News and Financial Intermediation in Aggregate and Sectoral Fluctuations

Christoph Görtz[1] and John D. Tsoukalas[2]

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[1] University of Birmingham
[2] University of Glasgow

Introduction – Financial Crisis

- 2007-2008 financial crisis highlighted the important role of **financial intermediation**
- Crisis highlighted role of factors that affect the supply of credit.
  - Deterioration of financial institutions balance sheets $\Leftrightarrow$ adverse valuation of assets, loss of equity, disruptions in lending
- Severe disruptions in financial markets $\rightarrow$ movements of financial market indicators, e.g. credit spreads on various private sector assets.
- These movements preceded significant declines in measures of real economic activity during the “Great Recession”.

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- Early signals of various financial market indicators (corporate bond spreads, slope of the yield curve)

↪ indicates **interaction** between real economy and financial markets.

↪ Financial indicators incorporate **advance information/news** about future developments in the real economy.

- Growing literature establishes the predictive power of such indicators for macroeconomic aggregates (e.g. Gilchrist and Zakrajsek (2009, 2011), Beaudry and Portier (2006), Kurmann and Otrok (2010), Philippon (2009), Mueller(2009)).
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- In addition to the broad declines in aggregates...
- Severe but **uneven** sectoral downturns, especially evident in hours worked
- Investment sector hours drag total business hours
  - Very pronounced in the 2008 and the 2001 recessions.

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Table: Peak to trough change of aggregate and sectoral hours in recessions

	Total Hours	Consumption Sector	Investment Sector
1990Q3 – 1991Q1	-2.0%	-0.7%	-2.9%
2001Q1 – 2001Q4	-4.2%	-2.0%	-6.3%
2007Q4 – 2009Q2	-9.7%	-5.4%	-14.9%

Total hours are non-farm business sector in per capita terms. The series for sectoral hours are non-farm average weekly hours times employees in per capita terms.

