance decompositions and impulse responses functions as the basis of our assessment.

This paper finds a significant effect of fluctuations in the stock and land prices on the interest rate, real GDP, and CPI. Specifically, we see that the responses of the interest rate were more affected by the disturbances of the stock price.[2)] At 5-year horizons, the fluctuations of the stock price explained 33.75% of the forecast error variance of the interest rate, whereas the land price explained 7.51%. The fluctuations of the stock price also have a more related to real GDP than those on the land price. For instance, at 5-year horizons, the disturbances in the land price accounted for 3.66% of the variation in real GDP, but more than

1) He left the stock price fluctuations' a puzzle.

2) Usually the BOJ has not considered the fluctuations of asset prices when they decide their target rate. Also, since the low interest rate has been blamed for large fluctuations in asset prices, it would be reliable to observe the responses of the asset prices according to the movement of interest rate. However, since the Japanese experience indicates that macroeconomic instability is closely related to large fluctuations in asset prices, we purposely derive the impact of fluctuations in the asset prices on the interest rate.

57% of the forecast error variance of real GDP is attributed to shocks in the stock price at the same year horizon. These results imply that the responses of the interest rate and real GDP were more immediate responsive to shocks of the stock price, and it corresponds to the behaviors of the time series data during the sample period. Figure 1 shows that the stock price started to grow and subsequently collapse faster than the land price over the sample period, and these differences reflect on the responses of the interest rate and real GDP. The innovations of CPI, however, were more related to variations in the land price. While the fluctuations of the stock price explained 9.82% of the forecast error variance of the CPI in the 4-year horizons, the land price explained 32.04%.

This result is supported by the evidence from the post-bubble period. After the Japanese bubble burst, the Bank of Japan (BOJ) has mainly functioned with the zero interest rate commitment. Due to this strong commitment by the BOJ, innovations in both the land and stock prices could not have significant impacts on interest rate during the post-bubble period. However, regardless of this restriction, the shock to the land price explained more than 50% of the forecast error variance of the CPI in the 5-year horizons, whereas the stock price innovations explained only 4.03% of variation in the CPI at the same period.

We also found that the land price, which functions as a risk factor in the stock market,[3] was more sensitive to the fluctuations of the stock price. While most of the stock price variations were accounted for by the stock price, more than 50% of the disturbances were attributed to the stock price from 4-year to 5-year horizons. It leads us to conclude that the fluctuations of the stock and land prices play a correlatively important role in the

3) see Braun and Shioji (2003) and Shiratsuka (2005) for more details.

Japanese economy.

The remainder of this paper is organized as follows. Section II discusses a VAR model, and the description of the data is summarized in Section III. Section IV presents the results. The last section provides concluding remarks.

II. Model

This paper applies a simple VAR (vector auto-regression) model in order to examine the dynamics among macroeconomic variables. VAR models, following Sims (1980), have gained its popularity due to the following reasons. First, by using a VAR model, we can test whether a particular variable with various lags jointly affect another variable. Since we could detect evidence that a particular variable is closely related to other variables, such information leads us to understand an economic linkage between variables. In addition, by employing an impulse response analysis, we can examine how the system reacts to a random shock to a particular economic variable. Finally, the decomposition of forecast error variance provides useful information about the relative importance of variables in generating the fluctuations of each variable.

Specifically, the economy is approximated by a system of linear equations, which is composed of macroeconomic variables: real GDP (GDP), CPI (CPI), interest rate (INTEREST), land price (LAND), and stock price (NIKKEI). Let Y_t denote a vector containing the values that the variables of interest assume at date t. Then, a reduced-form of the model is written in a very general representation,

$$Y_t = A_0 + \sum_{k=1}^{p} A_k Y_{t-k} + e_t$$

and it implies that Y_i is a linear combination of the current and past innovations. The innovation e_t has an unobservable zero mean white noise process with a time invariant positive definite variance covariance matrix Σ in correlation form. Y_i is a vector of n variables to be specified later, A_0 is an $n \times 1$ vector of constant terms, A_k is an $n \times n$ matrix of coefficients, e_t is an $n \times 1$ vector of error terms, and p is the order of autoregression. We set the number of lags as 4, based on Akaike information criterion.

Once a model is estimated, we generate variance decompositions and impulse response functions as the basis for our inferences. Variance decompositions partition the fluctuations in a variable of interest to shocks in other variables in the system including its own shocks. Thus, they provide measures of the relative importance of the shocks in explaining the concerned variable. Meanwhile, the impulse-response functions capture the directions, magnitudes and persistence of variable responses to impulses exerted to the system.

