Land Prices and Fundamentals*

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Motivation

- Have Japan's land prices been moving in line with "fundamentals" in the past 50 years?
- Are there any factors other than "fundamentals" which have influenced land prices?

Literature on land prices in Japan

The existing empirical studies can be subject to some criticisms.

1. Land price data is not appropriate.
   Official land price index is a simple average, underestimating actual land price developments.
2. Models do not strictly follow the theoretical foundation of asset pricing (Discounted Present Value (DPV) model).
   For instance, Idee(1992),Yoshioka(2002), and Imagawa(2002) do not take into account the expected growth rate of income in their DPV.
3. Critical values for a cointegration test are not appropriate.
4. Demographic developments are not adequately taken into account.

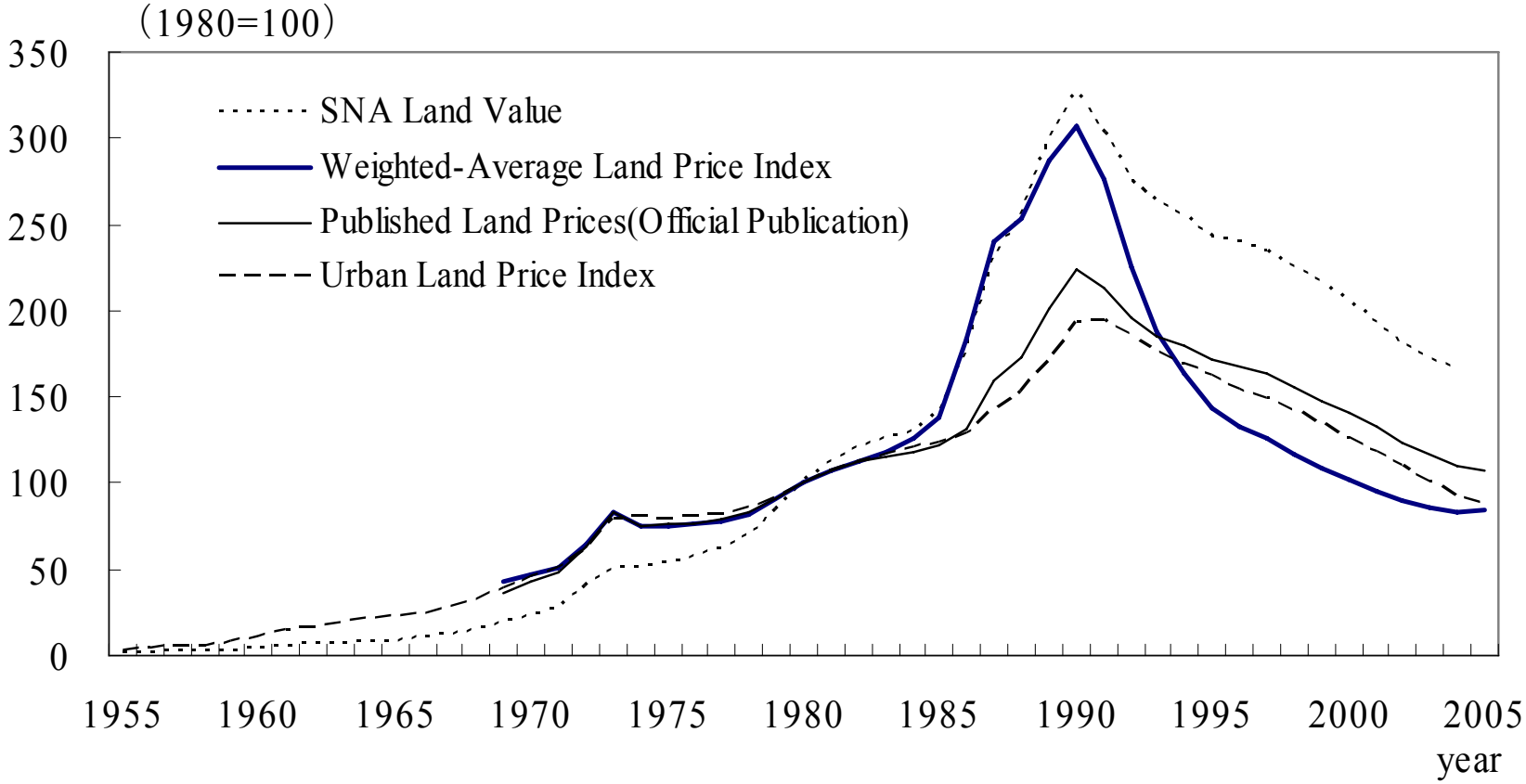
What is a weighted-average land price indicator?

- Calculated using the price levels as weights for aggregation of the annual growth rate of each observation point.
- Specifically, let $P_{j,t}$ ($j=1\ldots J$) denote the land price of the observation point j at time t, and the change in the aggregated land price indicator (p_t) at time t is defined as below.

$$\Delta p_t = \sum_{j=1}^{J} \frac{P_{j,t-1}}{\sum_{j=1}^{J} P_{j,t-1}} \Delta p_{j,t}$$

The lower case is the natural logarithm multiplied by 100 in percent, and Δ is the first-difference operator.

Comparison of land price indicators



Sources: Cabinet Office, "National Accounts"; Ministry of Land, Infrastructure and Transportation "Published Land Prices." ;Japan Real Estate Institute, "Urban Land Price Index."

Discounted Present Value (DPV)

DPV model

＝ Value of land prices equals the discounted present value of future income streams the land users will have.

$$P_t = \frac{Y_t + E_t P_{t+1}}{1 + r_t} \quad Eq.(1)$$

,where $r_t = i_t + \tau_t + RP_t$

P_t: price level of land at time t,

Y_t: income (rent) at period t,

τ_t: tax rate at period t,

RP_t: risk premium (6%)

