

**International Conference on Commercial Property Price Indicators on 10-11 May 2012
in the European Central Bank (Frankfurt)**

Biases in Commercial Property Price Indexes

Session1. May 10, 2012

Chihiro Shimizu

(Reitaku University& The University of British Columbia)

with

W.Erwin Diewert (The University of British Columbia),

Kiyohiko.G. Nishimura (The Deputy Governor of Bank of Japan),

Tsutomu Watanabe (The University of Tokyo)

Papers of Commercial Property Price Indicators for International Conference on CPPI at the ECB.

Biases in commercial appraisal-based property price indexes in Tokyo-Lessons from Japanese experience in Bubble period-

- Chihiro Shimizu, Kiyohiko.G. Nishimura, Tsutomu Watanabe

Commercial Property Price Indexes for Tokyo-Transaction- Based Index, Appraisal-Based Index and Present Value Index-

- Chihiro Shimizu, W.Erwin Diewert, Kiyohiko.G. Nishimura, Tsutomu Watanabe

Japanese experience in Bubble period.

- **What happen during “Collapse of Bubble” in Japan:**
- The most typical problem was the one surrounding financial institutions’ **disposal of bad loans.**
- Since no real estate price index/real estate price information existed that made it possible to capture real estate market conditions, it was not possible to calculate **correct bad loan debt amounts**, and it took a long time until policy measures were implemented, **including the injection of public funds.**
- This was a major factor leading to the prolonged economic stagnation known as the **“lost decade.”**

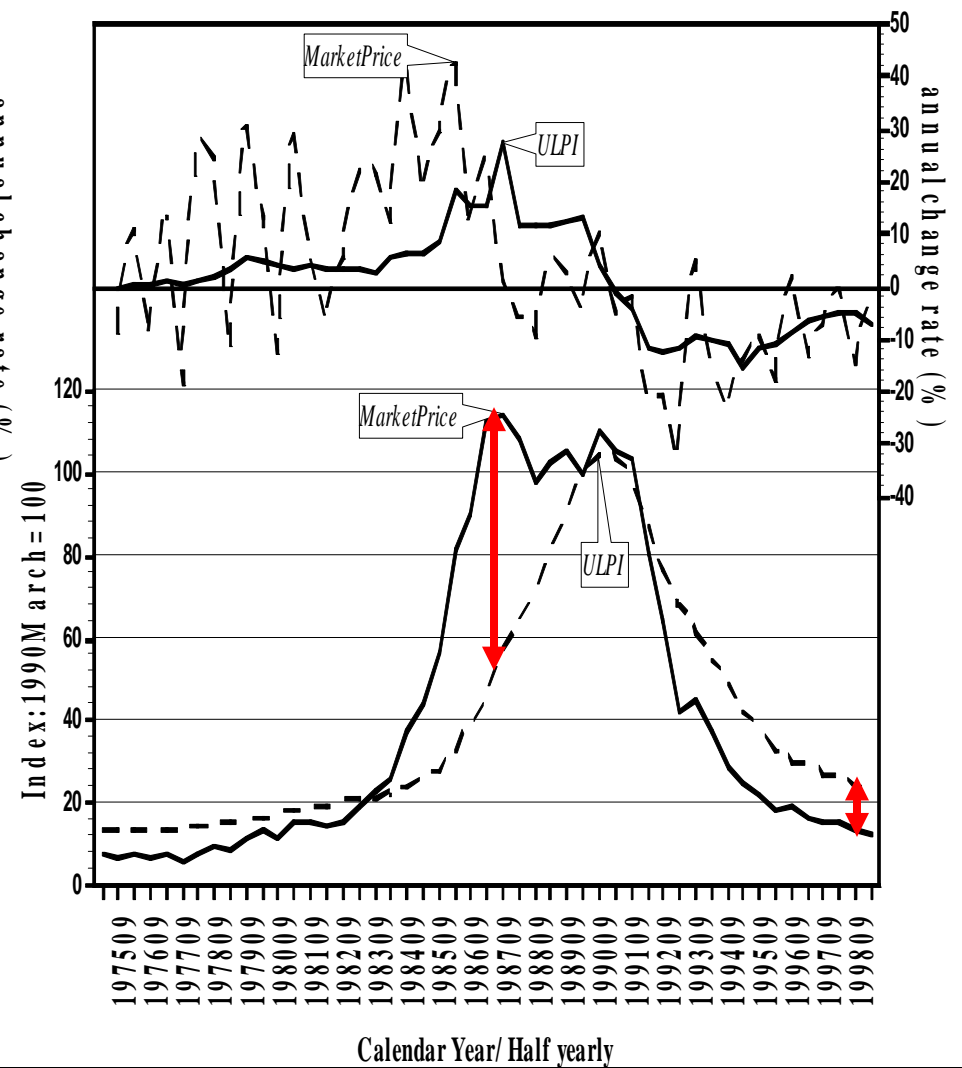
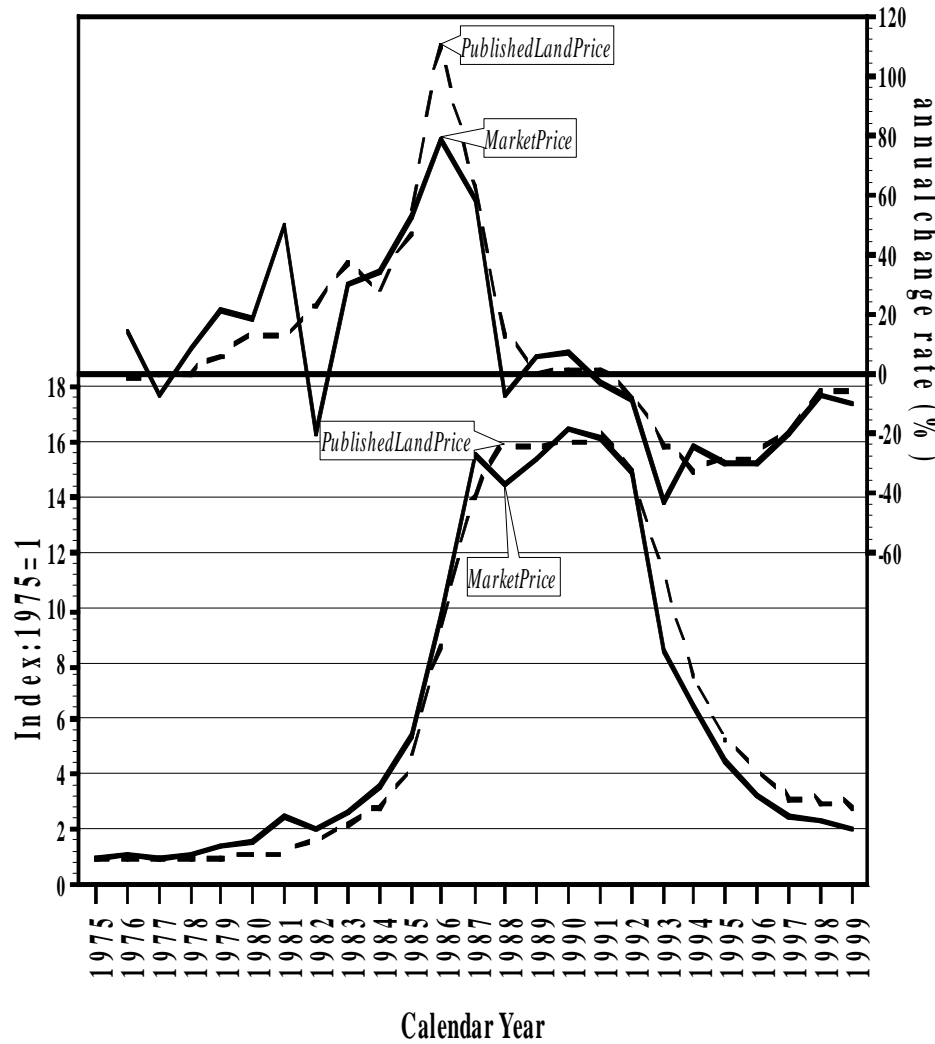
Commercial Real Estate Price Information in Japan.