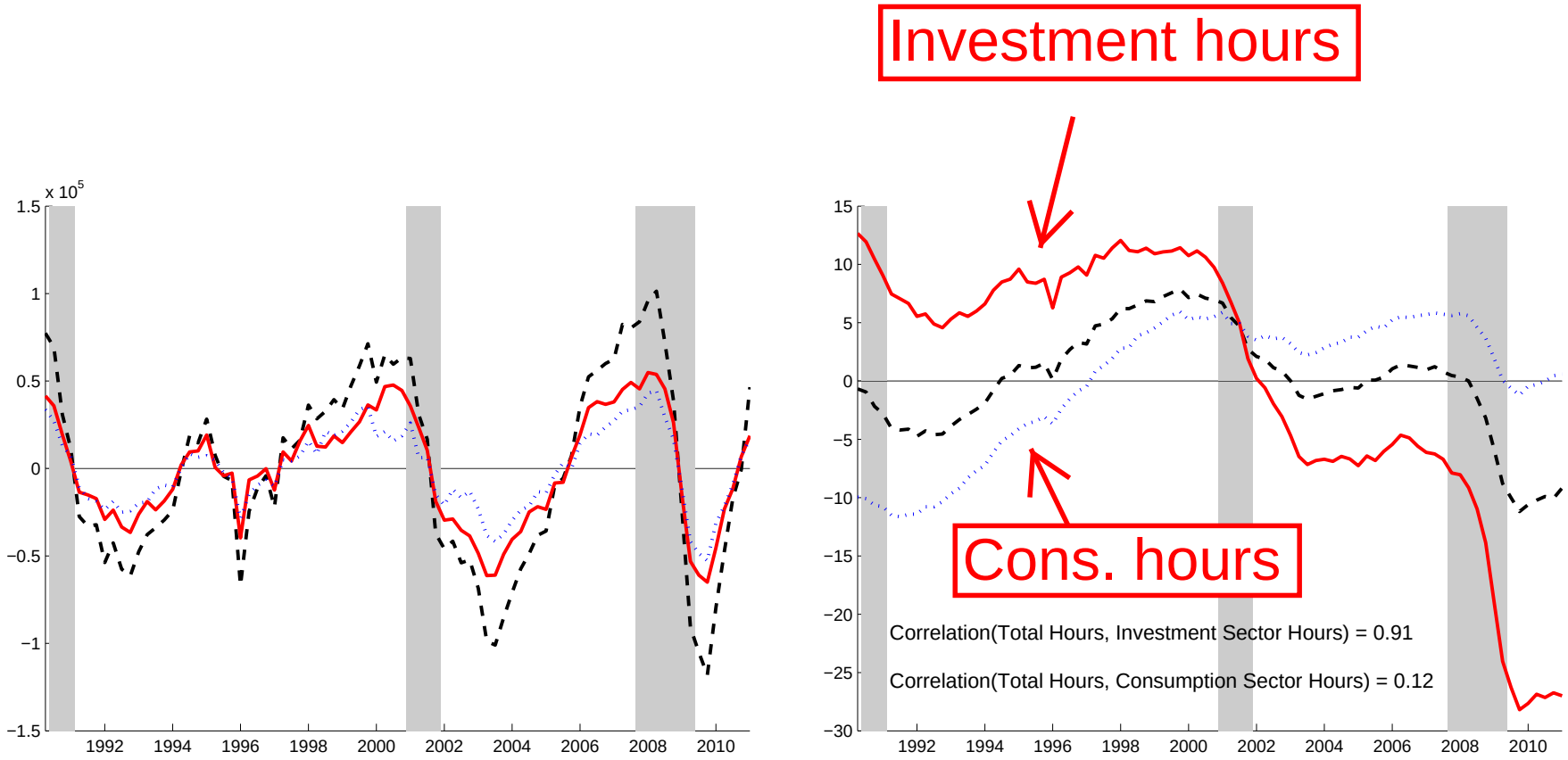

Figure: Total hours (black, dashed), consumption sector hours (blue, dotted) and investment sector hours (red, solid) (per capita average weekly hours times employees). Left figure: HP_{1600} detrended series. Right figure: Demeaned time series in levels.

This paper

We investigate quantitatively the link between financial factors, advance signals (news) and sectoral co-movement from a new angle:

- We build a two-sector DSGE model (investment and consumption sector) with explicit sectoral links $\rightarrow$ addresses sectoral **co-movement**.
- Introduce **financial frictions** a-la Gertler and Karadi (2011) or Gertler and Kiyotaki (2010)
- Quantitatively explore two FINANCIAL shocks that can affect the supply of credit.
  - **Asset value shocks/capital quality shocks**—qualitatively studied by Gertler and Karadi (2010) or Gertler and Kiyotaki (2010) and Gourio (2012) (e.g. proxy for time varying default risk).
  - **Bank equity shocks**

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- We focus on credit supply—banks' balance sheet ← high importance during the recent crisis.
- But linkages between sectors imply a *real sectoral channel* operating—consumption sector demand of capital goods from investment sector
  - Shocks that originate in consumption sector spill over to investment sector

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This paper — Overview of Results

1. Asset value shocks (especially of the anticipated type) explain sizeable fraction of fluctuations at both business cycle and lower frequencies.
2. Asset value news shocks can generate **aggregate** and **sectoral** co-movement.
3. Asset value news shocks can explain a large fraction of the decline in GDP and investment in the early stages of the 2008 recession.