E_t: expectation operator based on the information set at period t,

r_t: cost of funds at period t,

i_t: nominal interest rate

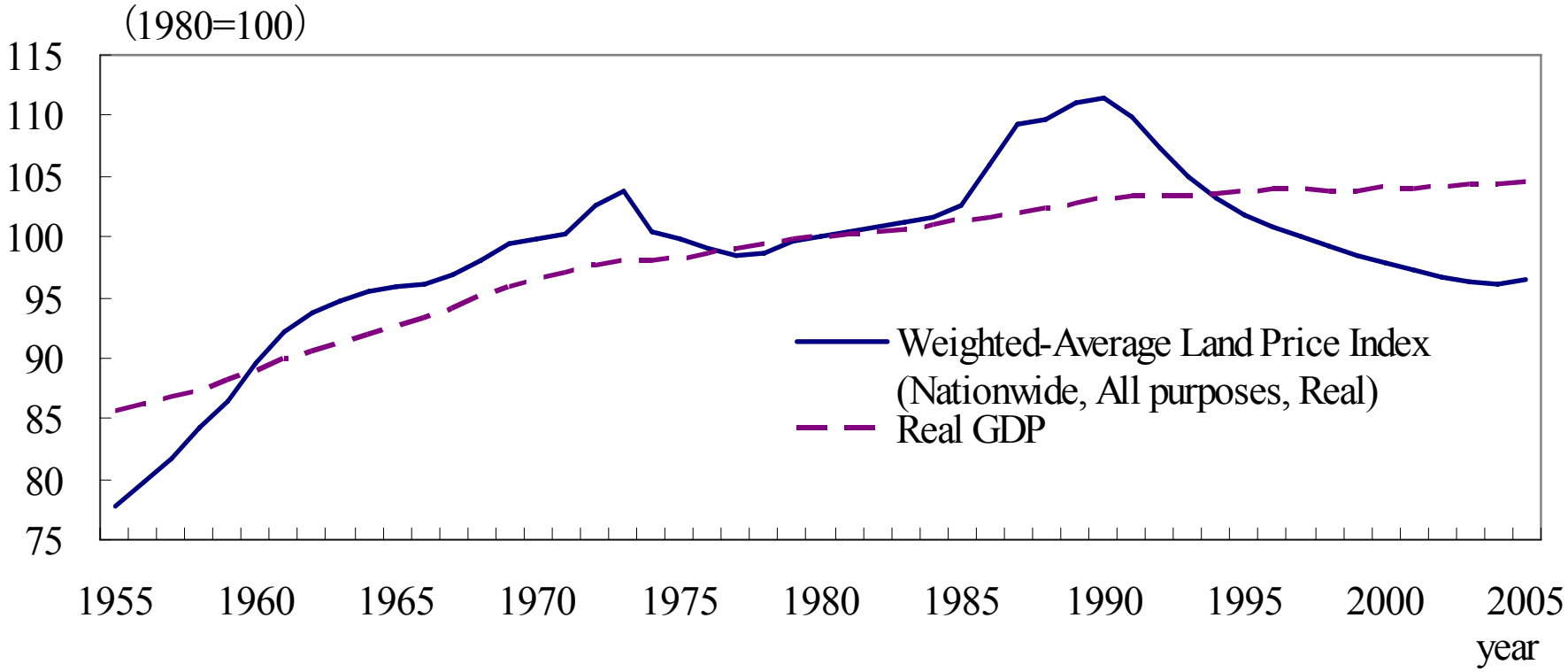
Discounted Present Value (DPV) -continued-

Solving the Eq.(1) forward and excluding the explosive bubble solutions by assuming static expectation for future income growth (g^e_t) and the cost of funds (r_t), eq.(1) can be rewritten as;

$$P_t = \frac{Y_t}{r_t - g^e_t} \qquad \text{Eq.(2)}$$

Components of DPV

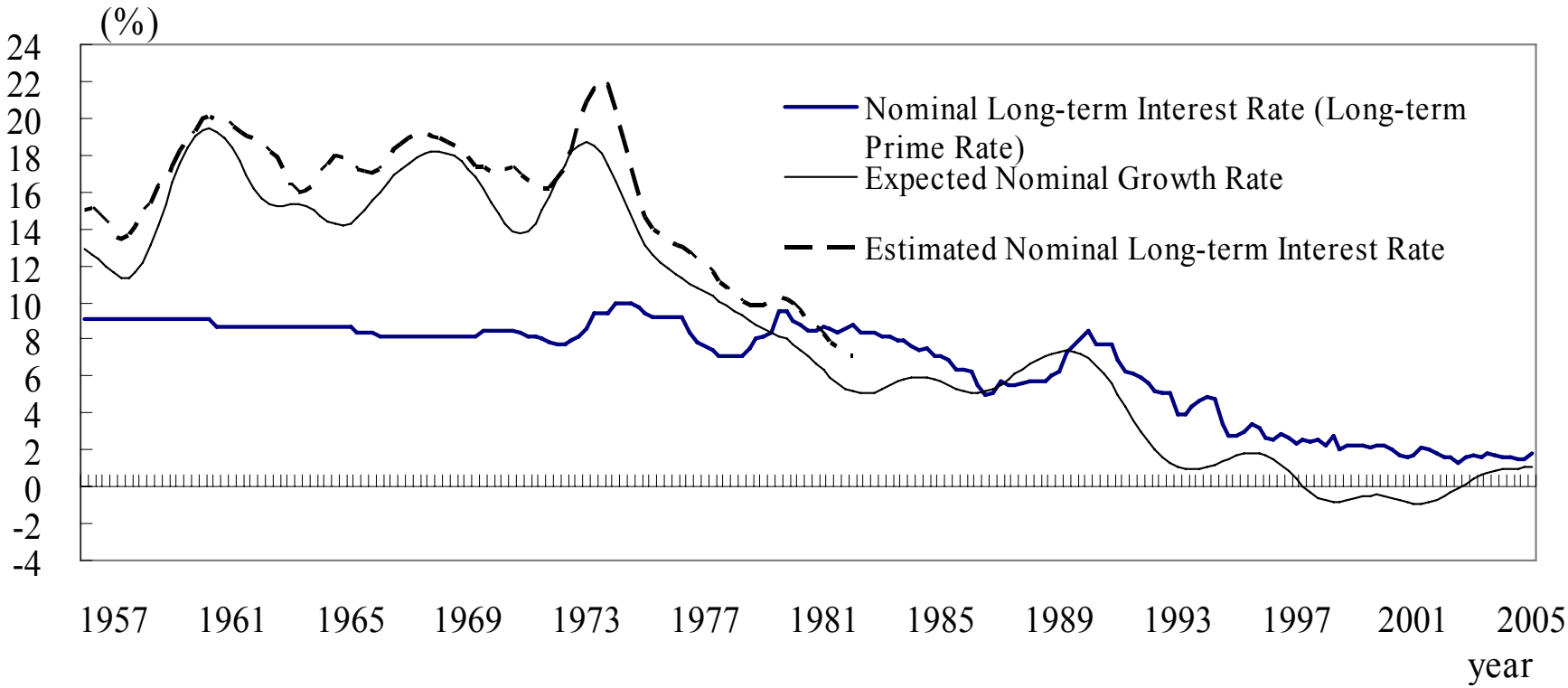
(1) Real GDP



Sources: Cabinet Office, "National Accounts"; Ministry of Land, Infrastructure and Transportation, "Published Land Prices."

