How Important are Financial Frictions in the US and the Euro Area?

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Purpose of the paper

- Are frictions in credit markets important for business cycles?

- Is the magnitude of financial frictions similar in the US and the Euro area?

Results

- Financial frictions help to explain business cycle fluctuations in both areas
- The size of these frictions is larger in the Euro area

Financial Frictions

- Inefficiencies in financial markets which affect the supply of credit and amplify business cycles

- Financial accelerator: Bernanke, Gertler and Gilchrist, 1999 (BGG)
  - A mechanism based on information asymmetries between lenders and entrepreneurs
  - Generates a negative relation between external financial premium and net worth

Related Literature

- Theoretical papers: BGG, Christiano-Motto-Rostagno (2003)

- Empirical studies:

- Christiano-Motto-Rostagno (2003): calibrate

- Christensen-Dib (2004), Neri (2004), Meier-Muller (2005): simpler model for US

- Levin-Natalucci-Zakrajsek (2004): micro-data

My Contribution

- Theoretical: put together a DSGE model with credit frictions

- Empirical:
- Estimate financial frictions using both US and European data
- Bayesian methods
- Identify structural parameters that underpin the financial contract

Outline

- The Model
- Estimation Methodology
- Results
- Conclusions

The Model

- (Standard) DSGE model + financial frictions
- Agents:
  - Households
  - Final good sector
  - Intermediate good sector
  - Capital Producers
  - Entrepreneurs
  - Financial Intermediaries
  - Government

Households

- Consume (external habit formation)
- Allocate wealth between real deposits ($d_{j,t}$) and nominal bonds ($b^n_{j,t}$)
- Supply a specialized labor input, l_{jt}
- Monopolistically set wages with Calvo-type frictions, if cannot reoptimize:

$$w_{j,t+1} = \pi_t \, w_{j,t}$$

Final Good Firms

- Perfectly competitive firms
- Combine a continuum of intermediate goods $y_{s,t}$ using a Dixit-Stiglitz aggregator

Intermediate Good Firms

- Monopolistically competitive firms
- Hire the services of capital and labor
- Production function of the firm *s*: $y_{s,t} = a_t k_{s,t}^{\alpha} l_{s,t}^{1-\alpha}$,
- Set prices subject to Calvo-style frictions with indexation

$$\widehat{\pi}_t = \frac{\widehat{\pi}_{t-1}}{(1+\beta)} + \frac{\beta}{(1+\beta)} E_t \widehat{\pi}_{t+1} + \frac{(1-\theta)(1-\beta\theta)}{(1+\beta)\theta} \widehat{s}_t + \frac{(1-\theta)(1-\beta\theta)}{(1+\beta)\theta} \frac{\lambda}{(\lambda+1)} \widehat{\lambda}_t.$$

Capital Producers

- Produce capital with increasing marginal adjustment costs

$$\max_{i^j_{t+1}} E_t\left[q_{t+1}\Phi\left(\frac{i^j_{t+1}}{\tilde{k}^j_{t+1}}\right)\tilde{k}^j_{t+1} - i^j_{t+1} \right]$$

Entrepreneurs

End of period t: Buy capital $q_t \tilde{k}^i_{t+1} = n^i_{t+1} + b^i_{t+1}.$

- The ex post return on capital is $\omega^i r^k$
- Agency costs: μ % gross return of the firm
- Optimal contract

Period t+1: Choose the level of capital utilization

Monetary Policy

- The Central Bank policy rule is a Taylor type rule of the form

$$\hat{r}_t^n = \rho^r \hat{r}_{t-1}^n + (1-\rho^r)(\gamma^\pi E \hat{\pi}_{t+1}) + (1-\rho^r)(\gamma^y \hat{y}_t)/4 + \hat{\varepsilon}_t^r.$$

Market Clearing Condition

$$y_t = c_t + i_t + g_t + \mu \int_0^{\overline{\omega}_t} \omega dF(\omega) r_t^k q_{t-1} \widetilde{k}_t$$

