Do Energy Price Fluctuations Matter?

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Literature

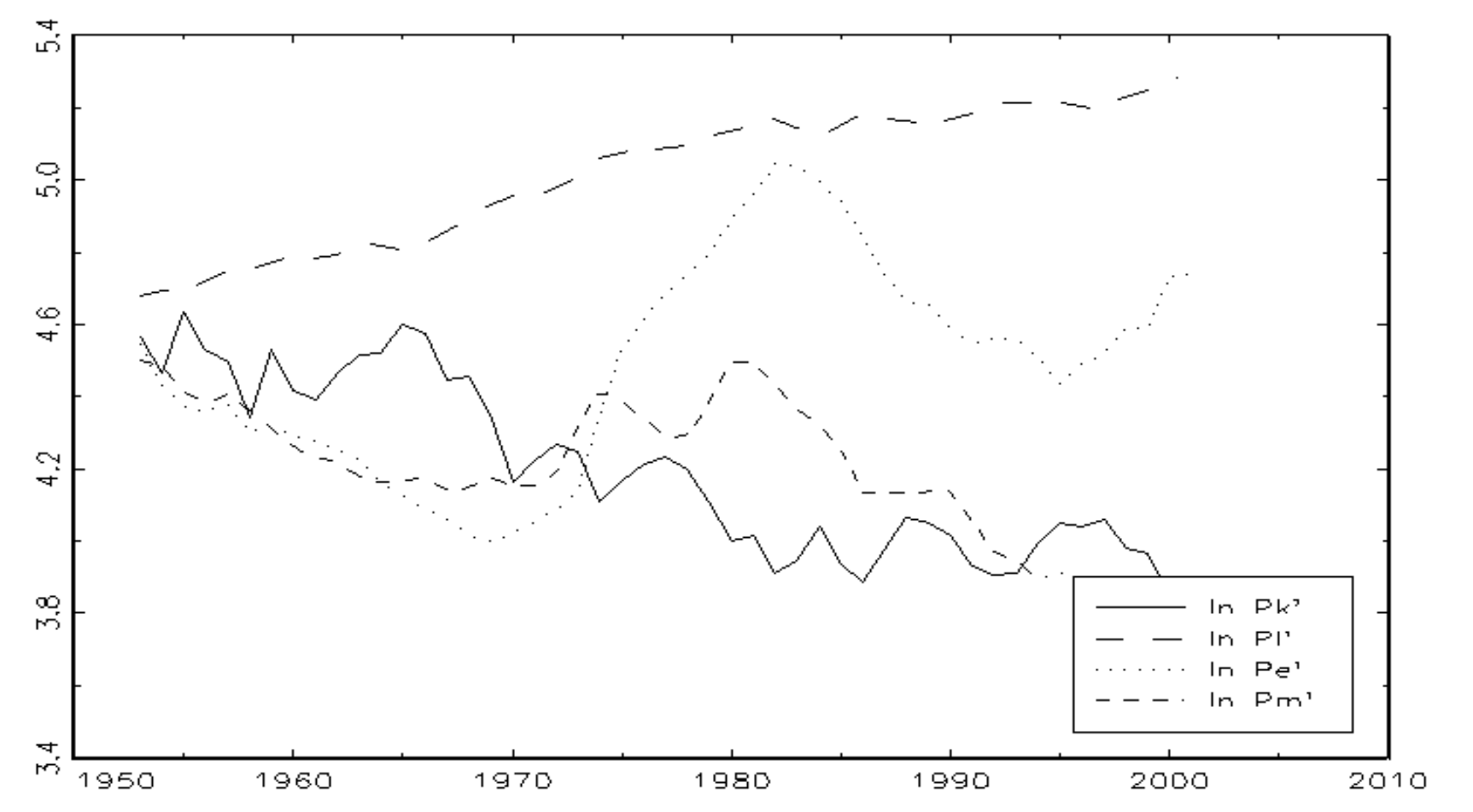
- Energy Consumption Rebound Effect, Long Run Energy Price Elasticities
  - ✓ Methodology: SUR, ECM
  - ✓ Benzen (2004), Urga (1999), Jones (1995), Dargay(1992)
- Instability of Long Run Relationship in the Factors Market (from 1985)?
  - ✓ Theoretical framework: Hierarchical SUR with Time-varying Parameters
  - ✓ Chib and Greenberg (1995)