Components of DPV

(2) Interest rate gap

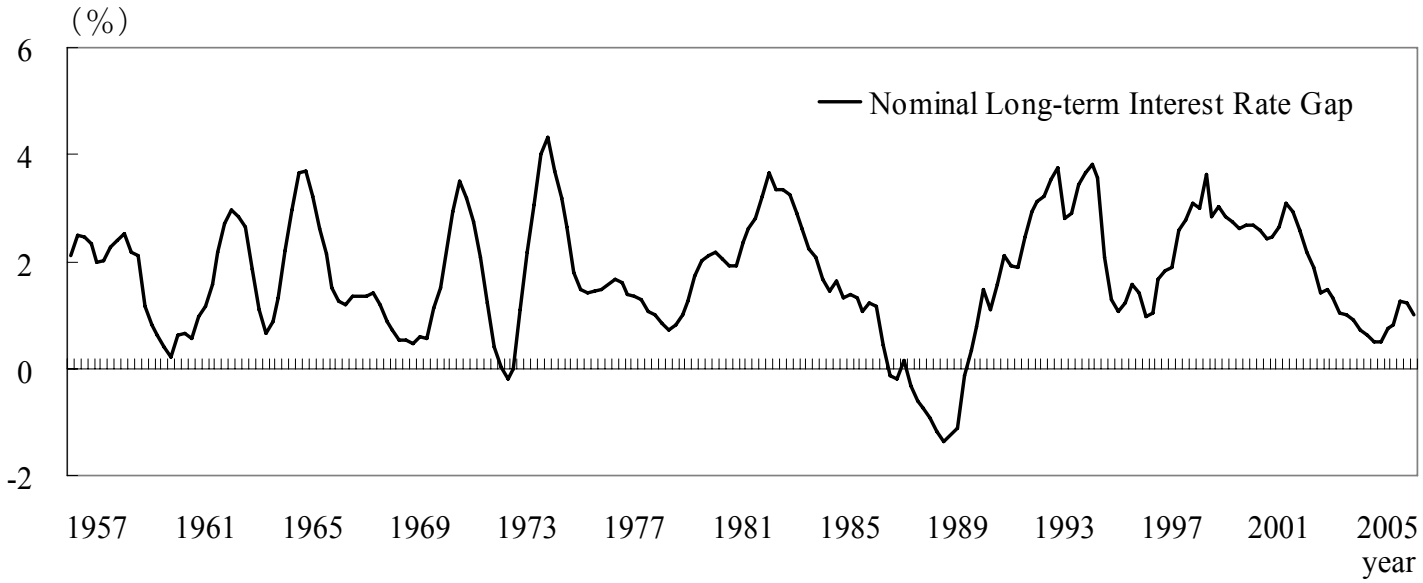


The interest rates during the period of financial regulation are not supposed to have reflected the demand-supply conditions of the economy. → We estimate the effective interest rate given the expected nominal growth rate.

Components of DPV

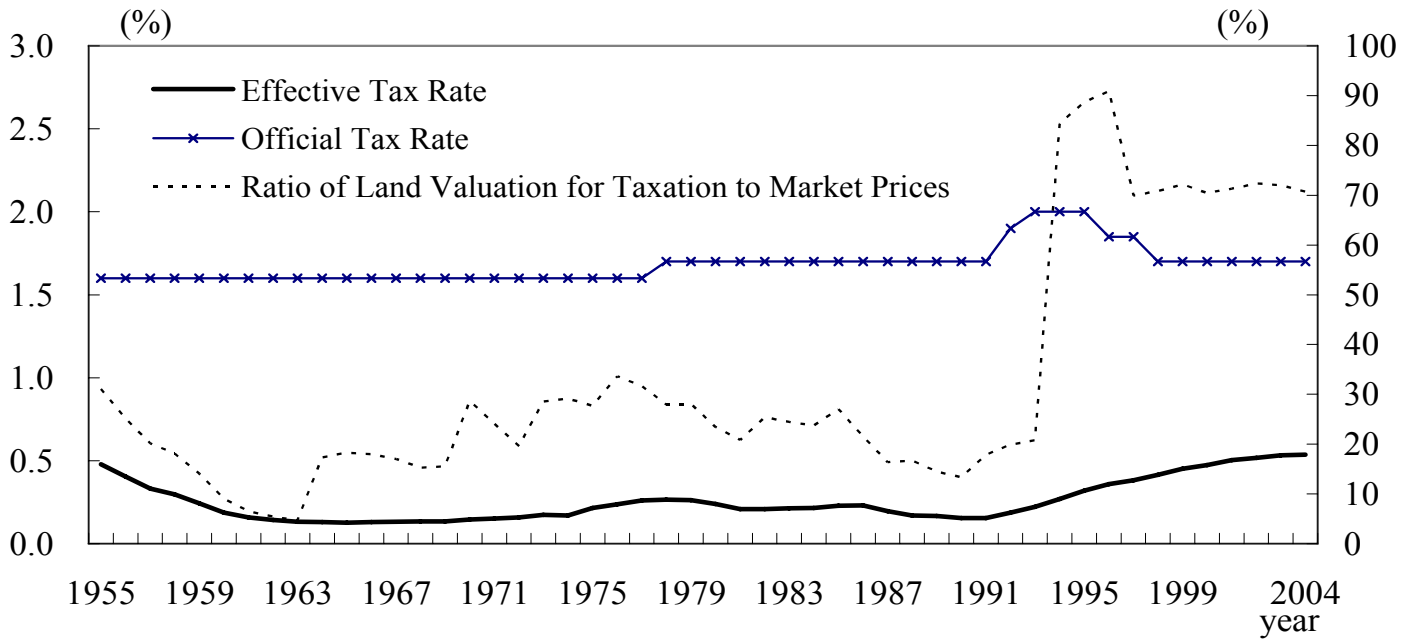
(2) Interest rate gap –continued-

- The interest rate gap moves cyclically because of the myopic expectation of economic growth.
- As a result, the DVP has a cyclical movement.
  - The interest rate gap should be constant in the long run.



Components of DPV

(3)Land Tax Rates



Sources: Ministry of Internal Affairs and Communications, "Records of Property Prices," "Reference on Municipal Taxes"; Cabinet Office, "National Accounts."

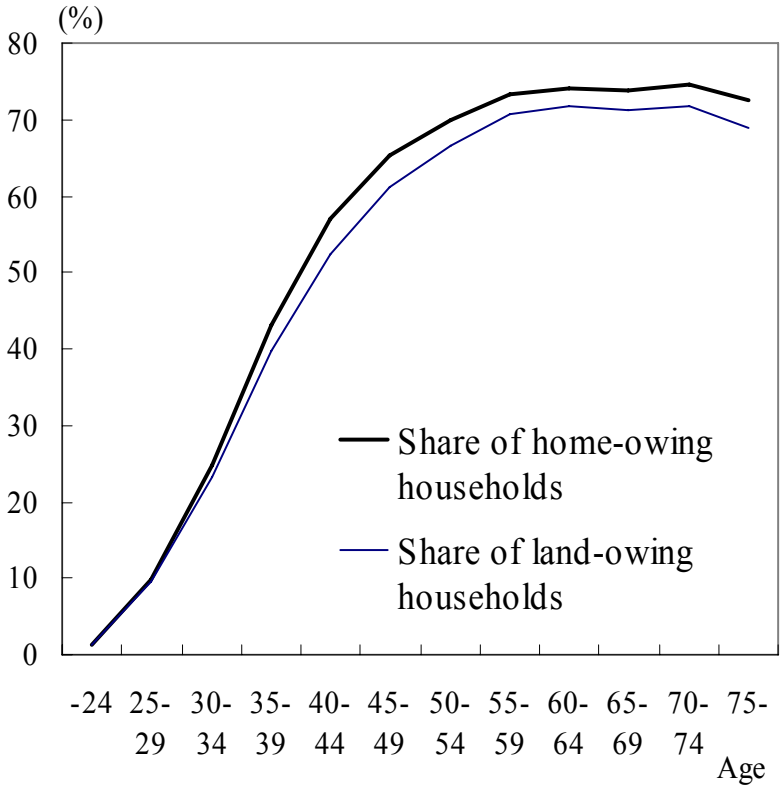
- Municipal property tax, city planning tax, and land price tax are considered.
- The amendment of the tax code in 1993 raised the tax base, leading to an increase in the effective tax rate.