◆ g_t : government consumption modeled as AR(1) process

◆ Last term: loss in monitoring costs associated with defaulting entrepreneurs

Exogenous Shocks

ε_t	monetary shock
λ_t	price mark up shock
τ_t	wage mark up shock
ξ_t	labor supply shock
υ_t	consumer preferences shock
g_t	government expenditure shock
a_t	technology shock

- The last 4 modeled as AR(1)

Model Solution

- Loglinearization of the model around the non stochastic steady state

- The solution has a linear structure

$$X_t = G X_{t-1} + Q \Psi_t$$

Estimation Methodology

- 30 free parameters in the model
- 7 are calibrated while the other are estimated using Bayesian Methods

β	Discount factor	0.99
δ	Depreciation in SS	0.025
g/y	Gov-output ratio in SS	19.5
$F(\varpi)$	SS probability of default	0.0075
α	Cobb-Douglas	0.33
λ	SS price mark up	0.20
τ	SS wage mark up	0.05

Bayesian Estimation

- Advantages relative to MLE
- Likelihood + Priors

Data

- 7 observables: output, consumption, investment, hours, nominal interest rate, inflation and real wages
- no financial data

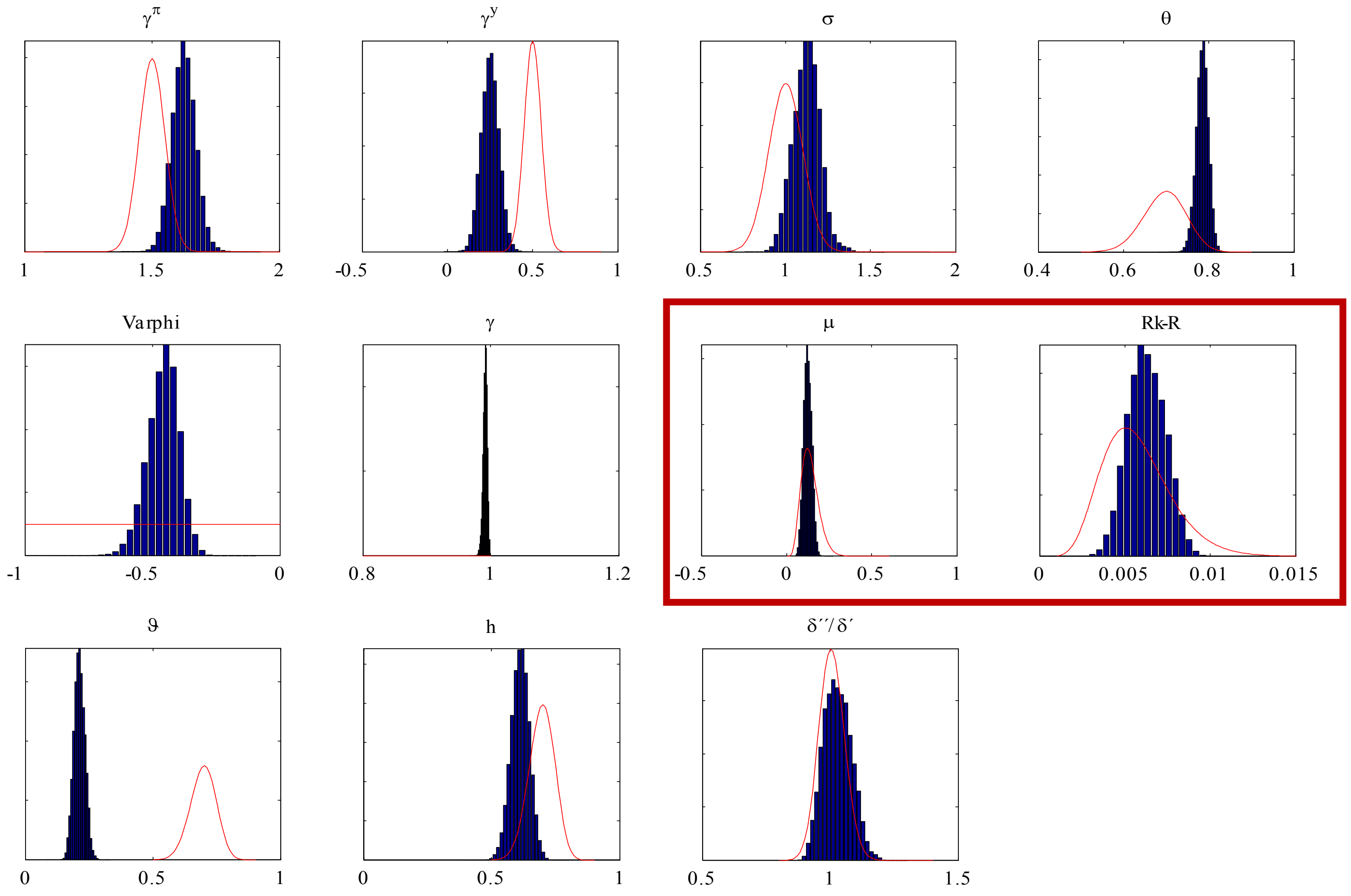
- U.S.: quarterly detrended data from 1980:I to 2004:I

