EMG Asia Workshop 1st meeting, 15 – 16 Oct 2013

Commercial Property Price Indexes for Tokyo

－Transaction-Based Index, Appraisal-Based Index and Present Value Index －

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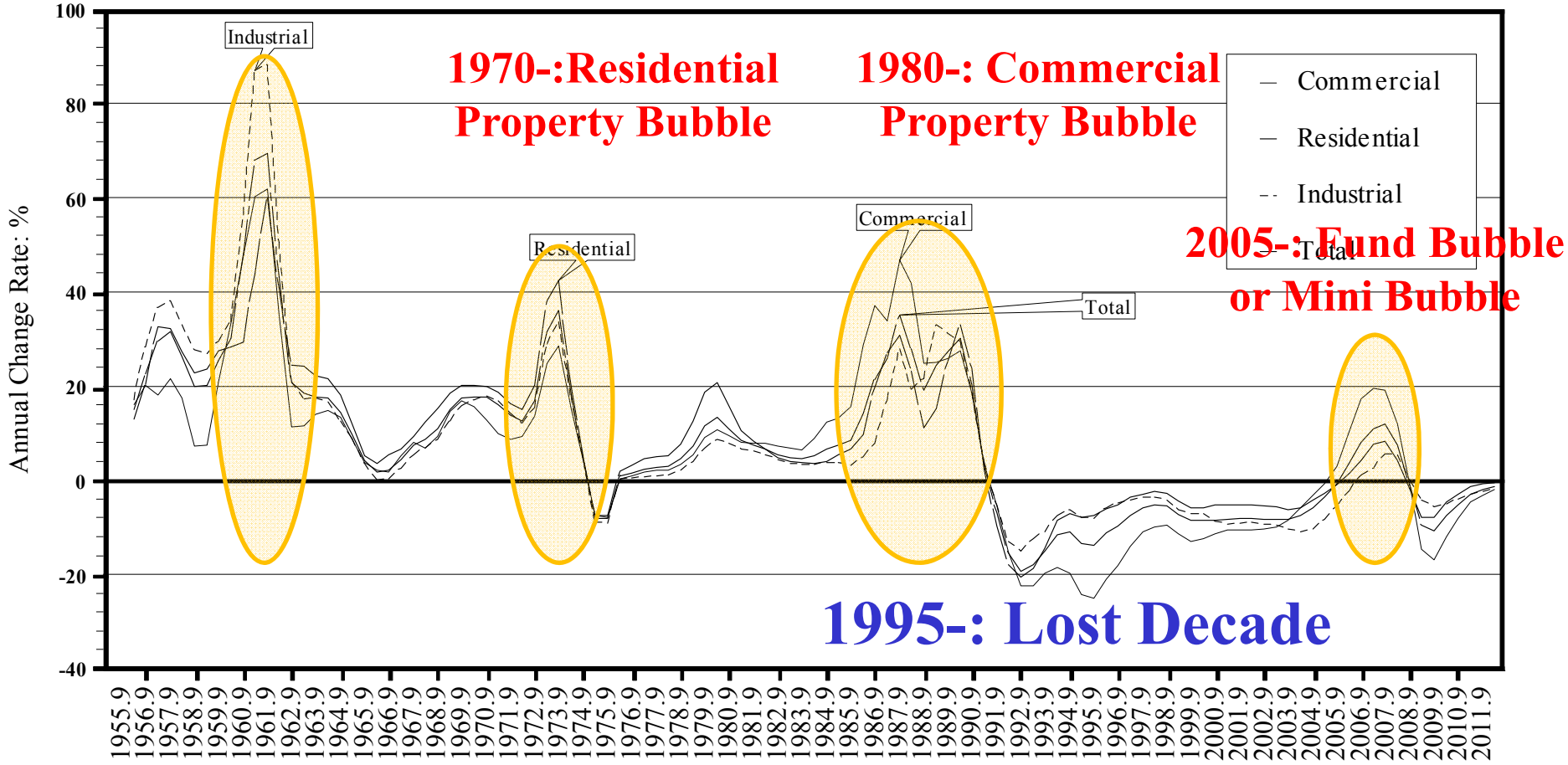
Property Bubbles and Economic Crisis

1960-: Industrial Property Bubble



Source: Japan Real Estate Institute

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Commercial Property Prices and Official Statistics

- Many countries have been experiencing large investments in commercial properties and in countries where the market has matured, *depreciation* and investments in *improvements* and *renovations* represents a substantial fraction of national output.

- But clear measurement methods for the treatment of these expenditures in the System of National Accounts are lacking.

- There is a need to construct commercial property price indexes but exactly **how should these prices be measured?**

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Ⅱ. How should we estimate CPPI?

Theoretical Framework

Present Value:

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

- 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

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Several methods of CPPI estimation.

- Methods based on commercial property sales transactions over time. Variants of this method include ***the repeat sales methodology*** and ***hedonic regression methods***.

- Methods based on observing published share prices for ***property stocks*** or REITs (Real Estate Investment Trusts) in order to estimate the asset value of the property.

- Methods based on capitalizing the ***Net Operating Income*** (NOI) of a building trust.

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Problems Stock Based Indexes

- The stock market valuation of a commercial property REIT that has a constant portfolio of ***properties does not provide a constant quality price for the fixed assets*** in that portfolio due to the depreciation of the structures in the portfolio.
- For national income accounting purposes, ***a decomposition of the asset value of a REIT into its structure and land components*** is required and the stock market valuation cannot provide this breakdown.→**Diewert's Presentation**
- Stock market valuations will generally be ***too volatile for statistical agency purposes***. The stock market price of a REIT will typically over react to daily news about macroeconomic events.

The most useful method for CPPI

- ***Thus in our view, the most useful method for obtaining constant quality prices for commercial properties is the capitalization of net operating income method***.

- Appraisal Based Indexes diverged significantly from the market price levels and could not detect the turning point of property price changes in Japanese Bubble period.
- **→Smoothing problem or Valuation Error Problem.**
- **(Nishimura and Shimizu (2003), Shimizu and Nishimura (2006), (2007)**

- **How can we estimate market based CPPI using Net Operating Income or NOI?**

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Data: Tokyo metropolitan area: 2001-2010

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

NOI(Y) , Appraisal Prices and & 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 Expenditure)	413.06	501.45	15.68	5,268.89
V^A : Appraisal price (million yen)	8,472.32	11,816.94	323.00	138,000.00
r^A : y / V^A ratio	5.40	1.18	2.02	11.04

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

NOI Model

$$\ln y_{it} = \alpha_0 + \sum_J \alpha_j X_{ij} + \sum_T \nu_t D_t + \nu_{1i}$$

Appraisal Price Model

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

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

Discount rate Model

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

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

X: Characteristics of property

D: Time Dummy

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

	α			β			$\alpha-\beta$			
	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: (mimutes)	**-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 $(k=0,\ldots,K)$	Yes: Census			Yes: Census			Yes: Census			-
TD_q $(q=0,\ldots,Q)$	Yes			Yes			Yes			-
	0.773			0.889			0.672			
	4,926			4,926			4,926			