  → A further decline in land prices occurred.

Other factors

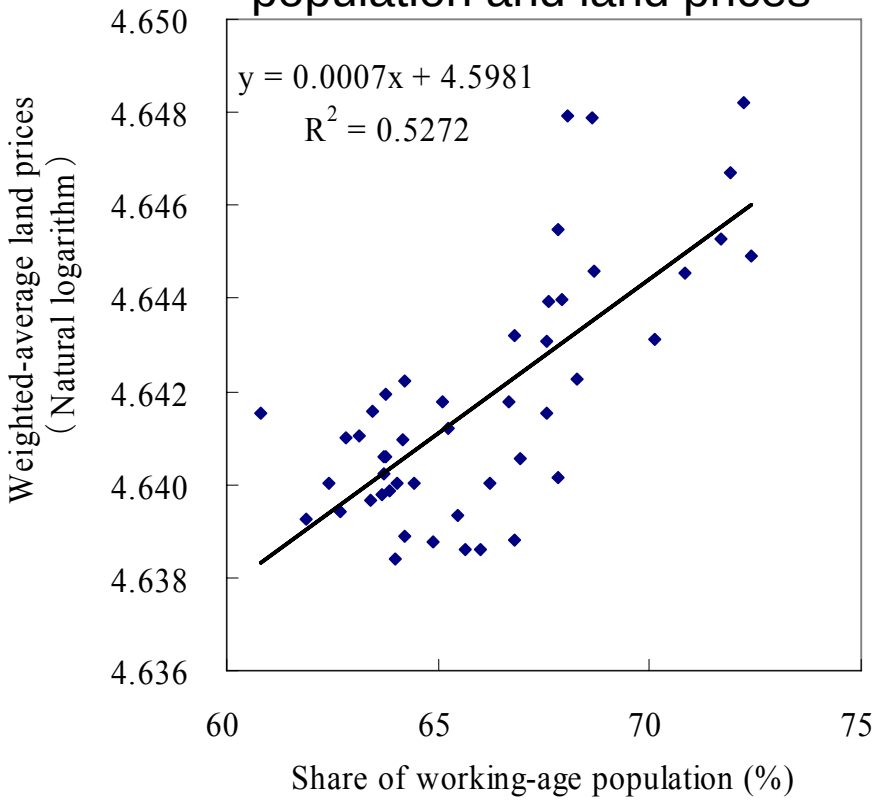
(1) Demography

Share of home- and land-owners



Demand for houses and land are high for working-population.

Share of working-age population and land prices

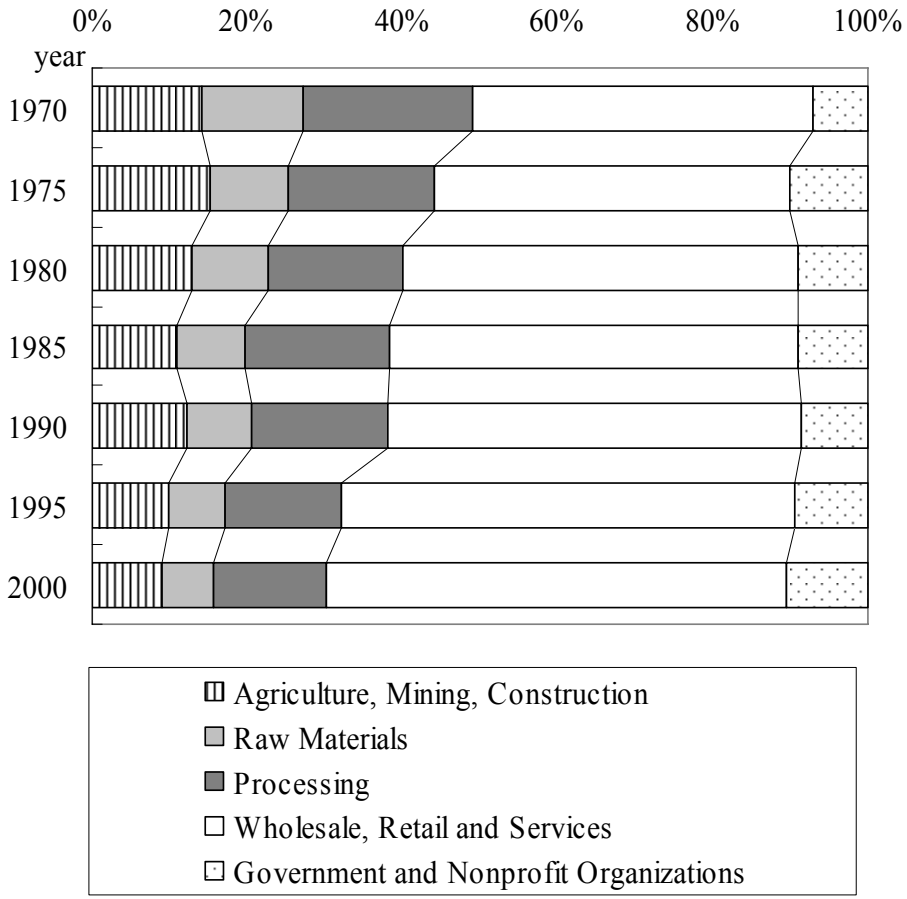


There is a high positive correlation.