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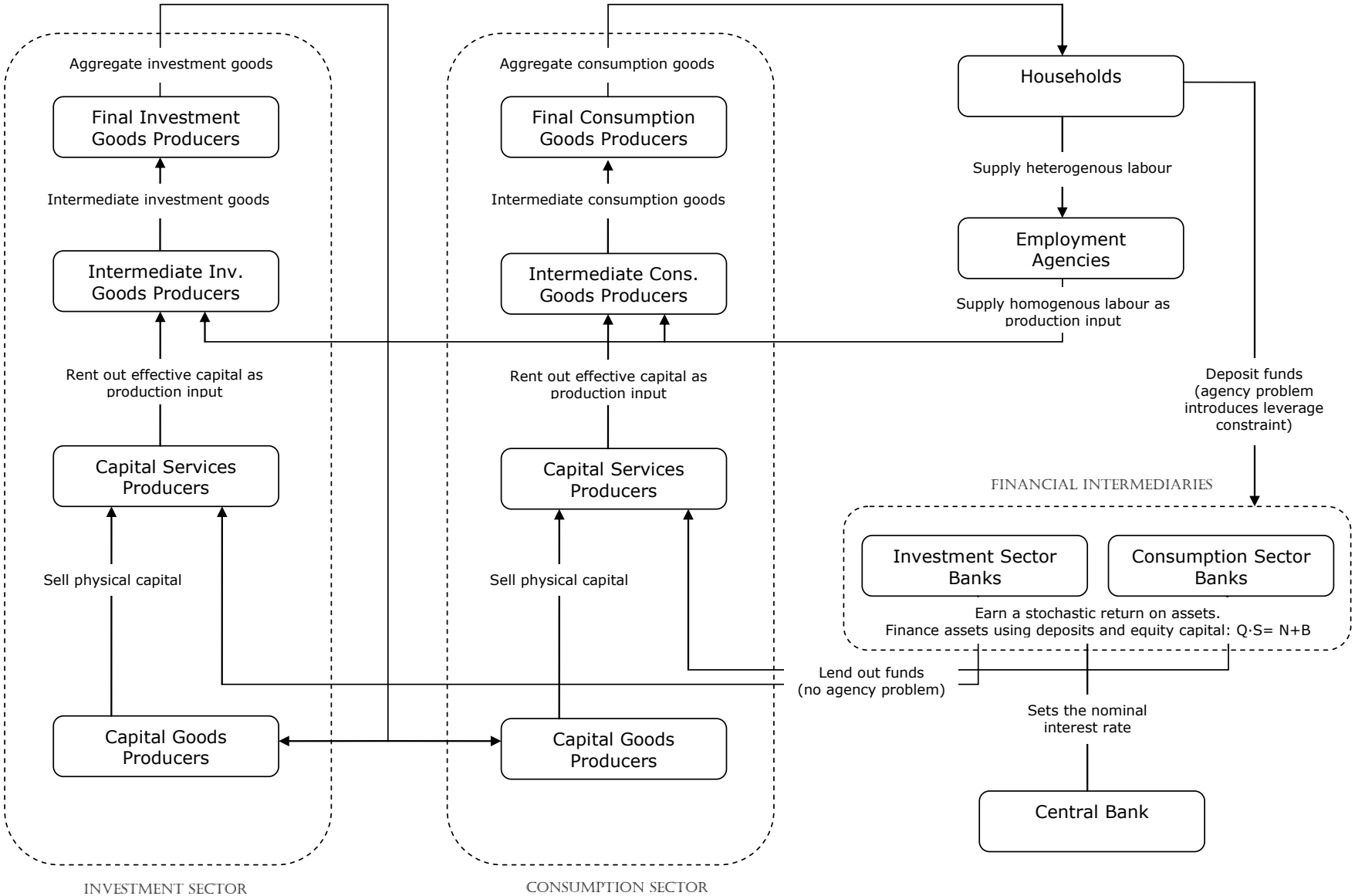
Aggregate investment goods
Final Investment Goods Producers
Intermediate investment goods
Intermediate Inv. Goods Producers
Rent out effective capital as production input
Capital Services Producers
Sell physical capital
Capital Goods Producers
INVESTMENT SECTOR
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Capital Services Producers
Sell physical capital
Capital Goods Producers
CONSUMPTION SECTOR
Households
Supply heterogenous labour
Employment Agencies
Supply homogenous labour as production input
Deposit funds (agency problem introduces leverage constraint)
FINANCIAL INTERMEDIARIES
Investment Sector Banks
Consumption Sector Banks
Earn a stochastic return on assets.
Finance assets using deposits and equity capital: Q·S= N+B
Lend out funds (no agency problem)
Sets the nominal interest rate
Central Bank

The Model – Intermediate Goods Producers

Intermediate goods in the consumption sector

$$C_t(i) = max\left\{A_t(L_{C,t}(i))^{1-a_c}(K_{C,t}(i))^{a_c} - A_t V_t^{\frac{a_c}{1-a_i}} F_C; 0\right\}.$$

Intermediate goods in the investment sector

$$I_t(i) = max\left\{V_t(L_{I,t}(i))^{1-a_i}(K_{I,t}(i))^{a_i} - V_t^{\frac{1}{1-a_i}} F_I; 0\right\},$$

where $K_{x,t}(i)$ and $L_{x,t}(i)$ are capital and labor *services* rented by firm i in sector $x = C, I$.
PLUS **price setting a-la Calvo** AND perfectly competitive final goods firms.

