"Japan's Real Estate Crisis" -What Went Wrong? Why? What lesson can be learned?-

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Abstract

This paper examines the Japanese residential land market in 1972-2006, a two decades of residential land price decline. We find that the problem is not only a slowdown of the population growth but also a huge oversupply in the housing market despite of the prolonged economic stagnation. The problem is high vacancy rate in the housing markets. If it remains higher pace of housing starts in Japan, Japanese residential land prices further decline. We do think that research effort should be focused on determining what policy reform allow the discounted present value of houses (lands) to again grow in a long-run.

1 Introduction

The Japanese housing market in the post-1990s period was less than stellar. The average annual growth rate of nationwide real residential land price was -3.7 percent in the 1992-2006. The comparable figure for the United States was 4.2 percent. The question is why.

A number of hypotheses have emerged: the population growth slowing down, the "lost decade" in the 1992-2001, and the deflation in the 1998-2005. These hypotheses, while possibly relevant for real estate cycles, do not seem capable of accounting for the chronic slump seen ever since the post-1990s. This paper offers a new account of the lost "two" decades based on an asset pricing model.

Krainer, Spiegel, and Yamori (2004) examine the pattern of price depreciation in Japanese land values subsequent to the 1990 stock market crash. While all land values fell heavily, the data indicate that Japanese commercial land values fell much more quickly than residential land values. Using an error-correction specification, they confirm that Japanese land price exhibited faster convergence to steady state values than residential land prices. They then develop an overlapping-generations model with two-sided matching and search to explain this disparity. In the model, when fundamentals decline, the old agents optimally "fish" for high service flow young agents by pricing above average valuation levels. This leads to higher illiquidity and default in times of price decline, as well as price persistence which is increasing in the variance of average service flows. Moreover, Nakamura and Saita (2007) find the cointegration relationships between land price indicators and the discounted present value of land calculated based on the macro -economic fundamentals indicators. They also find that the demographic factor has impacts on real land prices.

Three issues are worth noting. First, long-run equilibrium house (land) prices are determined by the fundamental economic determinants of housing demand, the size of the market, and housing supply. Second, expectations play an important role in determining short-run house price adjustments to long-run equilibrium. Third, the magnitude of the expectations' influence is related to an urban housing market's supply elasticity. The previous literatures do not seem capable of accounting for the housing supply issue and the market's supply elasticity. In particular, the housing supply tends to exceed very much the market demand in a "bubble" period. Furthermore, it seems unbelievable for non-Japanese, but the oversupply in the housing market can be occurred in the long economic stagnation. Economic stimulus measures and monetary policies (zero interest rate policy and ease money policy) have possibilities to cause the excess supply in the housing market. Housing investments may be counted on the enhancement of domestic demands. In our estimation, there may be 8 million vacant housing units in Japan in 2008.

There is a long literature on house price dynamics in US and UK. There is wide consensus that the house price is strong related to its long-run structural vacancy (Wheaton 1990). As summarized by a variant of "stock-flow" approach it takes several years for house prices adjust to equilibrium because of the inefficiency of the housing market (DiPasquale and Wheaton(1992)). Moreover as recently summarized by Cappozza, Hendershott and Mack (CHM.2004) house prices initially adjust by about 52% of the value of the new long-run equilibrium price and that house prices exhibit serial correlation. In such short-run house price adjustments to long-run equilibrium, a housing market's supply elasticity is related to the magnitude of the expectations' influence (Goodman and Thibodeau 2008).

This paper examine the characteristics of residential land price dynamics between 1972 and 2006 in Japan. Following the CHM.2004's approach, to do this we calibrate our 2-stage Error Correction model to the 1972-2006 data and compare our empirical results with US results. This comparison may give a similarity between US house price dynamics and Japan residential land price dynamics. The only puzzle is why Japan residential land price decline was so long subsequent to 1990. We discuss possible rasons for this decline in the conclusion of the paper.

However, the CHM.2004's ECM approach has been recently questioned by Gallin(2006). Our study revise the previous one in three important ways.

First, CHM approach has posited a cointegrating relationship between house prices and "fundamentals" such as such as income, and then estimating an error-correction specification. The "level" of house prices, however, does not appear to have stable long-run equilibrium relationship with the "level" of fundamentals such as income. Gallin(2006, 2008) has questioned that the levels regressions found in the approach are likely spurious, and the associated error-correction models may be inappropriate. Our approach focuse a cointegrating relationship between house prices and their "present discounted values" of future service flows. From the long-run perspective, the equilibrium price a household is willing to pay for a house should be equal to the present discounted value. The level of house prices, empirically, may also appear to have stable long-run equilibrium relationship with the level of the present discounted values.