One concern about the model is that innovations[4] are contemporaneously correlated. This means that a shock in one variable may work through the contemporaneous correlation with innovations in other variables. Since isolated shocks to individual variables cannot be identified due to contemporaneous correlation, the responses of a variable to innovations in another cannot be adequately represented (Lutkepohl, 1991). To solve this identification problem, Sims (1980) suggested an empirical strategy

4) We use innovation as a same terminology with shock.

that orthogonalizes the innovations using the so-called Cholesky factorization.[5] Cholesky uses the inverse of the Cholesky factor of the residual covariance matrix to orthogonalize the impulses.

A general guideline in ordering variables is the most exogenous variables are placed first and variables with the most responsive to shocks to variables are placed last. Note that given the nature of the Cholesky factorization results from impulse response functions may be sensitive to the ordering of the variables in the decomposition. We also need to note that the interactions between the stock/land prices and other aggregate variables are of interest. In this paper, we use the following Cholesky ordering: the stock price, GDP, the land price, CPI, interest rate based on the analysis of Granger Causality test at the 5% significance level. It implies that the stock price is the most exogenous and the movements of GDP, CPI, interest rate, and the land price would be sensitive to a shock to the stock price.

Ⅲ. Data

This paper employs a set of quarterly data over the period between 1980:1Q and 2008:1Q. This period is divided into two sub-periods: the bubble period (1971-1990) and the post-bubble period (1991-2007). Table 1 lists the macroeconomic variables that were used in the model.

For a measure of the short-term interest rate (INTEREST) we used collateralized money market values obtained from the *TANKAN* database of the Bank of Japan.[6] Real GDP and price

5) We need to note that the alternative of the recursive Cholesky orthogonalization is to impose enough restrictions to identify the orthogonal (structural) components of the error terms.

6) The Bank of Japan (BOJ) now officially announces that the overnight call

series, seasonally adjusted by using the Census X12 ARIMA method, were conventionally measured by the log of real GDP and the log of CPI, respectively. The real GDP series was also obtained from the TANKAN database, but the price series was taken from the *IFS* database of the Bank of Japan. As can be observed in Figure 1, the Japanese economy fell into a state of low growth and falling prices for more than a decade since 1990, a period corresponding to the lost decade. During this period, slow growth was accompanied by disinflation in the early 1990s, and deflation since the mid-1990s.

[Table 1] As the data on commercial land price are only available monthly, this series is interpolated quarterly to maintain consistency with other macroeconomic variables.

Symbol	Explanation Measurement	Meansurement	Mean	SD
GDP	Real GDP	ln(GDPt)	18.47	0.24
CPI	Consumer Price Index (2000=100)	ln(CPIt)	4.53	0.08
INT	short-term overnight call rate	%	3.19	3.22
LAND	commercial land price	ln(LANDt/CPIt)	2.36	0.31
NIKK	EI NIKKEI 225	ln(STOCKt/CPIt)	5.09	0.39

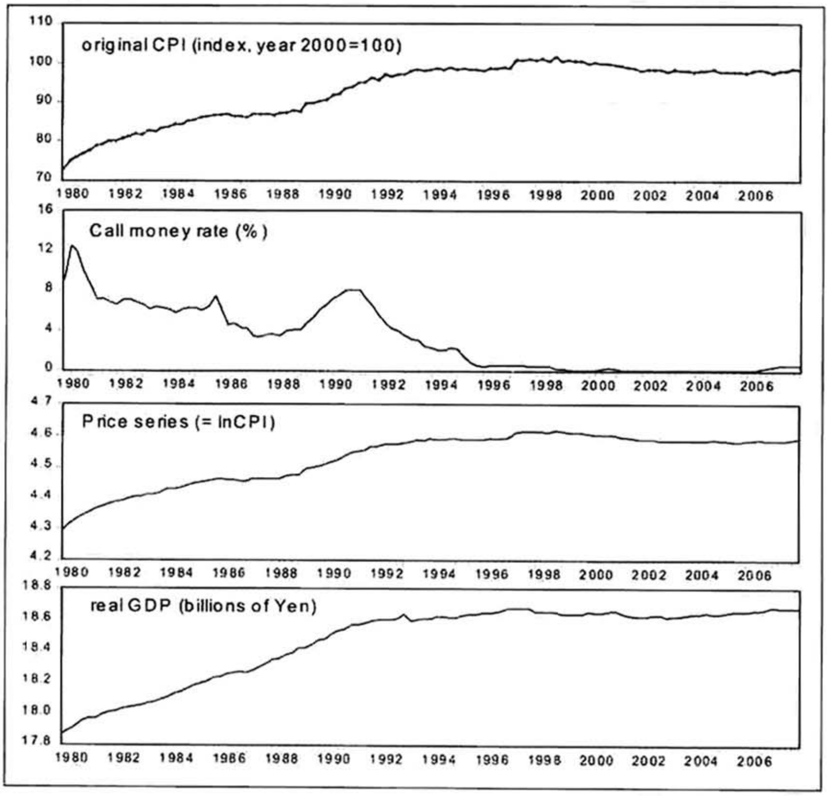
The seasonally adjusted land price was derived by using a log deviation from CPI.[7] The data on the land price are obtained from *Chika Koji Yoran* (Benchmark Land Price Survey) which is published by *Kokudocho* (National Land Agency; currently a part of Ministry of Land, Infrastructure and Transportation). The *Kokudocho* releases the land price indexes of city areas, which are classified