The Model – Households

Households maximize utility

$$E_0 \sum_{t=0}^{\infty} \beta^t b_t \left[\ln(C_t - hC_{t-1}) - \varphi \frac{(L_t(j))^{1+\nu}}{1+\nu} \right]$$

subject to budget constraint

$$C_t + \frac{B_t}{P_{C,t}} \leq \frac{W_t(j)}{P_{C,t}}(L_{C,t}(j) + L_{I,t}(j)) + R_{t-1}\frac{B_{t-1}}{P_{C,t}} - \frac{T_t}{P_{C,t}} + \frac{Q_t(j)}{P_{C,t}} + \frac{\Pi_t}{P_{C,t}},$$

where, $L_t(j) = L_{C,t}(j) + L_{I,t}(j)$—households supply labor services to both sectors PLUS wage setting as in EHL(2000)

The Model – Physical capital producers

Capital producers in sector $x = C, I$,

$$\max_{I_{x,t}, O_{x,t}} E_t \sum_{t=0}^{\infty} \beta^t \Lambda_t \left\{ Q_{x,t} \left[O_{x,t} + \left(1 - S\left(\frac{I_{x,t}}{I_{x,t-1}} \right) \right) I_{x,t} \right] - Q_{x,t} O_{x,t} - \frac{P_{I,t}}{P_{C,t}} I_{x,t} \right\},$$

where $Q_{x,t}$ denotes the price of capital (i.e. the value of installed capital in consumption units).

$$\bar{K}_{x,t} = (1 - \delta_x) \xi^K_{x,t} \bar{K}_{x,t-1} + \left(1 - S\left(\frac{I_{x,t}}{I_{x,t-1}} \right) \right) I_{x,t},$$

Installed capital is **sector-specific**.

The Model – Capital services producers

A perfectly competitive sector of capital services producers that transform physical capital to effective capital and rent it to intermediate goods producers in sector $x = C, I$

$$K_{x,t} = u_{x,t}\xi^K_{x,t}\bar{K}_{x,t-1}.$$

and incur costs when setting utilization, denoted by $a(u_{x,t})$

$$\max_{u_{x,t+1}}\left[\frac{R^K_{x,t+1}}{P_{C,t+1}}u_{x,t+1}\xi^K_{x,t+1}\bar{K}_{x,t} - a(u_{x,t+1})\xi^K_{x,t+1}\bar{K}_{x,t}A_{t+1}V_{t+1}^{\frac{a_c-1}{1-a_i}}\right]$$

The Model – Capital services producers

Total receipts of capital services producers in period $t+1$ are equal to:

$$\frac{R^K_{x,t+1}}{P_{C,t+1}} u_{x,t+1} \xi^K_{x,t+1} \bar{K}_{x,t} - a(u_{x,t+1}) \xi^K_{x,t+1} \bar{K}_{x,t} A_{t+1} V_{t+1}^{\frac{a_C - 1}{1-a_i}} + (1-\delta_x) Q_{x,t+1} \bar{K}_{x,t},$$

which can be expressed as

$$R^B_{x,t+1} Q_{x,t} \bar{K}_{x,t} \tag{1}$$

with

$$R^B_{x,t+1} = \frac{\frac{R^K_{x,t+1}}{P_{x,t+1}} \xi^K_{x,t+1} u_{x,t+1} + Q_{x,t+1} \xi^K_{x,t+1} (1-\delta_x) - a(u_{x,t+1}) \xi^K_{x,t+1} A_{t+1} V_{t+1}^{\frac{a_C - 1}{1-a_i}}}{Q_{x,t}}, \tag{2}$$

where $R^B_{x,t+1}$ is the rate of return on capital. The **asset value shock**, $\xi_{x,t}$ affects the return to capital.

The Model – Financial Intermediaries

The balance sheet of a bank that specializes to lend in sector $x = C, I$ is,

$$Q_{x,t} S_{x,t} = N_{x,t} + B_{x,t}, \qquad x = C, I,$$

where $S_{x,t}$ denotes the quantity of financial claims on capital services producers held by the intermediary and $Q_{x,t}$ denotes the price of a claim in sector x. $N_{x,t}$ denotes the bank's equity capital at the end of period t and $B_{x,t}$ are the household deposits.

The Model – Financial Intermediaries

A moral hazard/costly enforcement problem as in Gertler and Kiyotaki (2010) or Gertler and Karadi (2011) constraints the bank's ability to acquire assets indefinitely $\rightarrow$ leverage constraint.

$$N_{x,t+1} = (R^B_{x,t+1} - R_t)Q_{x,t}S_{x,t} + R_t N_{x,t}$$

Given $R^B_{x,t+1} - R_t \geq 0$ bankers have incentive to accumulate assets until exit.