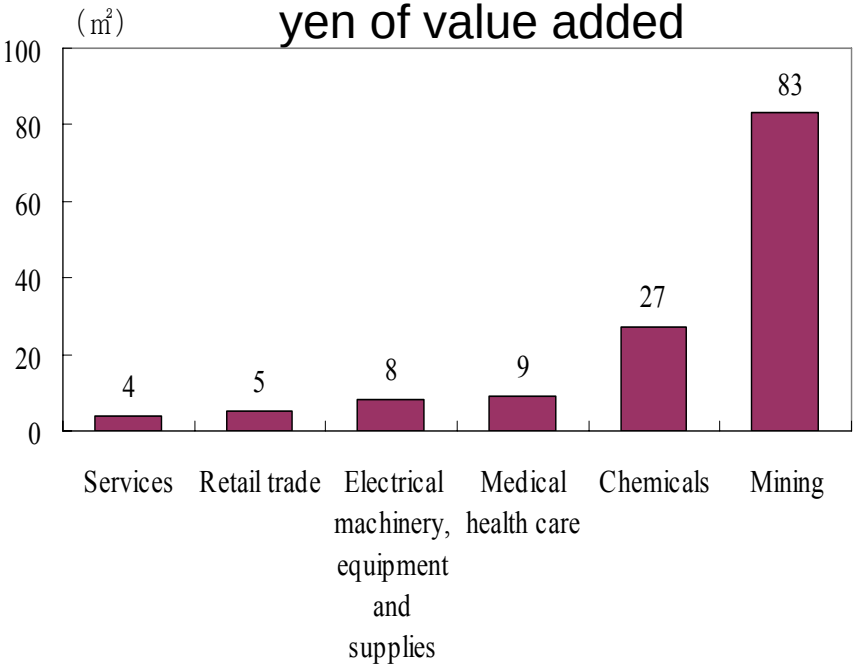
Other factors

(2) Changes in industrial structure

GDP by industry



Required land per 1 million yen of value added



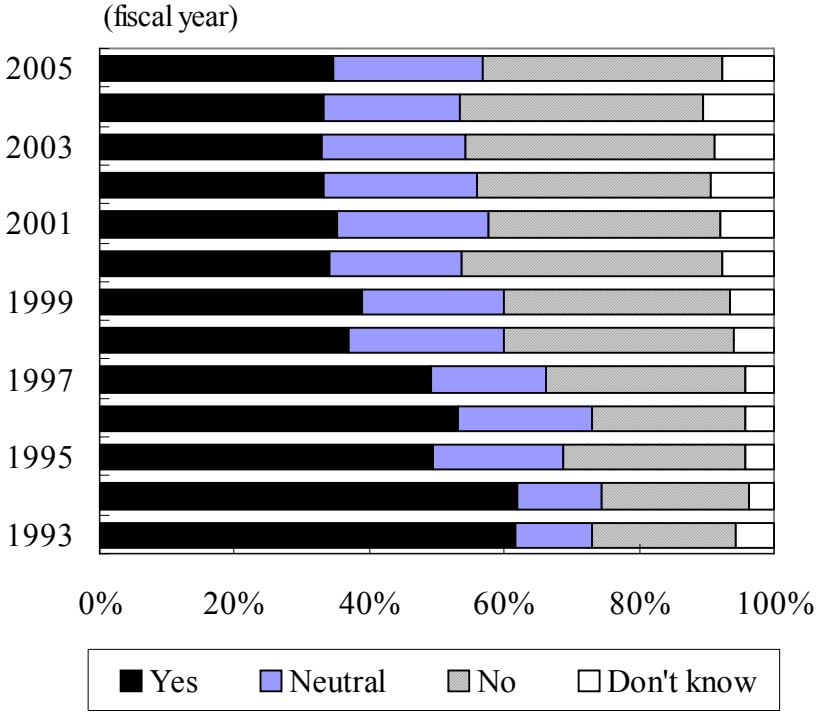
Changes in industrial structure such as a trend toward the services economy has reduced demand for land.

→ structural downward pressure on land prices

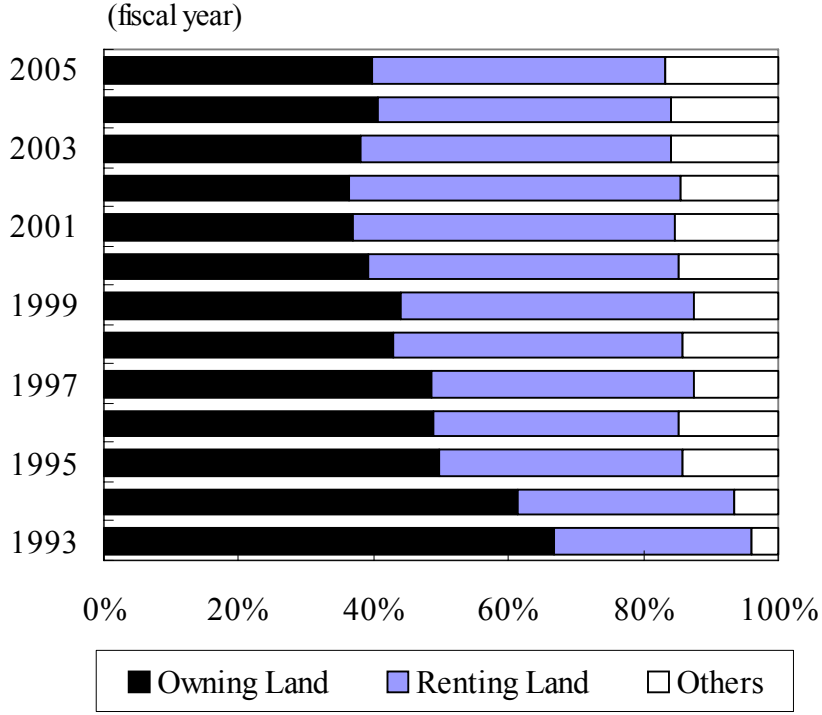
Other factors

(3) Attitude toward land-holding

(1) Is land a more advantageous asset than deposits and stocks? (Households)



(2) Is holding land more advantageous than renting land? (Corporations)



Demand for land as an ASSET started to increase recently.

Relationship between DPV and actual land values

Test whether the DPV model holds for land values based on the cointegration analysis.

[Specification 1] $p_t = \beta_0 + \beta_1 Trend_t + DPV_t + e_t$

[Specification 2] $p_t = \beta_0 + \beta_1 Trend_t + DPV_t + \beta_2 pop_t + e_t$

[Specification 3] $p_t = \beta_0 + \beta_1 Trend_t + \beta_2 DPV_t + e_t$

[Specification 4] $p_t = \beta_0 + \beta_1 Trend_t + \beta_2 DPV_t + \beta_3 pop_t + e_t$

p_t: real land value (in logarithm), $Trend_t$: time trend, DPV_t: discounted present values (in logarithm), pop_t: production population ratio, e_t: error term

Cointegration test statistics (Six large city areas)

(1)All

		Specification 1	Specification 2	Specification 3	Specification 4
ADF(t-value)		**-3.778**	**-4.058**	**-5.060**	**-5.671**
p-value		0.026	0.043	0.004	0.002
Critical Value	1%	-4.158	-4.665	-4.665	-5.074
	5%	-3.504	-3.984	-3.984	-4.375
	10%	-3.182	-3.648	-3.648	-4.028

(2)Residential

		Specification 1	Specification 2	Specification 3	Specification 4
ADF(t-value)		**-3.432**	**-3.664**	**-4.634**	**-4.665**
p-value		0.059	0.097	0.011	0.026
Critical Value	1%	-4.158	-4.665	-4.665	-5.074
	5%	-3.504	-3.984	-3.984	-4.375
	10%	-3.182	-3.648	-3.648	-4.028

(3)Commercial

		Specification 1	Specification 2	Specification 3	Specification 4
ADF(t-value)		**-3.294**	**-3.552**	**-4.565**	**-5.169**
p-value		0.079	0.120	0.013	0.002
Critical Value	1%	-4.158	-4.665	-4.665	-5.074
	5%	-3.504	-3.984	-3.984	-4.375
	10%	-3.182	-3.648	-3.648	-4.028

(4)Industrial

		Specification 1	Specification 2	Specification 3	Specification 4
ADF(t-value)		**-4.745**	**-5.206**	**-4.746**	**-5.040**
p-value		0.002	0.002	0.008	0.011
Critical Value	1%	-4.158	-4.665	-4.665	-5.074
	5%	-3.504	-3.984	-3.984	-4.375
	10%	-3.182	-3.648	-3.648	-4.028

Shaded figures indicate that the null hypotheses are rejected with the associated critical values.