Survey	Organisation	Type1	Type2	Frequency	Availability
Published Land Price Survey	The Ministry of Land, Traffic and Infrastructure	Appraisal	Price & index	Annual	1970
Urban Land Index	Japan Real Estate Association	Appraisal	Index	Bi-annually	1955
IPD Property Index	IPD: Investment Property Databank	Appraisal	Index	Monthly	2001
ARES JREIT Property Index	The Association fro Real Estate Securitization	Appraisal	Index	Quarterly	2001
MUTB-CBRE Real Estate Investment Index	Mitsubishi-UFJ Trust Bank & CB Richard Ellis	Appraisal	Index	Yearly	1968

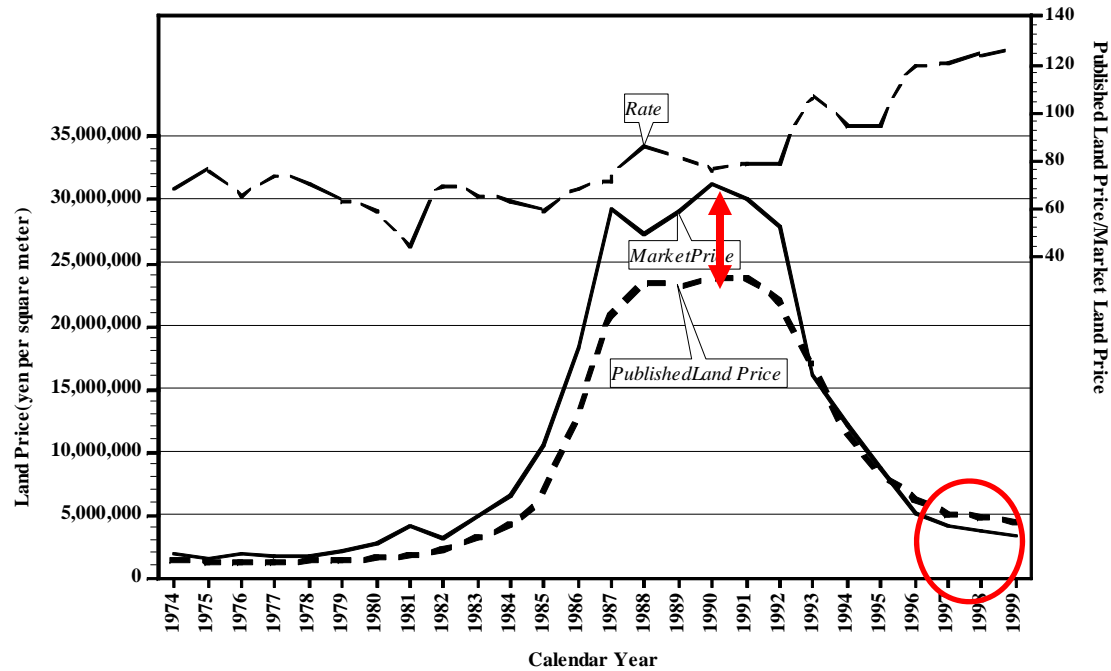
Why J-CPPI were not effective in policy management?

- The question of **why these real estate price indexes were not effective in policy management** during the bubble era and the subsequent collapse process is a vital one.
- → One cause suggested during the series of policy-related discussions following the bubble's collapse was that **there were significant errors in the real estate appraisal prices** forming the raw data for creating the indexes.
- **Smoothing problem, Valuation error problem, Lagging problem, Client influence problem.**
- (Nishimura and Shimizu(2003), Shimizu and Nishimura(2006), (2007)

Transaction price-based index and Appraisal value based index in Tokyo.



Value to price ratio: Appraisal value / estimated transaction price



ID	Neighbourhood	Area	Land Value(Yen/m ²) at 1975	Lot size	Road Width	Nearest Station	Distance to NS	FLR	Value/Estimate Ratio at 1975	Value/Estimate Ratio at 1987	Value/Estimate Ratio at 1999
Point 1	Small-sized retails and financial offices mix up	Chiyoda Ward	1,250,000	163m ²	27m	Kanda	150m	800%	75.98%	58.63%	126.01%
Point 2	Retails and offices mix up	Minato Ward	1,270,000	133m ²	10m	Omotesando	60m	700%	71.02%	63.14%	115.56%

Lessons from Japanese experience in Bubble period.

- 1. Appraisal-based information has **systematic problem**.
- 2. This kind of problem was a major factor in the delay in disposing of bad loans at financial institutions following the bubble's collapse and one of the factors leading to the subsequent stagnation of the Japanese economy.
- +
- Additional Comment:
- Who should supply policy-making indicator?
- Reporting of multiple real estate investment indexes supplied by the private sector ceased during the 2000s, **due to companies going under, finding it difficult to collect data, or abandoning the index business, which caused confusion in the market.**

Several methods of CPPI estimation.

- **Repeat sales price method: (Transactions)**
 - The depreciation problem and renovation problem
 - (Diewert, 2007; Shimizu, Nishimura, and Watanabe, 2010).
- **Hedonic Repeat sales price method: (Transactions)**
 - The hedonic price method, it is necessary to collect considerable property price-related attribute data. → **Omitted variable bias**
- **Present value method: (Rent or Income)**
 - In the appraisal practice, appraiser usually use Discounted Cash Flow approach or Income approach. (not comparable approach using transaction prices)
 - → Present Value in neo-Classical Economic Theory

Theoretical Framework

$$V_v^t = \frac{y_v^t}{1+r^t} + \frac{y_{v+1}^{t+1}}{(1+r^t)(1+r^{t+1})} + \dots + \frac{y_{m-1}^{t+m-v-1}}{\prod_{i=t}^{t+m-v-1} (1+r^i)}$$

$$- \frac{O_v^t}{1+r^t} - \frac{O_{v+1}^{t+1}}{(1+r^t)(1+r^{t+1})} - \dots - \frac{O_{m-1}^{t+m-v-1}}{\prod_{i=t}^{t+m-v-1} (1+r^i)}$$

- V_v^t : the initial asset value for the period t ,
- y_v^t : the income corresponding to V_v^t ,
- O_v^t : the expenses paid at the end of the period,
- r^t : the expected nominal discount (interest) rate for period t