- Euro Area: quarterly detrended data from 1980:I to 2002:4

Table 1-B: Prior and Posterior Distribution of the Parameters

Parameter	Prior			U.S. Posterior		
	Type	Mode	St. Error	5%	Mean	95%
γ^{π} Coef. inflation in monetary rule	Normal	1.50	0.05	1.542	1.614	1.687
γ^{y} Coef. output in monetary rule	Normal	0.50	0.05	0.157	0.240	0.322
σ risk aversion	Normal	1.00	0.10	0.984	1.110	1.227
θ prob. of not adj. prices	Beta	0.70	0.05	0.758	0.782	0.804
φ elasticity of capital price wrt I/K	Uniform	-0.5*	0.29	-0.578	-0.475	-0.386
γ Entrepreneurs rate of survival	Beta	.975	0.01	0.985	0.991	0.995
μ Monitoring costs	Beta	0.12	0.05	0.083	0.119	0.158
$r^k - r$ Risk premium	Gamma	0.005	0.002	0.004	0.006	0.008
ϑ prob. of not adj. wages	Beta	0.70	0.05	0.174	0.208	0.243
h Habit formation	Beta	0.70	0.05	0.548	0.604	0.659
δ''/δ' Variable dep. parameter	Gamma	1.00	0.05	0.939	1.020	1.106

US Data



Prior and posterior distribution for the benchmark model

Robustness and Model Comparison

- To check robustness and the relevance of the financial accelerator:
  - standard BGG model
  - price indexation to past inflation
  - sticky wages
  - consumption habits
  - variable capital utilization

