Modelling the Japanese Economy

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Practical Issues in DSGE Modelling at Central Banks

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Outline

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6. Conclusion

Bottom Line

- Isn't it hard to model the Japanese economy?
- YES! Because:

  - Data is limited.

  - There are several features that the canonical DSGE model cannot explain or be applied to.

  - Something specific to Japan should be incorporated.

Stylized Facts

Business Cycle Properties

Table 1
Volatility and cross-correlations: United States

Variable X	% Std. dev. and std. error	Relative to output	Cross correlation variable X with output and standard (S.E.)										
			X(t−5)	X(t−4)	X(t−3)	X(t−2)	X(t−1)	X(t)	X(t+1)	X(t+2)	X(t+3)	X(t+4)	X(t+5)
Output	1.61	1.00	0.02	0.21	0.42	0.67	0.86	1.00	0.86	0.67	0.42	0.21	0.02
	(0.17)		(0.10)	(0.11)	(0.14)	(0.17)	(0.20)	(–)	(0.20)	(0.17)	(0.14)	(0.11)	(0.10)
Consumption	1.21	0.75	0.17	0.35	0.52	0.71	0.85	0.89	0.76	0.57	0.35	0.14	−0.02
	(0.12)		(0.12)	(0.15)	(0.18)	(0.20)	(0.21)	(0.19)	(0.17)	(0.13)	(0.10)	(0.09)	(0.10)
Investment	5.93	3.67	−0.07	0.10	0.30	0.53	0.72	0.88	0.74	0.56	0.32	0.12	−0.07
	(0.53)		(0.12)	(0.11)	(0.10)	(0.13)	(0.16)	(0.19)	(0.19)	(0.17)	(0.15)	(0.11)	(0.10)
Government purchases	1.69	1.04	−0.10	−0.09	−0.08	−0.01	0.04	0.13	0.16	0.20	0.22	0.29	0.32
	(0.21)		(0.13)	(0.13)	(0.13)	(0.12)	(0.11)	(0.10)	(0.10)	(0.11)	(0.12)	(0.12)	(0.12)
Capital	0.37	0.23	−0.57	−0.57	−0.52	−0.40	−0.22	0.02	0.25	0.45	0.58	0.65	0.66
	(0.03)		(0.18)	(0.19)	(0.20)	(0.18)	(0.16)	(0.13)	(0.10)	(0.10)	(0.11)	(0.12)	(0.13)
Labor input	1.29	0.80	0.03	0.17	0.34	0.53	0.73	0.84	0.84	0.76	0.59	0.38	0.15
	(0.13)		(0.12)	(0.12)	(0.12)	(0.15)	(0.17)	(0.19)	(0.20)	(0.18)	(0.16)	(0.12)	(0.11)
Employment	0.98	0.61	−0.01	0.12	0.27	0.46	0.66	0.78	0.81	0.75	0.61	0.41	0.19
	(0.09)		(0.13)	(0.12)	(0.11)	(0.13)	(0.15)	(0.18)	(0.18)	(0.18)	(0.16)	(0.13)	(0.10)
Weekly hours	0.41	0.25	0.11	0.25	0.41	0.57	0.72	0.77	0.71	0.59	0.40	0.22	0.02
	(0.04)		(0.09)	(0.11)	(0.14)	(0.17)	(0.19)	(0.20)	(0.19)	(0.16)	(0.12)	(0.10)	(0.08)
Labor productivity	0.88	0.55	−0.01	0.14	0.27	0.45	0.51	0.60	0.34	0.09	−0.12	−0.20	−0.22
	(0.10)		(0.09)	(0.11)	(0.14)	(0.16)	(0.17)	(0.16)	(0.11)	(0.10)	(0.10)	(0.11)	(0.12)
TFP	1.63	1.01	0.07	0.26	0.44	0.66	0.78	0.88	0.64	0.37	0.10	−0.07	−0.19
	(0.19)		(0.09)	(0.11)	(0.15)	(0.19)	(0.21)	(0.20)	(0.17)	(0.13)	(0.11)	(0.10)	(0.11)

Variable X	% Standard deviation relative to employment	Cross correlation variable X with employment and standard error (S.E.)										
		X(t − 5)	X(t − 4)	X(t − 3)	X(t − 2)	X(t − 1)	X(t)	X(t + 1)	X(t + 2)	X(t + 3)	X(t + 4)	X(t + 5)
Weekly hours	0.42	0.23	0.37	0.49	0.61	0.68	0.66	0.52	0.36	0.23	0.14	0.04
		(0.09)	(0.11)	(0.14)	(0.16)	(0.17)	(0.17)	(0.15)	(0.12)	(0.11)	(0.10)	(0.09)

Sample period: 1960.q1–2002.q4.

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Table 2
Volatility and cross-correlations: Japan

Variable X	% Std. dev. and std. error	Relative to output	Cross correlation variable X with output and standard error (S.E.)										
			$X(t-5)$	$X(t-4)$	$X(t-3)$	$X(t-2)$	$X(t-1)$	$X(t)$	$X(t+1)$	$X(t+2)$	$X(t+3)$	$X(t+4)$	$X(t+5)$
Output	1.55	1.00	0.00	0.23	0.43	0.62	0.80	1.00	0.80	0.62	0.43	0.23	0.00
	(0.14)		(0.12)	(0.10)	(0.11)	(0.13)	(0.15)	(–)	(0.15)	(0.13)	(0.11)	(0.10)	(0.12)
Consumption	1.13	0.73	0.10	0.29	0.45	0.53	0.59	0.65	0.45	0.27	0.13	−0.05	−0.15
	(0.12)		(0.09)	(0.10)	(0.13)	(0.15)	(0.16)	(0.17)	(0.13)	(0.10)	(0.09)	(0.13)	(0.14)
Investment	4.30	2.78	−0.08	0.09	0.23	0.44	0.63	0.85	0.75	0.65	0.48	0.32	0.07
	(0.34)		(0.13)	(0.13)	(0.11)	(0.11)	(0.12)	(0.15)	(0.15)	(0.14)	(0.13)	(0.11)	(0.10)
Government purchases	2.37	1.53	0.09	0.13	0.18	0.14	0.14	0.14	0.01	−0.09	−0.08	−0.03	0.05
	(0.21)		(0.14)	(0.15)	(0.17)	(0.16)	(0.16)	(0.15)	(0.12)	(0.11)	(0.12)	(0.14)	(0.14)
Capital	0.89	0.57	−0.33	−0.33	−0.28	−0.16	−0.01	0.14	0.32	0.47	0.58	0.64	0.65
	(0.10)		(0.14)	(0.13)	(0.12)	(0.11)	(0.11)	(0.11)	(0.12)	(0.14)	(0.14)	(0.15)	(0.15)
Labor input	1.00	0.65	0.16	0.28	0.40	0.51	0.56	0.63	0.51	0.43	0.24	0.06	−0.19
	(0.11)		(0.14)	(0.12)	(0.11)	(0.12)	(0.14)	(0.17)	(0.17)	(0.14)	(0.12)	(0.10)	(0.11)
Employment	0.47	0.30	−0.17	−0.13	0.02	0.18	0.33	0.48	0.53	0.54	0.47	0.37	0.18
	(0.04)		(0.17)	(0.17)	(0.13)	(0.11)	(0.10)	(0.14)	(0.16)	(0.17)	(0.16)	(0.14)	(0.12)
Weekly hours	0.78	0.51	0.30	0.43	0.50	0.55	0.53	0.52	0.33	0.23	0.02	−0.13	−0.34
	(0.09)		(0.12)	(0.12)	(0.13)	(0.13)	(0.14)	(0.15)	(0.14)	(0.11)	(0.10)	(0.09)	(0.11)
Labor productivity	1.20	0.78	−0.13	0.06	0.22	0.37	0.56	0.76	0.61	0.44	0.35	0.24	0.16
	(0.10)		(0.10)	(0.09)	(0.10)	(0.11)	(0.13)	(0.15)	(0.14)	(0.12)	(0.11)	(0.11)	(0.13)
TFP	1.86	1.20	0.00	0.24	0.42	0.58	0.74	0.93	0.69	0.45	0.28	0.10	−0.06
	(0.15)		(0.11)	(0.10)	(0.10)	(0.13)	(0.15)	(0.16)	(0.13)	(0.11)	(0.10)	(0.11)	(0.13)

Sample period: 1960.q1–2002.q4.

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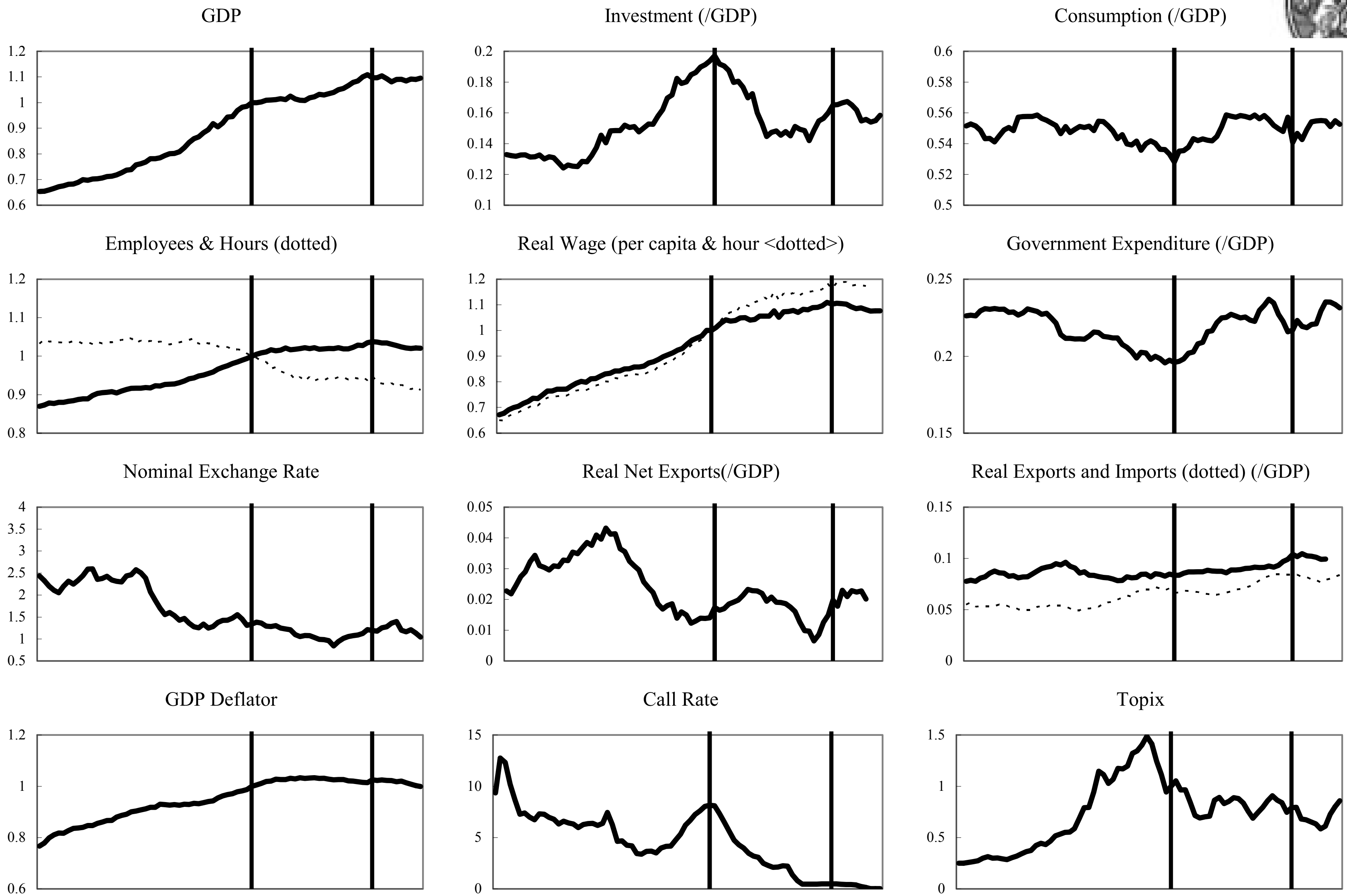
1. Japanese and US business cycles have similar magnitudes but US business cycles are more persistent.
2. Variations in productivity are larger and more correlated with output in Japan.
3. Consumption smoothing is higher in Japan.
4. Japanese economy is very effective at smoothing labor input.
5. Hours and employment are not positively correlated in Japan.



