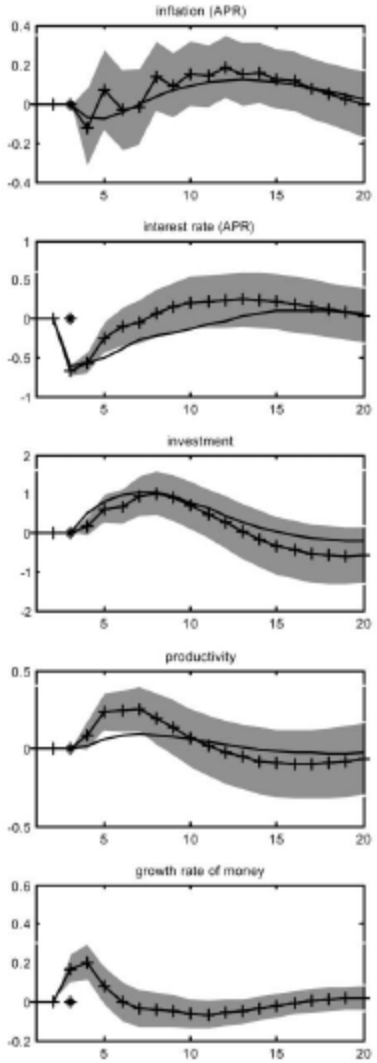
Monetary Economics

CEE (JPE '05)



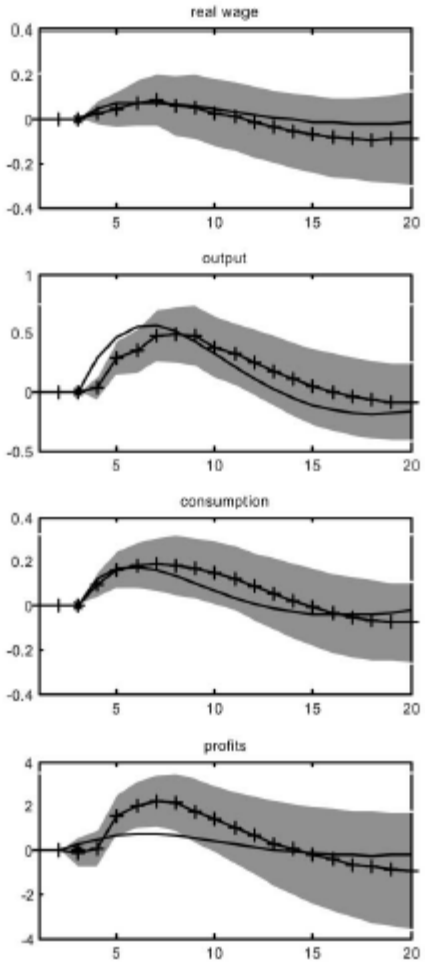


FIG. 1.—*Continued*

FIG. 1.—Model- and VAR-based impulse responses. Solid lines are benchmark model impulse responses; solid lines with plus signs are VAR-based impulse responses. Grey areas are 95 percent confidence intervals about VAR-based estimates. Units on the horizontal axis are quarters. An asterisk indicates the period of policy shock. The vertical axis units are deviations from the unshocked path. Inflation, money growth, and the interest rate are given in annualized percentage points (APR); other variables are given in percentages.

TABLE 2

ESTIMATED PARAMETER VALUES

Model	λ_f	ξ_w	ξ_p	σ_q	κ	b	σ_a	ν
Benchmark	1.20	.64	.60	10.62	2.48	.65	.01	NA
	(.06)	(.03)	(.08)	(.67)	(.43)	(.04)		
Flexible prices	1.11	.65	0	8.63	3.24	.66	.01	NA
	(.05)	(.02)		(.63)	(.47)	(.04)		
Unconditional indexation	1.36	.49	.72	11.09	1.92	.63	.01	NA
	(.09)	(.07)	(.16)	(.67)	(.35)	(.05)		
No variable capital utilization	1.85	.42	.92	10.83	1.58	.62	100	NA
	(.13)	(.05)	(.02)	(.67)	(.28)	(.05)		
No habit formation	1.01	.80	.28	10.12	.91	0	.01	NA
	(.04)	(.02)	(.15)	(.70)	(.18)			
Small adjustment costs in investment	1.06	.76	.64	10.92	.5	.52	.01	NA
	(.04)	(.03)	(.08)	(.70)		(.11)		
Lucas-Prescott investment adjustment costs	1.08	.62	.53	10.60	NA	.71	.01	−.74
	(.06)	(.03)	(.23)	(.60)		(.03)		(.22)
No working capital	1.25	.46	.89	10.85	1.89	.62	.01	NA
	(.06)	(.05)	(.02)	(.67)	(.37)	(.05)		