- Bayesian model selection: $BF_{ij}=p(Y|M_i)/\,p(Y|M_j)$

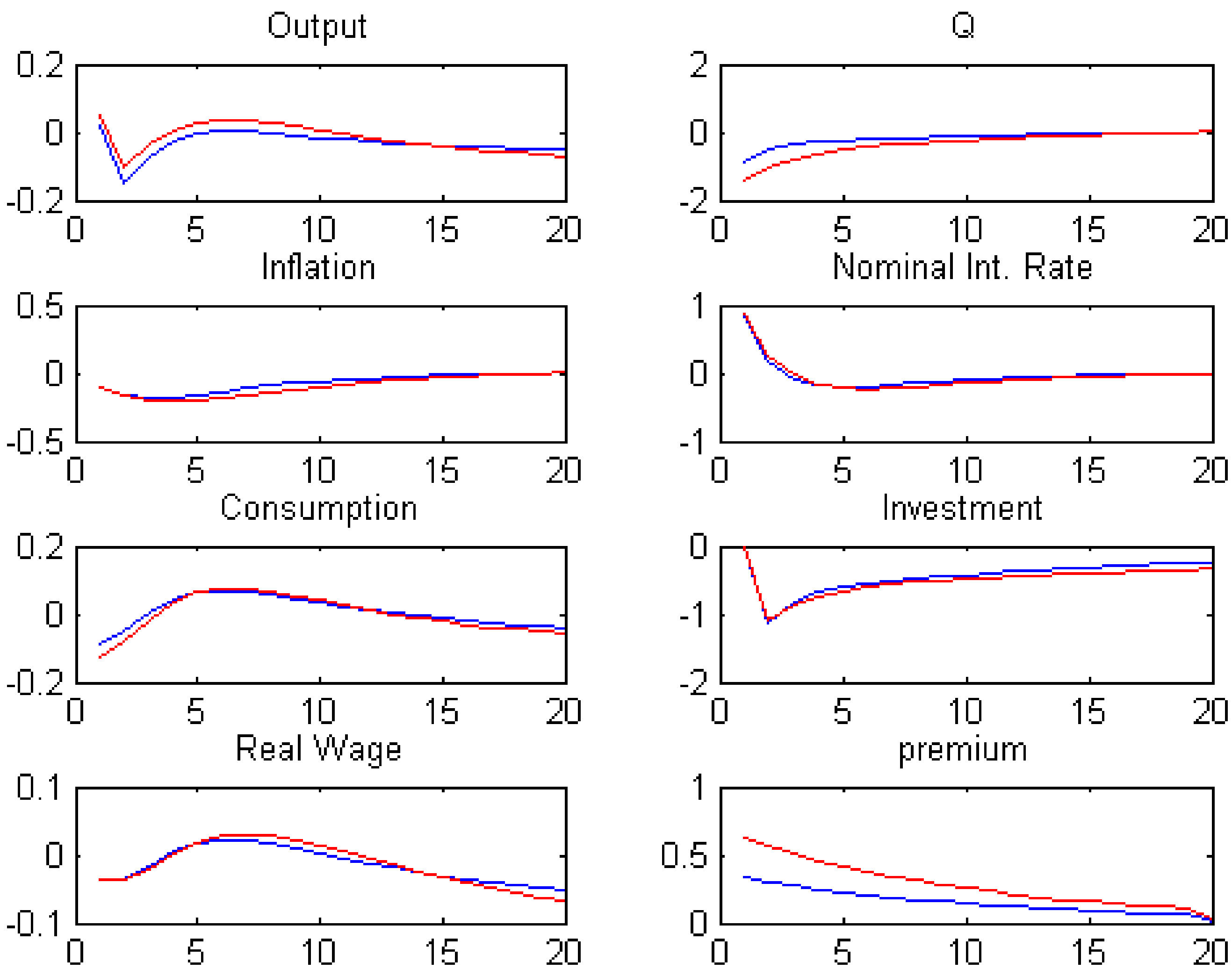
- Marginal likelihood approximated with modified harmonic mean

US data

Parameter	BGG Model		Benchmark	
	FA	no FA	FA	No FA
γ^{π} Coef. inflation in monetary rule	1.287	1.719	1.614	1.637
γ^{y} Coef. output in monetary rule	0.140	0.061	0.240	0.198
σ risk aversion	1.134	1.227	1.110	1.100
θ prob. of not adj. prices	0.700	0.710	0.782	0.759
φ elasticity of capital price wrt I/K	-0.100	-0.078	-0.475	-0.220
γ Entrepreneurs rate of survival	0.989	0.972	0.991	0.971
μ Monitoring costs	0.222	-	0.119	-
$r^k - r$ Risk premium	0.012	-	0.006	-
ϑ prob. of not adj. wages	-	-	0.208	0.186
h Habit formation	-	-	0.604	0.661
δ''/δ' Variable dep. parameter	-	-	1.020	1.005
Log Bayes Factor	0	121.3	0	50.5