Empirical Model : Hedonic model for rent, price and discount rate

Rent Model $\ln y_{it} = \alpha_0 + \sum_J \alpha_j X_{ij} + \sum_T v_t D_t + v_{1i}$

Price Model $\ln V_{it} = \beta_0 + \sum_J \beta_j X_{ij} + \sum_T \xi_t D_t + v_{2i}$

$$\ln(y_{it} / V_{it}) = (\alpha_0 - \beta_0) + \sum_J (\alpha_j - \beta_j) X_{ij} + \sum_T (v_t - \xi_t) D_t + (v_{1i} - v_{2i})$$

Discount rate Model $\ln r_{it} = (\alpha_0 - \beta_0) + \sum_J (\alpha_j - \beta_j) X_{ij} + \sum_T (v_t - \xi_t) D_t + \varepsilon_i$

$$(\alpha_j - \beta_j) = \frac{\partial \ln y_{it}}{\partial x_{ij}} - \frac{\partial \ln p_{it}}{\partial x_{ij}}$$

X: Characteristics of property

D: Time Dummy

J-REIT data: Tokyo metropolitan area:2001-2010

Appraisal price

	Mean	Std.Dev	Min	Max
Appraisal price (4,993 Observations)				
V^A : Appraisal price (million yen)	8,428.35	11,767.37	323.00	138,000.00

Transaction price

	Mean	Std.Dev	Min	Max
Transaction data (559 Observations)				
V^T : Transaction price (million yen)	7,229.37	11,110.93	324.00	110,000.00

Rent, Price & Rent-Price ratio

	Mean	Std.Dev	Min	Max
NOI, Appraisal price and NOI Price ratio (4,926 Observations)				
y^A : Net Operating Income (Rent - Operating	413.06	501.45	15.68	5,268.89

Estimating result of Hedonic Equation: **Appraisal data**

	Model V_{A1}			Model V_{A2}		
	Coef	std err		Coef	std err	
Constant	13.622	0.117	***	13.945	0.092	***
S : Floor space (m ²)	0.001	0.003		0.011	0.002	***
A : Age of Building (years)	-0.009	0.001	***	-0.007	0.001	***
H : Number of stories (stories)	0.006	0.002	***	0.010	0.001	***
TS : Time to the nearest station: (minutes)	-0.020	0.004	***	-0.043	0.002	***
TT : Travel Time to Central Business District (minutes)	-0.023	0.005	***	-0.017	0.002	***
LD_k ($k=0, \dots, K$)	Yes: Census			Yes: Municipalities		
TD_q ($q=0, \dots, Q$)	Yes			Yes		
Adjusted R-square=	0.889			0.569		
Number of Observations=	4,993			4,993		

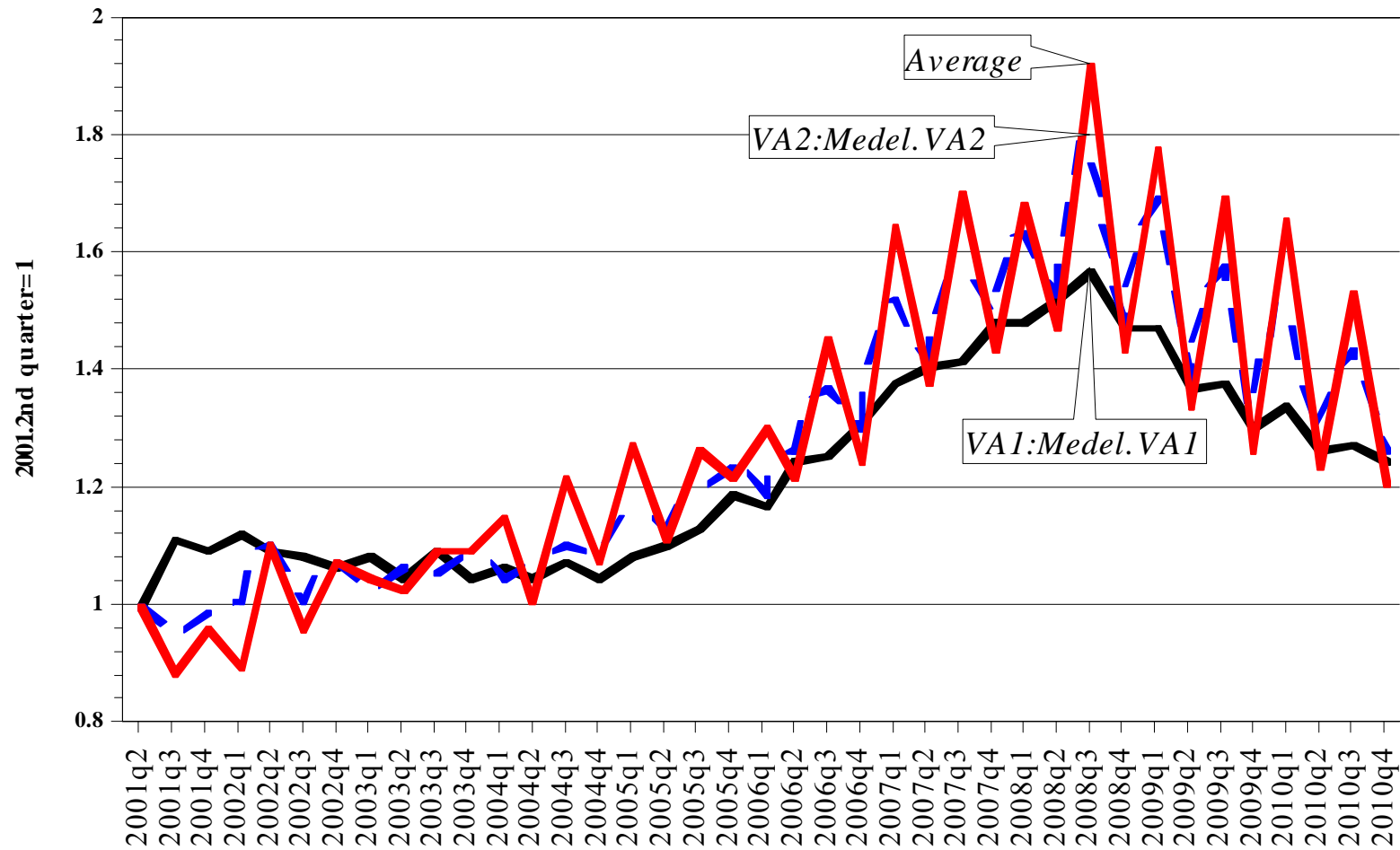
*P<.01, **P<.05, ***<.01

Note: The dependent variable in each case is the log of the price.