- Bankers can divert a fraction, λ of assets, $Q_{x,t}S_{x,t}$ and channel them back to the household. Lenders can force bankruptcy and recover only 1-λ.
- This introduces an incentive constraint:

$$\underbrace{V_{x,t}}_{\text{Banker's expected terminal wealth}} \geq \lambda Q_{x,t}S_{x,t}$$

The Model – Financial Intermediaries

Quantity of assets intermediary can acquire depends on equity capital, $N_{x,t}$, as well as the intermediary's *leverage ratio*, $\varrho_{x,t}$: the ratio of the bank's intermediated assets to equity. Formally (with binding constraint in equilibrium)

$$Q_{x,t}S_{x,t} = \varrho_{x,t}N_{x,t}, \tag{3}$$

This constraint exactly balances the benefit and cost of diverting funds from the bank to the household.

The Model – Financing capital acquisition

Capital services producers finance $\bar{K}_{x,t}$ by issuing claims, $S_{x,t}$, with price, $Q_{x,t}$.

$$Q_{x,t}\bar{K}_{x,t} = Q_{x,t}S_{x,t},$$

Claims are interpreted as state-contingent debt. It pays the bank (it assumes all the risk), the state contingent return defined in:

$$R^B_{x,t+1} = \frac{\frac{R^K_{x,t+1}}{P_{x,t+1}}\xi^K_{x,t+1}u_{x,t+1} + Q_{x,t+1}\xi^K_{x,t+1}(1-\delta_x) - a(u_{x,t+1})\xi^K_{x,t+1}A_{t+1}V_{t+1}^{\frac{a_c-1}{1-a_i}}}{Q_{x,t}}, \tag{4}$$

No frictions in this intermediation process—perfect information and enforcement.

The Model – Financing capital acquisition

Sources of variation in $R^B_{x,t+1}$:

- Two exogenous factors directly affect this return
  - TFP shocks in consumption, A_t and investment sectors, V_t.
  - Asset value shocks, $\xi^K_{x,t+1}$.
- Both unanticipated and news about TFP or capital quality can affect the (ex-post) return to assets held by banks
- Using credit spreads in estimation can potentially identify news components.
  - In estimation we set $spread_t = R^B_{x,t+1} - R_t$

The Model – Shocks

Contemporaneous and news asset value shocks compete with several other disturbances that have been found important in earlier work:

- C-sector TFP
- I-sector TFP
  - ↪ Referred to in the literature as investment specific (see Greenwood et al (1997, 2000) and Fisher (2006))
- Preference shock
- GDP measurement error
- Monetary policy shock
- Price markup shocks in C and I sector
- Wage markup shock
- Shocks to bank's equity capital in C and I sector
- C and I sector asset value shocks — contemporaneous and 4 and 8 quarter ahead news shock (best fit)

The Model – Information structure

- Consider the process for the asset value shock in sector $x = C, I$:

$$\xi^K_{x,t} = \rho_{\xi^K,x}\xi^K_{x,t-1} + \varepsilon^{\xi^K}_{x,t},$$

The innovation to the asset value shock consists of two components:

$$\varepsilon^{\xi^K}_{x,t} = \varepsilon^{\xi^{K,0}}_{x,t} + \varepsilon^{\xi^{K,news}}_{x,t},$$

with

$$\varepsilon^{\xi^{K,news}}_{x,t} = \varepsilon^{\xi^{K,4}}_{x,t-4} + \varepsilon^{\xi^{K,8}}_{x,t-8}$$

- News $\Leftrightarrow$ advance signals.
  - $\varepsilon^{\xi^{K,i}}_{x,t-i}$ is a part of $\varepsilon^{\xi^K}_{x,t}$ observed at $t-i$.
  - $\varepsilon^{\xi^{K,i}}_{x,t-i} \sim iid$, $E(\varepsilon^{\xi^{K,i}}_{x,t-i})^2 = \sigma_i^2$
- We introduce **NEWS SHOCKS** similar to Beaudry and Portier (2004), Jaimovich and Rebelo (2009), Schmitt-Grohe and Uribe (2010), Khan and Tsoukalas (2011)

Estimation — US Data

- The model is estimated with Bayesian techniques: 1990Q2 - 2011Q1.
- Eleven observable series: Output, consumption, investment, real wage, nominal interest rate, inflation in C sector, inflation in I sector, hours worked, bank equity capital, credit spreads in I, C sectors
- Corporate bond spreads shown to have high predictive power (e.g. Gilchrist and Zakrajsek (2009, 2011)) to help in identifying news components.