Data

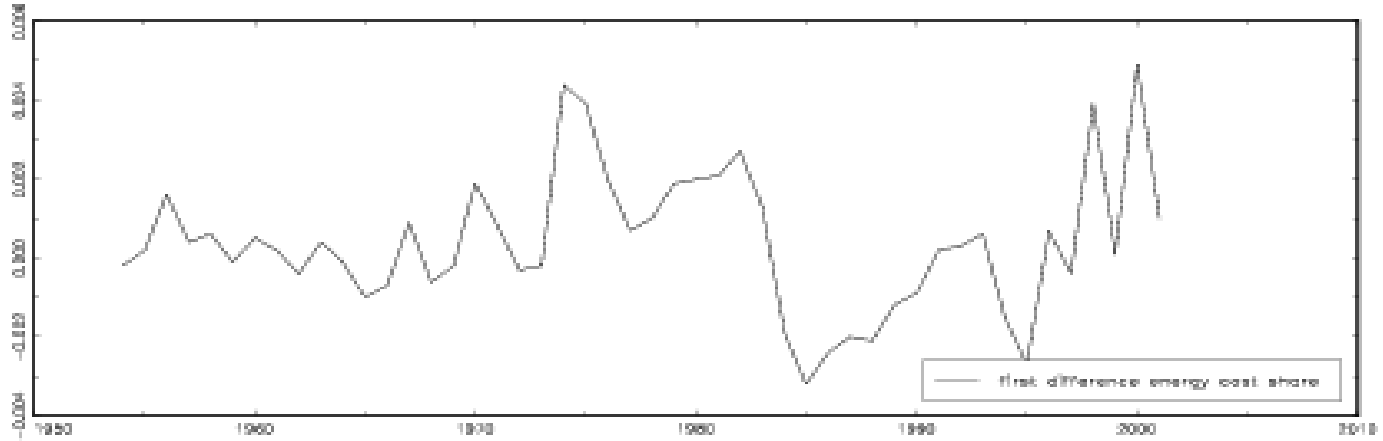
- Survey on the Manufacturing Sector from BLS

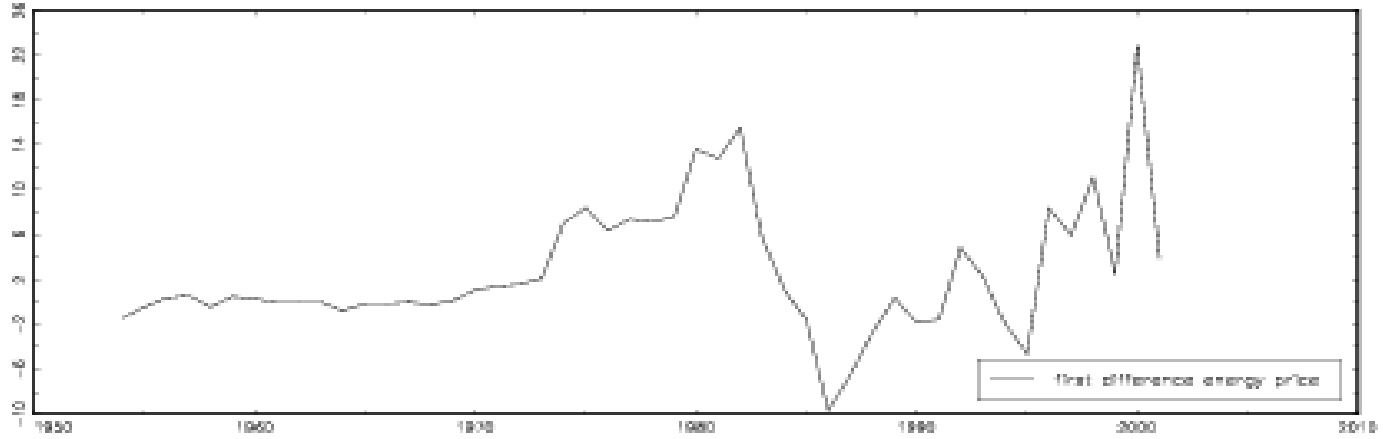
  - ✓Yearly Measures for Gross Real Output
  - ✓Price and Cost Share Measures for Inputs
  - ✓Input Categories: Capital, Labor, Energy, Materials, Services
  - ✓Services Chosen as Base Input

Data


5.4
5.0
4.6
4.2
3.8
3.4
1950
1960
1970
1980
1990
2000
2010
ln Pk'
ln Pl'
ln Pe'
ln Pm'