*P<.01, **P<.0.05, ***<.0.01

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

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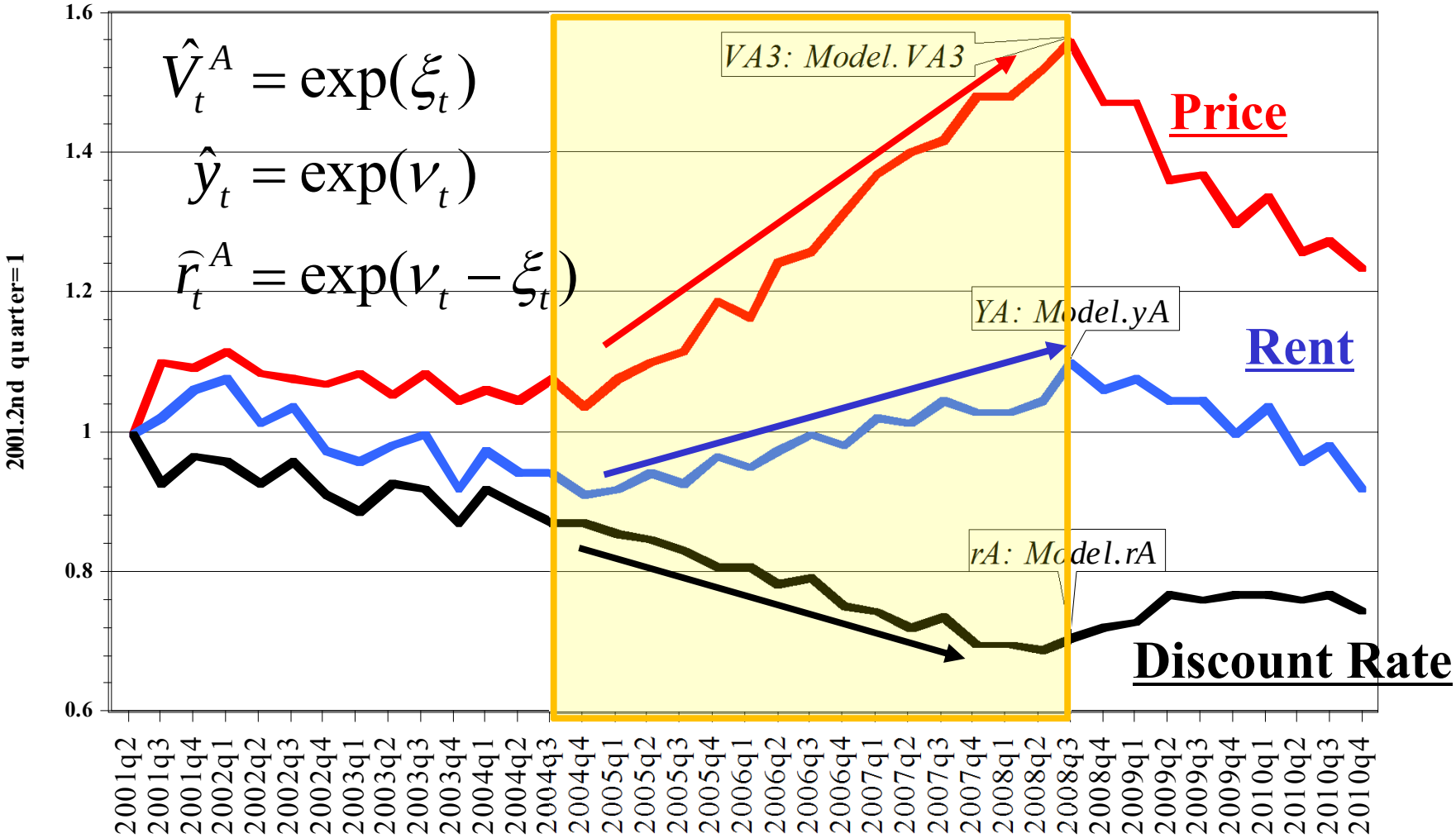
Appraisal Price, Rent and Discount Rate



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Stickiness (Rigidity) 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.