Results: European Data

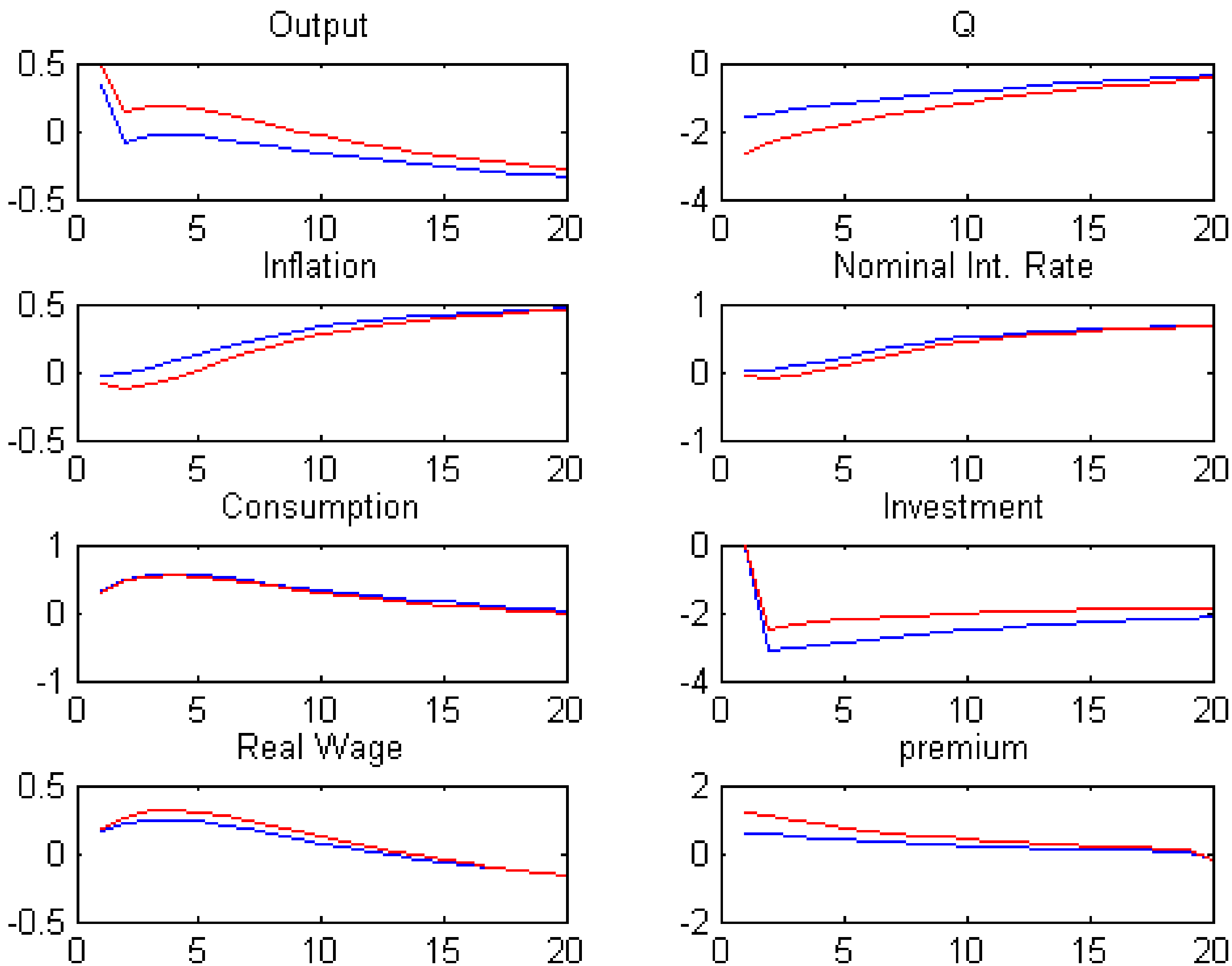
- Bayes factor favors financial frictions in all 5 specifications
- Posterior distribution similar to the US: the shocks driving the economy and the transmission mechanisms are not too different
- Some exceptions:
  - higher monitoring costs (18%)
  - higher capital adjustment costs
  - smaller monetary policy shocks
  - higher price stickiness (6 quarters)