Second, This study develops a simple "stock-flow" model of house as a variant of the present discounted values of house. As Poterba(1984) shown, the stock-flow approach induces that a house price equals the present value of future net service flow discounted at homeowner's user cost. We construct a log-linear approximation of the equilibrium residential land price based on the stock-flow model using the macro ecnomic fundamentals indicators. It may not cause the problem of the spurious regression between the level of residential land prices and the level of the macro ecnomic fundamentals. Because the log-linear approximation of the equilibrium residential land price enshures the cointegrating relationship between residential land prices and their present discounted values.

Third, apart from the ECM argument, we extend the long-run equilibrium prices as a trends for removing cycles. This study also analyze a relationship between the residential land price cycles and monetary poloccy such as interest rate changes based on VAR. In the VAR analysis, we show the usefulness of the removing trends based on the long-run equilibrium prices

Our contributions are first to offer a new account of the housing stock based on the asset pricing model. Second, to improve the deficiency of the 2-step ECM approach based on CHM.2004. Third, we provided additional evidence on the cause of the Japanese residential land prices deflation in the post-1990s period using the modified 2-step ECM and long historical land price data. Our results are consistent with earlier Japanese estimates but provide additional causes of falling discoutned present values of Japanese residential land in the periods.

The remainder of the paper is organized as follows. In Section2, we start with a brief catalogue of some facts about the residential land price deflation. We then proceed to examine the Japanese residential land market through the perspective of real estate cycle in Section 3. Finally, Section 4 concludes.

2 The Japanese Residential Land Market 1970-2008

We begin with an examination of the JREI (Japan Real Estate Institution) residential land price index for the 1970-2008 period and report the puzzle that are most germane to real estate deflation in the 1990-2007, which abstracts from the fundamental economic determinants of housing demand and supply, expectations, and housing market's supply elasticity. In the next section, we will identify determinants of land price cycles in Japan Economy in 1972-2006.

Poor performance during the post-1990 period

Figure 1 show the "lost decade". Japan's anemic annual growth rate of 0.99% during the period 1992-2001 is a puzzle in view of its spectacular growth performance during the previous three decades. During the last decade period, asset price volatility has been as high as it was during the Great Depression. Table 1 compares Japan stock price volatility and US one in terms of the "panic" which is quantified by identifying as any time when a daily stock closing price fell by at least 10 percent from the highest prevailing close during the preceding 30 calendar days, with no overlapping allowed. Among others, the negative shocks generated by sharp declines in asset prices in the early 1990s have been propagated and amplified by their interaction with the deterioration in the condition of the financial system. The larger decline of the stock prices may reflects that the stock prices might be closely related to the deflation of land price in Japan (Figure 2).

Puzzle on the deflation of residential land price during the post-1990 period

Figure 3 documents Japan's residential land price prolong slump since 1990. As the figure graph shown, Japan's residential land price deflation is something of a puzzle in view of US spectacular inflation of house price during the post-1990 period. It would be hard to deny that, Japan's residential land market experience during the last "two" decades has been quite extraordinary. Figure 4 plots Japan's real residential land prices (1986=100) in 1970-2008. The figure graph reports prices have not returned to their 1986 level. It is more than 20 years long. As can be seen in Figure 5, the ratio of residential land prices to household income has continued to fall since 1990. In contrast, during the previous 20-years period before 1990, the ratio has had no cyclical movement during the current 18-years. In contrasts to residential land prices, prices of final goods and services have been fairly stable in Japan during the post-1990 period. Figure 6 shows such contrast. The average annual rate of change in the general prices is 0.3% and one in the residential land prices is -3%, respectively, during the period 1992-2003. Even if there is little evidence for cointegration of residential land prices and various fundamentals, this does not mean that fundamentals do not affect the residential land prices. The prolong decline in the ratio of residential land prices to household income remains another puzzle.

Possible reasons for the residential land price deflation

The simple idea is that, if the nation's area is constant, the decrease in population leads to the decline in demand for land. In general, the demographic factor may be thought as one of the causes for Japan's residential land price deflation during the post-1990 period. As can be seen in Figure 7, Japan population growth rate has been slower since 1973, although the growth rates had never been declined during the post-1990 period. If the slowdown of the population growth rate was the cause of the residential land price deflation during post-1990 period, then it remains a question. Why land prices had raised so much in continuation of the slowdown of the population growth rate during 1980s? It is difficult to answer the question from the view point of the demographic factor. Thus the demographic factor may be not the only cause of the residential land price deflation during the post-1990 period.