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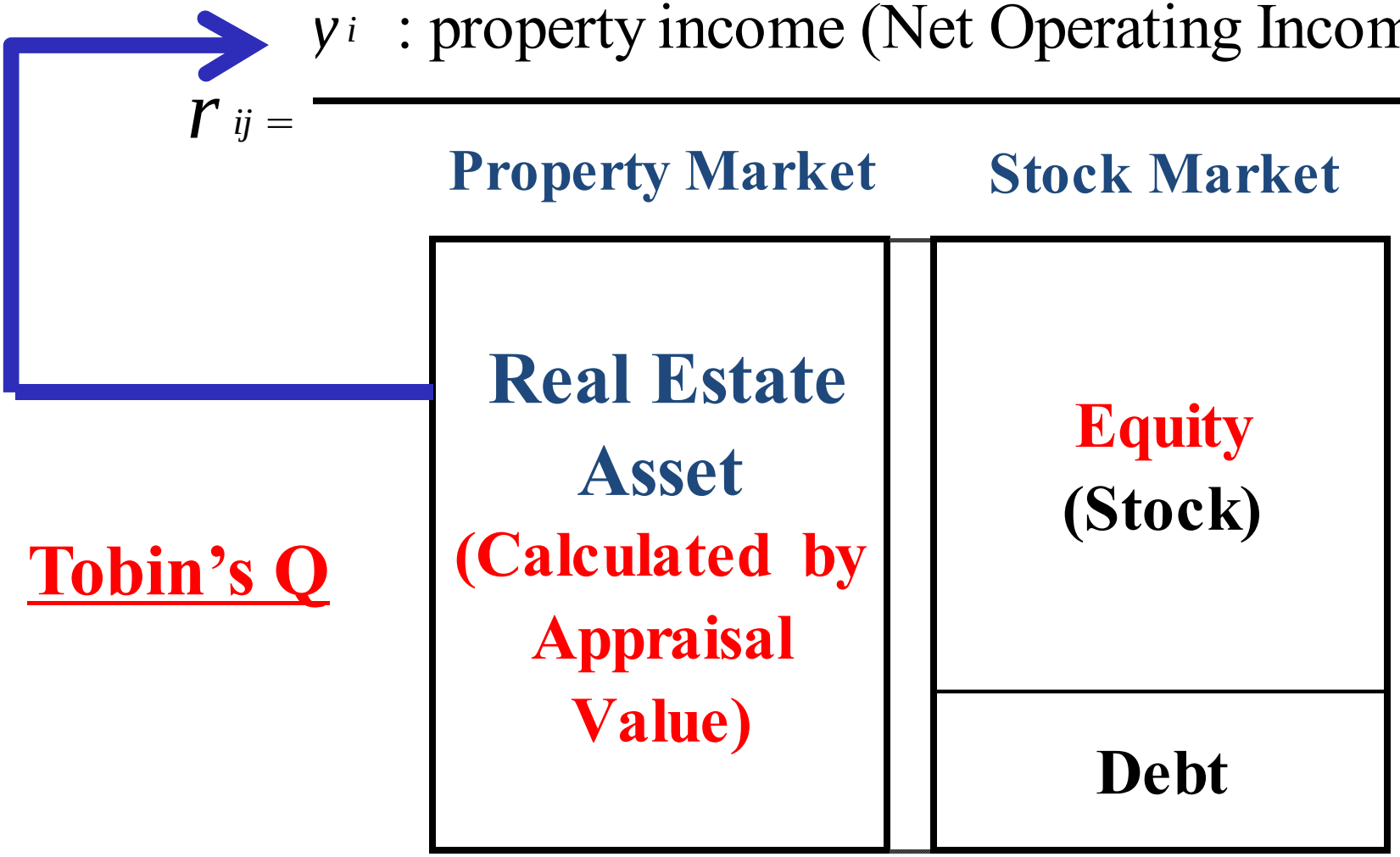
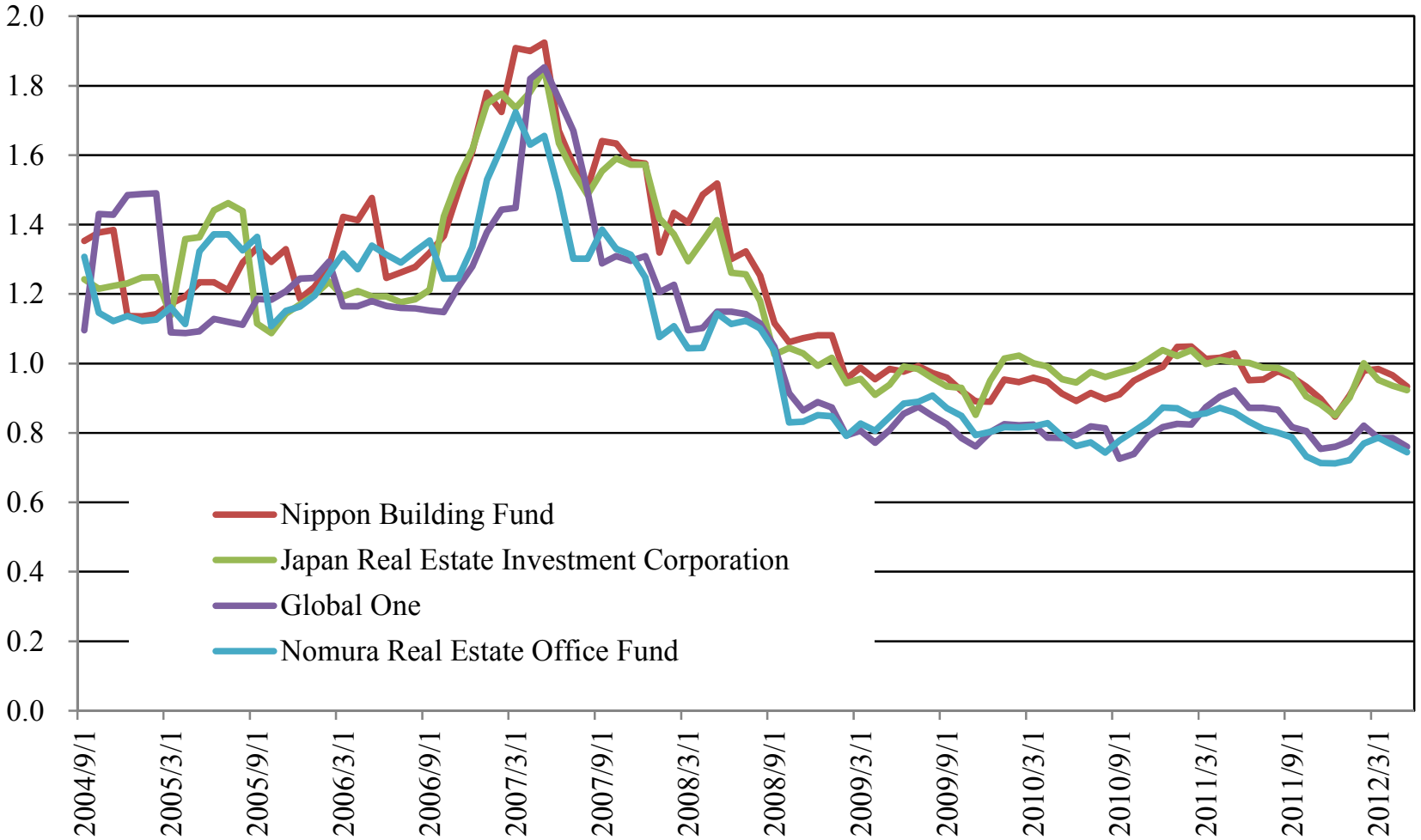
Two Discount Rate(r_M) from Appraisal & Stock market