Data


first difference energy cost share
1950
1960
1970
1980
1990
2000


first difference energy price
1950
1960
1970
1980
1990
2000

Long-run Factor Market Equilibrium Model

For all input categories (use Services as Base):

$$S_{it} = \gamma_i + \sum_{j=1}^{N} \gamma_{i,j} \ln(P_j) + \gamma_{i,y} \ln(y_t) +$$

$$+ \gamma_{i,t} Tr + \omega_{i,t} \qquad \omega_t \sim N(0, \Omega)$$

Two Models

- SUR

$$y_t = X_t\Gamma + \omega_t \qquad \omega_t \sim \mathrm{N}(0,\Omega)$$

- Hierarchical SUR with Time-Varying Parameters

$$y_t = X_t\Gamma_t + \omega_t \qquad \omega_t \sim \mathrm{N}(0,\Omega)$$
$$\Gamma_t = \Psi\Theta_t + \eta_t \qquad \eta_t \sim \mathrm{N}(0,\Sigma)$$
$$\Theta_t = \Theta_{t-1} + \nu_t \qquad \nu_t \sim \mathrm{N}(0,\mathrm{Y})$$

Estimation Methodology

- Conditional distributions for parameters easily available
- In the Case of HSUR-TV Use Kalman Iterations to Obtain the State Variable
- Stimulate Markov Chain Samples of the Parameters and the State Variable with Gibbs Sampler
- Compare Models with Partial Bayes Factor

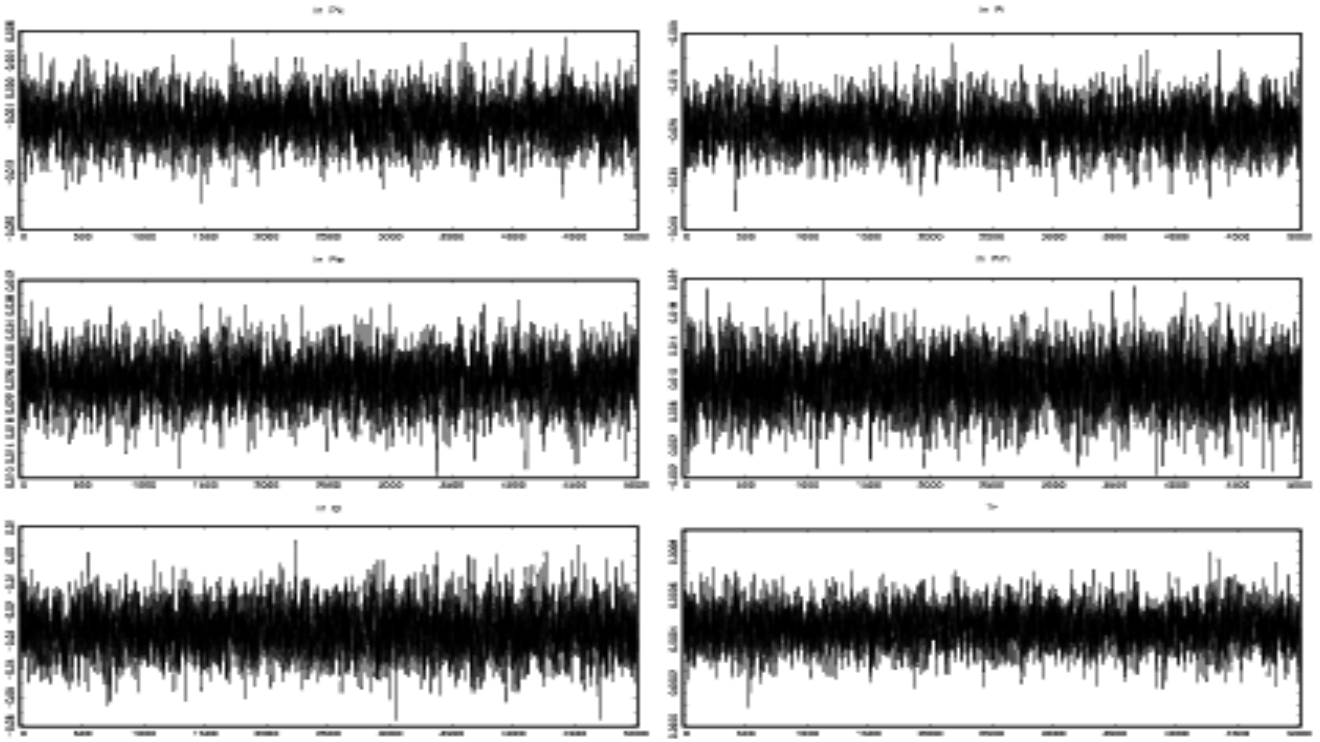
Posterior Mean and St. Deviation for the Factor Share Equations (SUR)