NOTE.—Standard errors are in parentheses.

SMETS AND WOUTERS:
SHOCKS AND FRICTIONS IN US BUSINESS CYCLES (*AER* '07)

TABLE 1A—PRIOR AND POSTERIOR DISTRIBUTION OF STRUCTURAL PARAMETERS

	Prior distribution			Posterior distribution			
	Distr.	Mean	St. Dev.	Mode	Mean	5 percent	95 percent
φ	Normal	4.00	1.50	5.48	5.74	3.97	7.42
σ_c	Normal	1.50	0.37	1.39	1.38	1.16	1.59
h	Beta	0.70	0.10	0.71	0.71	0.64	0.78
ξ_w	Beta	0.50	0.10	0.73	0.70	0.60	0.81
σ_l	Normal	2.00	0.75	1.92	1.83	0.91	2.78
ξ_p	Beta	0.50	0.10	0.65	0.66	0.56	0.74
ι_w	Beta	0.50	0.15	0.59	0.58	0.38	0.78
ι_p	Beta	0.50	0.15	0.22	0.24	0.10	0.38
ψ	Beta	0.50	0.15	0.54	0.54	0.36	0.72
Φ	Normal	1.25	0.12	1.61	1.60	1.48	1.73
r_π	Normal	1.50	0.25	2.03	2.04	1.74	2.33
ρ	Beta	0.75	0.10	0.81	0.81	0.77	0.85
r_y	Normal	0.12	0.05	0.08	0.08	0.05	0.12
$r_{\Delta y}$	Normal	0.12	0.05	0.22	0.22	0.18	0.27
$\bar{\pi}$	Gamma	0.62	0.10	0.81	0.78	0.61	0.96
$100(\beta^{-1} - 1)$	Gamma	0.25	0.10	0.16	0.16	0.07	0.26
$\bar{l}$	Normal	0.00	2.00	−0.1	0.53	−1.3	2.32
$\bar{\gamma}$	Normal	0.40	0.10	0.43	0.43	0.40	0.45
α	Normal	0.30	0.05	0.19	0.19	0.16	0.21

Note: The posterior distribution is obtained using the Metropolis-Hastings algorithm.

TABLE 1B—PRIOR AND POSTERIOR DISTRIBUTION OF SHOCK PROCESSES

	Prior distribution			Posterior distribution			
	Distr.	Mean	St. Dev.	Mode	Mean	95 percent	5 percent
σ_a	Invgamma	0.10	2.00	0.45	0.45	0.41	0.50
σ_b	Invgamma	0.10	2.00	0.24	0.23	0.19	0.27
σ_g	Invgamma	0.10	2.00	0.52	0.53	0.48	0.58
σ_I	Invgamma	0.10	2.00	0.45	0.45	0.37	0.53
σ_r	Invgamma	0.10	2.00	0.24	0.24	0.22	0.27
σ_p	Invgamma	0.10	2.00	0.14	0.14	0.11	0.16
σ_w	Invgamma	0.10	2.00	0.24	0.24	0.20	0.28
ρ_a	Beta	0.50	0.20	0.95	0.95	0.94	0.97
ρ_b	Beta	0.50	0.20	0.18	0.22	0.07	0.36
ρ_g	Beta	0.50	0.20	0.97	0.97	0.96	0.99
ρ_I	Beta	0.50	0.20	0.71	0.71	0.61	0.80
ρ_r	Beta	0.50	0.20	0.12	0.15	0.04	0.24
ρ_p	Beta	0.50	0.20	0.90	0.89	0.80	0.96
ρ_w	Beta	0.50	0.20	0.97	0.96	0.94	0.99
μ_p	Beta	0.50	0.20	0.74	0.69	0.54	0.85
μ_w	Beta	0.50	0.20	0.88	0.84	0.75	0.93
ρ_{ga}	Beta	0.50	0.20	0.52	0.52	0.37	0.66

Note: The posterior distribution is obtained using the Metropolis-Hastings algorithm.