Implication of the cointegration-test result

- A cointegrating relationship exists between the DPV and the actual real land value.
  - This result implies that land values have been broadly in line with their theoretical values.
- The cointegrating relationship can also be found when the share of the working-age population is included in the model.
  - This result implies that the demographic factor other than the NPV can have effects on the land value determination in the long-run.

Cointegration Vector
(Six large city areas)

Estimated vectors

1. Residential

DPV	1.27～1.50
Working-Age Pop	0.06～0.08
Time trend	−0.04～−0.01

2. Commercial

DPV	1.56～2.06
Working-Age Pop	0.11～0.14
Time trend	−0.08～−0.03

Cointegration Vector
(Regional area)

Estimated vectors

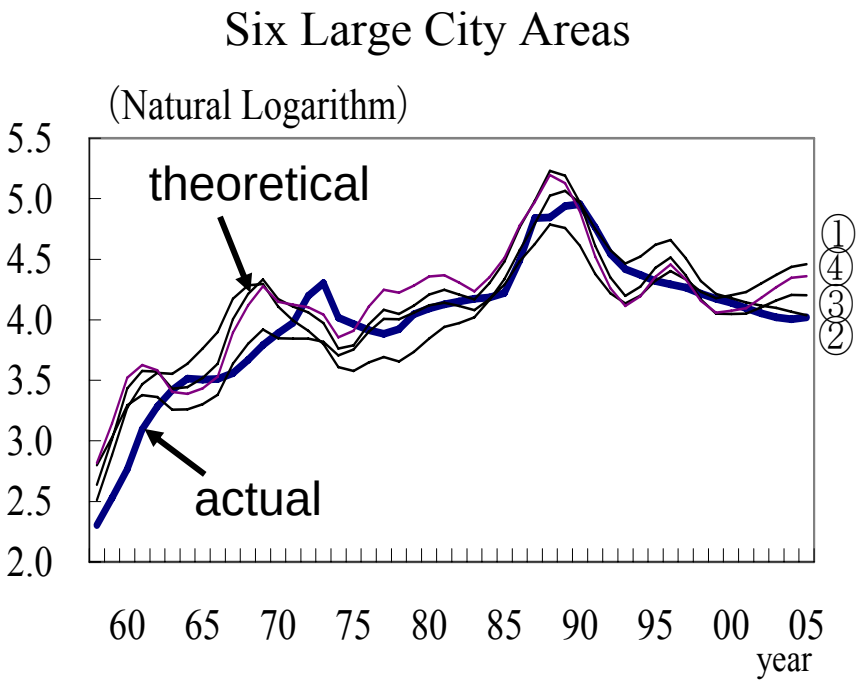
1. Residential

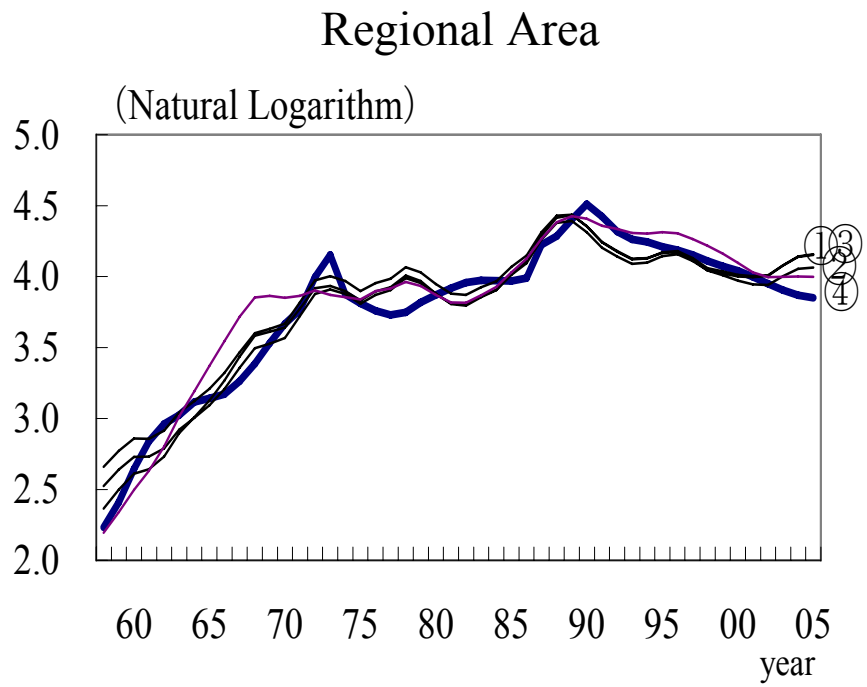
DPV	0.51～1.09
Working-Age Pop	0.04～0.16
Time trend	−0.02～−0.01

2. Commercial

DPV	0.50～0.95
Working-Age Pop	0.02～0.08
Time trend	−0.06～−0.02

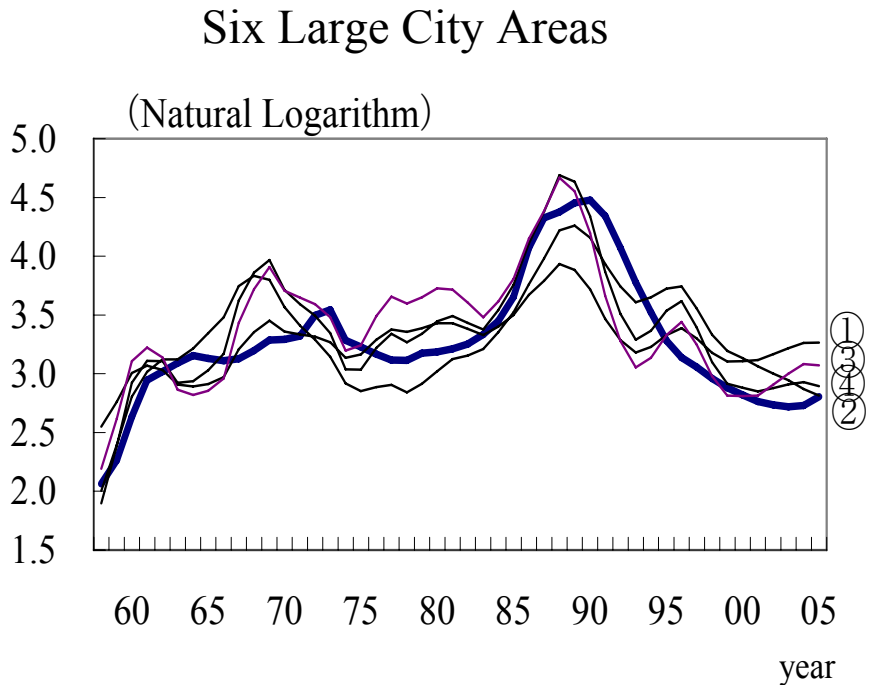
Theoretical and actual real land values (Residential)