▸ Sector Definitions

Results

- Total asset value shocks account for 34%, 27%, 34% in output, investment, hours.
- 8Q ahead asset value news shocks account for 29%, 21%, 30% in output, investment, hours.

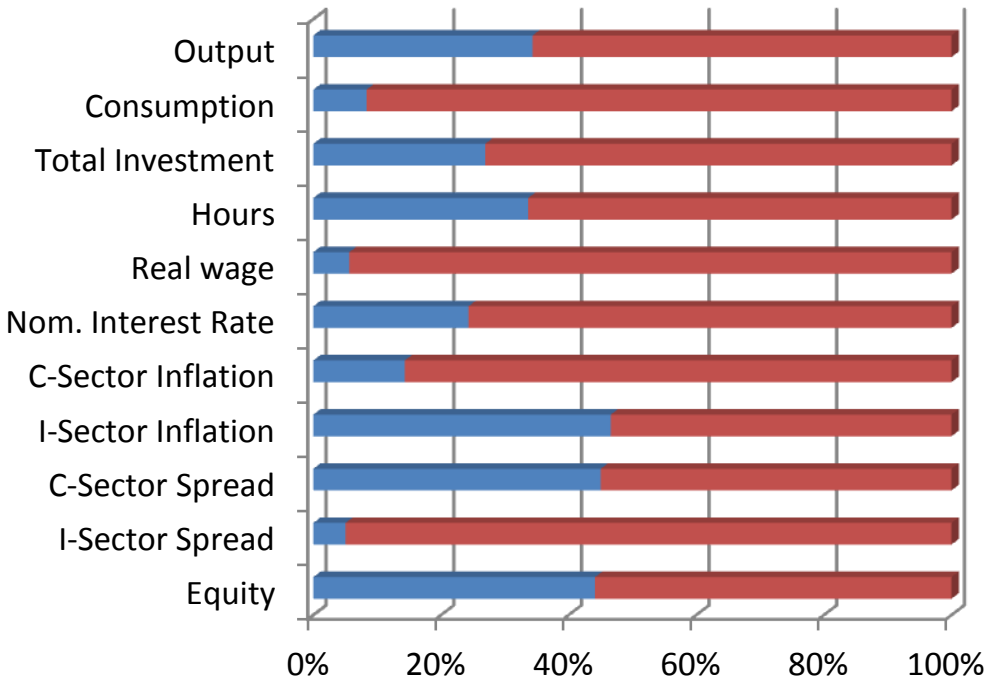