- Empirical Validation

Model Fit

TABLE 2—COMPARISON OF THE MARGINAL LIKELIHOOD OF ALTERNATIVE VAR MODELS AND THE DSGE MODEL

Order of the VAR	No other prior	Sims and Zha (1998) prior
VAR(1)	−928.0	−940.9
VAR(2)	−966.6	−915.8
VAR(3)	−1018.1	−908.7
VAR(4)	−1131.2	−906.6
VAR(5)	–	−907.7
Memo: DSGE model	−905.8	−905.8

Note: In order to increases the comparability of the marginal likelihood of the various models, all models are estimated using the period 1956:1–1965:4 as a training sample (Sims 2003).

Forecasting Performance

TABLE 3—OUT-OF-SAMPLE PREDICTION PERFORMANCE

	GDP	dP	Fedfunds	Hours	Wage	CONS	INV	Overall
VAR(1)	*RMSE-statistic for different forecast horizons*							
1q	0.60	0.25	0.10	0.46	0.64	0.60	1.62	−12.87
2q	0.94	0.27	0.18	0.78	1.02	0.95	2.96	−8.19
4q	1.64	0.34	0.36	1.45	1.67	1.54	5.67	−3.25
8q	2.40	0.53	0.64	2.13	2.88	2.27	8.91	1.47
12q	2.78	0.63	0.79	2.41	4.09	2.74	10.97	2.36
BVAR(4)	*Percentage gains (+) or losses (−) relative to VAR(1) model*							
1q	2.05	14.14	−1.37	−3.43	2.69	12.12	2.54	3.25
2q	−2.12	15.15	−16.38	−7.32	−0.29	10.07	2.42	0.17
4q	−7.21	31.42	−12.61	−8.58	−3.82	1.42	0.43	0.51
8q	−15.82	33.36	−13.26	−13.94	−8.98	−8.19	−11.58	−4.10
12q	−15.55	37.59	−13.56	−4.66	−15.87	−3.10	−23.49	−9.84
DSG	*Percentage gains (+) or losses (−) relative to VAR(1) model*							
1q	5.68	2.05	−8.24	0.68	5.99	20.16	9.22	3.06
2q	14.93	10.62	−17.22	10.34	6.20	25.85	16.79	2.82
4q	20.17	46.21	1.59	19.52	9.21	26.18	21.42	6.82
8q	22.55	68.15	28.33	22.34	15.72	21.82	25.95	11.50
12q	32.17	74.15	40.32	27.05	21.88	23.28	41.61	13.51

Notes: All models are estimated starting in 1966:1. The forecast period is 1990:1–2004:4. VAR(1) and BVAR(4) models are reestimated each quarter, the DSGE model each year. The overall measure of forecast performance is the log determinant of the uncentered forecast error covariance matrix. Gains and losses in the overall measure are expressed as the difference in the overall measure divided by the number of variables and by two to convert the variance to standard errors (times 100).

Which Frictions Are Important?