Moreover, it reminds of the paper by Mankiw and Weil, which predicted (based entirely

on demographics) falling real housing prices during the 1990s and 2000s in US. Their argument was: as the Baby Boom cohort reaches retirement, many households will try to trade down (i.e., sell their large house, and buy a smaller house) to support retirement consumption, and, in turn, this will cause real house prices to fall. However, if housing is elastically supplied, it follows that demography should have little, if any, affect on house prices. Further, in this environment housing should always be priced at its reproduction cost, and (in the limit) demographic changes will not have any effect on house prices. So perhaps the real question you are asking is what is the housing supply elasticity in the US versus Japan? Standard urban economic theory has traditionally assumed that both housing and land is perfectly elastically supplied (i.e., the construction market is perfectly competitive, with firms earning zero economic profits). Of course, in practice there are likely to be costs to adjusting the housing stock, which admits the possibility of a link between demography and house prices. Further, these costs are likely to vary from country to country depending on land use controls.

In related to population changes, there are long-term Kuznets cycles n the housing market. What are the housing cycles in the US versus Japan? Figure 8 plots cycle components of the de-trended Japan Residential land prices by H-P Filtered (1970-2008, data: Annualized JREI "Shigaichi-kakaku" index). Figure 9 plots cycle components of the de-trended US house prices by H-P Filtered (1987m01-2008m06, data: Semi annualized S&P-Case/Shiller index). As can be seen in those figures, we may recognize about 16-18 years cycles in US and Japan.

We should more focus on vacant houses because recently about 8 million housing units are vacant in Japan. As can be seen in Figure 10, it is equivalent to approximately 15% vacancy ratio. Figure 11 documents a balance of supply (new housing starts) with demand (population growth rate) in Japan housing market during 1970-2008. The figure graph shows the number of housing start seemed to be mean reversion to the population growth rate during 1972-1985. The figure graph also shows the number of housing start has been divergent oscillation from the population growth rate since 1986, when had stared the Land Price Bubble in Japan. Interestingly, such oversupply of housing units has kept in many years since after the bubble burst in 1990. Fiscal stimulus policy and monetary policy had supported the oversupply of housing starts during post-1990 periods.

3 Japanese Residential Land Market from the Real Estate Cycle Perspective

3.1 The discounted presented value of housing and its log-linear approximation

It is assumed that in each period, in each house, there is a discounted value of housing that is largely determined by economic conditions and institutional arrangements. As can be seen in the equation (3) of Poterba(1984), A house's real price(P_t^o) equals the present value of future net service flow discounted at homeowner's real user cost.

(1)

$$P_t^o = \int_t^\infty R(z) e^{-\{(1-\theta)i-\pi\}(z-t)} dz$$

$$\cong \frac{R(t+1)}{(1-\theta)i-\pi}$$

where, R(z) is net service flow(imputed net operating income of house), θ is marginal income tax rate, i is the Mortgage rate, and π_t is the Inflation rate of service flow (incorporating maintenance and obsolescence). The second column of the equation (1) is an approximation of the rigorous discounted present value, so called "simple Gordon growth model" in asset pricing literatures.

The Gordon growth model of (1) is true in "micro" level (each house). In this study, we convert the micro-level discounted present value equation into an aggregate-level one which is specified using macro ecnomic fundamentals indicators and their parameters. This is an approximation of the micro-level model (1) according to;

(2)
$$P_t = \frac{Y^{c_1} (\frac{H_t}{S_t})^{c_3}}{U_t^{c_2}}$$

where, Pt is the value of real house price index(aggregate-level house price), Yt is the gross service flow (real GDP is used as a proxy of real gross rent), Ht is the number of household. St is the stock of housing, Ht/St is the house utilization rate (it is equivalent to 1 minus vacancy ratio), Ut is the homeowner user cost, c_1, c_2, c_3 are the parameters for construction of the approximation. The relationship in the equation (2) can be theoretically induced as the simple stock-flow model of housing similar to Poterba (1984) and Dipasquale and Wheaton(1996). In the stock-flow model, the desired quantity of housing services (HSd) depends upon the real rental price of those services.