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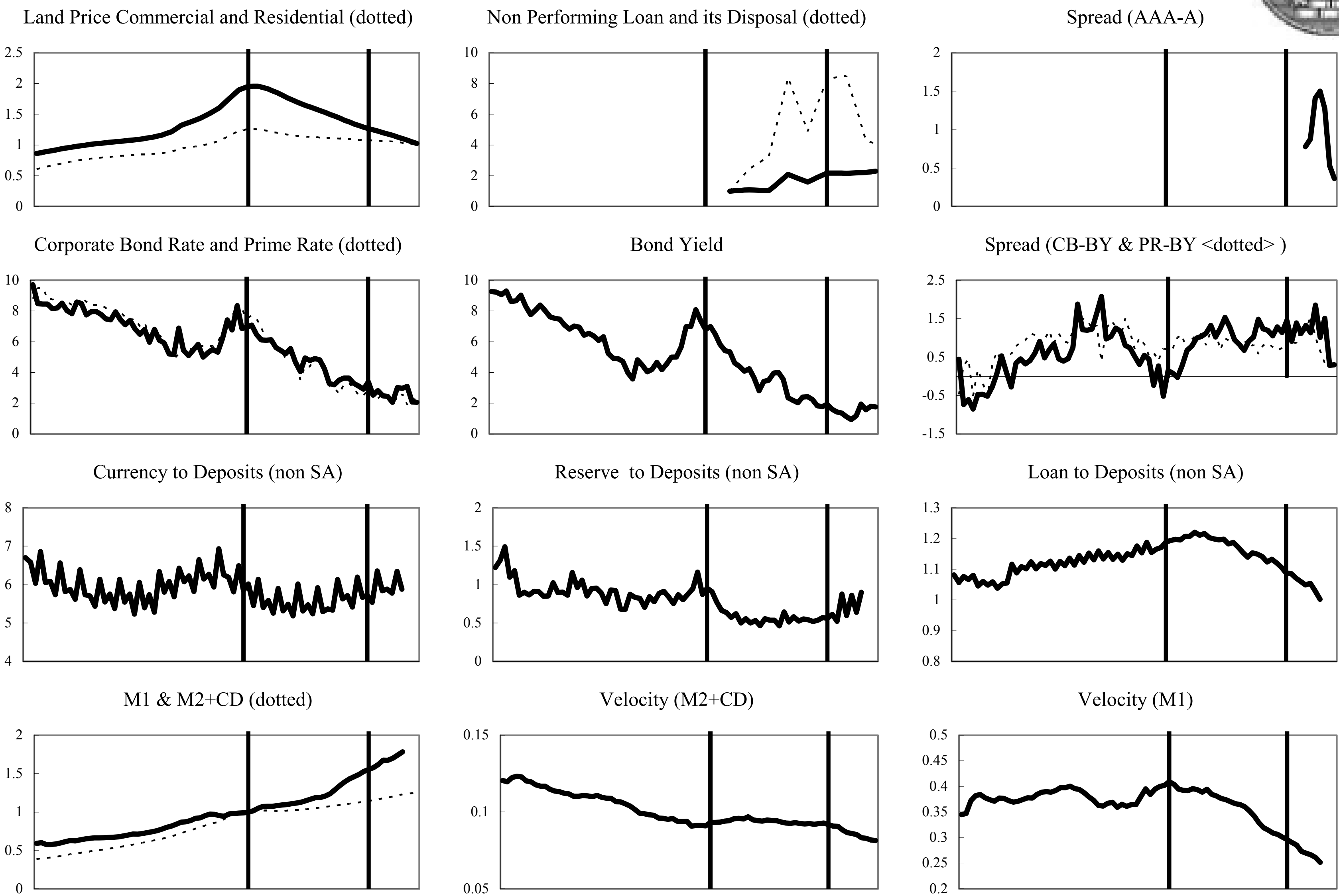
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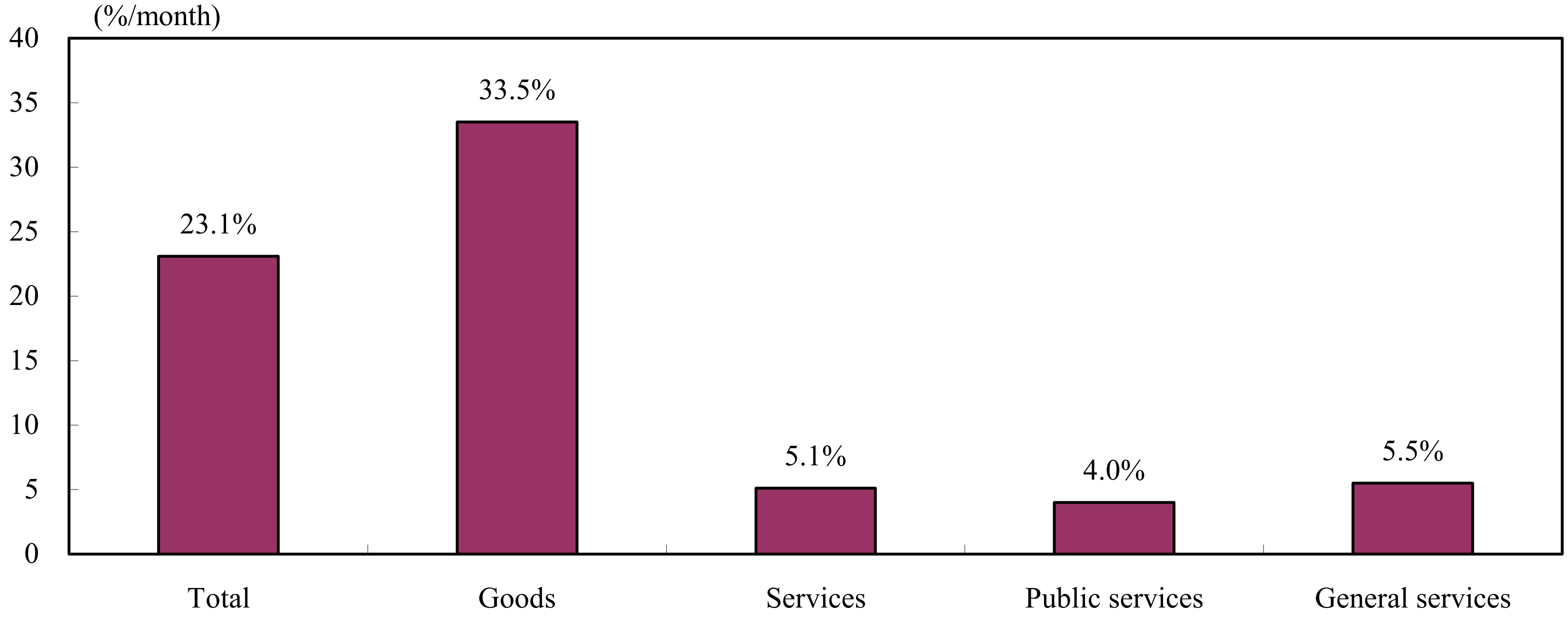
Non Performing Loan and its Disposal (dotted)
0 2 4 6 8 10
Spread (AAA-A)
0 0.5 1 1.5 2
Corporate Bond Rate and Prime Rate (dotted)
0 2 4 6 8 10
Bond Yield
0 2 4 6 8 10
Spread (CB-BY & PR-BY <dotted>)
-1.5 -0.5 0.5 1.5 2.5
Currency to Deposits (non SA)
4 5 6 7 8
Reserve to Deposits (non SA)
0 0.5 1 1.5 2
Loan to Deposits (non SA)
0.8 0.9 1 1.1 1.2 1.3
M1 & M2+CD (dotted)
0 0.5 1 1.5 2
Velocity (M2+CD)
0.05 0.1 0.15
Velocity (M1)
0.2 0.25 0.3 0.35 0.4 0.45 0.5

Price Stickiness

Figure 4 Frequency of Price Changes (CY 1999-2003)

(1) Total, Goods and Services



Higo, Nishizaki, Saita and Takagawa (2006)

Figure 6 Frequency of Price Changes; International Comparison

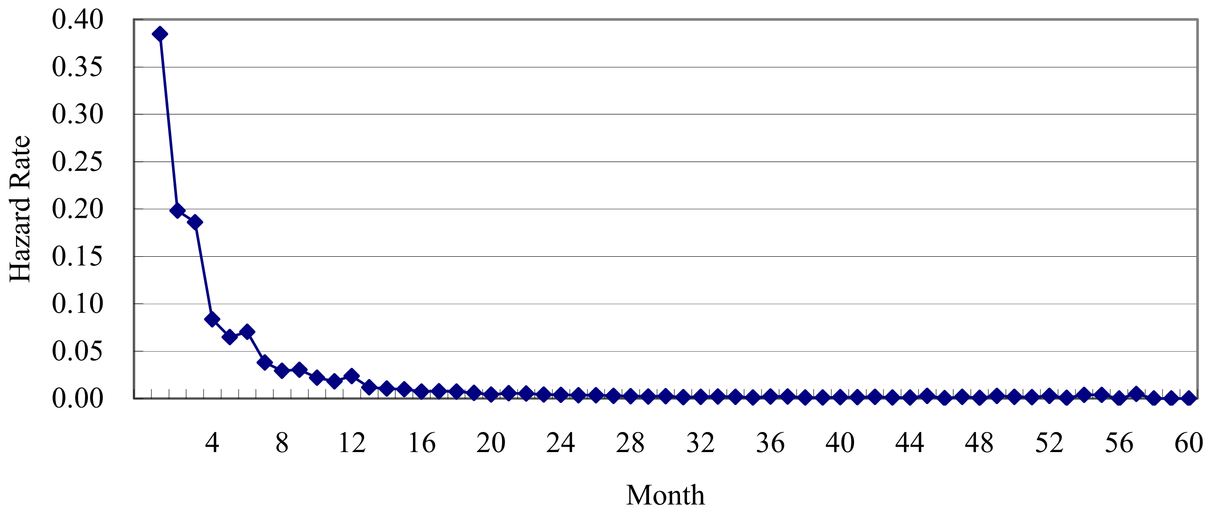
(1) Frequency of Price Changes by Product Type

Country	Unprocessed food		Processed food		Energy		Non energy industrial		Services		Total		sample period
	%/month	rank	%/month	rank	%/month	rank	%/month	rank	%/month	rank	%/month	rank	
Japan	**71.8**	**1**	**30.8**	**1**	**50.9**	**9**	**22.7**	**1**	**3.9**	**10**	**24.8**	**1**	CY 1999-2003
United States	47.7	5	27.1	2	74.1	4	22.4	2	15.0	1	24.8	1	CY 1995-1997
Austria	37.5	6	15.5	8	72.3	7	8.4	7	7.1	5	15.4	8	CY 1996-2003
Belgium	31.5	7	19.1	5	81.6	2	5.9	9	3.0	11	17.6	6	CY 1989-2001
Germany	25.2	9	8.9	11	91.4	1	5.4	11	4.3	9	13.5	9	CY 1998-2004
Spain	50.9	4	17.7	6	n.a.	n.a.	6.1	8	4.6	7	13.3	10	CY 1993-2001
France	24.7	10	20.3	4	76.9	3	18.0	3	7.4	4	20.9	5	CY 1994-2003
Italia	19.3	11	9.4	10	61.6	8	5.8	10	4.6	7	10.0	11	CY 1996-2003
Luxembourg	54.6	3	10.5	9	73.9	5	14.5	4	4.8	6	23.0	3	CY 1999-2004
Netherlands	30.8	8	17.3	7	72.6	6	14.2	6	7.9	3	16.2	7	CY 1998-2003
Portugal	55.3	2	24.5	3	15.9	10	14.3	5	13.6	2	21.1	4	CY 1992-2001

Note: Figures are calculated using country-specific weights for each item.
Source: Dhyne et al.[2005](except for Japan)

Figure 10 Hazard Function (CY 1999-2003)