rate is its operating target. Not until the late 1990s did the BOJ disclose how it implemented monetary policy. Nevertheless, there have been economists who have argued that the BOJ always attempted to control the overnight call rate. See, for example, Ueda (1993) and Yoshikawa (1995).

7) One of my referees suggests to employ a VECM (vector error correlation model), which circumvents the problem of cointegration between land and stock prices, as an alternative of a simple VAR model. This paper reserves this alternative model for a future study.

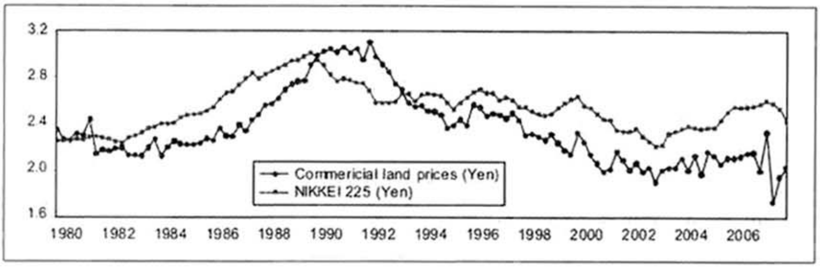
by three purposes of use: commercial, industrial, and residential. But, this paper utilizes the land price index for the commercial area. Since the land price series are available only monthly, the data are interpolated quarterly to maintain consistency with other macroeconomic variables. An alternative official survey of land price is available from the web of the Japanese Real Estate Institute (JREI), but the frequency of the data is annual.

【Figure 1】 Economic environment from 1980:Q1 to 2008:Q1



Data on the Japanese stock price series were obtained from the various issues of *Nikkei Business Database*. The stock price was also calculated by using a log deviation from CPI. The behaviors of the stock prices, as illustrated in Figure 2, are largely similar with the land price over the period (in particular, prior to 1987). Both increased in the late 80s and decreased in the 90s. However, there are some notable differences. First, the stock price started to grow earlier than the land price. The increase in the stock price started as early as in 1983. Second, the stock price collapsed earlier: the stock price show a sharp decline in 1990, while the real estate price started to decline in 1992.

【Figure 2】 Land-Stock prices from 1980:Q1 to 2008:Q1



The stock price shows a rapid rise in the 1980s. The average volume of trade during the late 1980s frequently exceeded one billion shares a day because the ascent in the stock price has led more firms and individuals to trade on the stock market. The land price had escalated nationwide from the mid-1980s to the early 1990s during the period of the bubble economy. The rise in the land price picked up its speed in 1986 and 1993, first in urban business districts and then gradually spreading outwards.

Note the correspondence between the asset price fluctuations and the real GDP and price series. The stable asset prices in the early 1980s corresponds to the stagnant productivity growth in that period; the rise in asset prices in the middle and late 1980s matches the fast productivity growth in that period; the decline in asset prices in the 1990s parallels the stagnant growth in the same period.

Ⅳ. Results

This section provides a series of impulse response functions and variance decompositions as the basis for assessing interactions of the stock and land prices with the real GDP, inflation, and the interest rate which can be used to explain the Japanese economy.