Moreover, the rental price depends on the number of household (Ht), user cost of housing (Ut), house price (Pt), and household income. The flow supply of services (HSs) is produced by the stock of housing (St) according a production relationship. Equilibrium house price equate the demanded quantity of services with existing quantity of services.

We also accomplish log-linear approximation of Equation (1), taking logs of Equation (2).

(3)
$$p_t = c_1 y_t - c_2 u_t + c_3 h_t - c_3 s_t$$

where, p_t, y_t, u_t, h_t, s_t are the log of P_t, Y_t, U_t, H_t, S_t in the equation (2).

We propose the relationship of Equation (3) as a substitute equation for specification of Equation (1) on the setp1 of the CHM.2004's 2-step EC approach. Our log-linear approximation of the discounted presented value of housing can avoid the spurious regression problem on the 1st-step estimation of the determinants of house price dynamics. The log-linear approximation like Equation (3) is also accomplished via a first-order Taylor Series approximation of Equation (1) around its steady state. This is a nice characteristic for our 2-step EC approach. If each of series take individually is I(1), that is, nonstationary with a unit root, while the linear combination (3) of series is

stationary, for some nonzero vector c_1, c_2, c_3 , the vector time series is ensured to be cointegrated. In order to ensure it, the cointegration must be check empirically using an actual data sample in the 2-step EC procedure

As we describe at the chapter 1 in this paper, our approach focus a cointegrating relationship between residential land prices and their present discounted values which are provided by Equation (3). Our approach has posited a cointegrating relationship between land prices and the "forcasted discounted present values" of them, although CHM approach has posited a cointegrating relationship between house prices and "fundamentals" such as income.

3.2 Short-run dynamics

In the CHM.2004 approach, short-run house price dynamics are modeled with mean reversion to the long-run equilibrium price, and serial correlation in house prices.

Their theoretical house price model reduces to a second order difference equation that depends on three parameters:

(7)
$$\Delta p_{t} = \alpha \Delta p_{t-1} + \beta \left(p_{t-1}^{*} - p_{t-1} \right) + \gamma \Delta p_{t}^{*}.$$

where, pt is the log of real house value at time t and Δ is the difference operator. There parameters are the serial correlation coefficient(α); the rate of mean reversion(β), and a parameter($\gamma; 0 \leq \gamma \leq 1$) that measures the contemporaneous adjustment to the long-run equilibrium price.

Equation (7) can be rewritten in another difference equation form:

(8)
$$p_t - (1 + \alpha - \beta)p_{t-1} + \alpha p_{t-1} = \gamma p_t^* + (\beta - \gamma)p_t^*$$

The dynamic behavior of (8) is studied by the characteristic roots of the corresponding characteristic equation of the differential equation in (8) given by the quadratic $B^2 - (1 + \alpha - \beta)B + \alpha = 0$, and the characteristic pair roots given by

(9)
$$B_1, B_2 = \frac{(1+\alpha-\beta)\pm\sqrt{(1+\alpha-\beta)^2-4\alpha}}{2}$$
,

Which determine the properties of house price dynamics (see CHM.2004 for details)?

Combinations of the serial correlation coefficient (α) and the rate of mean reversion (β) give the four different reactions to shocks in the market: (1) Prices that gradually and monotonically a new equilibrium (without overshooting the new equilibrium);(2) Prices that oscillate about, and eventually reach, the new equilibrium; (3) Prices that diverge from the new equilibrium exponentially; (4) Prices that diverge from the new equilibrium in an oscillatory pattern.

As we mentioned earlier in this paper, Japan's nationwide residential land prices do not return to their 1986 level. The real prices have continued to fall since 1991. If the two parameters of the land price dynamics satisfied $\{(1 + \alpha - \beta)^2 \ge 4\alpha \text{ and } (\alpha < 1 \text{ and } \beta > 0)\}$, then the Japan's land price decline is the type-(1) reaction. In this case, the land price movement only reflects cyclical movement in their discounted present value. It means the land price deflation may be mainly caused by their discounted present value decline. The type-(3) is $\alpha \ge 1 \text{ or } \beta \le 0$.

Such movements are very extreme case and may not be sustained for a long period. If $\{(1 + \alpha - \beta)^2 < 4\alpha \text{ and } (\alpha < 1 \text{ and } \beta > 0)\}$, the movements is the type-(2). Finally, the type-(4) is in $\{(1 + \alpha - \beta)^2 < 4\alpha \text{ and } (\alpha > 1 \text{ and } \beta > 0)\}$.