(2) Goods



(3) Services

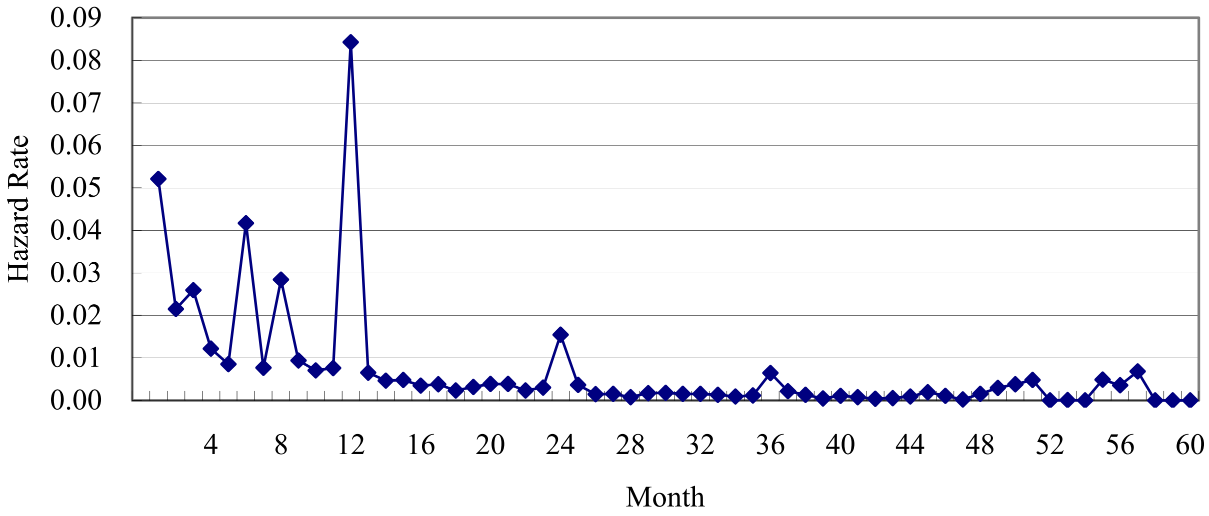
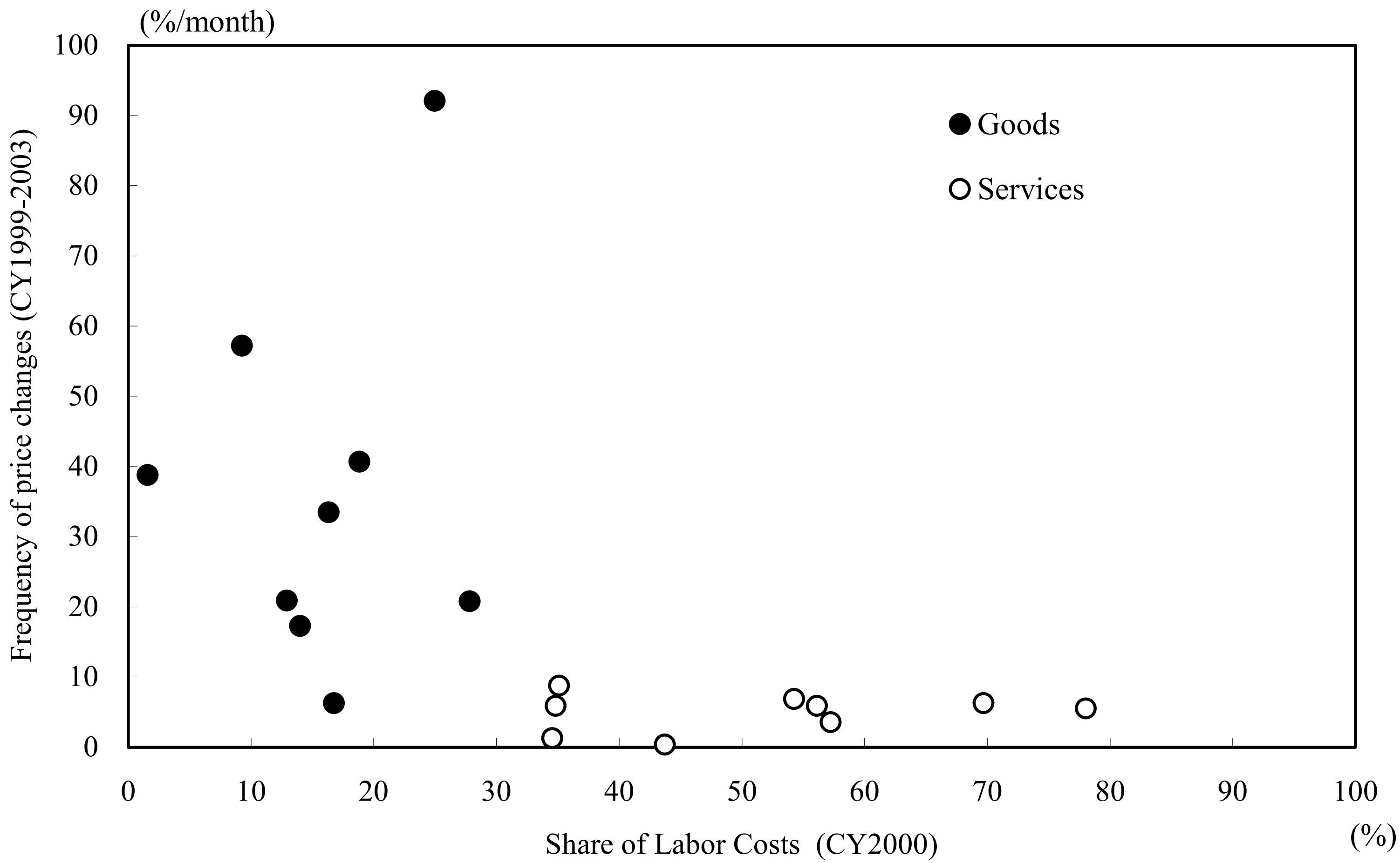


Chart 21 Share of Labor Costs and Frequency of Price Changes

(1) By Category



- The frequency of price changes is 23.1% per month for the CPI Total. For goods it is high at 33.5% per month, while for services it is extremely low at 5.1% per month.
- The results indicate a large discrepancy between goods and services in the frequency of price changes.
- The frequency of price changes in Japan is higher than that in the EU countries, and around the same level as that in the US. Price changes in Japan are far less frequent for services.

- The hazard function is downward sloping with a local mode at a duration of one month. For services, the probability at 12 months is particularly high.
- This implies Taylor-type (synchronized) price setting and the timing of monetary policy matters: Olivei and Tenreyro (2005).
- We can find a negative correlation whereby the frequency of price changes declined as the share of labor costs rose. This combined with above implies Taylor-type (synchronized) wage setting.

Monetary Policy Transmission

Table 3. United States: Contributions of consumption to the private sector domestic demand response to a monetary policy shock

VAR models

sample of estimation		1960:1 2001:4			1965:1 79:3+84:1 2001:4			1984:1 2001:4		
		Percentile			Percentile			Percentile		
	Horizon	10th	50th	90th	10th	50th	90th	10th	50th	90th
	4 quarters	0.55	0.69	0.96	0.52	0.64	0.85	0.11	0.58	1.45
Erceg-Levin	8 quarters	0.47	0.55	0.65	0.45	0.53	0.62	0.33	0.50	0.90
	12 quarters	0.48	0.56	0.66	0.46	0.54	0.63	0.34	0.52	0.86
Christiano, Eichebaum and Evans 2001	4 quarters	0.54	0.68	0.97	0.49	0.61	0.80	0.47	0.69	1.30
	8 quarters	0.47	0.56	0.69	0.46	0.54	0.65	0.46	0.56	0.79
	12 quarters	0.48	0.58	0.72	0.46	0.55	0.65	0.45	0.53	0.71
Gordon-Leeper	4 quarters	0.42	0.51	0.62	0.44	0.54	0.66	-134	-66.7	0.77
	8 quarters	0.40	0.48	0.55	0.41	0.48	0.56	-0.11	0.53	1.24
	12 quarters	0.39	0.47	0.54	0.39	0.47	0.55	-0.02	0.55	1.03

Federal Reserve Board - U.S. model

	Horizon	Point estimate
	4 quarters	0.81
	8 quarters	0.74
	12 quarters	0.66

Notes: Percentiles are based on 1000 Monte Carlo simulations

Angeloni et al (JMCB2003)

Table 4. Euro area: Contributions of consumption to the private sector domestic demand response to a monetary policy sho

VAR models							
sample of estimation		1980:4 - 2000:4			1970:4 - 2000:4		
		Percentile			Percentile		
	Horizon	10th	50th	90th	10th	50th	90th
Peersman-Smets baseline model	4 quarters	-0.79	0.20	0.84	-0.71	0.50	1.77
	8 quarters	0.04	0.36	0.48	-0.24	0.31	0.52
	12 quarters	0.15	0.43	0.58	-0.07	0.35	0.51
Peersman-Smets without M3	4 quarters	-0.70	0.19	1.01	-0.67	0.49	1.82
	8 quarters	0.04	0.35	0.46	-0.10	0.35	0.53
	12 quarters	0.15	0.43	0.53	0.04	0.38	0.52
Christiano, Eichenbaum, and Evans specification	4 quarters	-0.43	0.24	0.57	-0.19	0.28	0.45
	8 quarters	-0.34	0.27	0.69	0.21	0.35	0.44
	12 quarters	-0.17	0.36	0.89	0.23	0.37	0.46

Central Bank large-scale models		
		Point estimates
National models (NCBs)	4 quarters	0.45
	8 quarters	0.36
	12 quarters	0.35
Area Wide Model (AWM)	4 quarters	0.57
	8 quarters	0.43
	12 quarters	0.34

Notes: Percentiles are based on 1000 Monte Carlo simulations

Angeloni et al (JMCB2003)

sample of estimation		1980:1 1996:1				1980:1 2003:3			
				percentile				percentile	
	Horizon	Point estimate	10th	50th	90th	Point estimate	10th	50th	90th
Christiano-Eichenbaum-Evans	4 quarters	2.08	-1.83	0.91	2.78	3.21	-1.33	0.77	2.28
	8 quarters	0.59	0.57	0.62	0.78	0.49	0.50	0.52	0.63
	12 quarters	0.47	0.48	0.49	0.49	0.39	0.39	0.42	0.43
Erceg-Levin	4 quarters	0.35	0.38	0.41	0.42	0.10	-0.30	0.26	0.90
	8 quarters	0.34	0.34	0.39	0.39	0.17	-0.20	0.25	0.75
	12 quarters	0.34	0.35	0.39	0.39	0.20	-0.14	0.27	0.69
Generalized Erceg-Levin	4 quarters	0.76	0.41	0.51	0.57	-0.15	-0.13	0.32	1.01
	8 quarters	0.13	0.19	0.39	0.67	0.01	-0.44	0.24	1.14
	12 quarters	0.20	0.26	0.37	0.52	0.03	-0.42	0.23	1.07
Gordon-Leeper	4 quarters	0.47	0.08	0.41	0.77	-0.72	-0.12	0.41	0.87
	8 quarters	0.46	0.08	0.39	0.80	-0.15	-0.02	0.42	0.77
	12 quarters	0.46	0.10	0.38	0.75	-0.11	0.04	0.43	0.74
Leeper-Sims-Zha	4 quarters	1.43	0.36	0.44	0.55	0.26	0.21	0.36	0.49
	8 quarters	0.71	0.42	0.45	0.50	0.10	0.16	0.36	0.56
	12 quarters	0.54	0.41	0.43	0.44	-0.14	0.17	0.38	0.58
Peersman-Smets	4 quarters	-2.50	-0.83	0.34	1.97	0.35	0.35	0.43	0.46
	8 quarters	0.60	0.29	0.55	0.82	0.48	0.13	0.43	0.63
	12 quarters	0.47	0.42	0.45	0.60	0.39	0.21	0.40	0.51

Notes: Percentiles are based on 1000 bootstrap simulations

Fujiwara (BEJM2004)

- Results obtained from the Japanese models imply that the investment channel is more important.
- The downward pressure from the interest rate rise caused by the substitution effect may be mitigated somewhat by upward pressure from the income effect in Japan.
- The number of liquidity constrained consumers may be quite different in these two countries.