TABLE 4—TESTING THE EMPIRICAL IMPORTANCE OF THE NOMINAL AND REAL FRICTIONS IN THE DSGE MODEL

	Base	$\xi_p = 0.1$	$\xi_w = 0.1$	$\iota_p = 0.0$	$\iota_w = 0.0$	$\varphi = 0.1$	$h = 0.1$	$\psi = 0.99$	$\Phi = 1.1$
Marginal likelihood									
	−923	−975	−973	−918	−927	−1084	−959	−924	−949
Mode of the structural parameters									
φ	5.48	4.41	2.78	5.45	5.62	0.10	1.26	5.33	5.19
σ_c	1.39	1.31	1.80	1.43	1.42	2.78	1.90	1.39	1.27
h	0.71	0.70	0.34	0.70	0.71	0.12	0.10	0.70	0.71
ξ_w	0.73	0.55	0.10	0.75	0.75	0.89	0.73	0.73	0.78
σ_l	1.92	1.48	0.25	1.91	1.91	5.24	1.21	1.79	2.33
ξ_p	0.65	0.10	0.48	0.66	0.69	0.86	0.62	0.59	0.80
ι_w	0.59	0.71	0.68	0.61	0.01	0.39	0.61	0.63	0.58
ι_p	0.22	0.84	0.24	0.01	0.24	0.08	0.21	0.21	0.19
ψ	0.54	0.82	0.66	0.54	0.50	0.02	0.69	0.99	0.45
Φ	1.61	1.79	1.64	1.60	1.61	1.15	1.44	1.62	1.10
r_π	2.03	2.15	2.15	2.01	2.01	2.03	2.24	2.04	1.98
ρ	0.81	0.79	0.75	0.81	0.82	0.84	0.81	0.80	0.80
r_y	0.08	0.08	0.08	0.08	0.09	0.23	0.12	0.08	0.10
$r_{\Delta y}$	0.22	0.21	0.25	0.22	0.22	0.30	0.29	0.23	0.25
α	0.19	0.21	0.20	0.19	0.19	0.20	0.19	0.18	0.13
Mode of the autoregressive parameters of the exogenous shock processes									
ρ_a	0.95	0.96	0.97	0.96	0.95	0.99	0.97	0.96	0.96
ρ_b	0.18	0.19	0.67	0.18	0.18	0.89	0.79	0.18	0.28
ρ_g	0.97	0.96	0.97	0.97	0.97	0.99	0.97	0.97	0.96
ρ_I	0.71	0.71	0.78	0.70	0.69	0.99	0.90	0.73	0.74
ρ_r	0.12	0.14	0.13	0.12	0.11	0.02	0.03	0.13	0.11
ρ_p	0.90	0.97	0.94	0.88	0.88	0.60	0.93	0.92	0.85
ρ_w	0.97	0.98	0.98	0.97	0.97	0.92	0.98	0.97	0.95
μ_p	0.74	0.20	0.71	0.59	0.77	0.34	0.76	0.71	0.67
μ_w	0.88	0.75	0.14	0.91	0.88	0.96	0.95	0.90	0.87

Impulse Responses

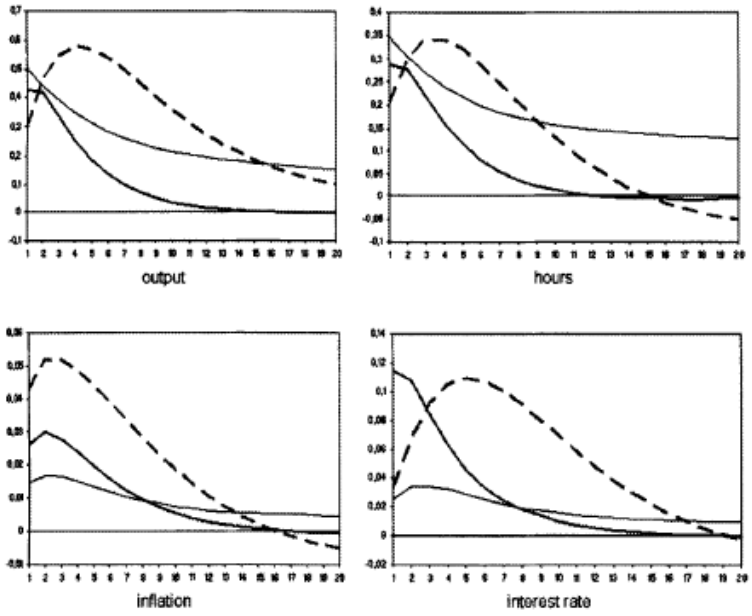


FIGURE 2. THE ESTIMATED MEAN IMPULSE RESPONSES TO "DEMAND" SHOCKS

Note: Bold solid line: risk premium shock; thin solid line: exogenous spending shock; dashed line: investment shock.