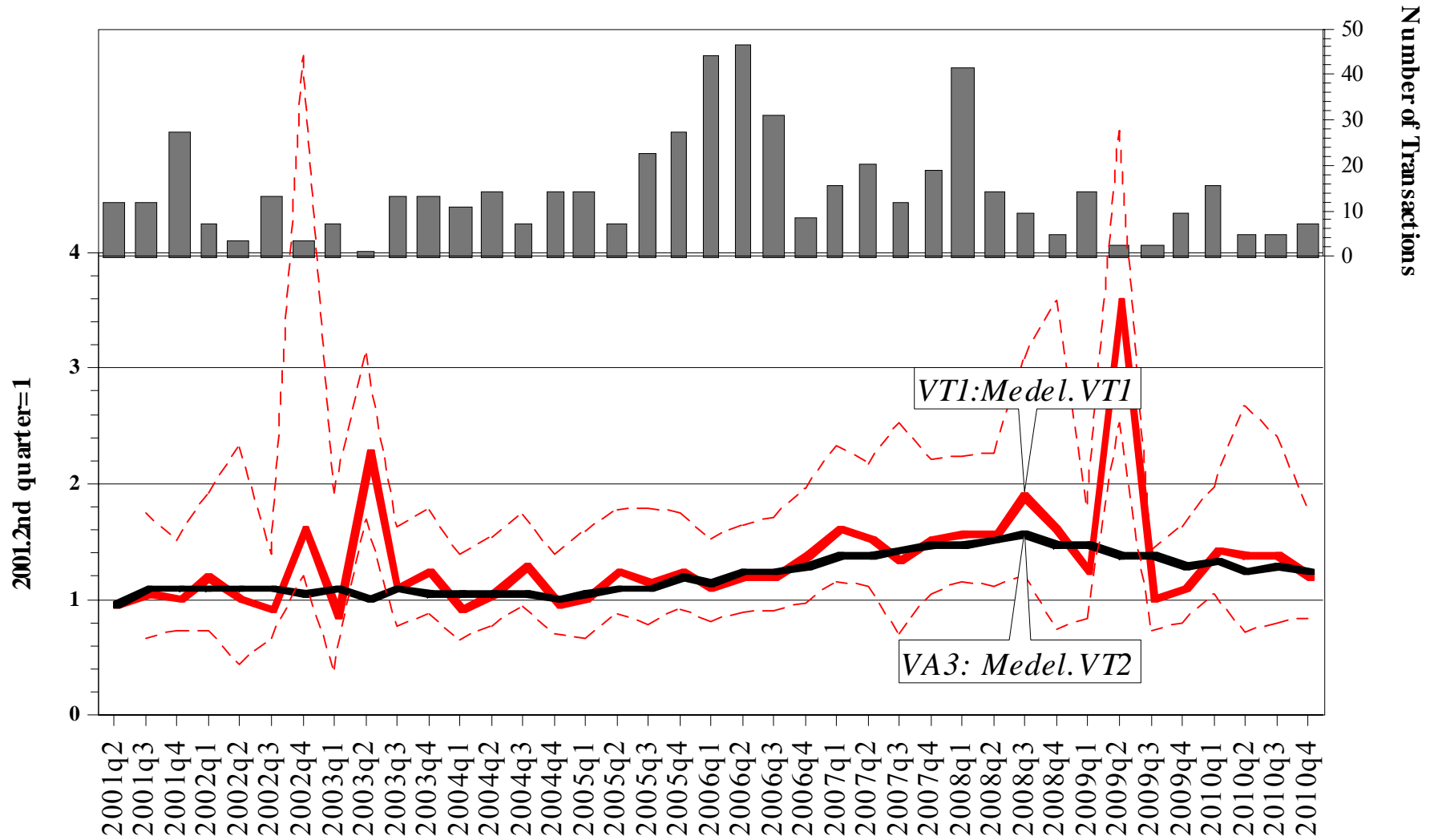
Model1: Census survey location dummy: **315 dummy variables.**

Model2: Municipalities location dummy : **45 dummy variables.**

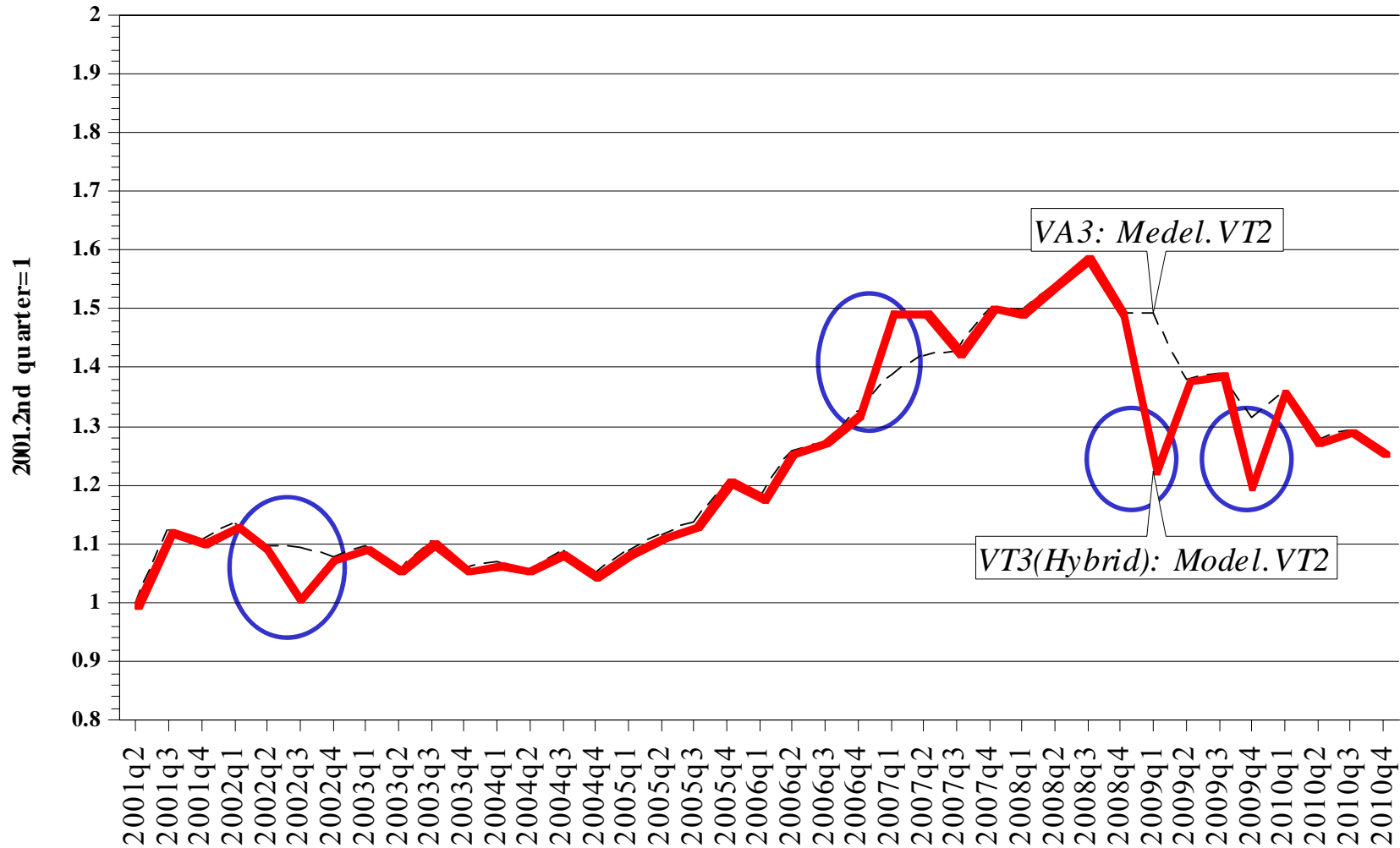
Trend of Hedonic **Appraisal Based Indexes**