	S_k	S_l	S_e	S_m
C	0.1726 (0.0416)	0.3987 (0.0840)	-0.0311 (0.0387)	0.5638 (0.0486)
ln P_k	0.1159 (0.0052)	-0.1040 (0.0061)	-0.0046 (0.0031)	-0.0129 (0.0039)
ln P_l	-0.1040 (0.0061)	0.0848 (0.0205)	-0.0238 (0.0043)	0.0032 (0.0088)
ln P_e	-0.0046 (0.0031)	-0.0238 (0.0043)	0.0257 (0.0040)	0.0097 (0.0033)
ln P_m	-0.0129 (0.0039)	0.0032 (0.0088)	0.0097 (0.0033)	0.0118 (0.0064)
ln Q	-0.0337 (0.0082)	-0.2207 (0.0109)	-0.0262 (0.0084)	0.2595 (0.0092)
Tr	0.0037 (0.0001)	-0.0035 (0.0003)	0.0005 (0.0001)	-0.0002 (0.0002)
Mean(S_i)	0.1948	0.4769	0.0304	0.2979

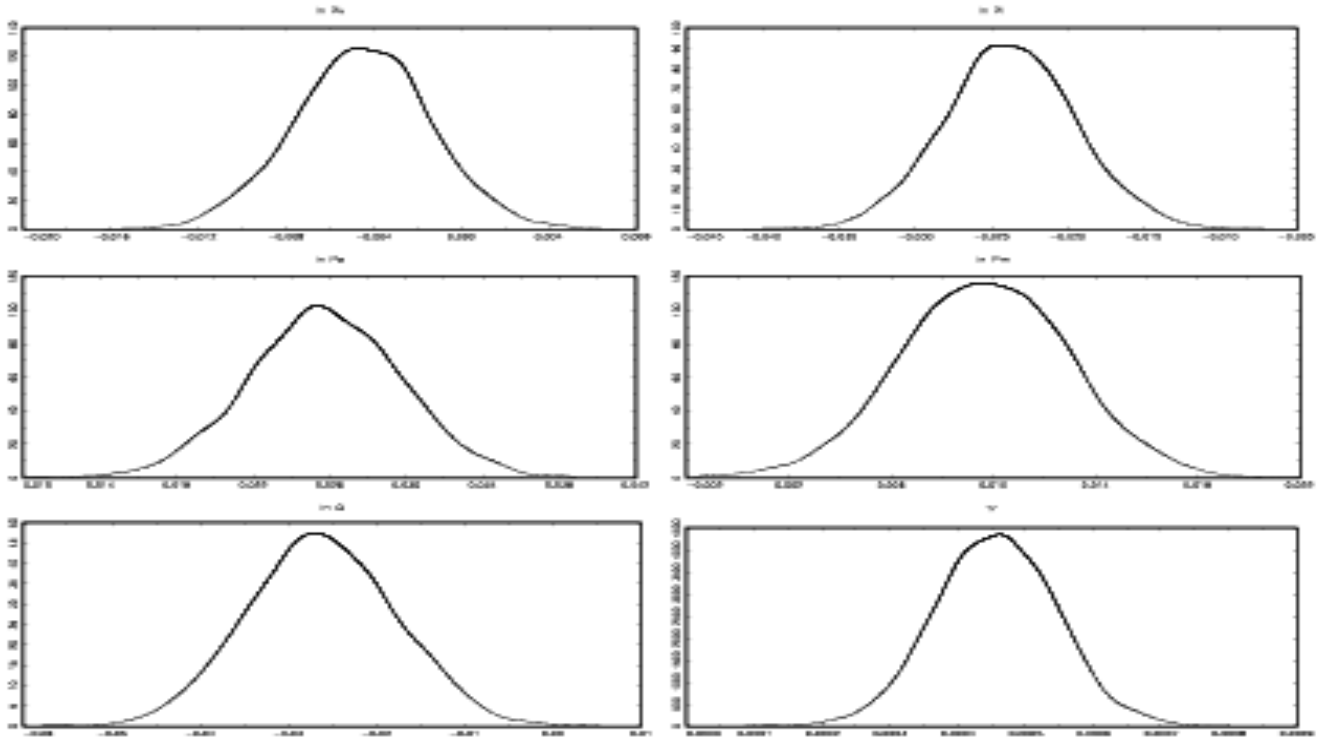
Own-price and Cross-price Elasticities from SUR