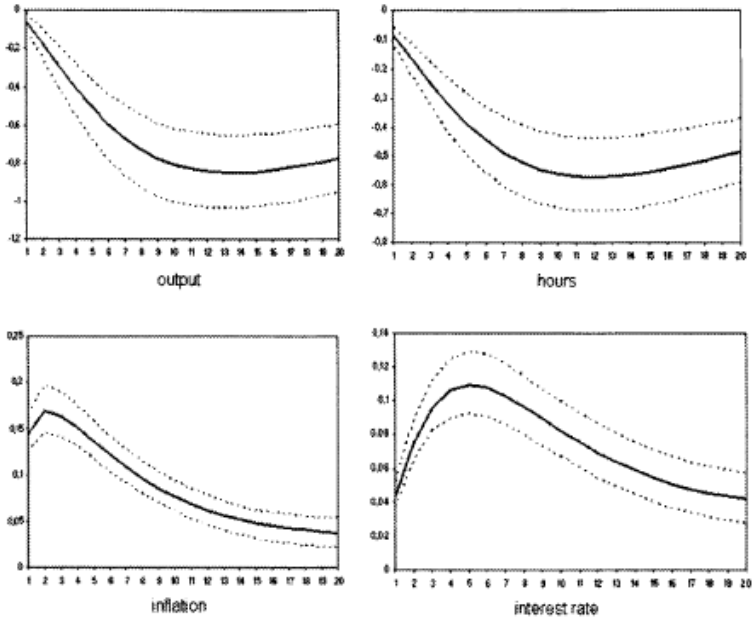


FIGURE 3. THE ESTIMATED IMPULSE RESPONSE TO A WAGE MARK-UP SHOCK

Note: The solid line is the mean impulse response; the dotted lines are the 10 percent and 90 percent posterior intervals.

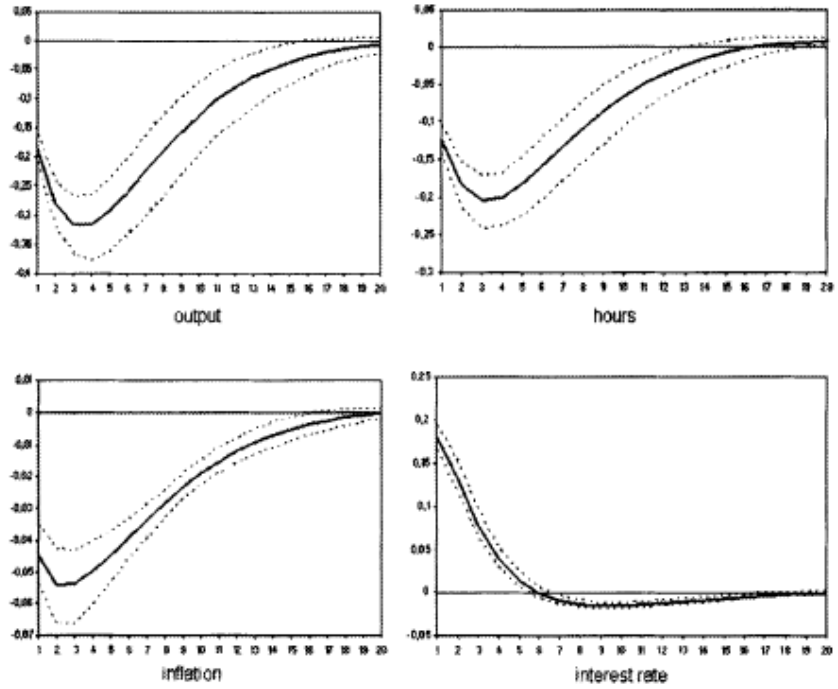


FIGURE 6. THE IMPULSE RESPONSES TO A MONETARY POLICY SHOCK

Note: The solid line is the mean impulse response; the dotted lines are the 10 percent and 90 percent posterior intervals.