Error of Estimated **Transaction Based Index**



Trend of Adjusted Transaction Based Index



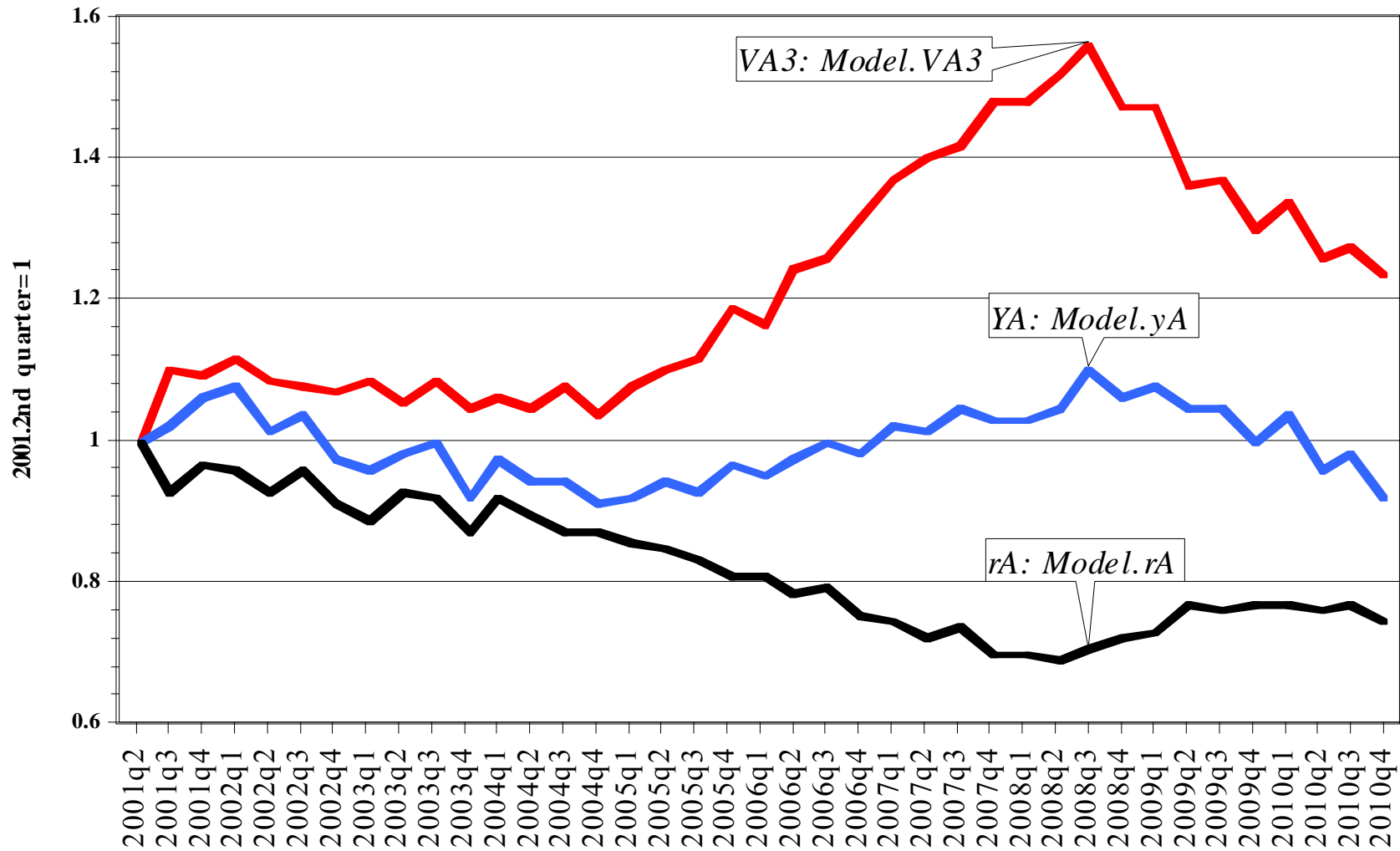
Estimation result of hedonic equation: Income, Price and Discount rate

	Model y_A			Model V_{A3}			Model r_A			$\alpha - \beta$
	α : Coef	std err		β : Coef	std err		Coef	std err		
Constant	11.057	0.130	***	13.614	0.117	***	-2.557	0.078	***	-2.557
S : Floor space (m ²)	0.006	0.003	*	0.002	0.003		0.005	0.002	**	0.005
A : Age of Building (years)	-0.006	0.001	***	-0.009	0.001	***	0.003	0.001	***	0.003
H : Number of stories (stories)	-0.001	0.002		0.006	0.002	***	-0.007	0.001	***	-0.007
TS : Time to the nearest station: (minutes)	-0.004	0.005		-0.018	0.004	***	0.014	0.003	***	0.014
TT : Travel Time to Central Business District (minutes)	-0.015	0.006	***	-0.023	0.005	***	0.008	0.003	***	0.008
LD_k ($k=0, \dots, K$)	Yes: Census			Yes: Census			Yes: Census			-
TD_q ($q=0, \dots, Q$)	Yes			Yes			Yes			-
	0.773			0.889			0.672			
	4,926			4,926			4,926			

*P<.01, **P<.05, ***<.01

Note: The dependent variable in each case is the log of the price.

Appraisal Price, Rent and Discount Rate



Stickiness of Appraisal Value = Smoothing

$$V = \frac{y}{r}$$

- **Rigidity of Discount Rate(r)**
- **Rigidity of Rent(y).**
- Shimizu, C, K.G.Nishimura and T.Watanabe (2010), Residential Rents and Price Rigidity: Micro Structure and Macro Consequences, *Journal of Japanese and International Economy*, Vol.24, pp.282-299.