$\varepsilon_{i,j}$	K	L	E	M
K	-0.2102	-0.0573	0.0070	0.2318
L	-0.0234	-0.3453	-0.0194	0.3046
E	0.0447	-0.3051	-0.1234	0.6163
M	0.1515	0.4875	0.0629	-0.6623

MCMC Draws for the Energy Equation Parameters



Posterior Densities for Energy Equation Parameters

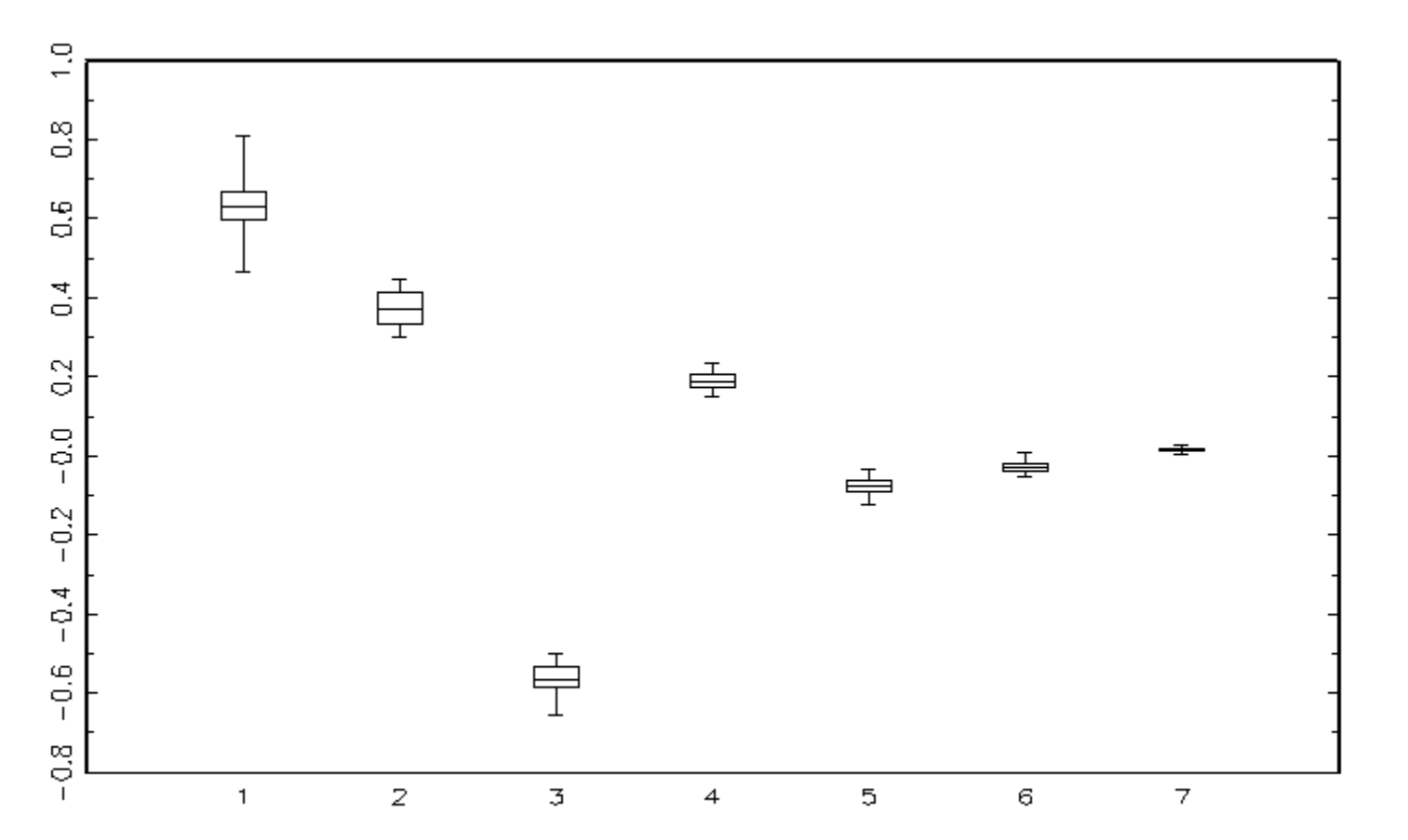


Mean Posterior distribution for energy coefficients (averaged over time)