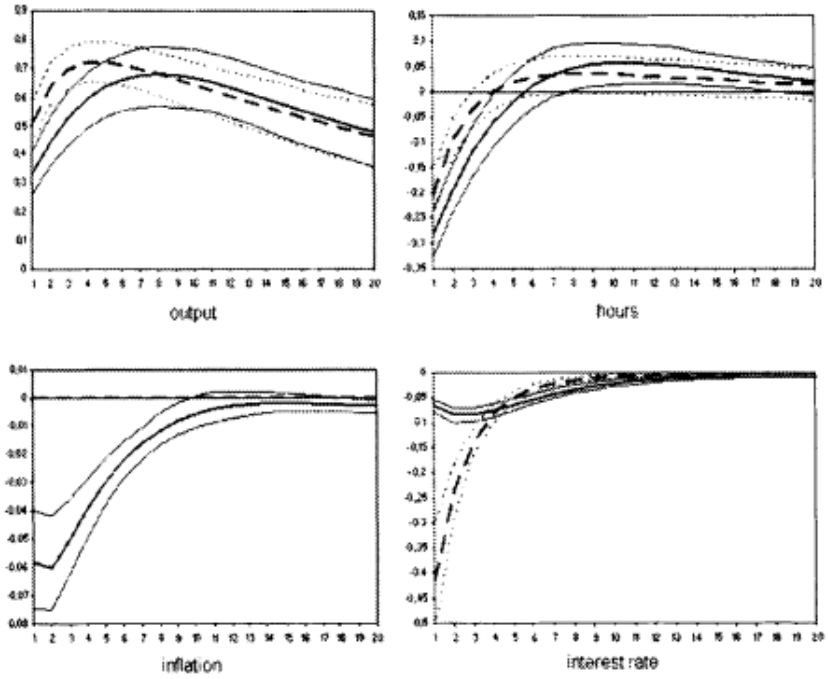


FIGURE 7. THE ESTIMATED IMPULSE RESPONSES TO A PRODUCTIVITY SHOCK

Note: The solid lines represent the estimated actual mean responses and the 10 percent and 90 percent posterior interval; the dashed lines represent the counterfactual flexible-wage-and-price responses.