Three Discount Rate from J-REIT market

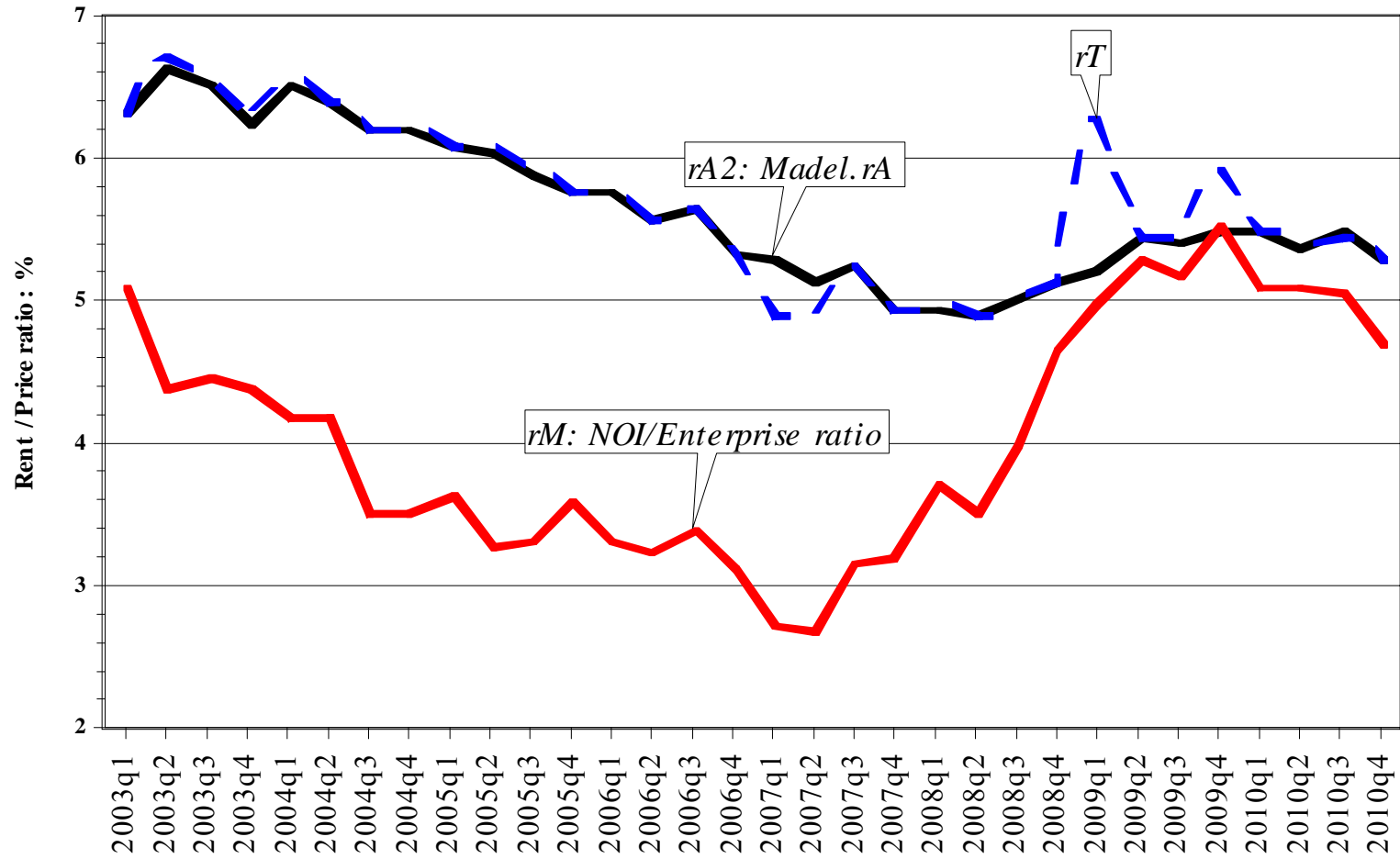
y : property income (Net Operating Income)

$$r = \frac{\text{Property Market} + \text{Stock Market}}{\text{Denominator}}$$

Tobin's Q

<p>Sum of Real Estate Appraisal Value in the REIT</p>	<p>Sum of Real Estate Transaction Price in the REIT</p>	<p>Stock</p>
		<p>Debt</p>

Trend of Rent / Price ratio: %



Discount Rate and Risk Premium: %

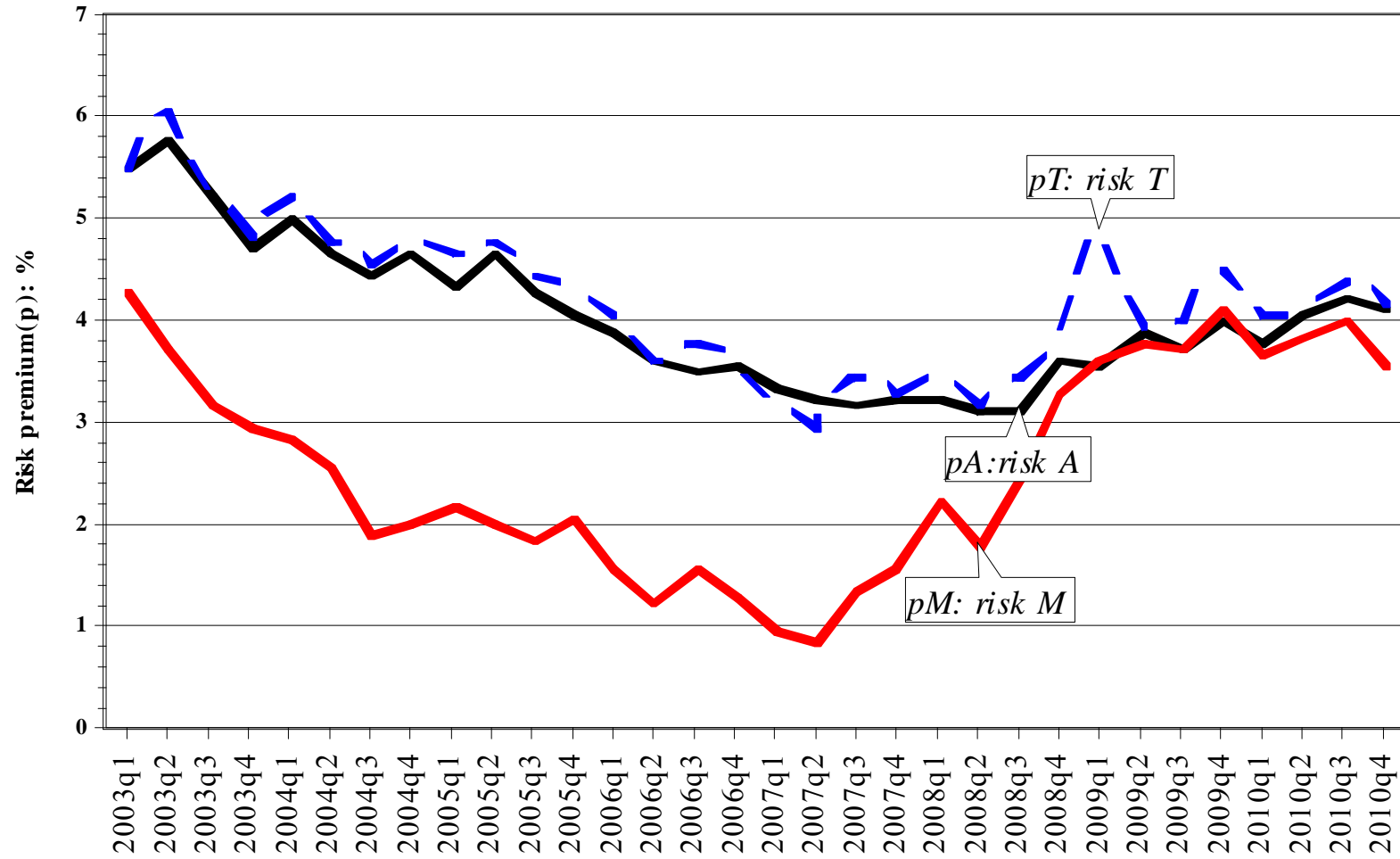
Gordon(1959):