1. Sources of fluctuations: Do stock and land prices matter?

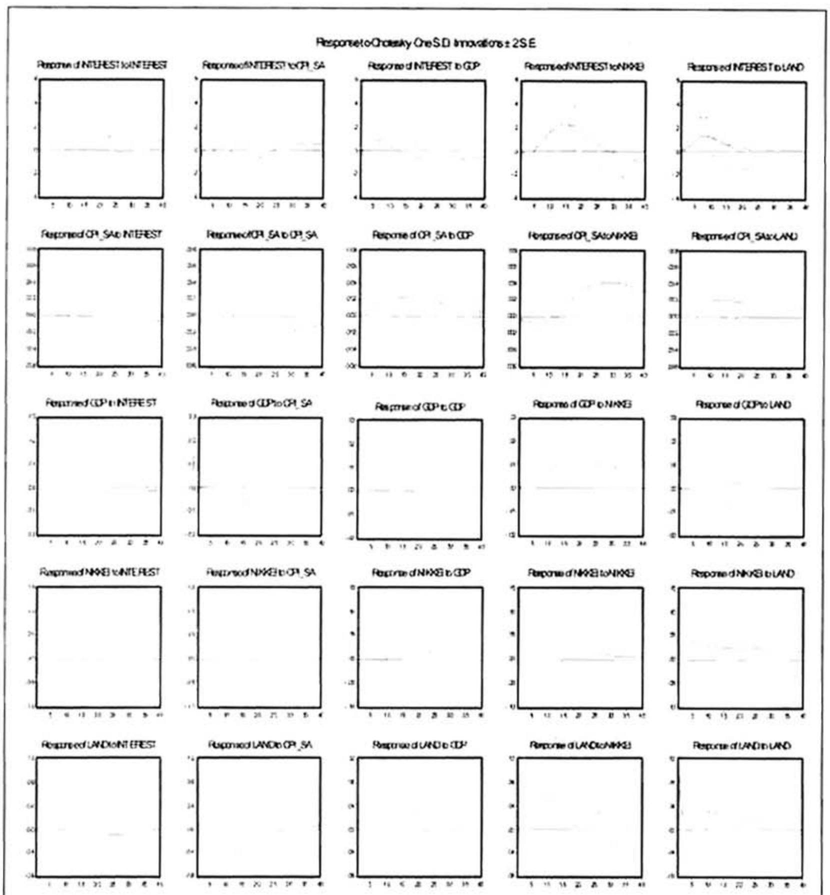
Figure 3 depicts the impulse responses to a shock to each variable over a 20-quarter time span.[8] The two right-most panels display the responses of the interest rate, CPI, real GDP, the land price, and the stock price to each and their own shocks. They indicate that shocks to the land/stock price lead to an increase in the interest rate. However, a shock to the stock price lasted for 20 quarters while a shock to the land price disappeared after 20 quarters. For the responses of real GDP, we can find similar results. Both shocks show statistically significant positive impacts on the interest rate and real GDP, but the influences of the stock price was more persistent. The magnitude of the responses both in the interest rate and real GDP to the stock price shock exhibit larger increases, compared to an increase according to the land price shock. Compared to the responses of interest rate and real GDP to the land/stock shock, the influences of the land/stock price to CPI were more persistent.

These results are further supported by the variance decompositions of real GDP, CPI, and interest rate over 5 years (20 quarters), respectively, presented in Tables 3-7. The tables

8) The response functions are plotted together with two standard deviations bands. Generally stated, if the bands do not encompass zero, then the responses are said to be significantly different from zero.

report the proportion of the movements in each sequence due to its own shock and the shocks to other variables. If the shocks to land and/or stock price explain none of the forecast error variance in the sequences of real GDP, CPI, and the interest rate during all forecast horizons, these sequences are said to be exogenous. Overall, all variables were responsive to their own shocks, but they became less sensitive to their own shocks toward the end of the periods.

[Figure 3] Impulse-response functions from 1980:Q1 to 2008:Q1. Note that each response is plotted over the sample periods with two standard error bands.



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by 81.83% of its own disturbances in the first year and 59.55% at 2-year period. However, from the 3-year horizons, the disturbances in the land price have the most significant explanatory power in accounting for variations in CPI. More than 27% of the forecast error variance of CPI can be explained by the shocks to the land price from 3-year to 5-year periods. Note that the influences of the land price and real GDP, compared to the influences by the stock price are more immediate. Specifically, at 4-year horizon, 32.04% and 21.65% of the fluctuations in CPI were explained by the disturbances in the land price and real GDP, respectively. At the 5-year horizons, CPI was responsive to all fluctuations. The land/stock price, real GDP, and CPI all explained approximately 20% of innovations in CPI.

More interesting results are found between 4-year and 5-year horizons. While the fluctuations of the stock price explained 9.82% in the 4-year horizons, their explanatory power strengthened to 22.01% in the 5-year horizons. During the same period, the fluctuations of the land price explained 32.04% (4-year) and 29.13% (5-year) of the forecast error variance in CPI. It implies that fluctuations by both prices have a significant impact on aggregate variables, but the disturbances of the land price have more immediate influences on variations of the CPI series.