Variance Decomposition

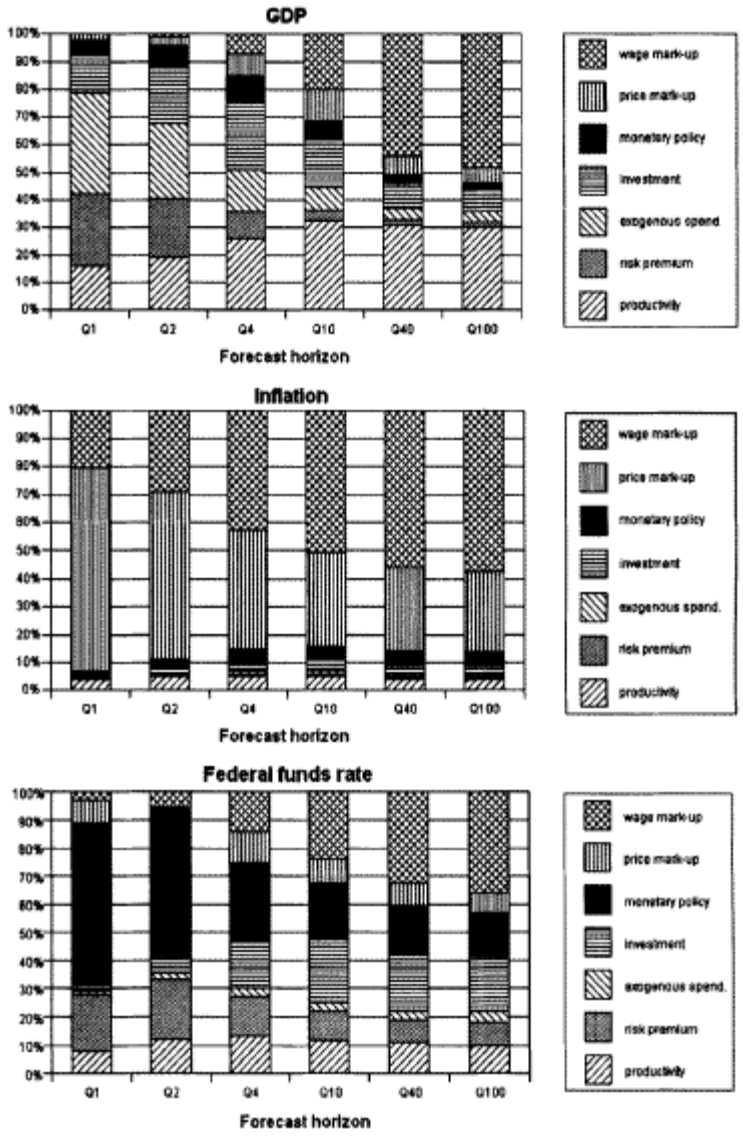


FIGURE 1. FORECAST ERROR VARIANCE DECOMPOSITION
(*At the mode of the posterior distribution*)

Cross-Correlations

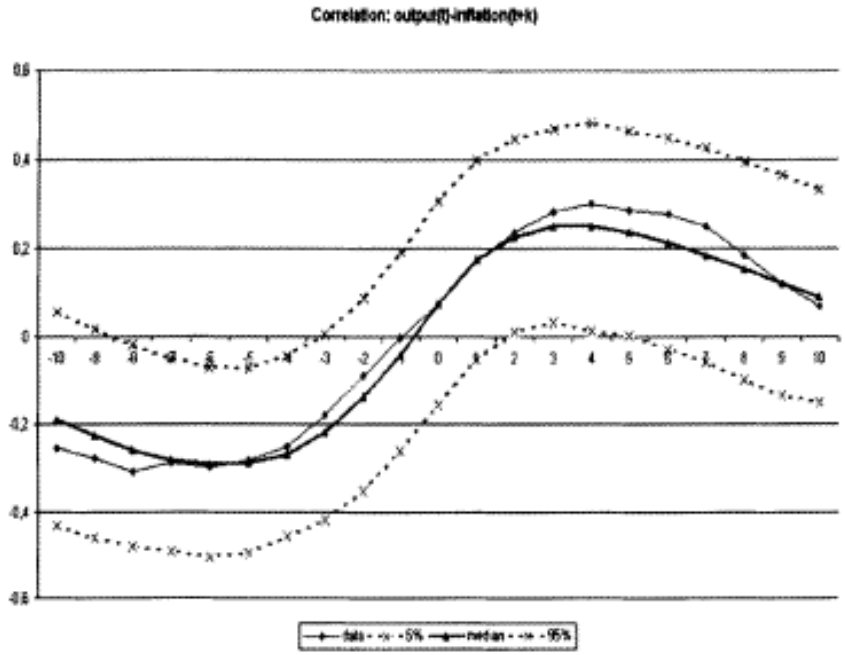


FIGURE 5. THE ACTUAL AND MODEL-BASED CROSS-CORRELATION FUNCTION BETWEEN OUTPUT AND INFLATION

Note: Output is Hodrick-Prescott filtered real GDP.

- Also read:

  Chapter 7 - DSGE Models for Monetary Policy Analysis by Christiano et al.

Chari-Kehoe-McGrattan critique

TABLE 1. FORECAST ERROR VARIANCE DECOMPOSITION IN THE SMETS-WOUTERS (2007) MODEL

1,000 Quarters	1-Monetary shock	2.3	3.4	4.6
	2-Productivity shock	29.5	2.0	4.0
	3-Investment shock	7.9	8.6	3.4
	4-Risk premium shock	1.6	2.6	0.6
	5-Exogenous spending shock	4.2	10.5	1.0
	6-Price markup shock	6.4	6.2	28.6
	7-Wage markup shock	48.2	66.7	57.8
	All shocks	100.0	100.0	100.0
	Shocks 4−7	60.3	86.0	88.0