Estimation Results of the Canonical Model

a la Christiano, Eichenbaum and Evans (JPE2005, CEE) and Smets and Wouters (JEEA2003, SW)

Structural Parameters

	SW EURO	LOWW US	INW Japan
habit	0.592	0.294	0.641
relative risk aversion	1.391	2.045	2.041
inverse of the Frisch elasticity	2.503	1.405	2.427
investment adj. cost	6.962	1.822	8.338
inverse of util. adj. cost	4.975	0.198	0.182
fixed cost-1	0.417	0.082	0.581
Calvo prices	0.905	0.824	0.65
Calvo wages	0.742	0.807	0.367
indexation wages	0.477	0.116	0.613
indexation prices	0.728	0.773	0.578

Smets and Wouters (JEEA2003)
Levin et al (Macroannual 2005)
Iiboshi et al (2006)

1. Consumption habit is very high.
2. Investment adjustment cost is also very high.
3. Frisch elasticity is low.
4. Wages are very sticky.

- However, INW employ HP filter for de-trending. Proper comparison is not possible.

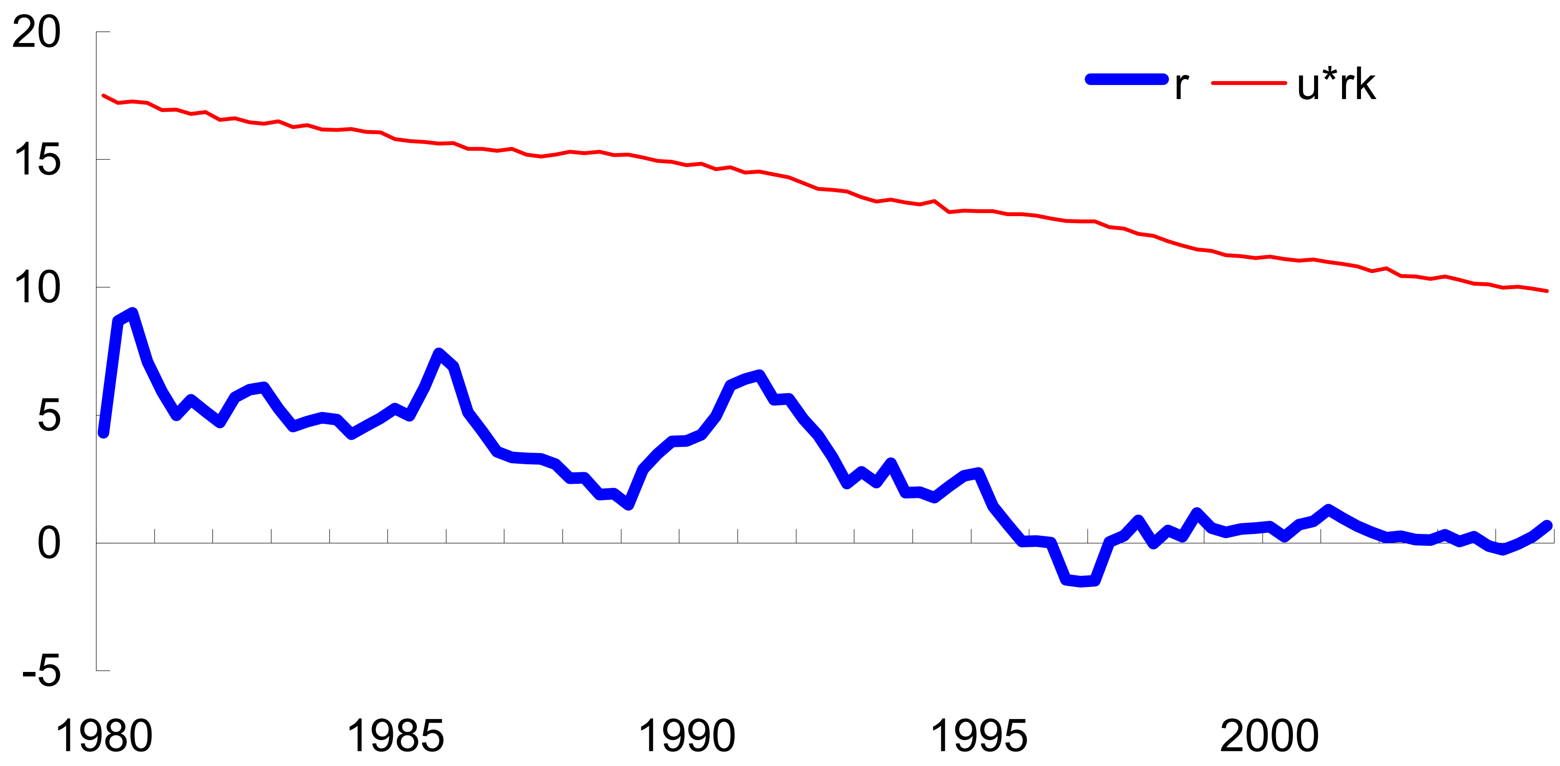
- Points are as usual on firm's factor demand side whether both
  <funds demand>
  Cost of Capital = MPK, and
  <labor demand>
  Real Wage = MPL,
  can be considered to hold or not, namely, whether wedges are adjusted swiftly enough.
- On household's factor supply side, we need to rely on micro data analysis.

<Funds Demand>

- Under a production function with elasticity of substitution is unity,

$$u_{t+1} r_{t+1}^{K} = \frac{1-\alpha}{\alpha} \frac{L_{t+1}}{K_{t+1}} \frac{W_{t+1}}{P_{t+1}} = q_t \left(1 + r_{t+1}\right) - q_{t+1}\left(1-\delta\right) + a'\left(u_{t+1}\right).$$

- With the canonical model, difference between real interest rate and above defined cost of capital is absorbed via theoretical stock price, utilization, or stochastic investment adjustment cost, since depreciation rate is fixed.
- Investment specific technology and capital obsolescence may further explain that difference observed in data.


20
15
10
5
0
-5
1980
1985
1990
1995
2000
r
u*rk

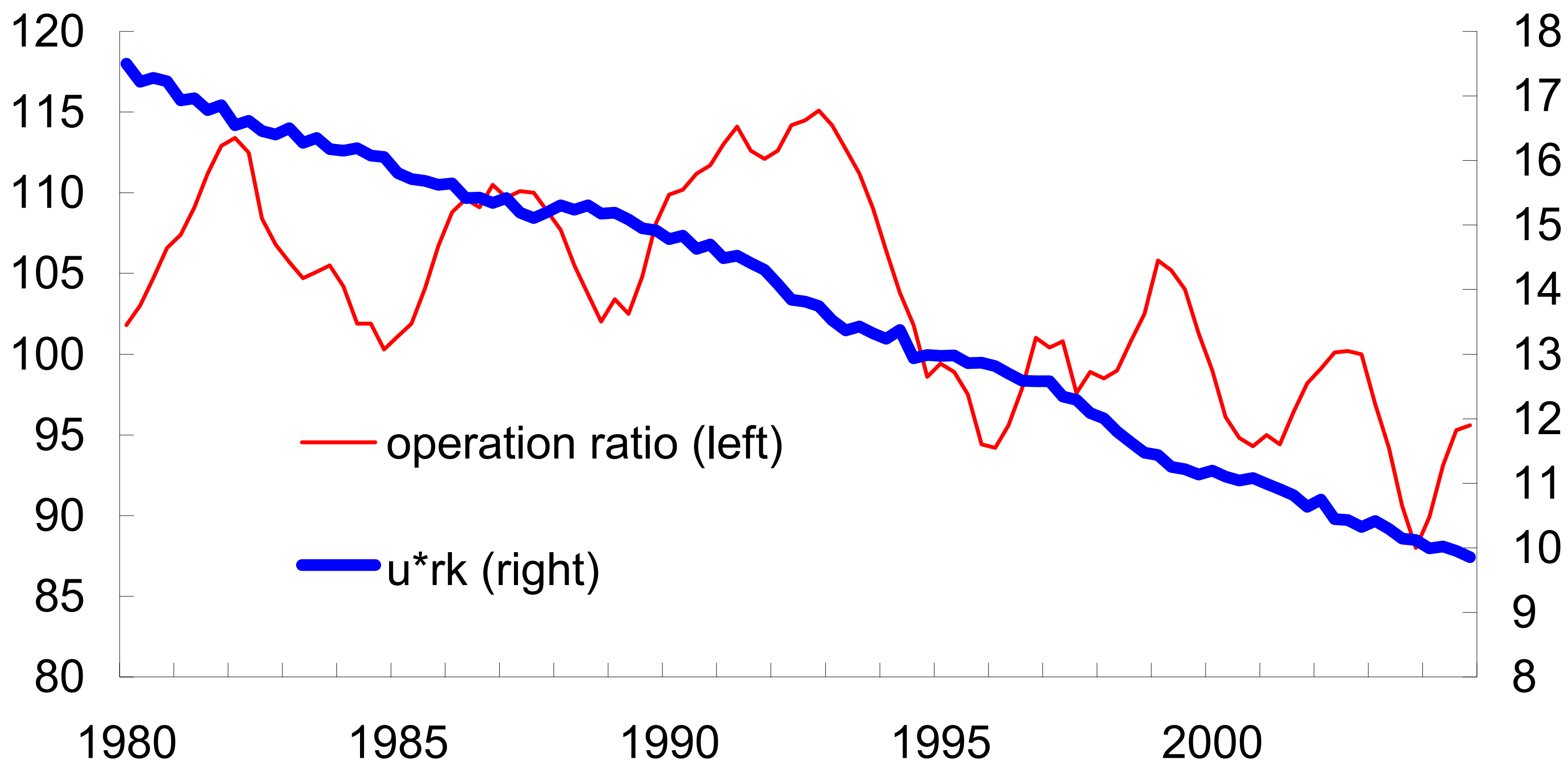
- Things become worse with observed utilization.
- Below can be derived from the production function with elasticity of substitution being unity:
  (a) cost on consumption goods

$$u_{t+1} r_{t+1}^{K} = \frac{\alpha - 1}{\alpha} \frac{L_{t+1}}{K_{t+1}} \frac{W_{t+1}}{P_{t+1}} = a'(u_{t+1}) u_{t+1}$$

  (b) cost on higher depreciation

$$u_{t+1} r_{t+1}^{K} = \frac{\alpha - 1}{\alpha} \frac{L_{t+1}}{K_{t+1}} \frac{W_{t+1}}{P_{t+1}} = q_{t+1} \delta'(u_{t+1}) u_{t+1}$$

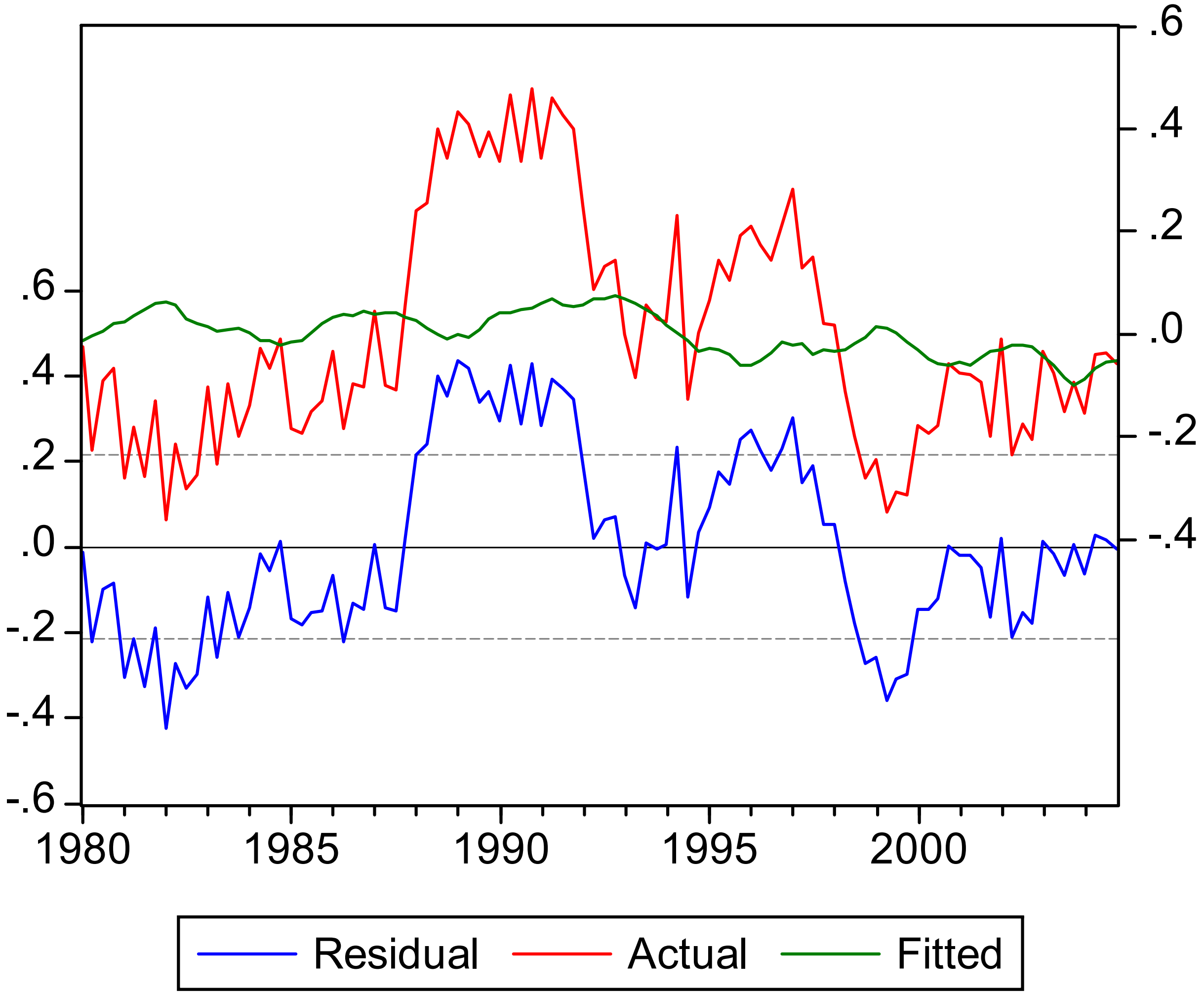
- Since f'(x)x>0, observed utilization should have strong positive correlation with cost of capital in (a).