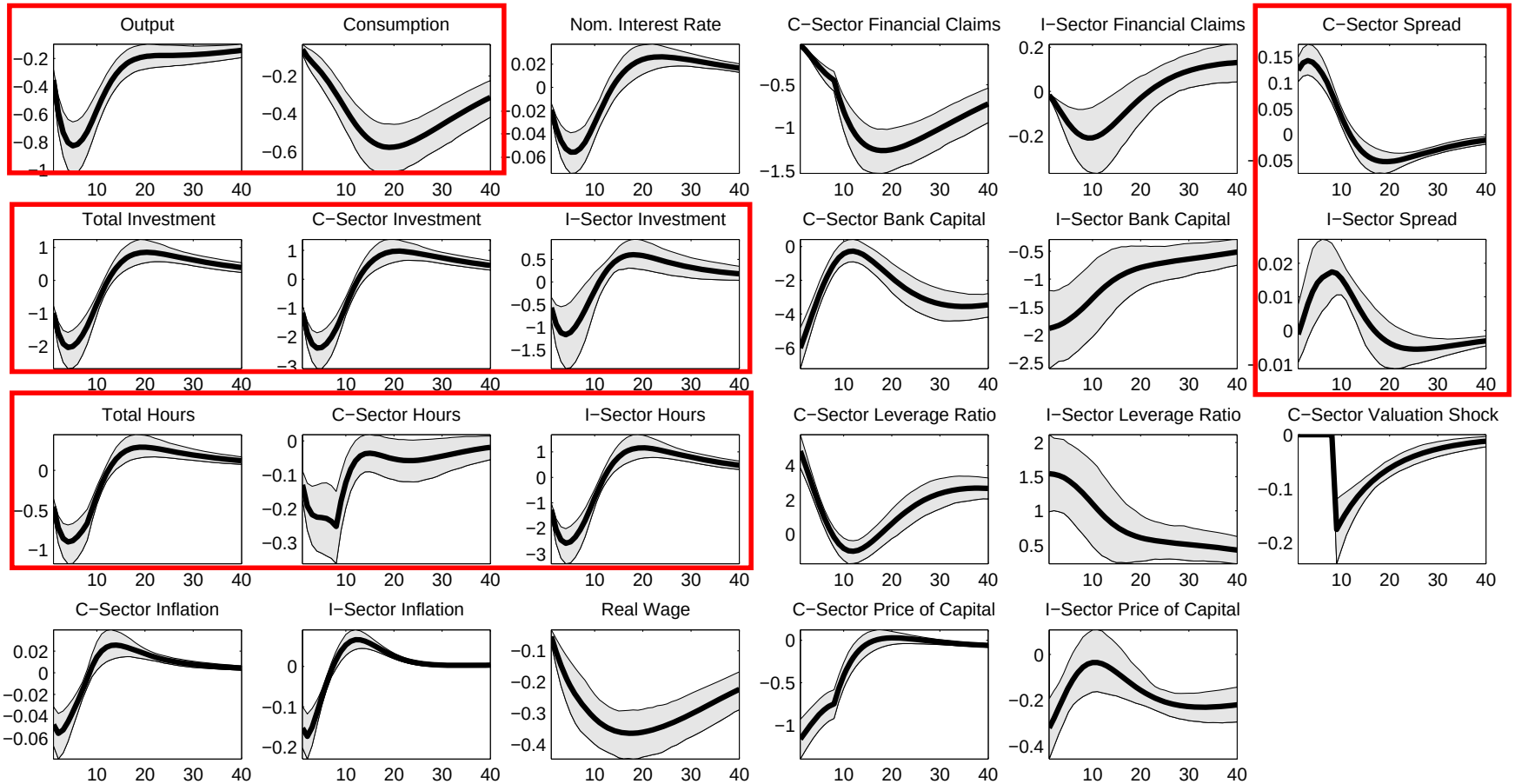
Figure: Variance Decomposition: Percentage Share of variance explained by shocks at cyclical frequencies. Asset value shocks (contemporaneous and news) and all other shocks.