FIGURE 4. ANNUALIZED INTEREST RATE AND RISK PREMIUM SHOCK OF THE SMETS-WOUTERS (2007) MODEL

Quarterly 1965–2005, Series Demeaned

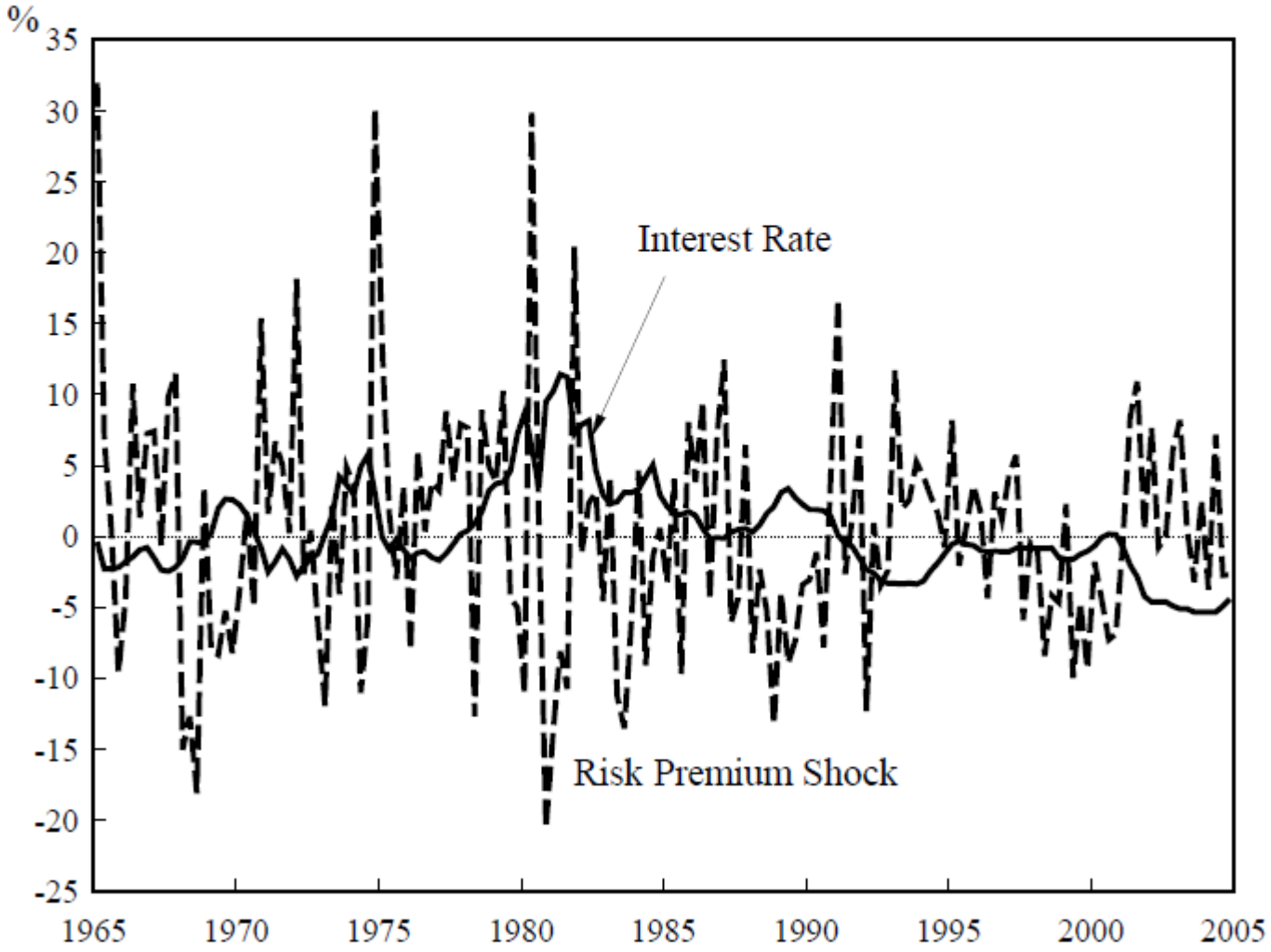


FIGURE 5. PRICE OF ANGEL SOFT BATHROOM TISSUE AT CHICAGO'S DOMINI FINER FOODS AND PRICE IMPLIED BY BACKWARD INDEXATION

Weekly, from Week 11 of 1991 to Week 5 of 1993