120
115
110
105
100
95
90
85
80
18
17
16
15
14
13
12
11
10
9
8
1980
1985
1990
1995
2000
operation ratio (left)
u*rk (right)

rk2=-0.67+0.006*u

where rk2 is linearly de-trended u*rk.

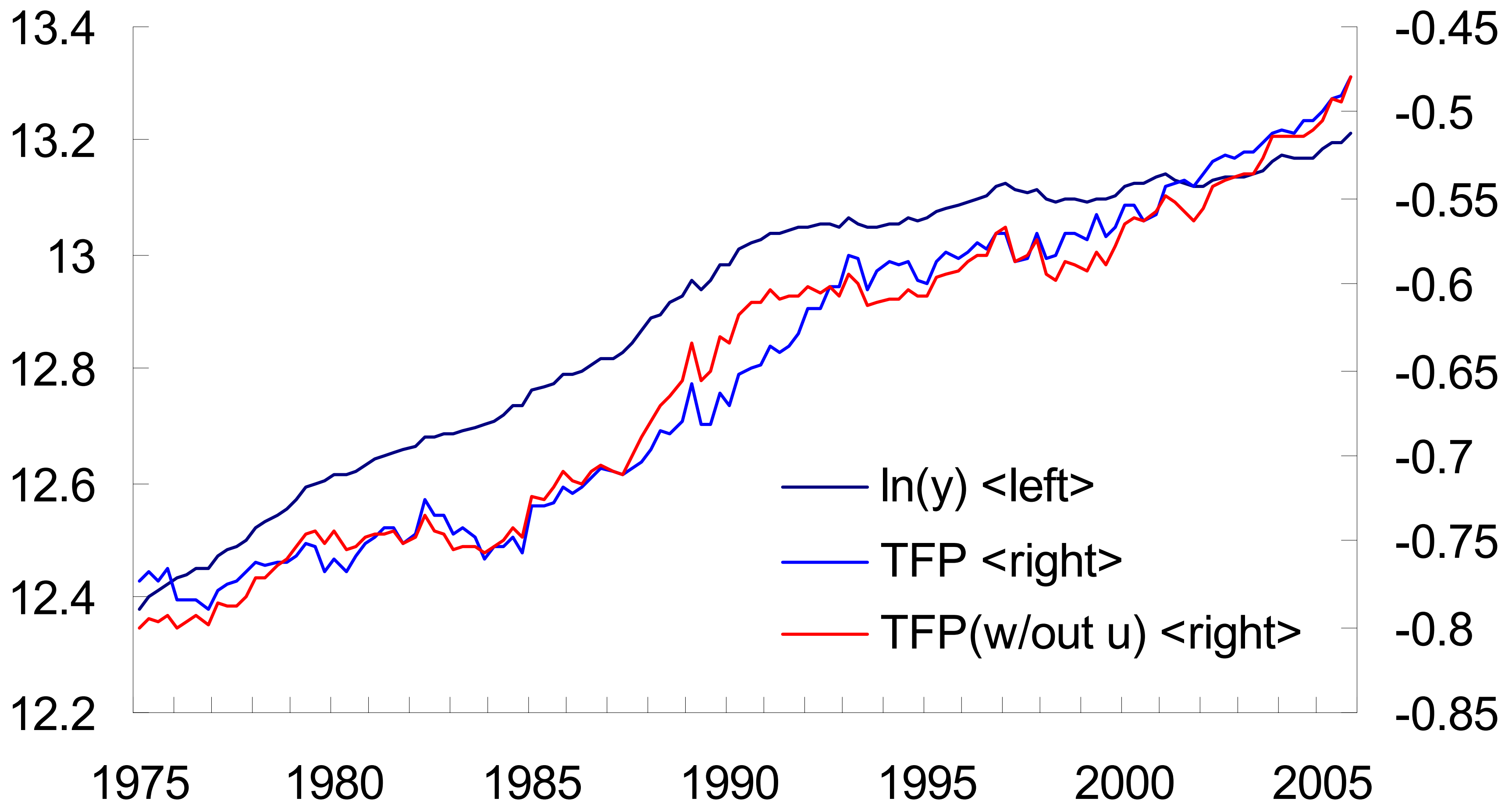


- Utilization should be explained mostly by shocks when the cost of increased utility is paid by consumption goods.
- When the cost is on higher depreciation, this wedge is just covered by another unobservable variable, the theoretical stock price.
- Why does the case with observed utilization become problematic?

$$f\left(u_{t+1}\right)=\frac{\alpha-1}{\alpha}\frac{L_{t+1}}{K_{t+1}}\frac{W_{t+1}}{P_{t+1}}$$

- Utilization is highly pro-cyclical but right hand side is NOT!
- According to elasticity of substitution, if utilization is raised, (1) capital should be decreased, (2) labor should be increased, or (3) real wage should increase.
- On (2), the idea that dynamics of “effective labor” is pro-cyclical is compelling.

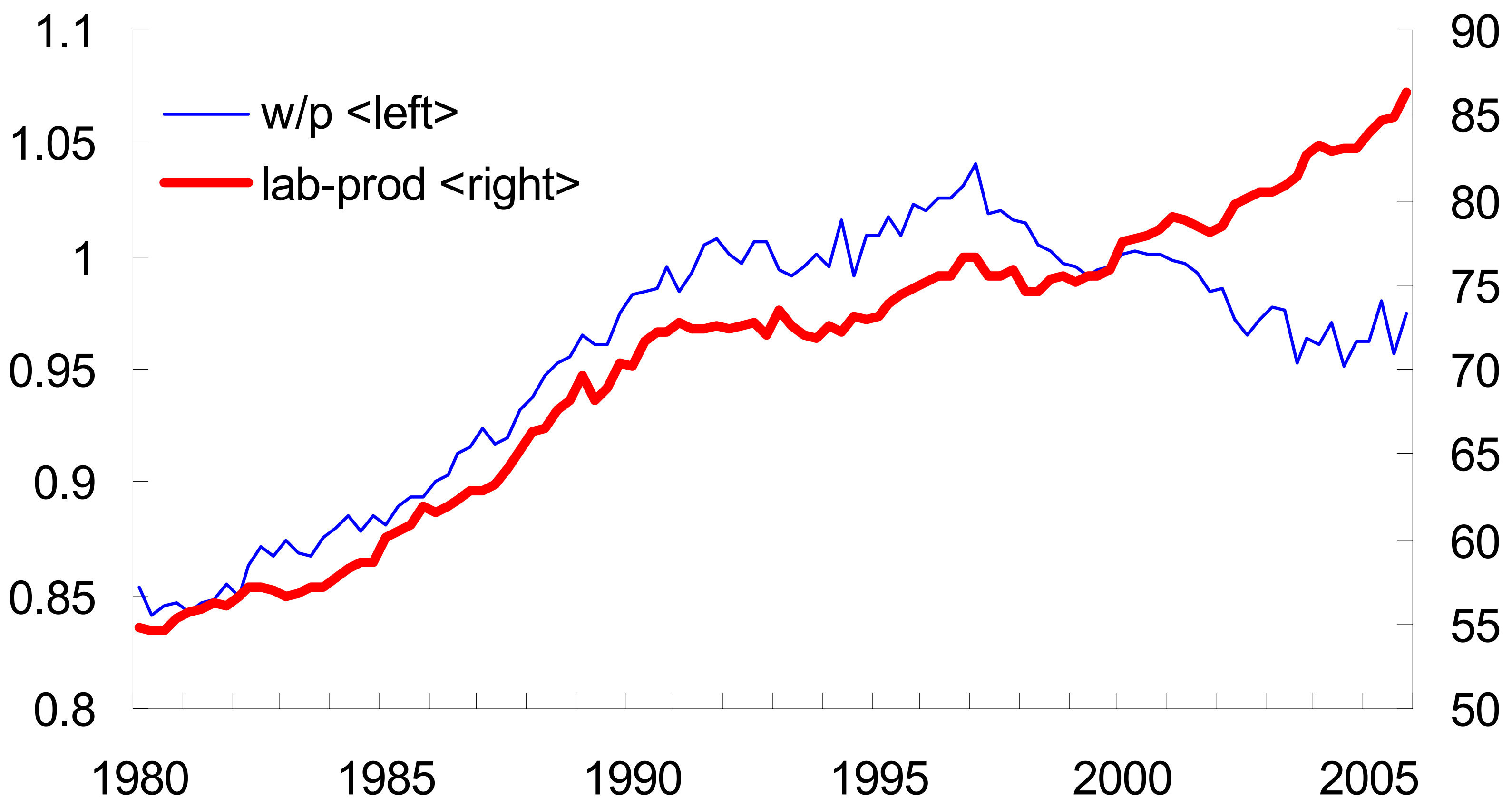
- In order to have pro-cyclical effective labor, “corrections to the labor-share measure of real marginal cost” in Rotemberg and Woodford (HM1999), such as, “overhead labor,” and “labor hoarding” seem very useful for the Japanese economy.
- Yet, labor hoarding, namely labor intensity, should have significant implication on welfare evaluation.


13.4
13.2
13
12.8
12.6
12.4
12.2
-0.45
-0.5
-0.55
-0.6
-0.65
-0.7
-0.75
-0.8
-0.85
1975
1980
1985
1990
1995
2000
2005
ln(y) <left>
TFP <right>
TFP(w/out u) <right>

- With very high cost on utilization, business cycle is mostly determined by technology.
- Yet, with variable utilization,
  case (a) does not match the data, and case (b) will result in a decrease in utilization after a shock which expands resource constraint as explained in CEE.
- Need a theory for better labor market!