3.3 Land Price Short-run dynamics and Business Cycle

If land prices adjusted instantaneously to economic shocks and if housing markets were perfectly efficient, then γ , the contemporaneous adjustment of prices to current shocks would 1 in Equation (7). However, abundant academic research has shown that γ is less than 1 and land (house) prices deviate from their long-run equilibrium.

In the third-stage analysis, we also examine the interaction between the deviation of the residential land prices and the business cycle based on the VAR impulse responses. The third-stage focuses on the "cross-sectional" short-run dynamics of land price with macroeconomic fundamentals, although the second-stage described in the previous section 3.2 in this paper focuses on the land prices' own adjustment process. The VAR evidence of the residential land prices and the monetary business cycle may provide additional facts of the Japanese residential price behavior related a monetary policy.

Moving trend issue is worth noting. In order to characterize the cycle behavior of a set of time series and the time series exhibit both trends and cycles, the trends are eliminated prior to analysis. The trends are eliminated appropriately and the analysis proceeds with an investigation of cycle behavior. There are three approaches to removing trends from macroeconomic time series; detrending, differencing, and filtering. The goal under all three is to transform the data into mean-zero covariance stationary stochastic processes. The first two approaches to trend removal, detrending and differencing, are conducted under the implicit assumption that the data follow roughly constant growth rates. House prices and residential land prices may not behave on such constant growth rates. They may have intrinsic slowly evolving movements (Charles, and Chen (2005)).

Given the admission of the slowly evolving trend, the use of filters designed to separate trend from cycle is better for the residential land prices than the first two approaches. In fact, literatures on a monetary business cycle model with housing prices use the filter to remove frequencies from housing prices (Iacoviello.2005 et.al.). As we introduce later on this paper, however, there is the case in which the frequencies separated by a filter do not make sense in terms of a response of the residential land price with interest rate changes. There are some possible explanations of such inappropriateness in removing trends(Cogley and Nason.1995 and Murray.2003, et.al.) For example, the application of the H-P and B-P filters to nonstationary data may result in spuriousness.

The residential land prices are different from the macroeconomic fundamentals indicators such as GDP, GDP deflator, and interest rates in terms of their long-run equilibrium values. There is a long-run equilibrium value for the residential land price that is determined by economic conditions. This means that there are two candidates of the long-run "trends" in the land market, one is the equilibrium value and another is the statistical filtered trend. Which candidate is the appropriate for removing frequencies from the land prices? We should check the appropriateness of the candidates empirically. On the contrary, the macroeconomic fundamentals indicators have no long-run equilibrium values like residential land prices.

3.4 Data and empirical findings

3.4.1 Data

Our data are a simple data set. Included among the variables are residential land prices, Gross Domestic Product, population, housing stock, and long-term prime rate. The data are annual series. Table2 provides summary statistics on the data series.

The source and definition of all the variables appear in Appendix A.

User Cost

The user cost is a derived variable. It is an attempt to capture the cost of home ownership. Our calculation adjusts ownership costs for mortgage rates and expected appreciation rates. That is;

(10) User cost of capital = Mortgage rate - expected appreciation rate.

Four data issues are worth noting. First, there is no income tax reduction in related to the mortgage rate in owner housing investment in Japan. There is another income tax reduction treatment of owner housing investment in our country. However, the tax reduction measure of the housing has changed over time and its benefit for owner is relative small in a long term. We adapt the before-tax cost of home ownership. Second, we use the long-term prime rate in place of the mortgage rate. Until 2006, former Japan Housing Loan Corporation (JHLC, public body) had directly lent mortgages since after WWII. Private mortgage lending had been crowding out by the JHLC during periods of 1970-early2000. The JHLC's mortgage rate had closely related the long-term prime rate. Third, the expected appreciation rate is being measured by the real GDP growth rate during previous year, because the real GDP is used as a proxy of real gross rent in our empirical estimates. Fourth, property tax and maintenance and obsolescence costs are negligible in this study, since other variables are national series.

The user cost is used as an explanatory variable in fitting a long-run equilibrium equation for residential land price levels in nationwide. The user cost described above is based on a myopic expectation. In order to be economical consistency in the fitting, we use a statistical filtered trend of the user costs as the proxy for a long-run expected user cost. Our user costs are slowing evolving. So we introduce the Hodrick-Prescott (H-P) filter to extract the long-run expected user cost.