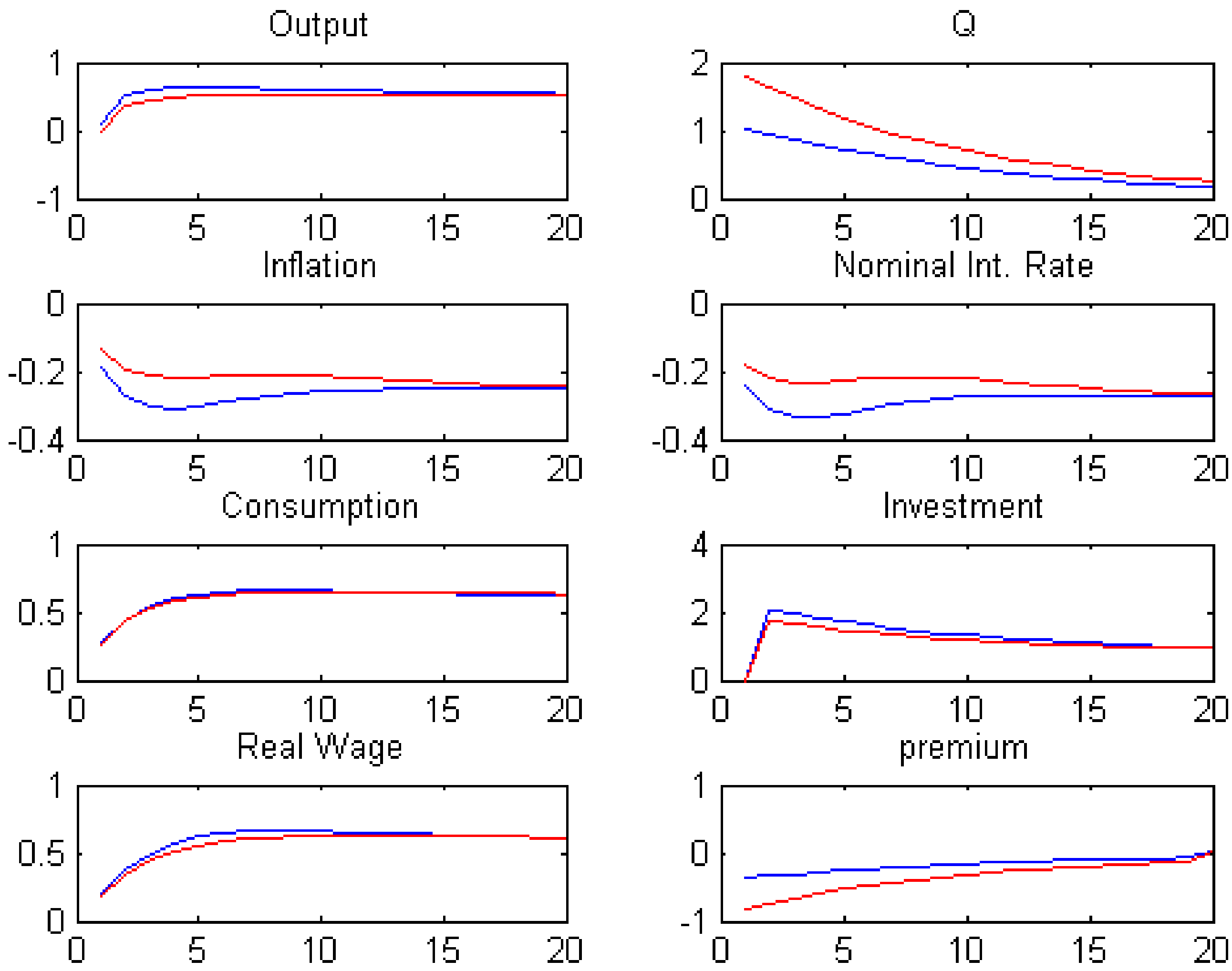
IRFs to a one percent shock to the nominal interest rate (annual) for the benchmark model evaluated at the posterior mean. Blue line: U.S. data. Red line: European data.

Discussion

- After a monetary policy shock, the response of the observables variables is the same with higher financial frictions and higher adjustment costs of capital
- The model is not able to explain the ”output composition puzzle” (Angeloni et al. 2003)
- What about other shocks?



Counterfactual: IRFs to a one std. dev. preference shock for the benchmark model evaluated at the posterior mean. Blue line: U.S. data. Red line: U.S. data using credit market frictions and investment adjustment costs as in the Euro area.



Counterfactual: IRFs to a one std. dev. shock to productivity for the benchmark model evaluated at the posterior mean. Blue line: U.S. data. Red line: U.S. data using credit market frictions and investment adjustment costs as in the Euro area.

Conclusion

- Financial frictions are relevant in both areas
- The size of the frictions is larger in the Euro area
- The main differences are after preference and technology shocks

Road Ahead

- Compare with a reference model
- Use financial data: $F(\omega)$
- Introduce investment shocks
- Estimate breaks in μ in the Euro area