【Table 4】 Variance Decomposition of CPI series (CPI)

	Explained by Innovations in				
Period	INTEREST	CPI	GDP	NIKKEI	LAND
4	5.22	81.83	5.63	5.78	1.53
8	5.79	59.55	11.44	6.82	16.40
12	4.21	44.85	17.75	5.22	27.96
16	3.13	33.35	21.65	9.82	32.04
20	2.42	25.02	21.42	22.01	29.13

Interest rate

Table 5 indicates that the interest rate is also the most responsive to its own disturbances. Up to 5-year horizons, more than 47% error variances of the interest rate can be explained by its own disturbances. These results correspond to the general idea that the low interest rate caused the escalation of the asset prices in the 1980s. The most notable influence, however, is the stock price. More than 15% of the forecast error variance of the interest rate was attributed to shocks in the stock price from 3-year to 5-year horizons. Note that the land price innovations explained less than 7% at the same year horizons.

Our observations imply that influences by the stock price played a more immediate and persistent role in accounting for fluctuations in real GDP and the interest rate, whereas influences by the land price played a significant role in accounting for variations in CPI over the same period.

[Table 5] Variance Decomposition of short-term call rate (INTEREST)

	Explained by Innovations in				
Period	INTEREST	CPI	GDP	NIKKEI	LAND
4	95.22	1.90	1.41	0.16	1.31
8	83.98	2.01	3.75	3.02	7.24
12	65.50	5.54	3.18	15.84	9.94
16	53.28	7.77	2.70	27.75	8.50
20	47.62	8.08	3.04	33.75	7.51

2. Correlated Land and Stock price

In practice, it is difficult to separate one factor as the key functional one which has a strong effect on the economy, because the land and stock price may play a correlatively important role. The dramatic rise and fall of land prices in the 1980s and beginning of the 1990s may have affected bank lending, possibly due to the collateral value of land held by borrowers and the risk-taking capacity of the Japanese banking industry. Ogawa and Kitasaka (2000) presented empirical evidence that land plays an active role as collateral in loan contracts of banks. Accordingly, high stock prices may have resulted from a high land price. Ziemba (1991) previously showed that the stock market level is closely related to commercial land prices and the correlation between these biannual series up to 1988 is over 99%.

【Table 6】 Variance Decomposition of stock price (NIKKEI)

	Explained by Innovations in				
Period	INTEREST	CPI	GDP	NIKKEI	LAND
4	1.29	6.32	1.58	86.81	4.01
8	3.81	6.98	0.88	82.67	5.66
12	4.41	6.54	0.70	83.01	5.34
16	4.41	6.02	0.74	83.42	5.40
20	4.38	5.69	0.89	83.26	5.79

【Table 7】 Variance Decomposition of land price (LAND)

	Explained by Innovations in				
Period	INTEREST	CPI	GDP	NIKKEI	LAND
4	0.84	0.37	5.24	10.80	82.76
8	1.13	2.03	6.01	28.74	62.09
12	1.03	4.28	4.69	44.90	45.10
16	1.63	5.53	3.43	54.97	34.44
20	2.09	5.81	2.77	60.55	28.78

【Table 8】 Variance Decomposition of real GDP in the bubble period

	Explained by Innovations in				
Period	INTEREST	CPI	GDP	NIKKEI	LAND
4	6.54	28.22	46.37	10.21	8.66
8	7.89	25.57	29.22	27.77	9.54
12	22.27	16.03	28.34	25.84	7.52
20	38.86	7.67	22.21	12.22	19.03

The collapse in the land price in the 1990s has been cited as a major cause of the bad loan problem, which also influenced the stock price.[9] Ogawa and Kitasaka (1993) insisted that real investment activities by Japanese firms strongly depend on the land price. Japanese banks also had an influence on the aggregate economic activity by using aggressive bank lending with high collateral values of land during the second half of 1980s. About 45% of total secured bank loans have been collateralized by land, whereas only about 3% have been backed by stocks and bonds.

Kiyotaki and Moore (1997) derived the following procyclical deterministic dynamics of asset prices: a productivity shock pushes up the output so that the demand for land will increase. As the land price goes up, the debt and investment of firms also increase because firms are able to borrow more capital by using real estate as the collateral value. As the stock price of the firm is associated with the value of the real estate held by the firm, stock prices also go up with land prices. But this mechanism does not continue forever. When asset prices become unrealistically high, the price effect reduces the demand for land/stock. When land price begins to go down, the multiplier effect works in the opposite downward direction; as the asset price goes down, corporate debt and investments decline, which severely affects the whole economy. This was the Japanese situation that prevailed from the late 1980s to the early 1990s in which the collateral value of land played a major role in bank lending. Therefore, we could expect a strong positive relationship between stock price and land price.

Figure 3 confirms that the responses of the stock price exhibit the largest increase according to a shock to the stock price, compared to small responses of other variables. However, the

9) A series of studies on the real estate finance problem have explored the effects of falling asset prices on bank lending (e.g. Ito 1983; Bernanke 1995).