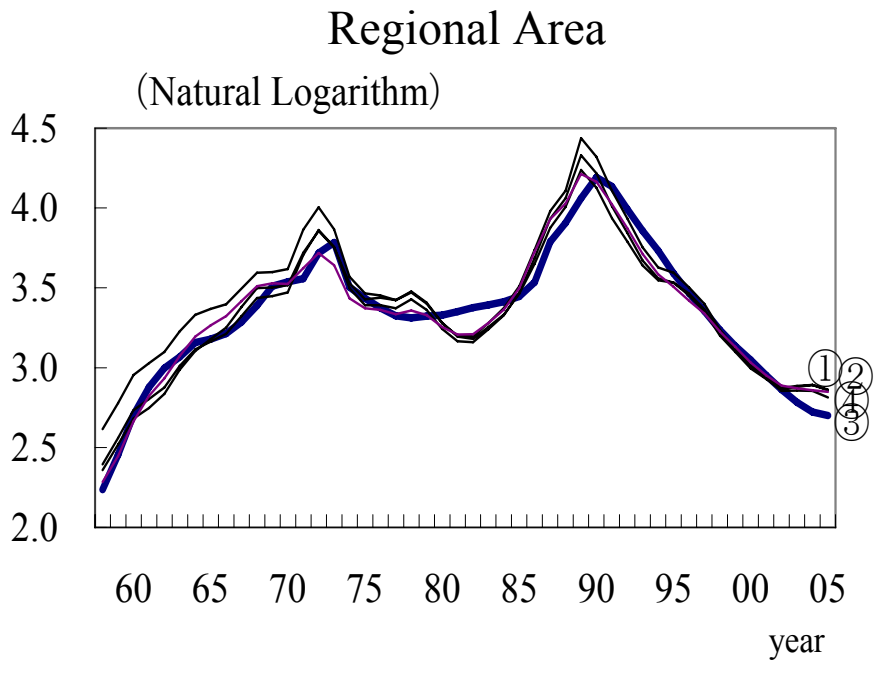




- Recently, the theoretical values have been above the actual real land values.

Theoretical and actual real land values (Commercial)





- Similar results for commercial area.
- For regional area, there is no cointegrating relationship between the DVP and the actual real land value.
  - A model taking account of (a) bank lending and (b) spillover from the land value of city area is cointegrated.

Interpretation of developments in theoretical land values

- The DPV has fluctuated largely owing to the cyclical movement of the interest rate gap.
  - The discrepancy between the myopic growth expectation and the long-term interest rate has been a source of the evolution of land values.
- Demographic developments affect the land value determination in the long run.

Determinants of the short-term changes in land values

- Estimate an error correction model (ECM) for the changes in land values using the cointegrating relationship.

$$\Delta p_t = \beta_0 + \beta_1 EC_{t-1} + \beta_2 \Delta DPV_t + \beta_3 \Delta pop_t + \beta_4 \Delta c_t + \varepsilon_t$$

Δp_t	EC_{t-1}	ΔDPV_t	Δpop_t	Δc_t
Growth rate of the real land values	Error Correction term	Growth rate of the DVP	Change in the share of the working-age population	Growth rate of the real bank lending*1

*1 the growth rate of the DPV is subtracted from the growth rate of real bank lending.

Estimation results of ECM

Six Large City Areas

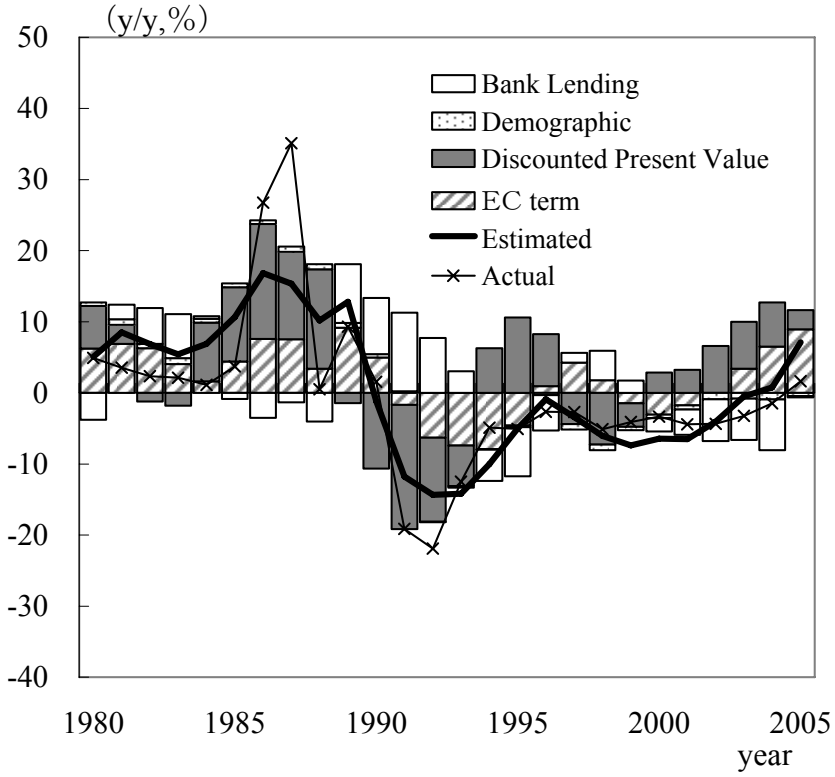
	Residential		Commercial		Industrial	
EC(-1)	-0.26	(0.05) ***	-0.25	(0.06) ***	-0.21	(0.05) ***
ΔY	0.80	(0.21) ***	0.94	(0.27) ***	0.83	(0.23) ***
ΔD	0.02	(0.03)	0.13	(0.04) ***	0.06	(0.03)
ΔC	0.49	(0.19) **	0.44	(0.25) *	0.68	(0.20) ***
C	-0.04	(0.01) ***	-0.05	(0.02) ***	-0.01	(0.02)
Adj. R-squared	0.69		0.63		0.63	
S.E.	0.07		0.09		0.08	