Dividend=

$r_{ij} = \dfrac{y_i \text{ : property income (Net Operating Income)}}{}$



Tobin's Q



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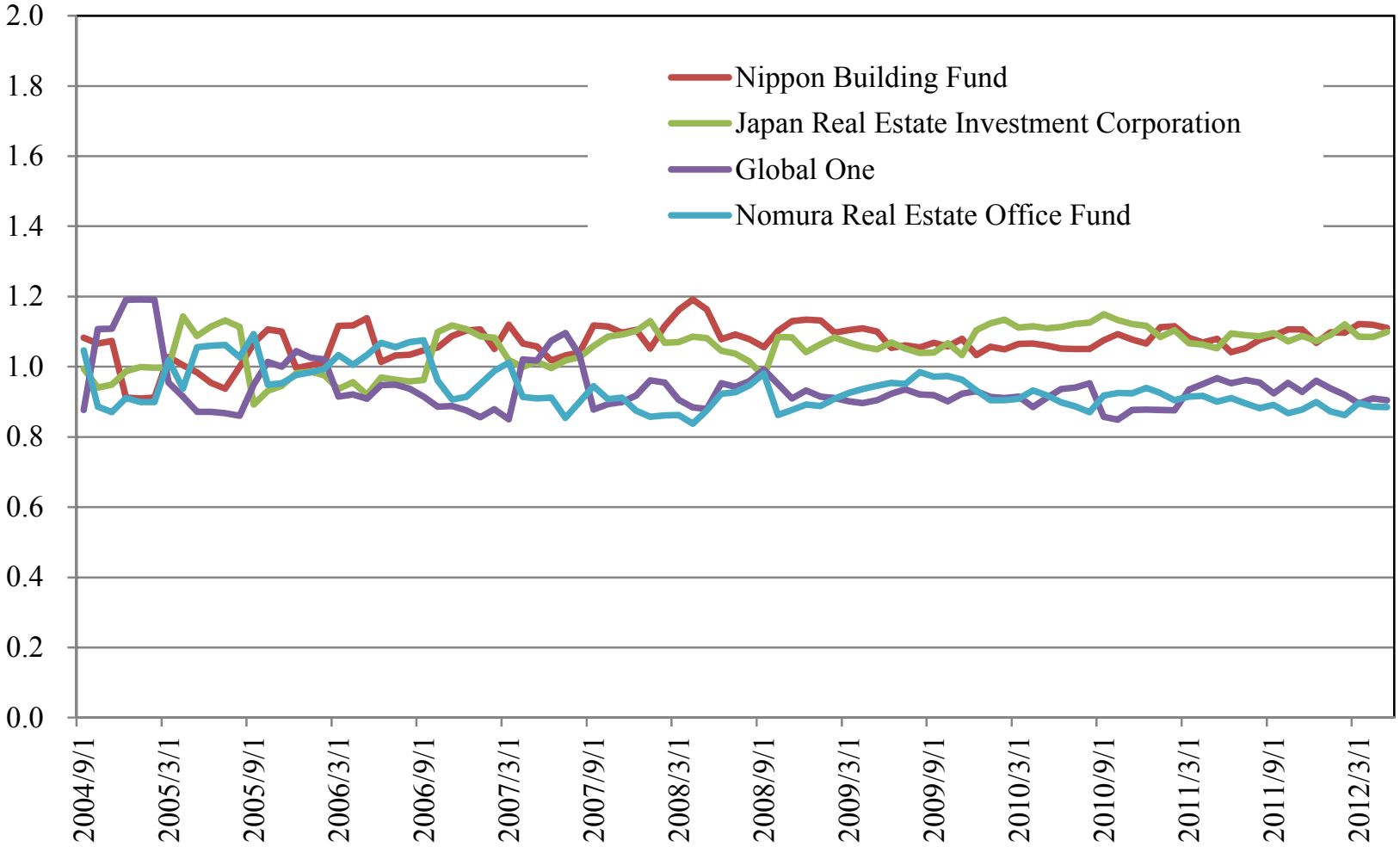
Tobin's q relative to the average



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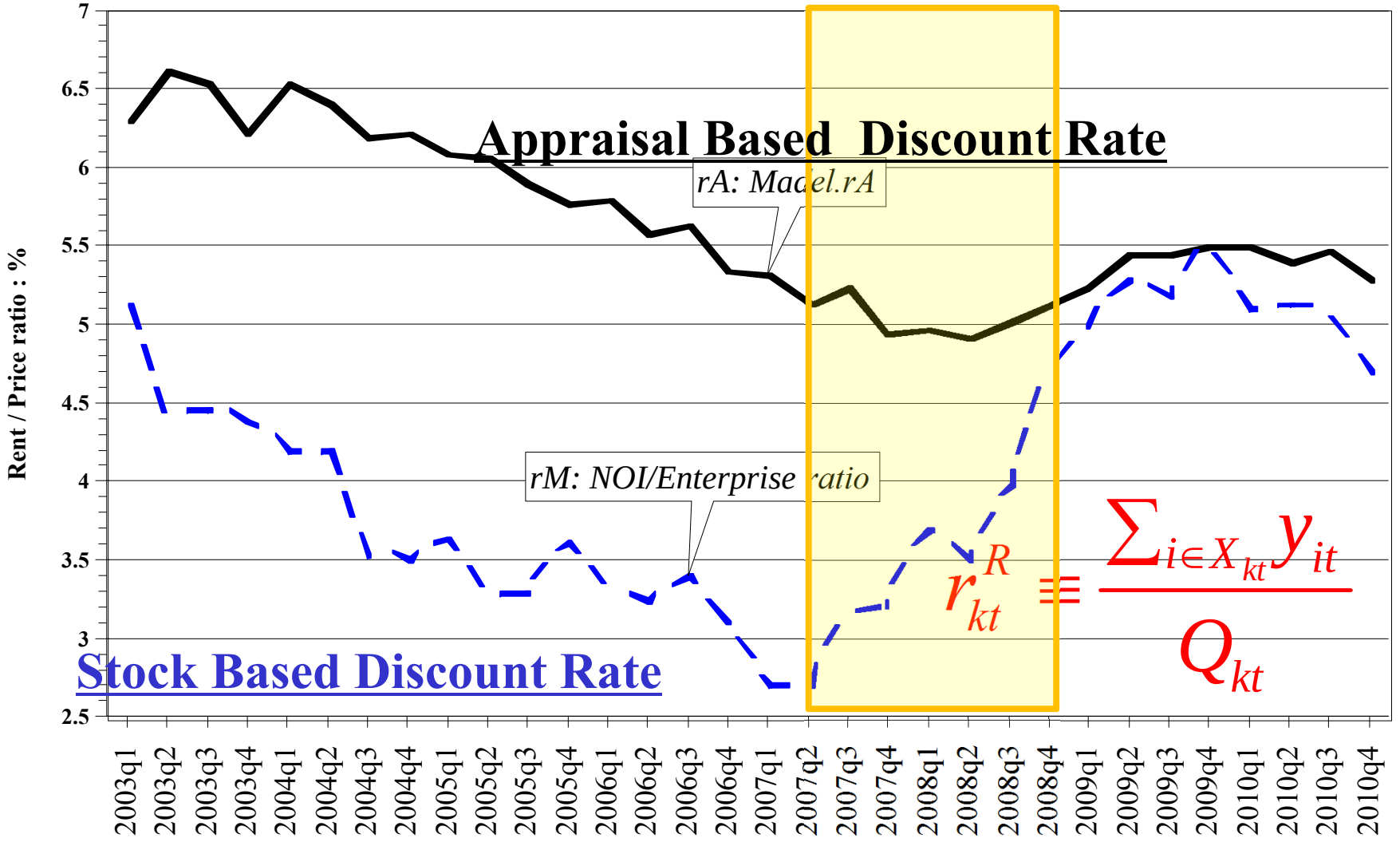
Trend of Rent / Price ratio: %



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

Discount Rate

Geometric Mean of income

JGB (10 year)