$$r = i + \rho - \delta$$

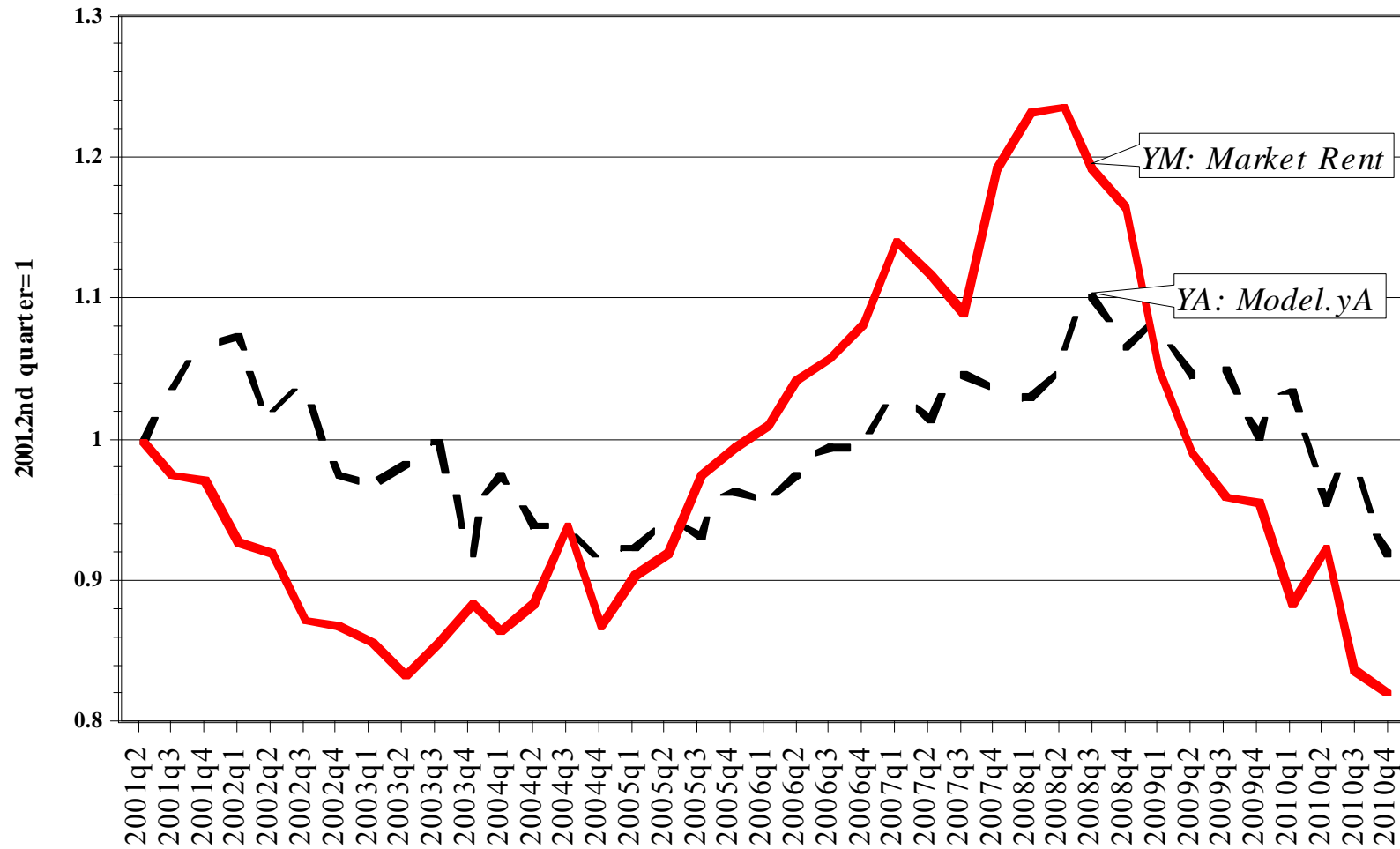
- i the investment return on safe assets,
- ρ the risk premium with respect to property investments,
- δ the anticipated growth rate of property income (y).

- **Risk premium:** $\rho = r + \delta - i$

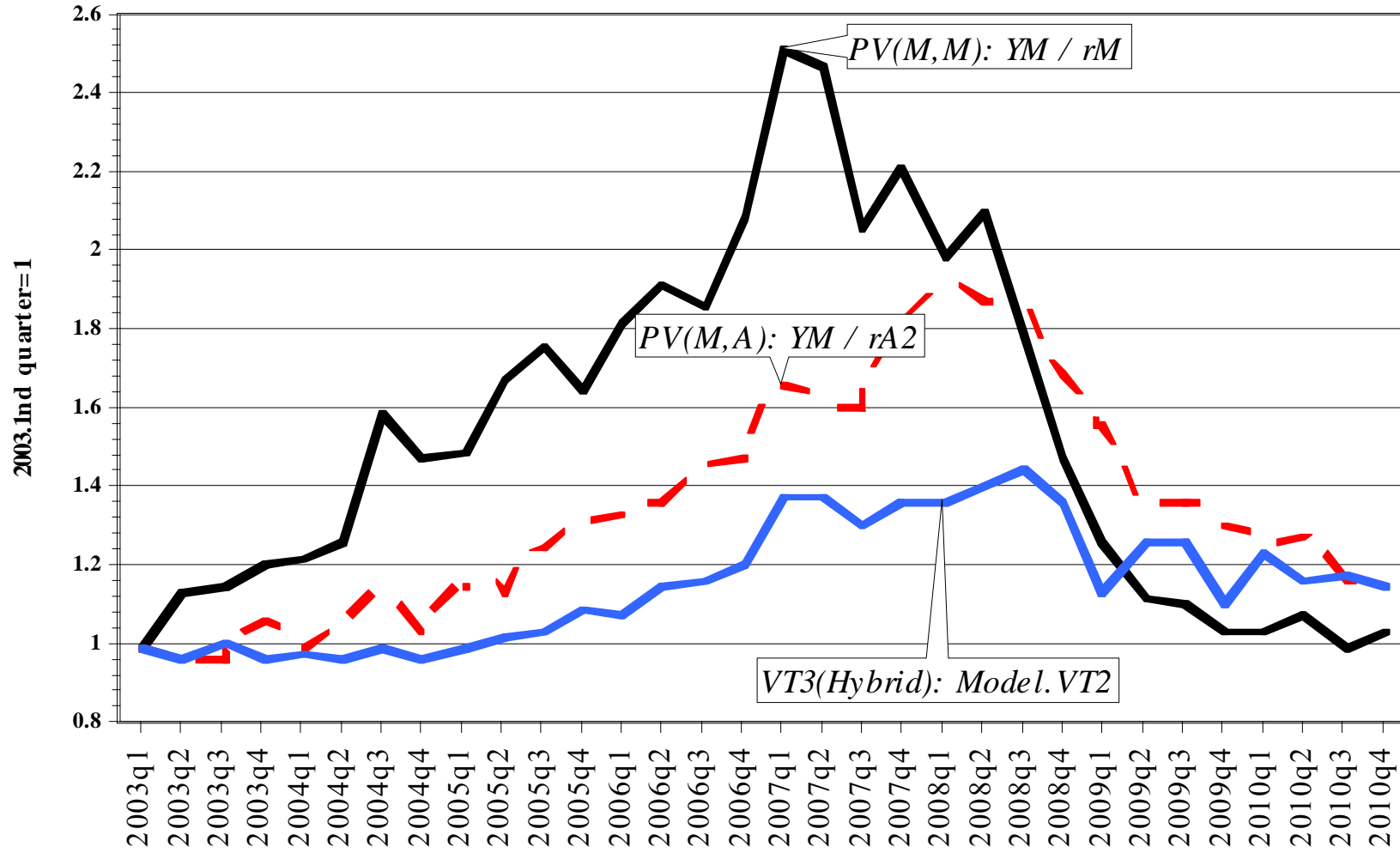
Trend of Risk Premium: %



Trend of Market Rent and Appraisal Rent Indexes



Trend of Present Value Indexes & TBI



Shiller's Test

- Then should the change in risk amount that occurred in **the stock market therefore be reflected in the property market?**
- It is known that present values determined using dividend income and prices and risk amounts **determined using the stock market are not necessarily matched** (LeRoy and Porter, 1981; Shiller, 1981).
- **Shiller's Test, (1981)**