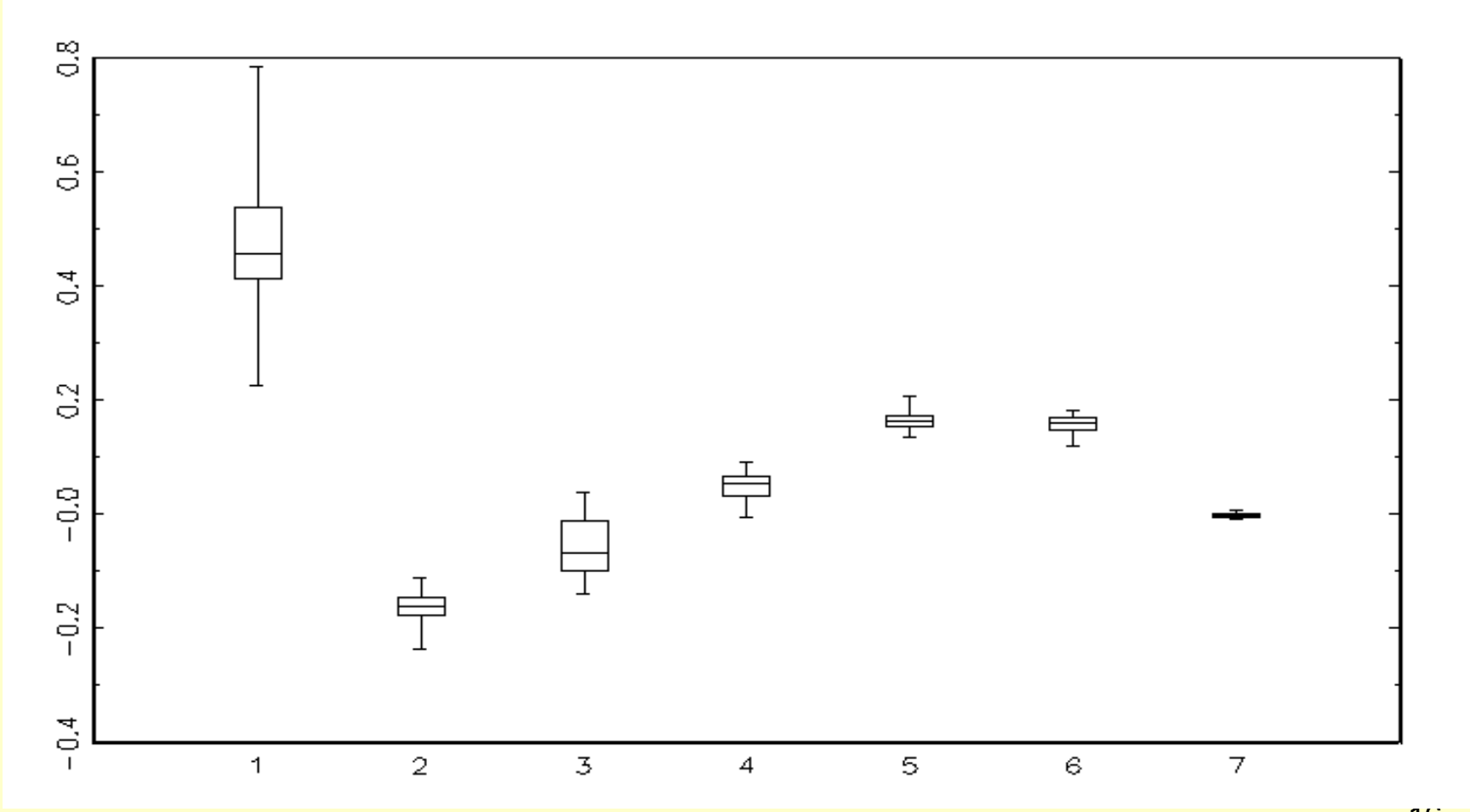
	S_e (SUR)	S_e (HSUR-TV)
C	-0.0311	0.1165
ln P_k	-0.0046	0.0929
ln P_l	-0.0238	-0.1323
ln P_e	0.0257	0.0294
ln P_m	0.0097	0.0138
ln Q	-0.0262	0.0944
Tr	0.0005	0.0017

Posterior distribution for energy coefficient in the energy equation (HSUR-TV)