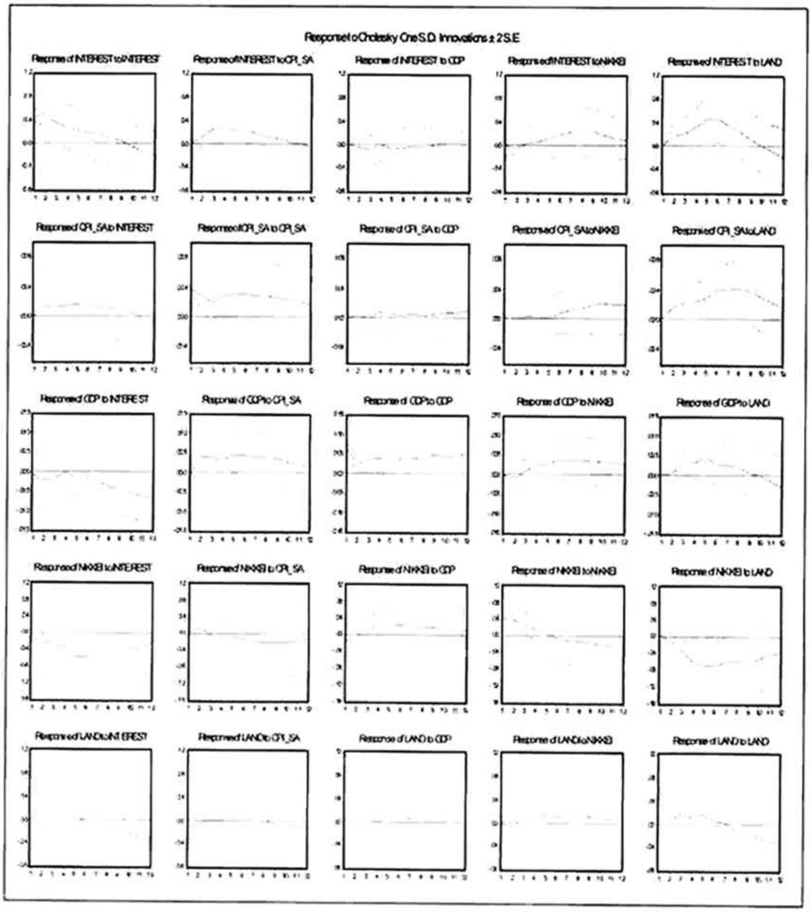
responses of the land price display a significantly persistent increase according to a shock to the stock price, compared to the responses to movements in the land price.

Tables 6 and 7 are also consistent with the argument that there is a good reason to believe a correlation between the land and stock prices. Most of the stock price variations are accounted for by the stock price, more than 80% during up to 5-year horizons. Interestingly, however, Table 7 shows that variations of the land price are mostly accounted for by the stock price, more than 50% from 4-year to 5-year horizons. To be more specific, 60.55% of the forecast error variance of the land price was attributed to shocks in the stock price in the 5-year horizons, whereas the land price innovations explained only 28.78% at the same year. It implies that the land price is more sensitive to the movement of the stock price.