Conclusion1: Issues in conducting of Commercial Property Price Indexes

- First, in estimating commercial property price indexes, it is **necessary to rigorously perform quality adjustment.**
- (Commercial property has **a high level of heterogeneity** compared to housing)
- Second, data selection must be performed carefully. For transaction prices, it is possible that there will be very few – and in some cases zero – transactions. On the other hand, for property appraisal prices, there are inherent problems such as **the smoothing problem, valuation error problem, and lag problem.**

Conclusion2: Issues in conducting of Commercial Property Price Indexes

- Third, setting of risk premiums for property appraisals must be performed in light of market data. In terms of **the reasons that smoothing and lags** occur with property prices determined using the capitalization method, it has become clear there are problems **in the setting of risk premiums**.
- Fourth, price indexes must be explicitly defined: do they measure **investor-observed market values**, or do they measure **potential market values**?

Conclusion3: How to conduct CPPI?

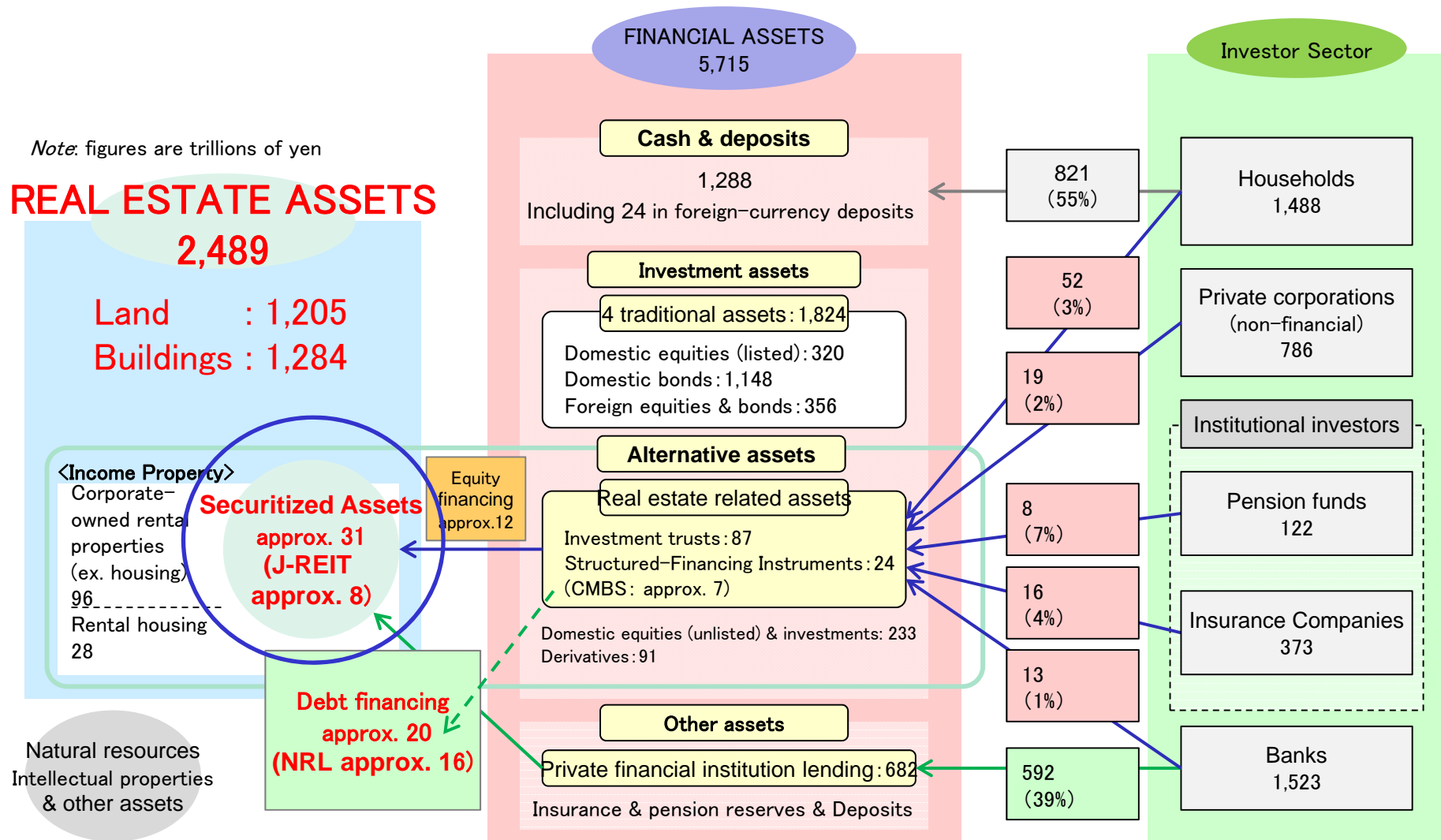
- The estimation of commercial property price indexes is restricted in different ways based on the data that is available in different countries.
- **Type.A**
- In countries where data for **the property investment market is available**, it is possible to use both property appraisal price data and transaction price data.
- For such countries, it is perhaps necessary to outline how property appraisal prices should be modified after understanding their mechanism.

Conclusion4: How to conduct CPPI?

- **Type.B**
- In countries where the investment market is undeveloped, indexes are estimated after collecting/preparing transaction prices.
- In such countries, since it is **difficult to obtain property characteristics data**, there are many problems accompanying the application of the hedonic method.
-
- **With the strong data limitations in different countries, when it comes to the preparation of commercial property price indexes, one must perhaps select the estimation method based on the available data and consider how to prepare it.**

Overview of Real Estate Investment Market in Japan

Real Estate and Financial Assets and Real Estate Investment Market in 2010.



Appraisal Value & Transaction Price in J-REIT and Transaction Price in the Land Registry.

- **Tokyo Metropolitan Area: 2005-2010**
- **New Japanese CPPI will use MLIT data.**
- **Land Registry & Ministry of Land,
Infrastructure, Transport and Tourism.**
- **Transaction Price : 14,817 observations**
- **J-REIT.**
- **Transaction Price : 380 observations**
- **Appraisal Value : 4,103 observations**

Chihiro Shimizu

(Reitaku University & The University of British Columbia)

- Our papers are available at:
- **<http://www.cs.reitaku-u.ac.jp/sm/shimizu/English.html>**