Regional Area

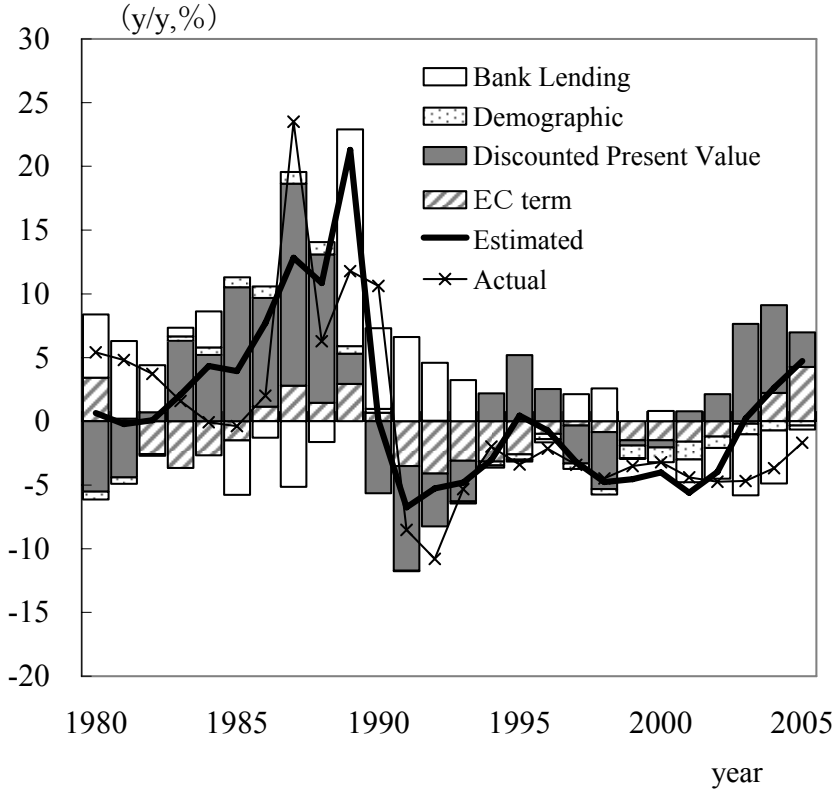
	Residential		Commercial		Industrial	
EC(-1)	-0.23	(0.09) **	-0.28	(0.06) ***	-0.15	(0.06) **
ΔY	0.87	(0.21) ***	0.60	(0.13) ***	0.77	(0.19) ***
ΔD	0.03	(0.03)	0.05	(0.02) **	0.07	(0.03) **
ΔC	0.60	(0.18) ***	0.54	(0.11) ***	0.69	(0.18) ***
ΔP_u		—	0.36	(0.06) ***		—
C	-0.02	(0.01)	-0.03	(0.01) ***	-0.03	(0.01) **
Adj. R-squared	0.49		0.87		0.53	
S.E.	0.07		0.04		0.07	

Determinants of land price changes (Residential)

Six Large City Areas

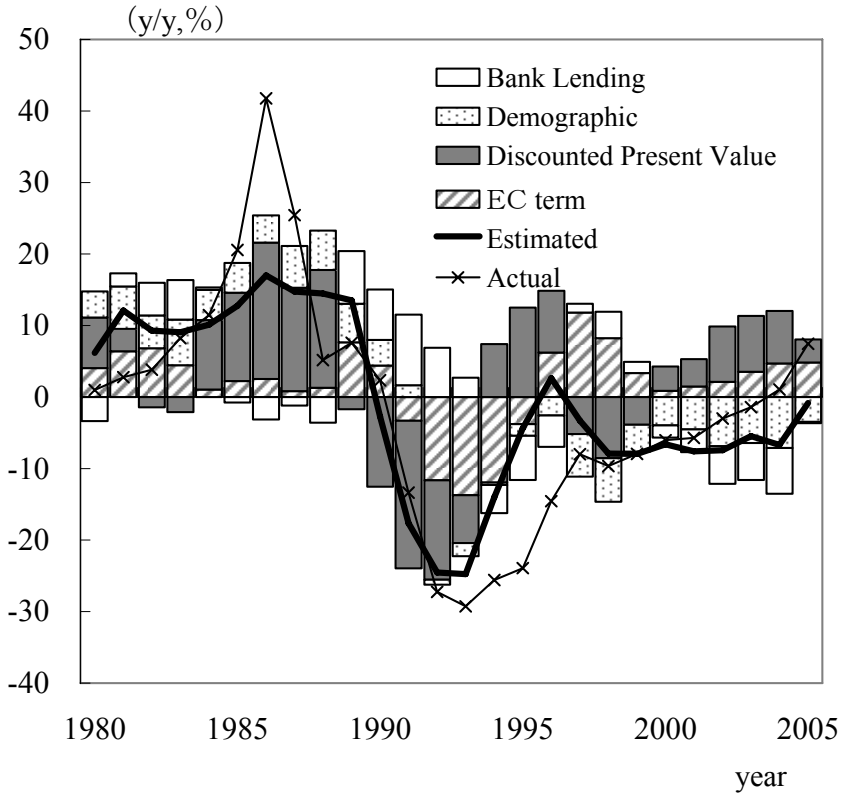


Regional Area

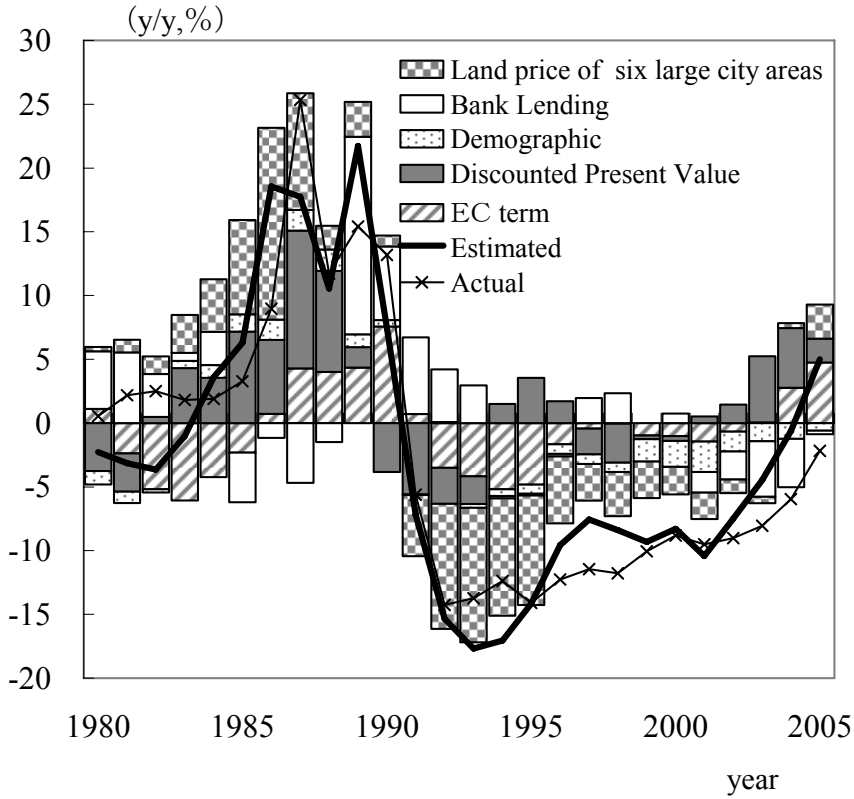


Determinants of land price changes (Commercial)

Six Large City Areas



Regional Area



Conclusion

1. There are cointegrating relationships between the real land values and the discounted present values of land.
    - This relationship resulted from cyclical movements of the interest rate gap based on the myopic growth expectations.
2. The demographic factors have significant impacts on land values even in the long run.
3. The recent recovery of land values has been brought about by
    - Upturn in economic fundamentals under the low-interest rate environment,
    - Convergence with the theoretical land values,
    - Halt in the decline in bank lending.

Remarks

How do we consider “Bubble”?

1. Myopic expectation:
   “Expectation Bubble”
2. Discrepancies between estimated land values and actual land values:
   “Temporary Bubble”