3. Bubble period vs post-bubble period

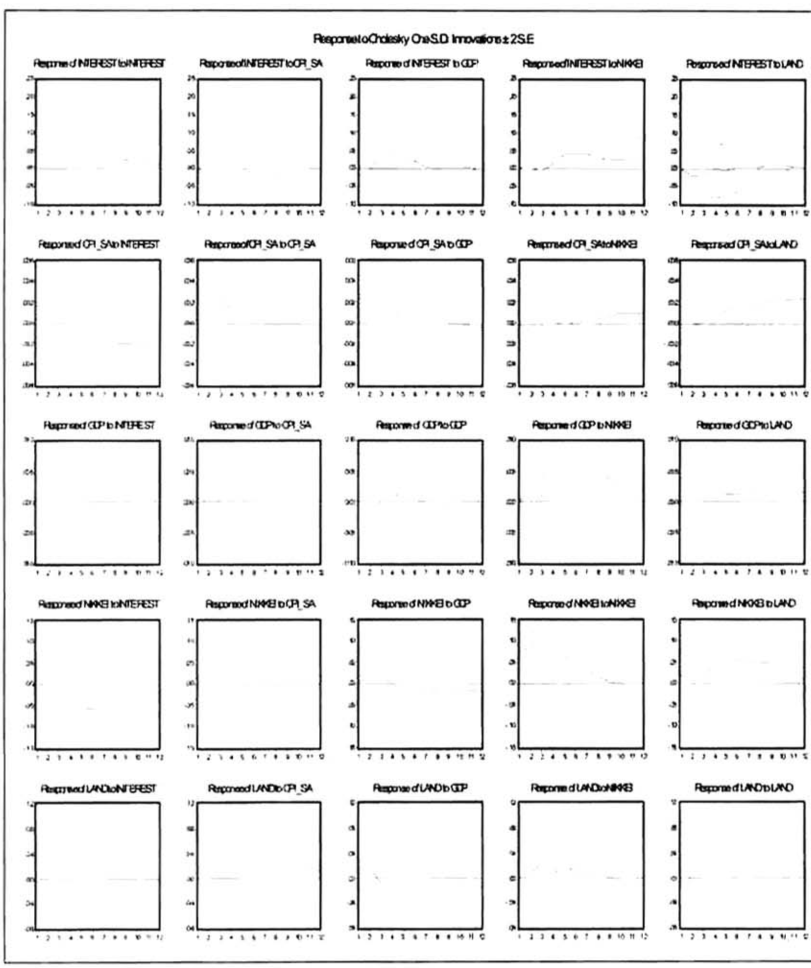
An interesting feature of the Japanese economy in the last two decades is the large fluctuations in the asset prices. Specifically, Figure 2 shows that the asset price(s) boom occurred in the late 1980s, followed by the collapse in the 1990s. A look back over Japan's experience in the 1980s and 1990s shows that the emergence and bursting of the bubble played an important role in economic fluctuations in this period. This experience clearly indicates that macroeconomic instability is closely related to large fluctuations in the asset prices. The increase of the asset prices in the late 1980s occurred in the context of the excessively optimistic expectations that the trend of the increasing asset price would be sustainable. In reality however, the stock and land prices consistently declined in the early 1990s. These observations are reflected in Table 2 for two different periods: the bubble period (from 1980:Q1 to 1991:Q4) and the post-bubble period (1992:Q1 to 2008:Q1), respectively.

[Figure 4] Impulse-response functions from 1980:Q1 to 1991:Q4. Note that each response is plotted over the sample periods with two standard error bands.



The two right-most panels of Figure 4 and 5 do display that the effects by the land and stock prices on real GDP were significant at the time of the bubble period because the magnitude of responses at the bubble period depict a bigger increase. The positive responses of CPI to a shock to the land price were significant at both periods, whereas the responses to the stock innovations were more significant at the bubble period. As explained before, the responses of the interest rate to shocks to both prices displayed more significant magnitudes at the bubble period. The responses of interest to the land price innovations have much smaller magnitude at the post-bubble period, especially compared to the responses at the bubble period.

【Figure 5】 Impulse-response functions from 1992:Q1 to 2008:Q1. Note that each response is plotted over the sample periods with two standard error bands.



We can also find that shocks to the asset prices can explain the proportion of the movements in each sequence due to its own shock and the shocks to other variables by the analysis of variance decompositions. Tables 8-10 present variance decompositions of real GDP, CPI, and the interest rate over 5 years (20 quarters) for the bubble period, while Tables 11-13 report variance decompositions for the post-bubble period.

【Table 9】 Variance Decomposition of CPI series in the bubble period

	Explained by Innovations in				
Period	INTEREST	CPI	GDP	NIKKEI	LAND
4	11.18	63.03	1.94	6.48	17.36
8	8.18	45.95	1.33	14.36	30.18
12	5.98	39.13	1.98	24.48	28.43
20	19.27	27.48	5.45	20.09	27.72

【Table 10】 Variance Decomposition of call rate in the bubble period

	Explained by Innovations in				
Period	INTEREST	CPI	GDP	NIKKEI	LAND
4	63.45	20.66	0.50	4.17	11.22
8	34.85	17.61	0.77	17.20	29.57
12	33.12	16.09	0.94	21.60	28.25
20	28.78	16.83	0.92	18.85	34.62

【Table 11】 Variance Decomposition of real GDP in the post-bubble period

	Explained by Innovations in				
Period	INTEREST	CPI	GDP	NIKKEI	LAND
4	20.16	0.57	60.08	18.55	0.64
8	26.59	9.26	26.14	35.73	2.29
12	28.29	10.60	22.85	34.47	3.80
20	27.36	10.55	22.62	35.39	4.08

Real GDP

At the time of the bubble period innovations in the land and stock price all played a significant role in accounting for variations in real GDP. Specifically, More than 22% of variations in real GDP were explained by the stock price up to the 5-year horizons, as illustrated in Table 8. 19.03% of the forecast error variance of real GDP is attributed to shocks in the land price in the 5-year horizons. However, at the time of the post-bubble period, most of the real GDP variations are accounted for by the stock price rather than the land price. Table 11 shows that the land price innovations explain only 4.08% of the error variances, whereas the stock price could explain 35.39% of the real GDP variations in the 5-year horizons.