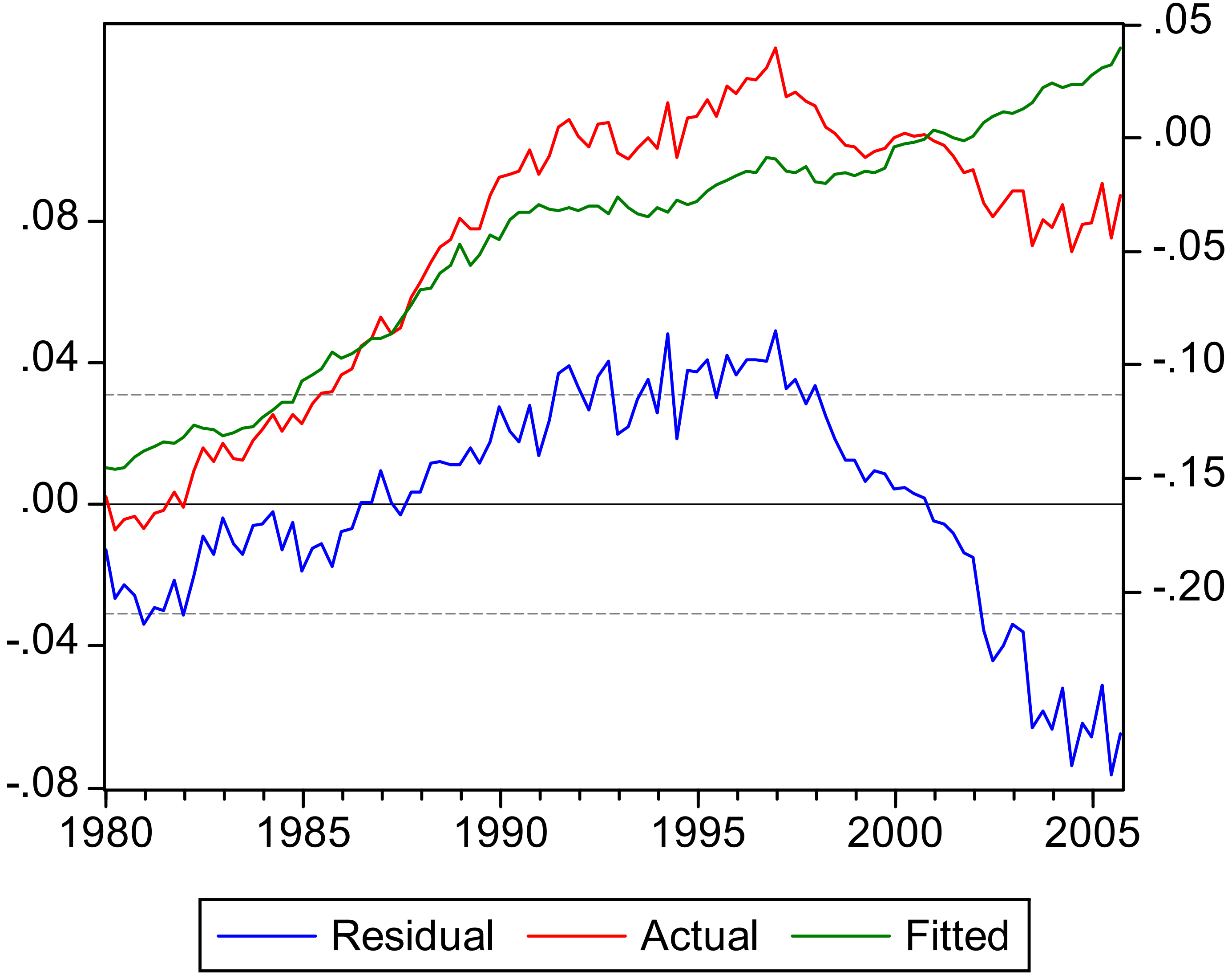
<Labor Demand Side>

- The point is whether real wage = MPL holds or not.
- The canonical model incorporates sticky wage *a la* Erceg, Henderson and Levin (JME2000) so that above equality does not have to hold all the time.



w/p <left>
lab-prod <right>
1.1
1.05
1
0.95
0.9
0.85
0.8
90
85
80
75
70
65
60
55
50
1980
1985
1990
1995
2000
2005

Log(real_wage)=-1.8+0.4*log(labor_productivity)

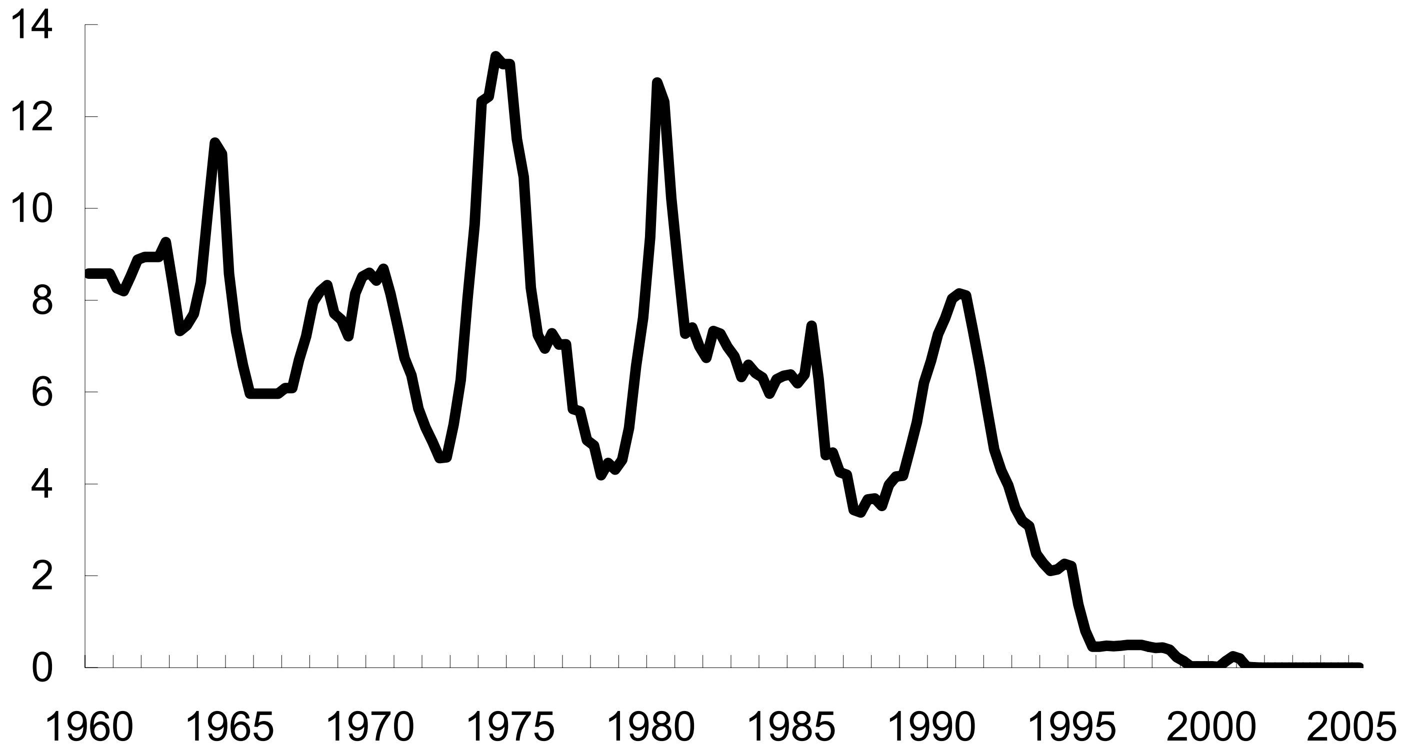


- Search models: Walsh (RED2005) but Krause and Lubik (2005) point out the irrelevance of real wage rigidity in New Keynesian model with search frictions on the model's persistence against monetary policy shock. How about Gertler and Trigari (2006)?
- Above have less welfare implication due to complete insurance.
- Efficiency wage model: Alexopoulos (JME2004)

Other Features

Zero Bound

Call Rate



Short-term nominal interest rates have been almost zero for the last ten years.

(Kuhn-Tucker)

- Jung, Teranishi and Watanabe (JMCB2005) simulate the dynamic New Keynesian model by applying Kuhn-Tucker condition to Blanchard-Kahn method.
- Eggertson and Woodford (BPEA2003) extend above to stochastic environment by assuming a Markov process for the natural rate.

(Numerical method)

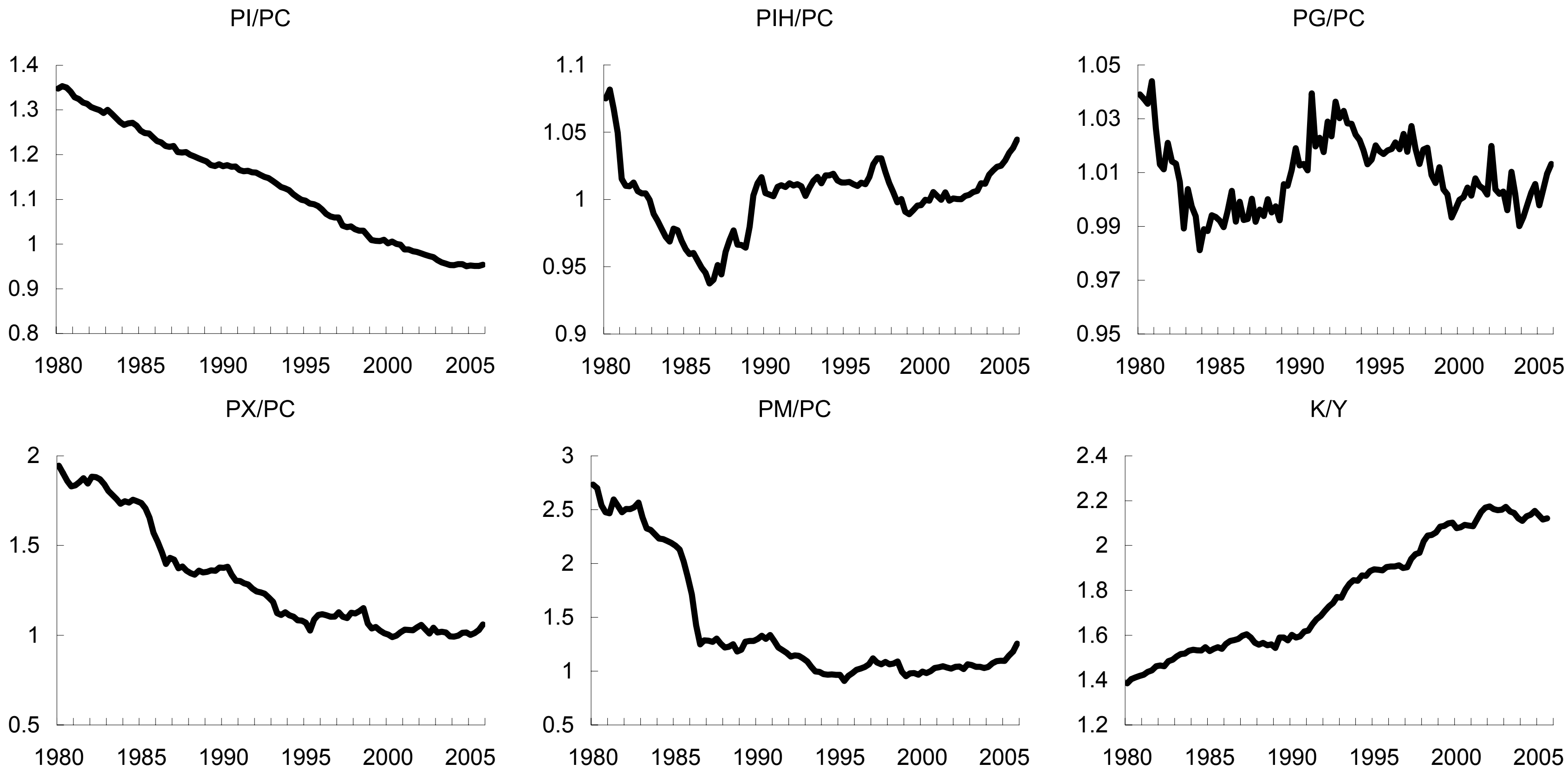
- Kato and Nishiyama (JEDC2005) simulate a backward-looking model with projection method.
- Adam and Billi (2005a,b) extends above with forward looking expectations by discrete state-space method.

(Stacked-time algorithm)

- Reifschneider and Williams (JMCB2000) solve the FRBUS using TROLL under perfect foresight.

- Simulation can be conducted but estimation….
- We are currently considering: First estimate a DSGE-VAR model advocated by Del Negro and Schorfheide (IER2004). Then, use minimum distance method to match the impulse responses as examined in CEE.

Factor-specific Technology



- We can see distinct downward trend in PI/PC and upward trend in K/Y.
- These should be due to the Investment-specific technology *a la* Greenwood et al (AER1997,EER2000).
- Yet, fluctuations around the trend are not very large.
- If de-trended data is employed, we may be able to ignore the investment-specific technology shock.