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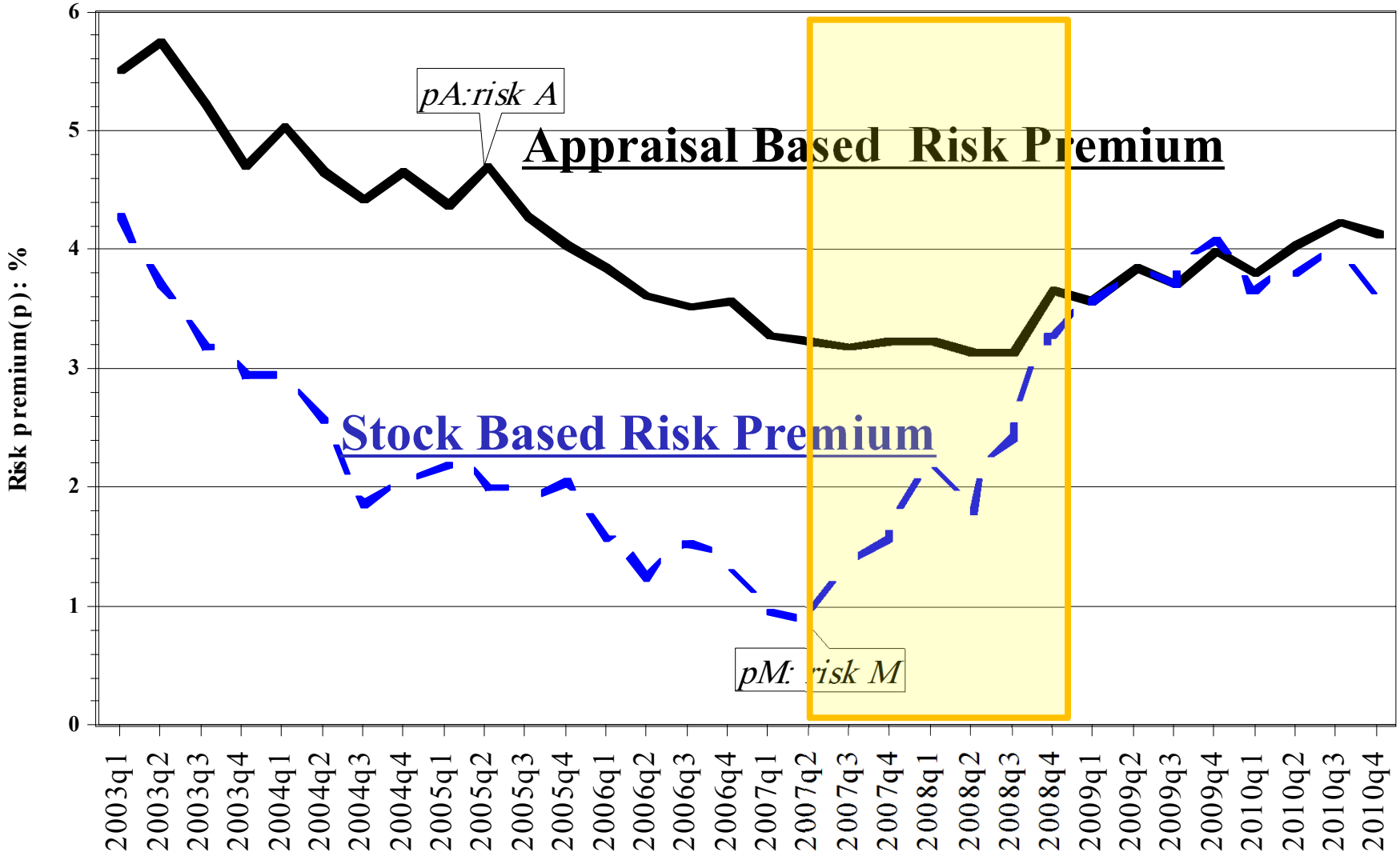
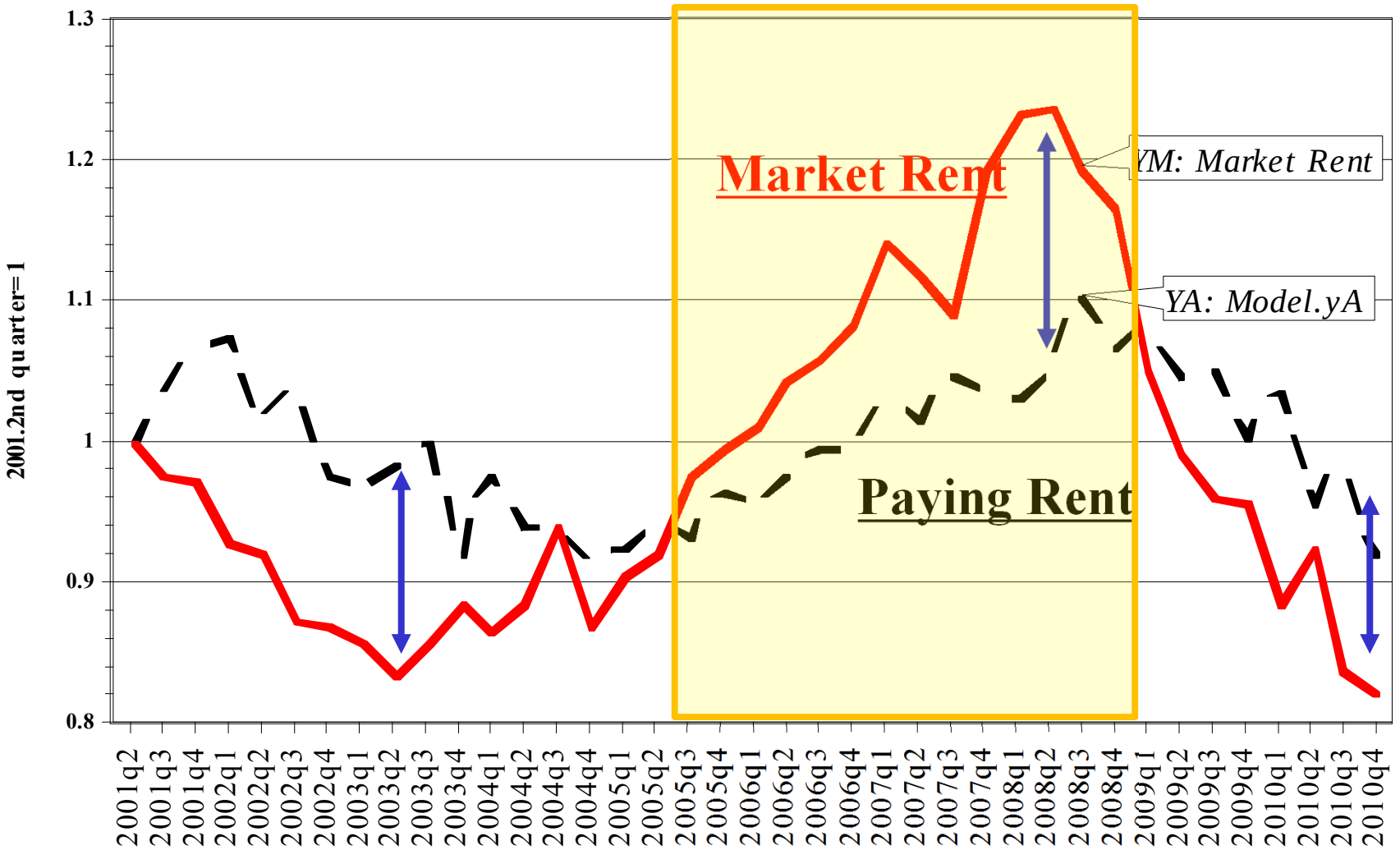
Trend of Risk Premium: %