The aggressive lending by collateralizing the land in the late 1980s led to the rapid increase in the stock price and subsequently the land price in the 1990s. The fluctuations to the stock and land price led to an increase in real GDP at the bubble period. Once the bubble burst, the stock price collapsed sharply during the post-bubble period, whereas the land price took a longer time to decline. The rapid fluctuations of the stock price were reflected in real GDP so that innovations of the stock price were more attributed to variations of real GDP.

CPI

The land price was the main source of variations in the CPI series at both periods, while the stock price had a significant influence at the bubble period only. Table 9 indicates that more than 20% of the forecast error variance of CPI was attributed to shocks in the land price even from 1-year to 5-year horizons. The stock price also explained approximately more than 15% of the error variance of the CPI. Compared to the innovations of real GDP and interest rate, both land and stock prices played a significant role in accounting for variations of CPI during the bubble period.[10)]

At the post-bubble period, however, the disturbances in the land price have more explanatory power in accounting for variations in the CPI than those in the land price. Table 12 shows that innovations of the land price explained 50% of the forecast error variance of the CPI, whereas the stock price innovations explained 4.03% only in the 5-year horizons. This result implies that the land price was a main collateral value even after the bubble period.

【Table 12】 Variance Decomposition of CPI series in the post-bubble period

	Explained by Innovations in				
Period	INTEREST	CPI	GDP	NIKKEI	LAND
4	0.90	74.85	13.72	4.54	6.00
8	16.01	41.66	9.76	2.59	29.97
12	23.11	25.33	6.08	4.32	41.17
20	23.36	16.47	6.13	4.03	50.00

【Table 13】 Variance Decomposition of call rate in the post-bubble period

	Explained by Innovations in				
Period	INTEREST	CPI	GDP	NIKKEI	LAND
4	94.23	0.29	4.20	0.36	0.92
8	86.11	1.58	5.00	6.15	1.17
12	83.01	2.97	4.83	7.84	1.35
20	81.03	3.81	5.08	7.97	2.11

Interest rate

Table 9 shows that most of the interest rate variations are accounted for by the stock and land prices in the 5-year horizons. Land price innovation explained 34.62% of the forecast error variance of interest rate and 18.85% of the stock price was attributed to shocks in interest rate in the 5-year horizons.

10) Note that the influences of the land price are more immediate.

During the post-bubble period, however, the disturbances in both prices have no significant explanatory power in accounting for variations in interest rate. Table 12 indicates that the land and stock innovations explain only 7.97% and 2.11%, respectively, of the forecast error variances of the interest rate in the 5-year horizons. Most of the interest rate variations during the post-bubble period are accounted for by own innovations.

These results actually come from the special situation of Japan during the post-bubble period. The Bank of Japan (BOJ) monetary policy has functioned mainly thorough the zero interest rate commitment,[11] roughly defined as the BOJ's promise to keep its policy rate at zero as long as the economy experiences deflation.[12] Due to this strong commitment by the BOJ, innovations in the land and stock prices could not have significant impacts on interest rate during the post-bubble period.

V. Conclusion

This paper has reviewed the implications of asset price fluctuations on Japanese macroeconomic stability by using a VAR model. It was found that real GDP, CPI, and the interest rate are affected by land and stock prices. In particular, real GDP and the interest rate are more responsive to shocks to the stock price, whereas the CPI series is more sensitive to land price shocks. Our work also implies that the innovations of the stock price are very influential to the responses of the land price. This result supports the existing argument that the land price played a risk factor role

11) There was one exception of zero interest commitment for 8 months from August 2000 to March 2001.

12) see Shirakawa (2002), Svensson (2001), and Oda and Okina (2001).

in the financial market because land has served as the primary collateral in the Japanese economy. This paper also demonstrates that both prices could not have a significant impact on interest rate during the post-bubble period due to the zero interest rate commitment, whereas the fluctuations of both prices have significant impacts on the all aggregate variables during the bubble period.

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부동산가와 주가의 변동이 일본경제에 미치는 영향에 대한 고찰

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논문초록

본고는 부동산가와 주가가 일본경제와 연관을 가지고 변동하는지를 고찰하였다. VAR 모형을 이용하여, 부동산가와 주가는 실질GDP, CPI, 이자율과 밀접한 관련을 가지고 움직인다는 사실을 발견하였다. 특히, 주가의 변동은 실질 GDP의 변동에 즉각적인 영향을 미치며, 부동산가의 변동은 일본의 zero interest commitment하에서도 CPI의 변동에 중요한 변수로 작용함을 밝혔다. 또한 부동산가와 주가의 상호연관성도 발견하였다.

그러나 일본경제의 버블이 터진 후에는 두 가격 모두 이자율과는 큰 연관성을 갖지 않는 것으로 나타났다.

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