Household and Total population

The number of households is unobservable annually. We use total population in place of the number of households because the total population is observable annually. The total population is more accurate than the number of households annually. We adapt the he total population as the explanatory variable in the empirical estimates.

3.4.2 Empirical estimates

(1) The Equilibrium relationship

We fit a long-run equilibrium equation for residential land price levels in nationwide using the annual data described in the previous section. The equation is estimated using OLS.

As indicated above, our choice of variables is motivated by the discounted present value approach related the simple housing stock-flow model.

Estimates for this equation are given in Table 3. All variables of Table 3 have the expected sign, and many coefficients have the expected magnitude. The expected magnitudes of household variable and housing stock variable are the same in Equation (3) in this paper. In particular, the real residential land prices are negatively related to the housing stock and the user cost of housing and they are positively related to the real GDP and population.

The coefficient on housing stock suggests that a 1% rise in a nationwide housing stock

leads to almost a 5% decrease in real residential land prices. The mean index value is 1.9% during the period of 1972-2006; therefore, the increase in the housing stock leads to a 9.3% decline in land prices. During the same period, mean index values of real GDP and population are 2.9% and 0.6% respectively. These increases lead to 8.6% increase in land prices. If real residential land prices kept at least zero percent growth, then the user cost must decline to offset effects from changes in the housing stock, real GDP, and population. In fact, during the period, the user cost has been declined. In particular, during the Lost Decade and the deflationary economy, mean values are 1% in real GDP and 0.2% in population. These lead to 3.5% increase in land prices. Despite this, the mean value of the housing stock is 1.5% and leads to 7.7% decline in land prices. The mean value of land prices is -3.7% after 1992. This is almost equivalent to the gap between the 3.5% increase by real GDP and population growth and the 7.7% decline by housing stock growth.

In the next procedure of our 1st step, we conduct a cointegration test to check the spuriousness of the regression results, although our log-linear approximation approach for the discounted present value of residential land ensures theoretically the cointegrated relationship among the variables as we describe in the section 3.1 of this paper.

Table 4 shows the result from the cointegration tests for the actual residential land price levels and their forecasted ones based on Johansen's Trace test and Maximum Eigen value test. Both tests, with deterministic trend, reject the null of zero cointegrating vectors. The hypothesis that there is one cointegrating vector cannot be rejected on the other hand; that is, based on the cointegration test, there is no support for both variables in the system being stationary. Based on the evidence in Table 4, we would conclude that there is a cointegrating relationship and the above regression is not spurious. The results from Unit Root tests for all the variables appear in Appendix B.

(2) The adjustment equation

Following CHM.2004 approach, the second-stage analysis uses the estimates of p* from the first-stage equation to anchor the estimates of price changes. We estimate Equation (7) where α represents the degree of serial correlation, β is the extent of mean reversion and γ is the contemporaneous adjustment of prices to current shocks.

Estimates from this second-stage equation are given Table 5. The empirical results in

Table 5 are consistent with the previous literature (CHM.2004). The immediate adjustment coefficient, γ , for example, suggests that current land prices adjust by 40% of the value of a shock to the equilibrium land price levels in the year of the shock. In addition, residential land prices also exhibit strong serial correlation, with a coefficient of 0.38. Furthermore, our estimates show that the other 60% of land price adjustment occurs only gradually over time. Actual prices converge 40% (= β) of this difference every year.

The estimated coefficients satisfy $\{(1 + \alpha - \beta)^2 < 4\alpha \text{ and } (\alpha < 1 \text{ and } \beta > 0)\}$. This means

that the pattern of the Japanese land price dynamics falls in the type (2) described in the section 3.2 of this paper, prices that oscillate about, and eventually reach, the new equilibrium. Thus the Japanese land price movement is not extreme case. One possible explanation of the reason why the real prices have continued to fall since 1991 is the continuation of oversupply in housing market, that is, long-run new equilibrium prices continuously decline.

(3) VAR evidence of residential land price and business cycle

The third-stage analysis uses the estimates of residuals from the first-stage equation as land price short-run cycles.

Figure 12 presents impulse responses (with 90-percent confidence bands) from a VAR with de-trended real GDP (G), change in the log of CPI (PI), de-trended real residential land prices (q), and Long Term Prime Rate (R) from 1975 to 2006. The logs of real GDP are de-trended with an H-P filter and real residential land prices are de-trended with the first-stage equation.