Trend of Market Rent and Appraisal Rent Indexes



Calvo Parameter : λ (New Keynesian Style) :

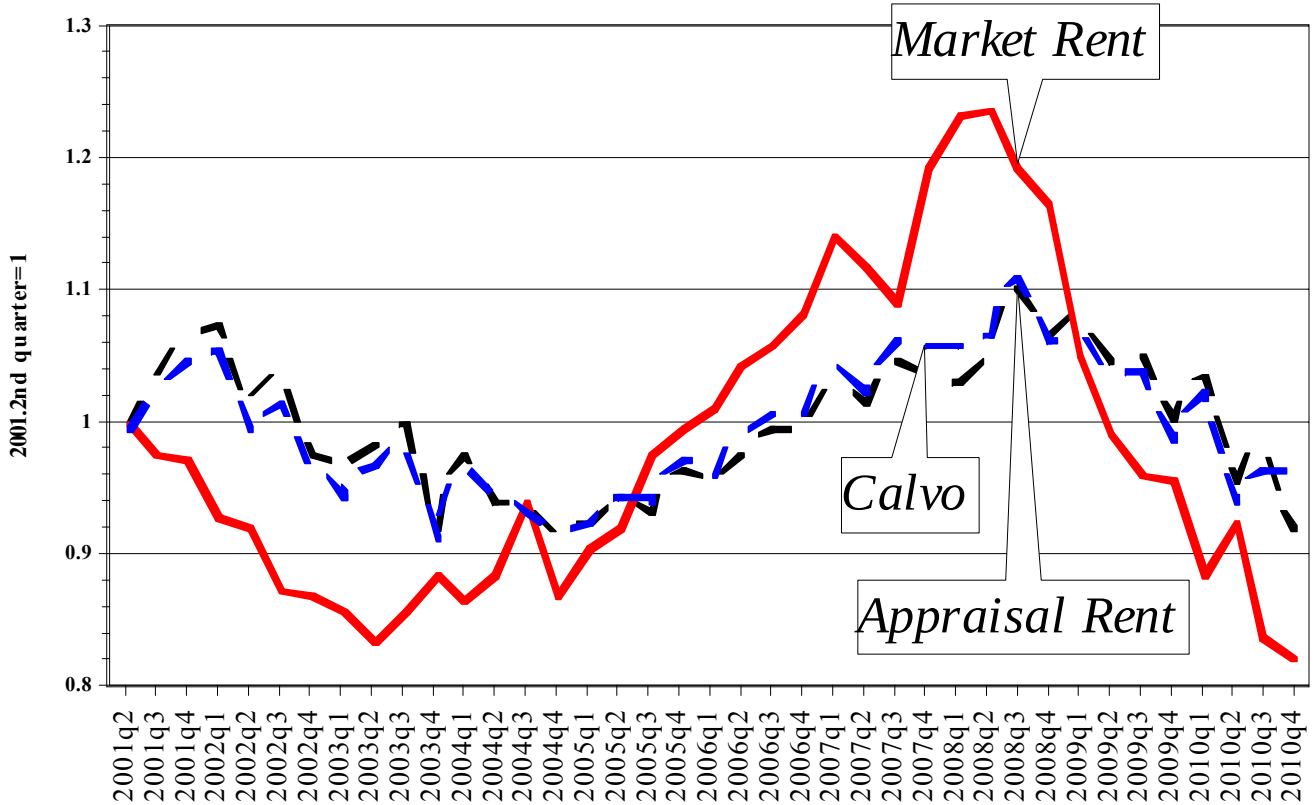
Rigidity of Office Paying Rent

$$\hat{y}_{At} = (1-\lambda)\hat{y}_t^{N(M)} + \lambda \hat{y}_{A,t-1}$$

$$\lambda = 0.874, s.e = 0.050$$

$$1 \div 0.124 \fallingdotseq 8$$

$$0.124 = 1 - \lambda(=0.874)$$



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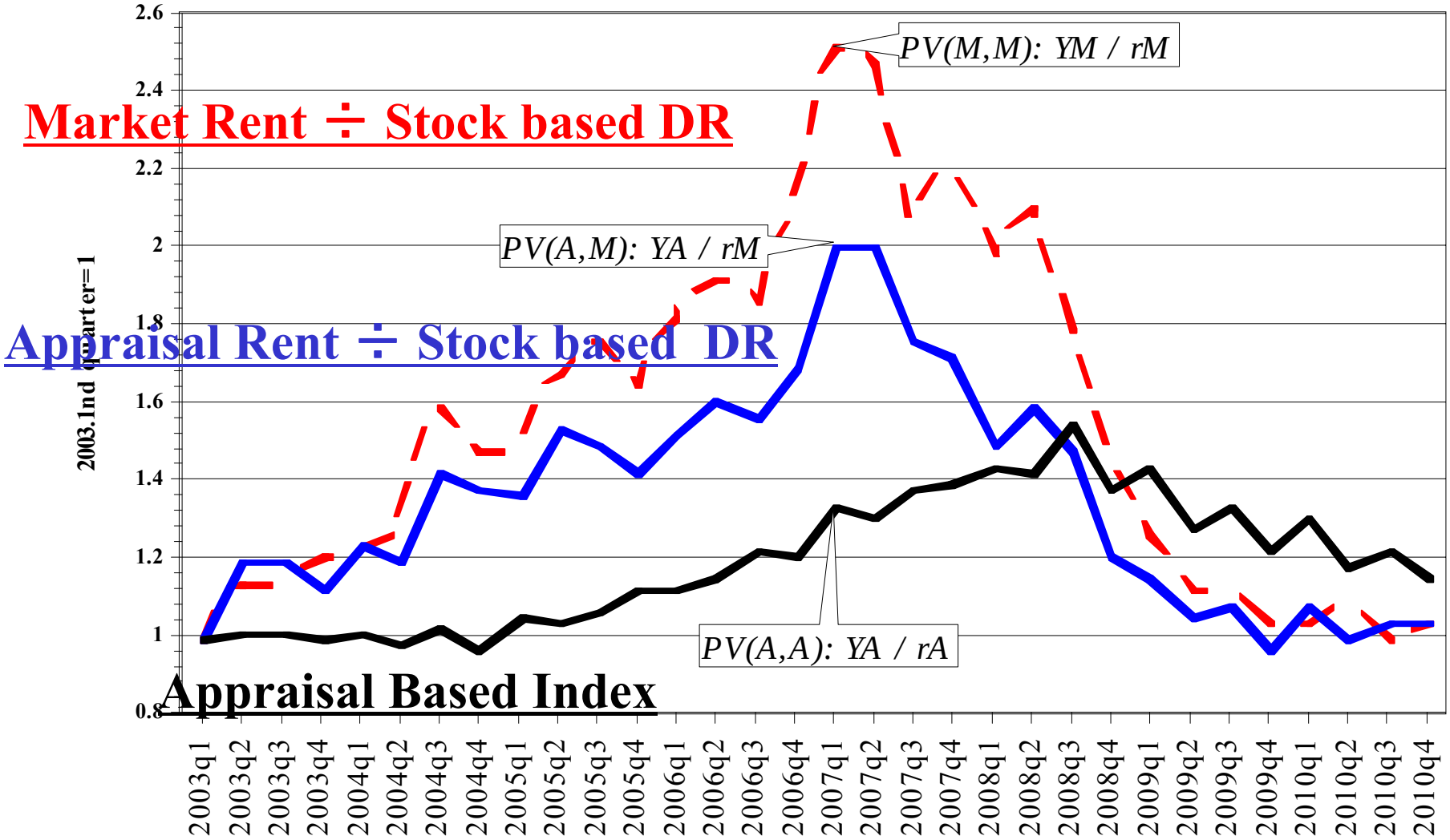
Trend of New Present Value & Appraisal Indexes