Heterogeneous Workers

ratio of part-timers / total employees

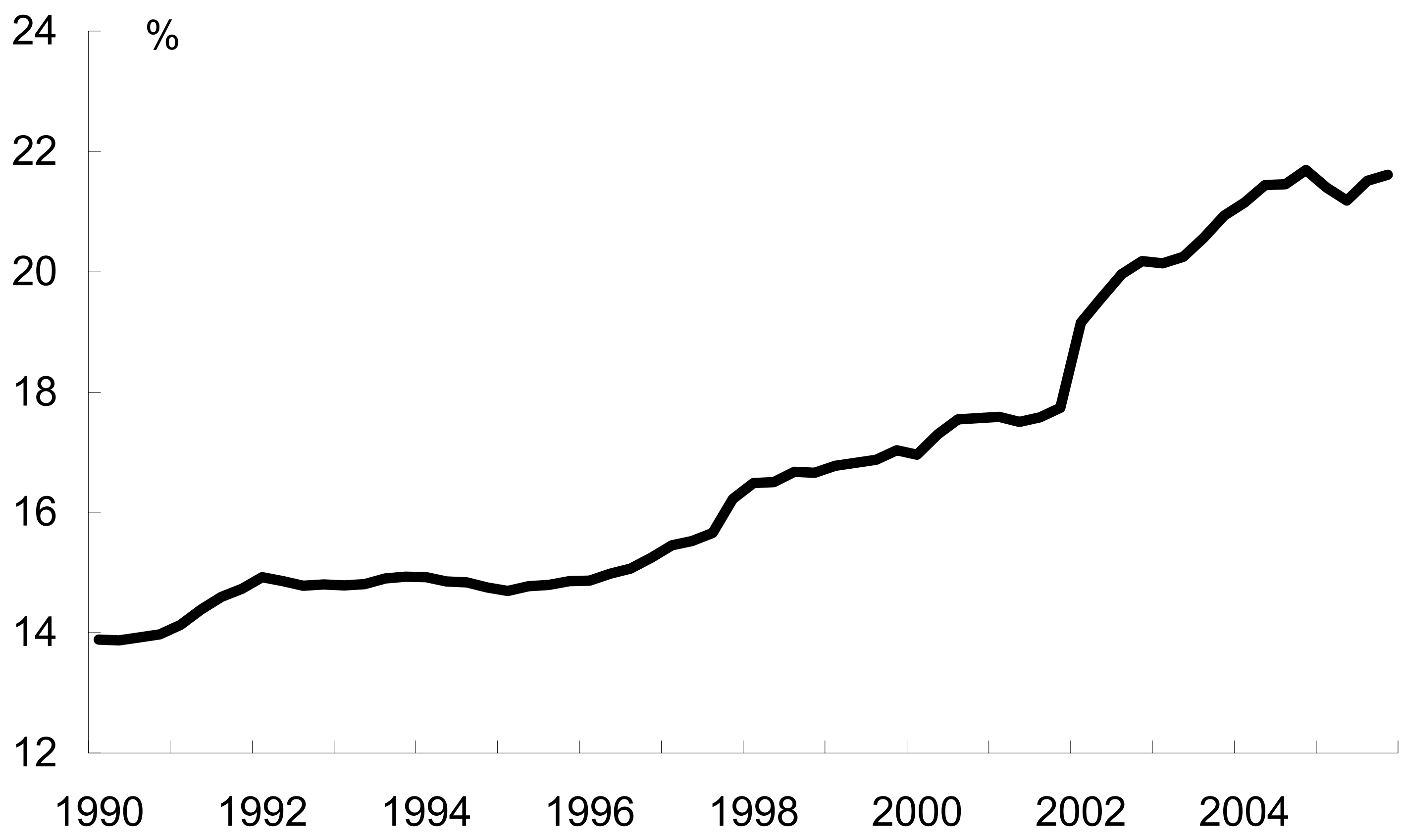
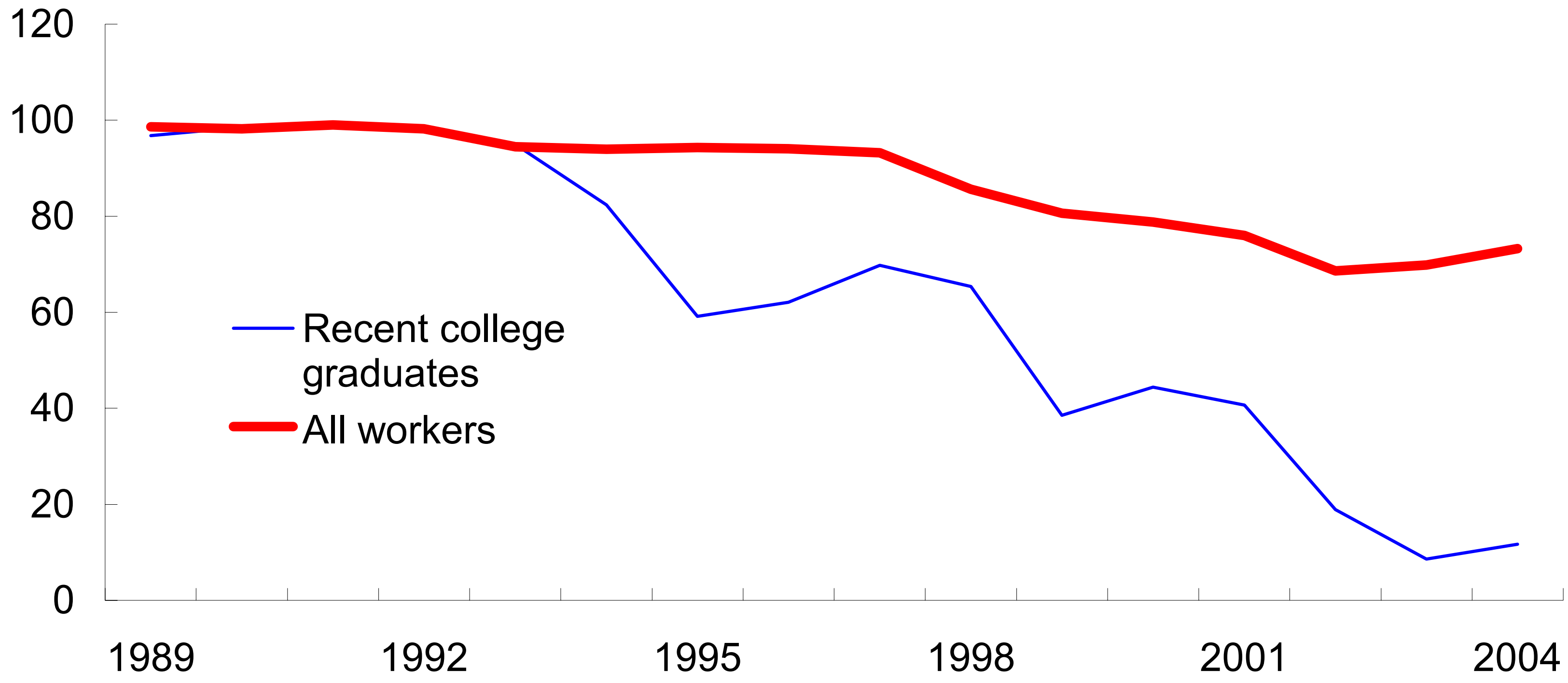


Figure 23 Changes in Wages and Frequency of Wage Revision

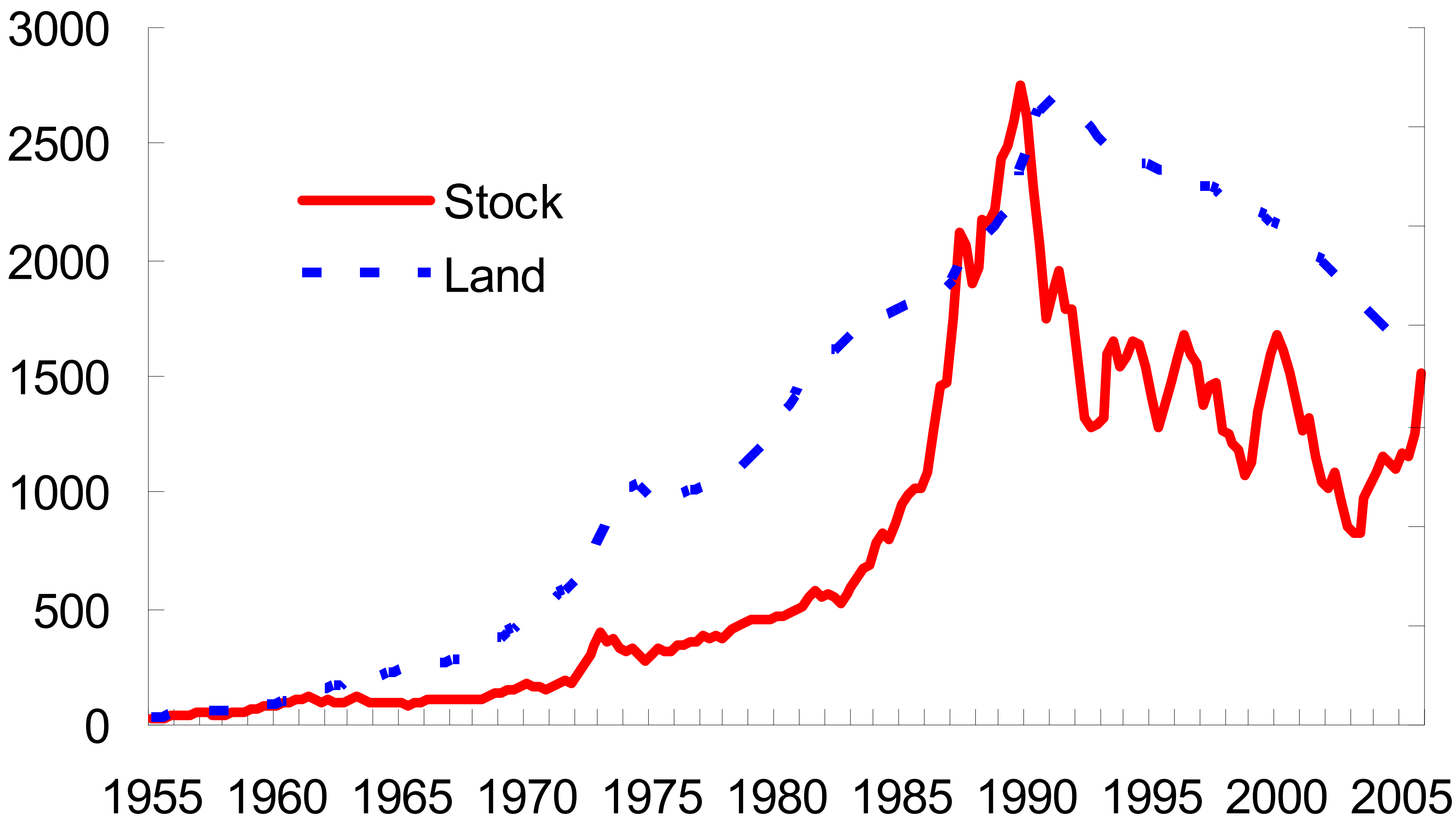
(2) Share of workers having their wages revised (Full-time workers)



Higo, Nishizaki, Saita and Takagawa (2006)

- How to model part time workers? Campbell and Fisher (RED2004) but with idiosyncratic shock.
- Heterogeneity among workers or generations (and consumers with partial insurance) becomes more prevalent. This must have significant welfare implication.
- Nakajima (2005) shows the possibility that zero-inflation policy is no longer optimal using the dynamic efficiency wage model under partial insurance.