The results suggest that a model of the interaction between house prices and business cycle has to deliver:

- (a) A positive response of nominal prices to tight money. A significant negative response of real land prices to tight money although a small positive response of real land prices to tight money in early time. A significant negative response of GDP to tight money.(Figure12 first row)
- (b) A negative response of real land prices to a positive inflation disturbance. A significant positive response and then significant negative response of outputs to a positive inflation disturbance. (Figure 12 second row)

(c) A positive co movement of asset prices and output in response to asset prices shocks (third row). No co movement of asset prices and output in response to output shocks (fourth row). Taken together, the two rows highlight a one-way interaction between housing prices and output.

Figure 13 also presents impulse responses from a VAR with G, PI, q, and R during the same period. The only difference in both figures is that the real residential land prices are de-trended with the H-P filter in Figure 13 but with the first-stage equation in Figure 12.

The both results are similar except for two things:

- (d) A significant "positive" response of real land prices to tight money in early a few years although a negative response of real land prices to tight money in later time."No" response of GDP to tight money.(Figure13 first row)
- (e) A positive co movement of asset prices and output in response to asset prices shocks (Figure14 third row). A positive co movement of asset prices and output in response to output shocks (Figure13 fourth row). Taken together, the two rows highlight a "two-way" interaction between housing prices and output.

By comparison above, the method of de-trended with the first-stage equation (results in Figure 12) may dominate the method with the H-P filter (results in Figure 13) in getting the short-run cycles from land prices.

4. Concluding Comments

In examining the Japanese residential land market in 1972-2006, a two decades of residential land price decline. We find that the problem is not only a slowdown of the population growth but also a huge oversupply in the housing market despite of the prolonged economic stagnation.

The problem is high vacancy rate in the housing markets. If it remains higher pace of housing starts in Japan, Japanese residential land prices further decline. Why had such higher pace of housing starts been kept during the "Lost Decade" and the deflation period? Government and Industries had to take a "counter-cyclical" measure to stimulate domestic demands. The counter-cyclical measure may cause some side effects to the housing market. In particular, zero interest rate policy, ease money policy, and tax reduction on housing investments may distort the real estate cycles.

We do think that research effort should be focused on determining what policy reform allow the discounted present value of houses (lands) to again grow in a long-run.

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Appendix A: Data Sources and Definitions

<u>Residential land prices</u>: "Nationwide" residential land price index ("Zenkoku Shigaichi Kakaku sisu") based on semiannual repeat-appraiser on 2,000 residential lands in Japan. In our data set, we convert the semi-annual value into the annual value, taking the average in time. Japan Real Estate Institution (JREI).

Real Gross Domestic Product: Bureau of Statistics in Cabinet Office.

<u>Population</u>: Total population, Census Population and Population Registration, Bureau of Statistics in Ministry of Internal Affairs and Communications

<u>Housing stock</u>: Census housing stock, The quinquennial census. In our data set, we estimate annual stocks using the quinquennial stocks, annual housing starts, and annual demolition rates. The annual demolition rates are interpolated using he quinquennial census data. The quinquennial census is provided by Bureau of Statistics in Cabinet Office. The housing starts data by Ministry Land Infrastructure and Transportation.

Long-term prime rate: Bank of Japan

Appendix B: Unit Root Tests

The null hypothesis of the existence of unit root for the actual residential land price levels and their forecasted ones are not rejected at the 5 percent significance level (Table B1). The null hypothesis of the existence of unit root for the independent variables' levels is not rejected at the 5 percent significance level except for population (Table B1).

Table B1 Results from Unit Roots Tests

(1) Real Residential Land Prices

		Nationwide	
		test statics	p-value
Actual	Level	-1.25	<0.639>
	1st difference	-4.33	<0.001> ***
Forecast	Level	-1.02	<0.920>
	1st difference	-4.02	<0.017> ***

Note: p-value in parenthess \diamondsuit .

(2) Independent Variables

		Nationwide		
		test statics	p−value	
Real GDP	Level	-1.73	<0.403>	
	1st difference	-4.41	<0.001>	***
Population	Level	(-8.85)	<0.000>	***
	1st difference	-10.50	<0.000>	***
Housing Stock	Level	0.84	<0.999>	
	1st difference	-3.97	<0.022>	***
User Cost (Trend component)	Level	-0.51	<0.970>	
	1st difference	-4.70	<0.004>	***

Note: p-value in parenthess \diamond .