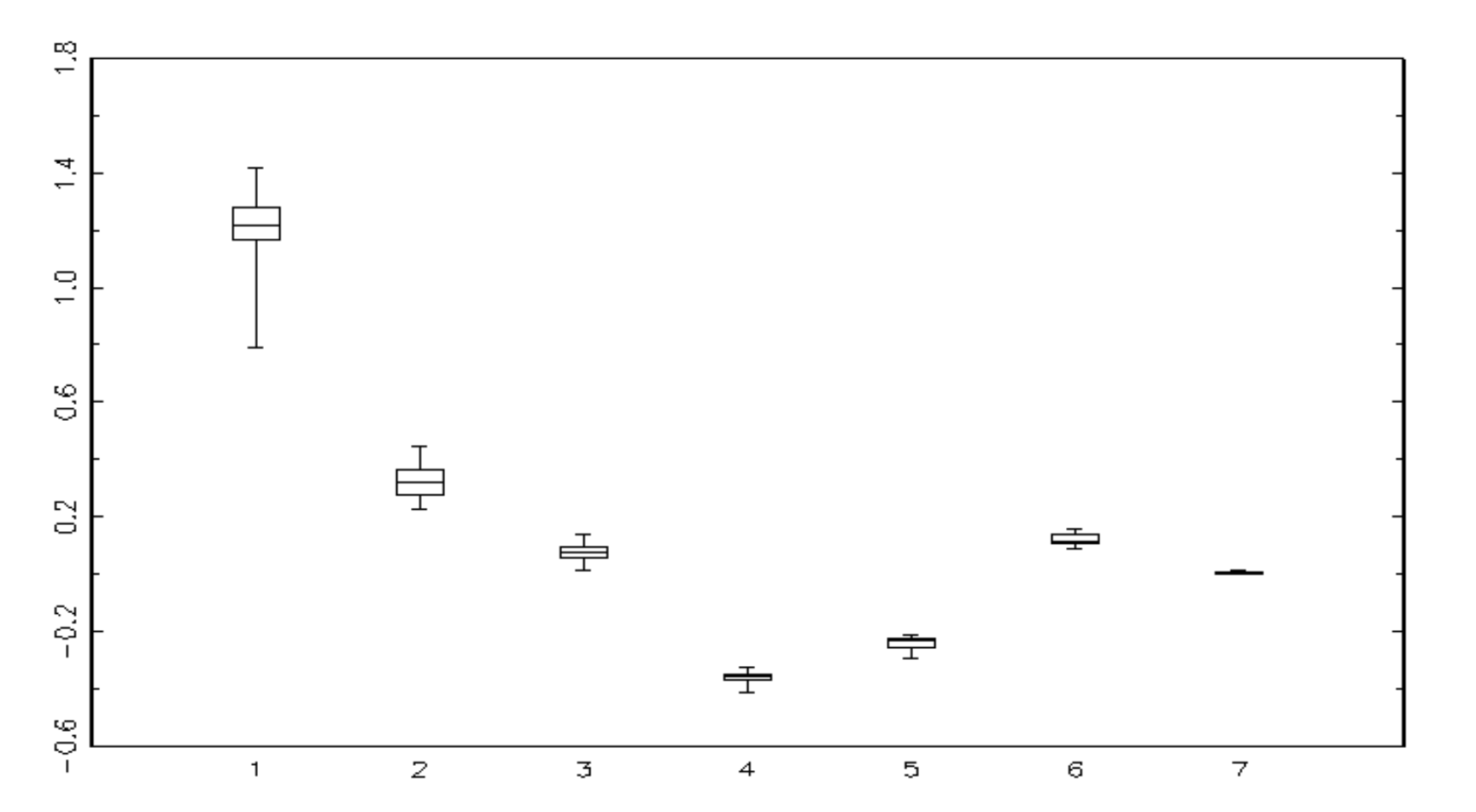
Posterior distribution for Θ_{1975}



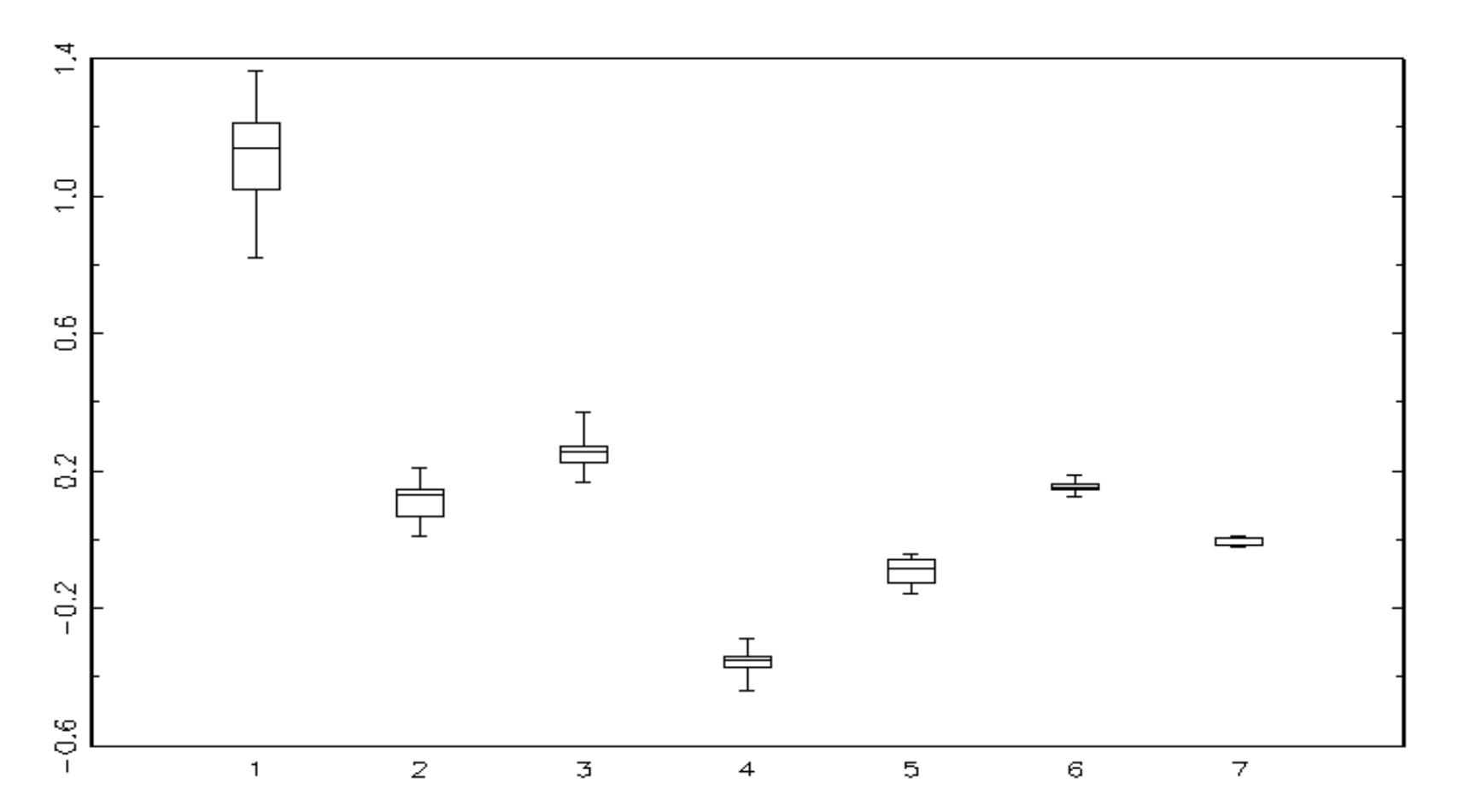
Posterior distribution for Θ_{1985}



Posterior distribution for Θ_{2000}



Posterior distribution for Θ_{2001}



Y mean posterior

0.0490	0.0367	-0.0198	-0.0084	-0.0227	-0.0067	0.0010
0.0367	0.0488	-0.0386	0.0054	-0.0273	-0.0053	0.0014
-0.0198	-0.0386	0.0365	-0.0121	0.0206	0.0021	-0.0013
-0.0084	0.0054	-0.0121	0.0111	-0.0018	0.0024	0.0003
-0.0227	-0.0273	0.0206	-0.0018	0.0158	0.0029	-0.0008
-0.0067	-0.0053	0.0021	0.0024	0.0029	0.0019	-0.0001
0.0010	0.0014	-0.0013	0.0003	-0.0008	-0.0001	0.0001

Ω mean posterior

0.0025	-0.0072	0.0050	-0.0018
-0.0072	0.0605	-0.0407	0.0157
0.0050	-0.0407	0.0285	-0.0110
-0.0018	0.0157	-0.0110	0.0046

Conclusions

- Structural changes in the energy market suggest for more dynamic models
- Possible to estimate HSUR-TV with MCMC methods
- Partial Bayes Factor is close to 2 in favor of Time-Varying parameters