Asset Prices



- Stock and land price bubble must have played an important role in the Japan’s lost decade.
- Expectation about future high technology results in an increase in real interest rates.

$$q_t = \mathrm{E}_t \sum_{i=1}^{\infty} \left(\prod_{j=1}^{i} \frac{1}{R_{t+j}} \right) (1-\delta)^i \, MPK_{t+1}$$

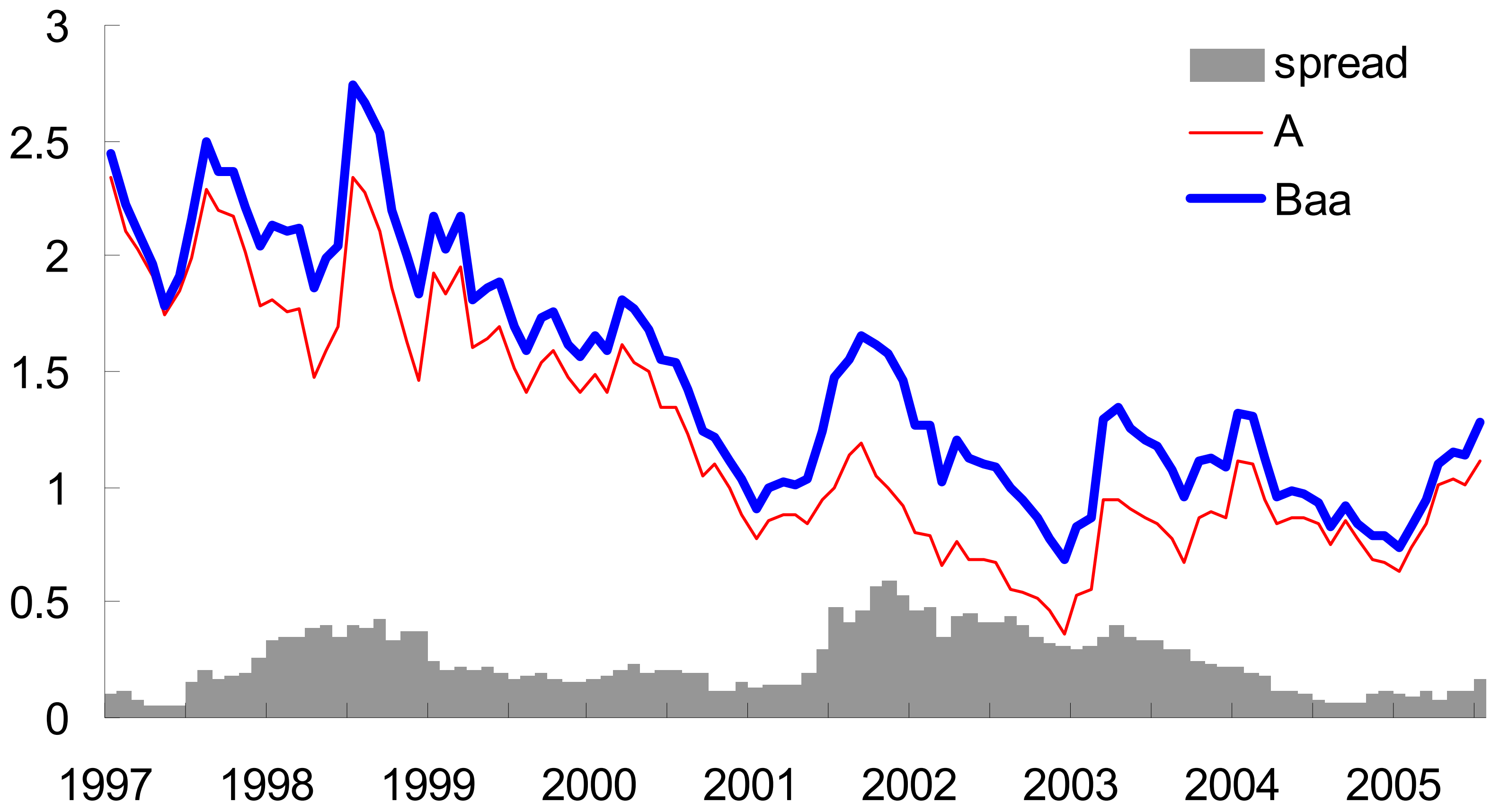
$$R_{t+1} = \frac{U'(C_t)}{\beta \mathrm{E}_t U'(C_{t+1})}$$

- See Nakajima (2003), Gilchrist and Saito (2006), Christiano, Motto and Rostagno (2006)

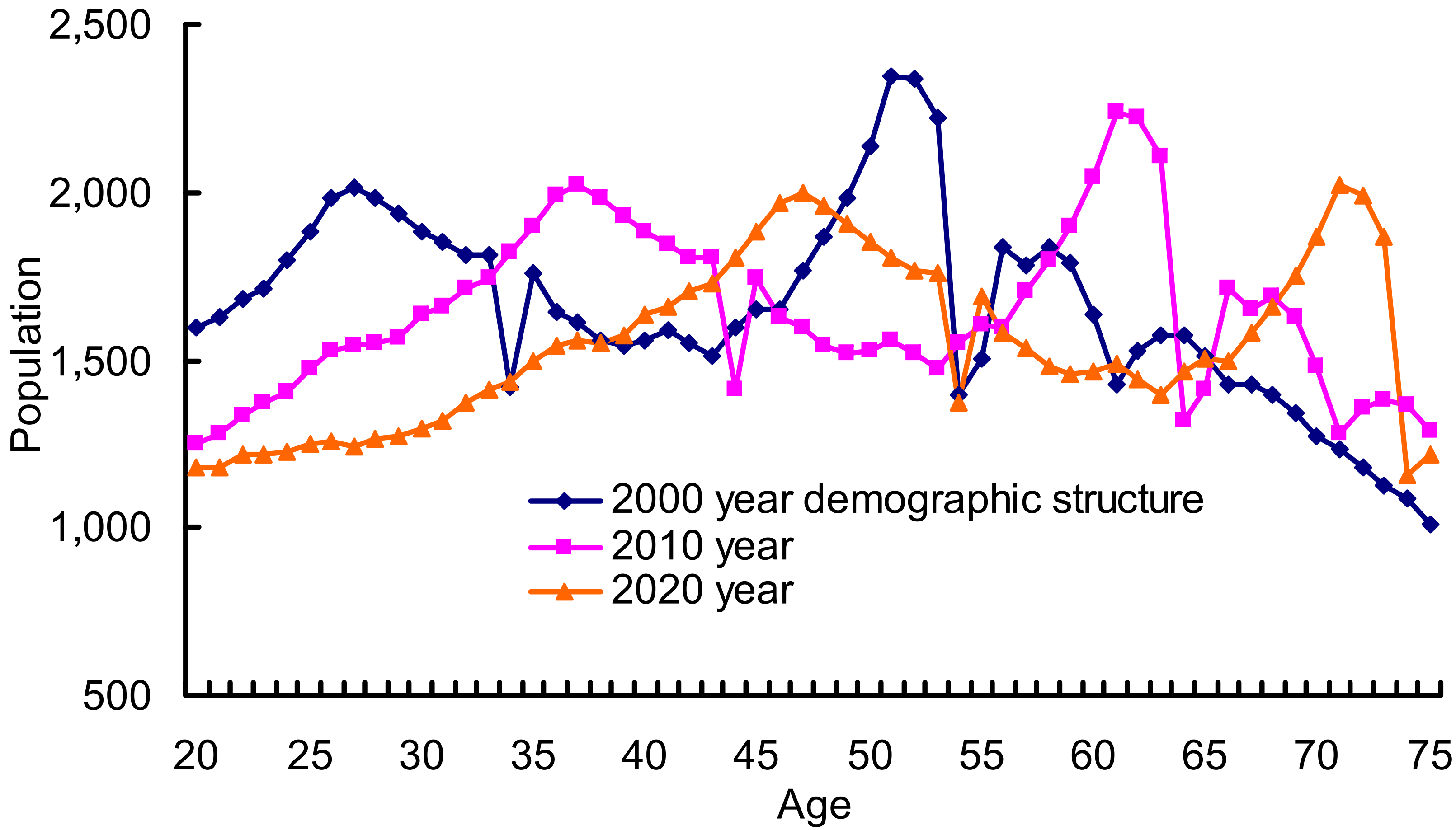
- Under investment specific technology, real stock price should decrease. Is this very realistic?
- Should bubble or asset prices be modeled or ignored? Are there any significant welfare differences between modeling asset prices and capturing them as shocks?

Financial Market Imperfection

- Why has the Japanese economy caught by the zero bound?
  Increased Degree of Uninsured Idiosyncratic Risk *a la* Bewley (JET1977), Aiyagari (QJE1993) may be an answer.
- Collateral Constraint
  Kiyotaki and Moore (JPE1997), but not very flexible model.
- Costly state verification
  Townsend (QJE1979), Christiano, Motto and Rostagno (JMCB2003), but such cost appears rather in quantity not in price (premium).


spread
A
Baa
3
2.5
2
1.5
1
0.5
0
1997
1998
1999
2000
2001
2002
2003
2004
2005

Societal Ageing



- Fujiwara and Teranishi (2006) build a model based on Gertler (CR1999) and the AINO.
- The optimal instrument rule for workers is quite different from the one for retirees. Workers prefer more inflation-fighting monetary policy than retirees since they have longer life-expectancy for consumption smoothing.
- Again, heterogeneity among agents becomes prevalent and should have important welfare implication since it means incomplete insurance among agents.

Current Exercises

Suites of Models

- JEM
- Old Keynesian model
- Small-model
- Medium-model
- Judgmental forecast

JEM

- Core Non-Core Approach
  Model construction started before the success of SW.
  Japanese economy was considered to be very far away from SS.
- Simulation under zero bound is possible with level model.
- Intuitive explanation is possible with the usage of trend output gap

Old Keynesian Model

- Backward-looking old Keynesian model
- 239 variables and 163 equations
- Individual equations are estimated by OLS
- For checking the judgmental forecast and simulation purpose
- Very little forecast adjustment is needed to implement forecast
- Traditional but very good forecasting performance in the short-run

Small Model

- Based on Rudebusch (EJ2002).
- Parameters are estimated via GMM.

$$\pi_t = .43\tilde{\pi}_{t-1} + .57\mathrm{E}_t\tilde{\pi}_{t+4} + .04\left(y_{t-1} - y^*_{t-1}\right) + \mu_t$$

$$y_t - y^*_t = .95\left(y_{t-1} - y^*_{t-1}\right) - 0.09\left(i_t - \mathrm{E}_t\tilde{\pi}_{t+4} - r^*_t\right) + \varepsilon_t$$

$$\tilde{\pi}_t = \frac{1}{4}\sum_{j=0}^{3}\pi_{t-j}$$

Medium Model

- Based on Christiano and Fujiwara (2006), the canonical model like CEE and SW.
- Primal Approach: Bayesian estimation and empirically relevant simulation
- Dual approach: Business cycle accounting *a la* Chari, Kehoe and McGrattin (2004).
- We cannot estimate the model under the zero bound. Therefore, we instead express forecast as a process of dissipating wedges under very transparent assumption of economy (parameters)

- Assume that economy is in steady state before some point
- Plugging de-trended data in the level model and compute shocks as stochastic parameters (wedges).
- Model is expressed in level so that we can apply zero bound.
- Forecasting (forecasting assumption) is very transparent since common trends are employed.

- There are two trends, labor augmenting technology and investment specific technology.
- De-trending is consistent to the story and theory.

$$Z_t^* = Z_t \Upsilon_t^{\frac{\alpha}{1-\alpha}},\ c_t = \frac{C_t}{Z_t^*},\ i_t = \frac{I_t}{Z_t^* \Upsilon_t},\ k_{t+1} = \frac{K_{t+1}}{Z_t^* \Upsilon_t},$$

$$\tilde{\lambda}_t = \lambda_t Z_t^*,\ \tilde{P}_{K,t} = \Upsilon_t P_{K,t}, w_t = \frac{W_t}{P_t Z_t \Upsilon_t^{\frac{\alpha}{1-\alpha}}},\ \pi_t = \frac{P_t}{P_{t-1}},\ \pi_t^W = \frac{w_t}{w_{t-1}}$$

Judgmental Forecast

- Main forecast method since no monetary policy!
- Decide on exogenous variables
- Discuss the possible main scenario = the central message
- Also alternative or risk scenario = the second message
- Forecast of individual components
- Y = C + I + Inv + G + Ex – Im plus p and w
- Iteration and necessary adjustment, making a coherent view on the economy throughout demand, production and distribution sides
- Centered on GDP coordinator.

Conclusion

Conclusion

- Zero bound hinders investigation into empirically relevant model. Hence, we need to rely on dual approach.
- Individual de-trending is not preferred as a forecasting tool.
- Investigation into firm's demand for funds and labor should be continued.

- We need to inquire into what mechanisms are important for forecasting but can be ignored for welfare evaluation or vice versa.
- Welfare evaluation under partial insurance becomes practically more relevant, but it is not a very tractable problem and still unclear whether it is targeted by monetary policy.

Three Key Points

- **Highly Pro-cyclical Productivity**: Should be avoided?
- **Better Labor Market Model**: both for positive as well as normative analysis
- **Better Financial Model**: Is capturing frictions as a shock OK for forecasting and welfare evaluation?