Figures and Tables



Figure 1 Lost Decade and Real GDP Growth in Japan

Table 1 Frequency of panics in US (1890-2008) and Japan (1980-2008)

Troqueries of Faint	50, 1000 E000	
Decade Beginning	Numbers of Panics	Numbers of Panics
[<u>Dow Jones Industrial</u>	Nikkei 225
1890	11	
1900	9	
1910	7	
1920	9	
1930	38	
1940	4	
1950	2	
1960	3	
1970	9	
1980	4	3
1990	1	33
2000-2008	9	28

Frequency of Panics, 1890-2008



Figure 2 Residential Land prices in 6 large cities and Stock prices in Japan



Source: Japan("Shigaichi-kakaku" land price index by JREI, Nation residential land price and 6 large cities residential land price index), US(S&P.Case&Shiller index, San Francisco and New York)

Figure 3 Residential Land Prices in Japan(1965.1s-2008.1s) and House Prices in US(1986.2s-2008.1s)(Semiannual, 1986.2s=100)

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Figure 4 Japan's real residential land prices (1986=100) in 1970-2008.



Figure 5 Residential land prices to household incomes Ratio



Figure 6 Residential Land Prices and General Good Prices in Japan (1988-2007)



Figure 7 Japan population growth rate (Annual, 1971-2007)



Figure 8 Cycle components of the de-trended Japan Residential land prices by H-P Filtered (1970-2008, data: Annualized JREI "Shigaichi-kakaku" index) Notes: CYCLEJP represents "Nationwide" residential land prices and CYCLETY is "6 large cities" residential land prices.



Figure 9. Cycle components of the de-trended US house prices by H-P Filtered (1987m01-2008m06, data: Semi annualized S&P-Case/Shiller index) Notes; CYCLE_CM (Chicago), CYCLE_CS (San Francisco), CYCLE_MI (Miami), CYCLE_NY (New York).



Figure 10 Vacant housing units and vacancy ratio in Japan's housing market



Figure 11 Population Growth rate and Housing Starts in Japan

Table 2Summary statistics.

	Standard			
	Mean	Deviation	Minimum	Maximum
Real Residential Land Price Index in 1986=100	98.5	2.7	74.8	132.5
Change in Real Price	-0.2%	1.1%	-14.7%	17.2%
Real GDP (¥trillion)	386.9	17.6	213.1	534.8
Change in Real GDP	2.9%	0.4%	-2.5%	8.1%
Population (million)	120.4	1.0	105.9	127.1
Change in Population	0.6%	0.1%	0.0%	2.2%
Housing Stock (million)	43.1	1.3	29.9	56.1
Change in Housing Stock	1.9%	0.1%	1.1%	3.9%
User Cost	2.8%	0.5%	-1.9%	10.8%

Table 3 Steady state regression.

Dependent variable: log of real residential land prices

	OLS			
	Coefficient	T-Statistics		
Log of Real GDP	2.41	12.2		
Log of Population*	3.22	9.1		
Log of Housing stock	-4.90	-9.9		
Log of user cost**	-6.00	-2.7		
Adjuseted R2	0.82			
* The log of population is used in place of the household.				
** The log of uset cost is the trend components removed by H-P filte				

Table 4 Results from Cointegration Test

Null hypothesis	J (trace)	J (max)	
r=0	22.034	20.193	
	<0.005>	<0.005>	
r=1	1.841	1.840	
	<0.174>	<0.174>	

Note: p-value in parenthess <>.

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Dependent variable: real house price inflation/deflation			
	Model(Nationwide):OLS		
	Coefficient	T-Statistics	
Persistence parameter(alpha)	0.38	4.1	
Mean reversion	0.43	4.5	
Contemporaneous adjustment parameter(gamma)	0.40	3.3	
Adjuseted R2		0.64	



Figure 12 VAR evidence of residential land price cycle and business cycle Notes: VAR estimated from 1975 to 2006, using "residuals" from the first-stage equation as land price short-run cycles. The dashed lines indicate 90-percent confidence bands. The Choleski ordering of the impulse responses in R (long term prime rate), PI (Inflation), q (land price), G (GDP). Coordinate: percent deviation from the base line.



Figure 13 VAR evidence of residential land price cycle and business cycle

Notes: VAR estimated from 1975 to 2006, using "cycles" land price short-run cycles by H-P filter. The dashed lines indicate 90-percent confidence bands. The Choleski ordering of the impulse responses in R (long term prime rate), PI (Inflation), q (land price), G (GDP). Coordinate: percent deviation from the base line.