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Conclusion: Issues in conducting of Commercial Property Price Indexes

- Setting of discount rate 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 discount rate(or risk premiums)**.

- Price indexes must be explicitly defined: do they measure **investor-observed market values(PV(A,M))**, or do they measure **potential market values(PV(M,M))**?

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Commercial Property Price Information in Japan.

Survey	Organisation	Type1	Type2	Frequency	Availability
Published Land Price Survey	The Ministry of Land, Infrastructure, Transport and Turism	Appraisal	Price & Index	Annually	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 for Real Estate Securitization	Appraisal	Index	Quarterly	2001
MUTB-CBRE Real Estate Investment Index	Mitsubishi-UFJ Trust Bank & CB Richard Ellis	Appraisal	Index	Yearly	1968

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Co-movement in Tobin's q among the four REITs

- An important thing to note is that there is a strong co-movement in Tobin's q among the four REITs, suggesting that the divergence between stock market based prices and appraisal prices was caused by the factors common to the four REIT rather than idiosyncratic factors.

- Another potential source of the deviation of Tobin's q from unity is the lack of price arbitrage between the REIT market and the property market.

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Why Tobin's q is not unity?

- Such an arbitrage transaction may not take place for some (unknown) reasons.

- As discussed in Lamont and Thaler (2003), the lack of price arbitrage is sometimes observed in financial markets; for example, the price of a close-end mutual fund sometimes deviates from the underlying value of the asset it owns.

- We cannot rule out the possibility that such "mispricing" occurred in J-REIT market during this period.

Shiller's Test

- Then should the change in risk amount that occurred in **the stock market be reflected in the property market**?

- It is known that present values determined using dividend income and prices and risk amounts, and those **determined in the stock market are not necessarily matched** (LeRoy and Porter, 1981; Shiller, 1981).

- **Shiller's Test, (1981)**

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State-Dependent or Time-Dependent Pricing:

Caballero-Engel's definition of price flexibility:
Shimizu, Watanabe and Nishimura(2010)

$$\Delta \log R_{it}^{*} = \Delta \xi_t + \nu_{it}$$
$$X_{it} \equiv \log R_{it-1} - \log R_{it}^{*}$$
$$\Lambda(x) \equiv \Pr(\Delta R_{it} \neq 0 \mid X_{it} = x)$$

Caballero-Engel(1993)
:Adjustment Hazard

$$\lim_{\Delta \xi_t \to 0} \frac{\Delta \log R_t}{\Delta \xi_t} = \int \Lambda(x) h(x) dx + \int x \Lambda'(x) h(x) dx$$

Caballero-Engel's measure of price flexibility

Intensive margin

Extensive margin

Caballero-Engel(2007)

$$\Lambda(x) = \Pr(\Delta R_{it} \neq 0 \mid I_{it}^{N} = 1, X_{it} = x) \Pr(I_{it}^{N} = 1 \mid X_{it} = x)$$
$$+ \Pr(\Delta R_{it} \neq 0 \mid I_{it}^{R} = 1, X_{it} = x) \Pr(I_{it}^{R} = 1 \mid X_{it} = x)$$

Japanese RPPI: http://tochi.mlit.go.jp/english/secondpage/6280

Residential Property Price Index (Preliminary Figures)

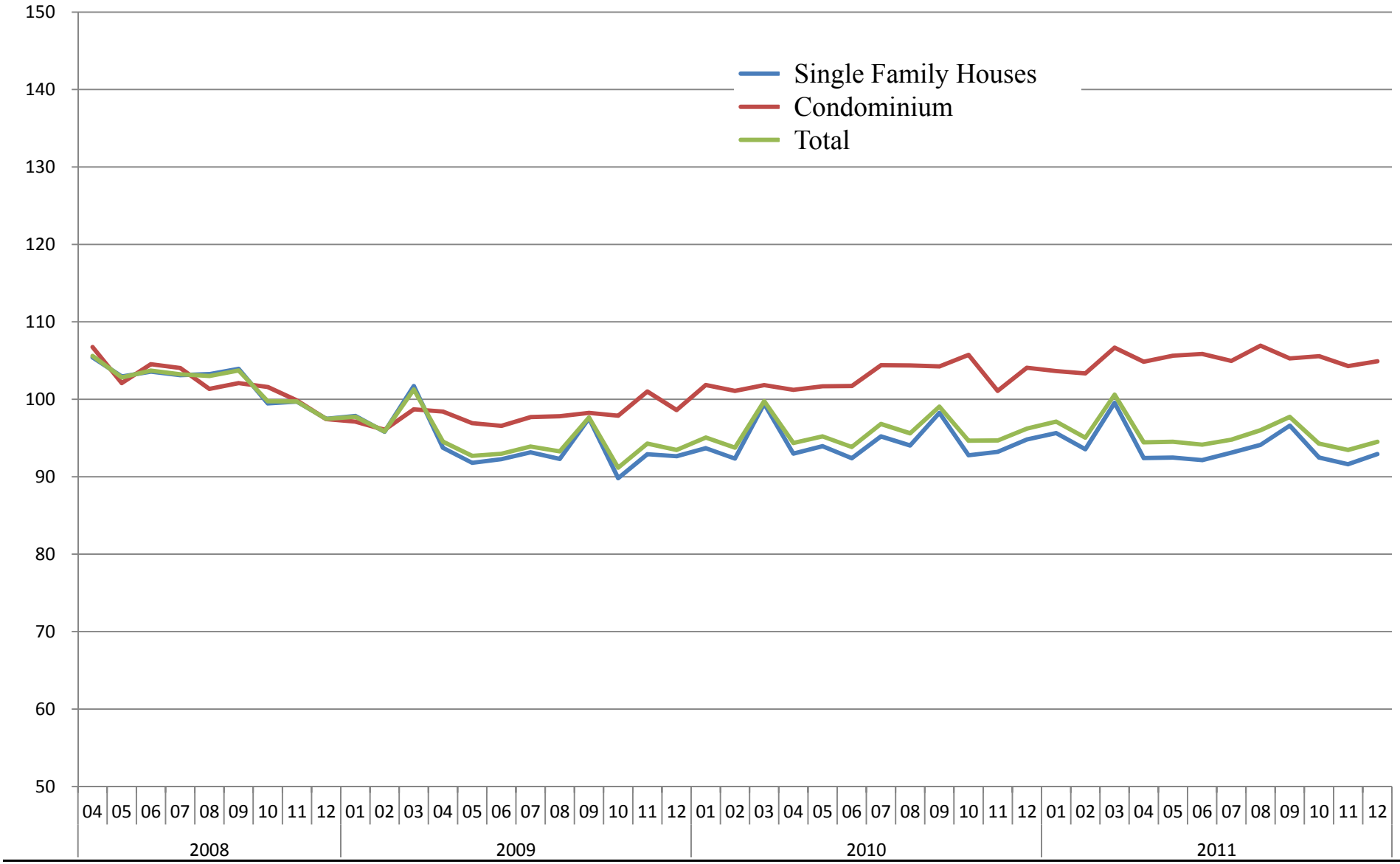
【All Japan】

【Regions : Hokkaido, Tohoku, Kanto, Hokuriku, Chubu, Kinki, Chugoku, Shikoku, Kyushu-Okinawa】

【3 Metropolitan Areas : Tokyo, Nagoya, Kyoto-Osaka-Kobe】

※Revised Figures will be available in Jan 2013.

New Japanese RRPI



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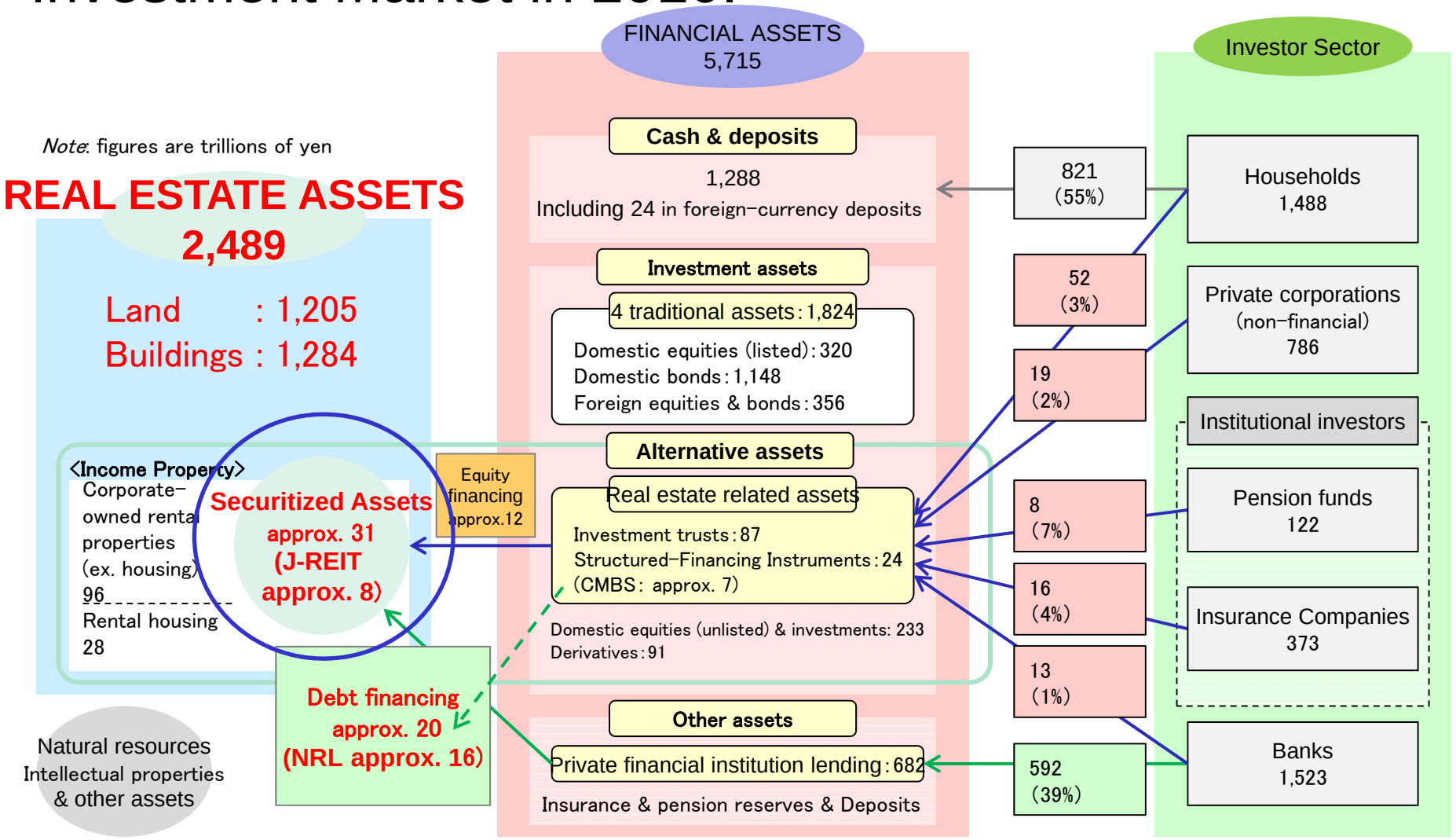
Overview of Real Estate Investment Market in Japan

Property and Financial Assets and Property Investment Market in 2010.



Source) NRI Based on MLI, CAO, BOJ, JASDA, ARES, Statistics Bureau, Trust Banking Association, STBRI

Major CPPI in the world:

- **MSCI-IPD property index: MSCI-Investment Property Data Bank, UK**
- 25 countries (UK, France, Germany, Sweden, Denmark, Spain, US, Australia, Japan, Korea……)

- **NCRIEF property index, PREA, US**

- **MIT commercial property price index (TBI) ,US**
- **→the hedonic price method using NCRIEF transaction price data.**
- **→Investment market**

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Retail

Construction Year: 2002
Total Floor Space: 1,727.24m^2
Total Land Area: 564.97 m^2

Construction Year: 1999
Total Floor Space: 26,951.11 m^2
Total Land Area: 40,280.18 m^2

Hotel

Construction Year: 1998

Construction Year:2001

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Logistics

Construction Year: 1993

Construction Year:2012

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- My presentation slides and papers are available at:

- **http://www.cs.reitaku-u.ac.jp/sm/shimizu/English.html**