Results

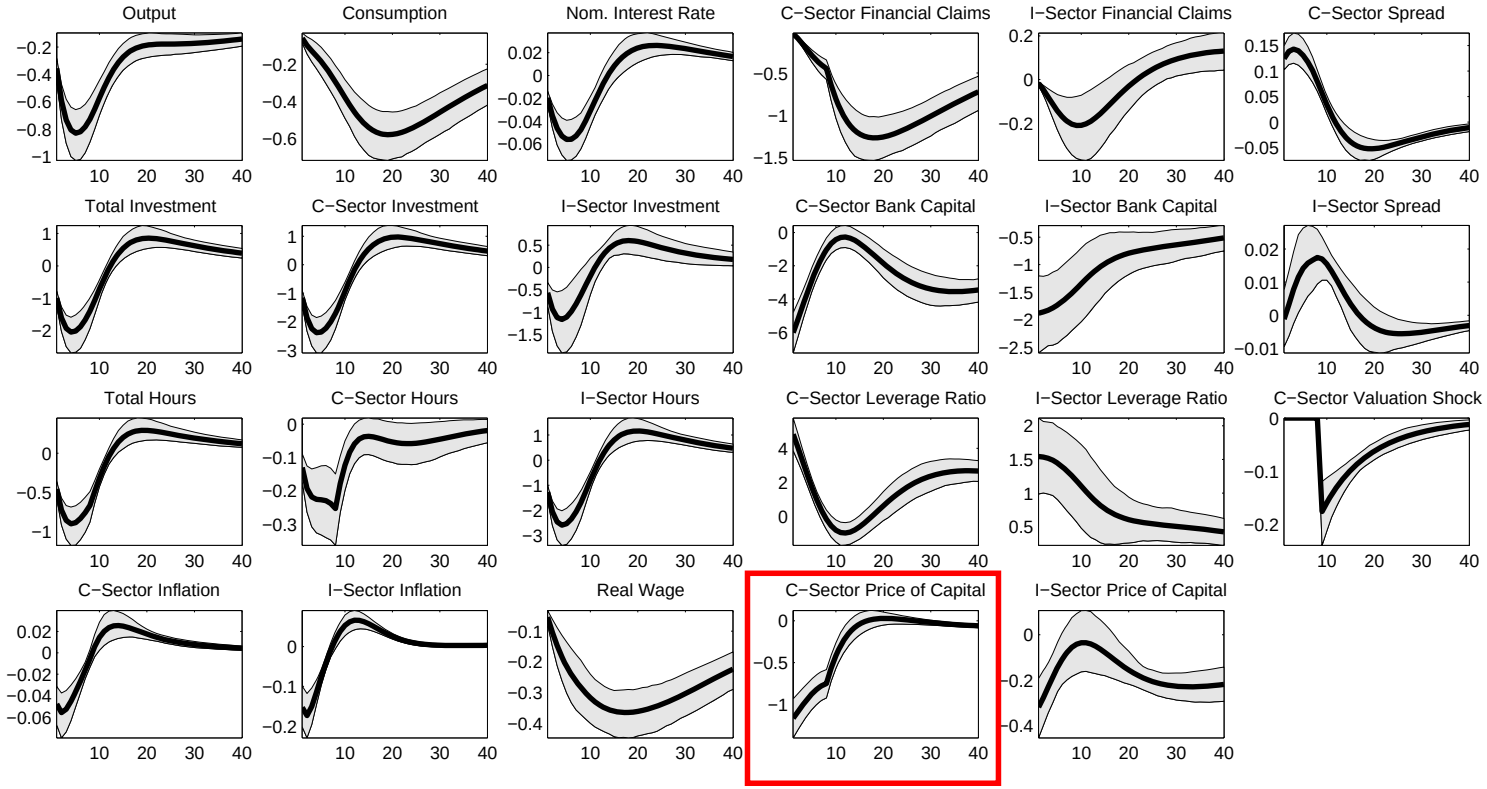
Table: Variance decomposition at business cycle frequencies (6-32 quarters)

									Financial Shocks							
	z	v	b	e	η_{em}	λ_p^C	λ_p^I	λ_w	ς_C	ς_I	$\xi_C^{K,0}$	$\xi_I^{K,0}$	$\xi_C^{K,4}$	$\xi_C^{K,8}$	$\xi_I^{K,4}$	$\xi_I^{K,8}$
Output	0.055	0.141	0.013	0.034	0.080	0.015	0.214	0.085	0.018	0.000	0.017	0.021	0.015	0.290	0.000	0.000
Consumption	0.106	0.006	0.425	0.001	0.135	0.075	0.020	0.146	0.003	0.000	0.014	0.010	0.006	0.053	0.000	0.000
Total Investment	0.007	0.308	0.012	0.000	0.018	0.001	0.344	0.025	0.013	0.000	0.009	0.036	0.010	0.214	0.000	0.000
Hours	0.006	0.122	0.013	0.001	0.072	0.007	0.344	0.085	0.014	0.000	0.012	0.015	0.015	0.295	0.000	0.000
Real wage	0.068	0.086	0.014	0.000	0.017	0.134	0.054	0.565	0.001	0.000	0.007	0.007	0.003	0.039	0.000	0.000
Nom. Interest Rate	0.001	0.094	0.100	0.001	0.234	0.188	0.085	0.051	0.003	0.000	0.004	0.009	0.007	0.223	0.000	0.000
C-Sector Inflation	0.004	0.099	0.115	0.000	0.120	0.368	0.038	0.109	0.000	0.000	0.001	0.004	0.003	0.135	0.000	0.000
I-Sector Inflation	0.001	0.220	0.005	0.001	0.075	0.001	0.203	0.016	0.009	0.000	0.011	0.115	0.013	0.326	0.000	0.000
C-Sector Spread	0.005	0.033	0.008	0.000	0.022	0.042	0.106	0.004	0.327	0.000	0.016	0.025	0.016	0.393	0.000	0.000
I-Sector Spread	0.019	0.187	0.033	0.001	0.191	0.179	0.097	0.025	0.009	0.206	0.000	0.026	0.001	0.023	0.000	0.000
Equity	0.066	0.211	0.013	0.001	0.090	0.078	0.042	0.008	0.074	0.001	0.027	0.077	0.014	0.294	0.000	0.000

▸ IS shock ▸ Financial Shocks



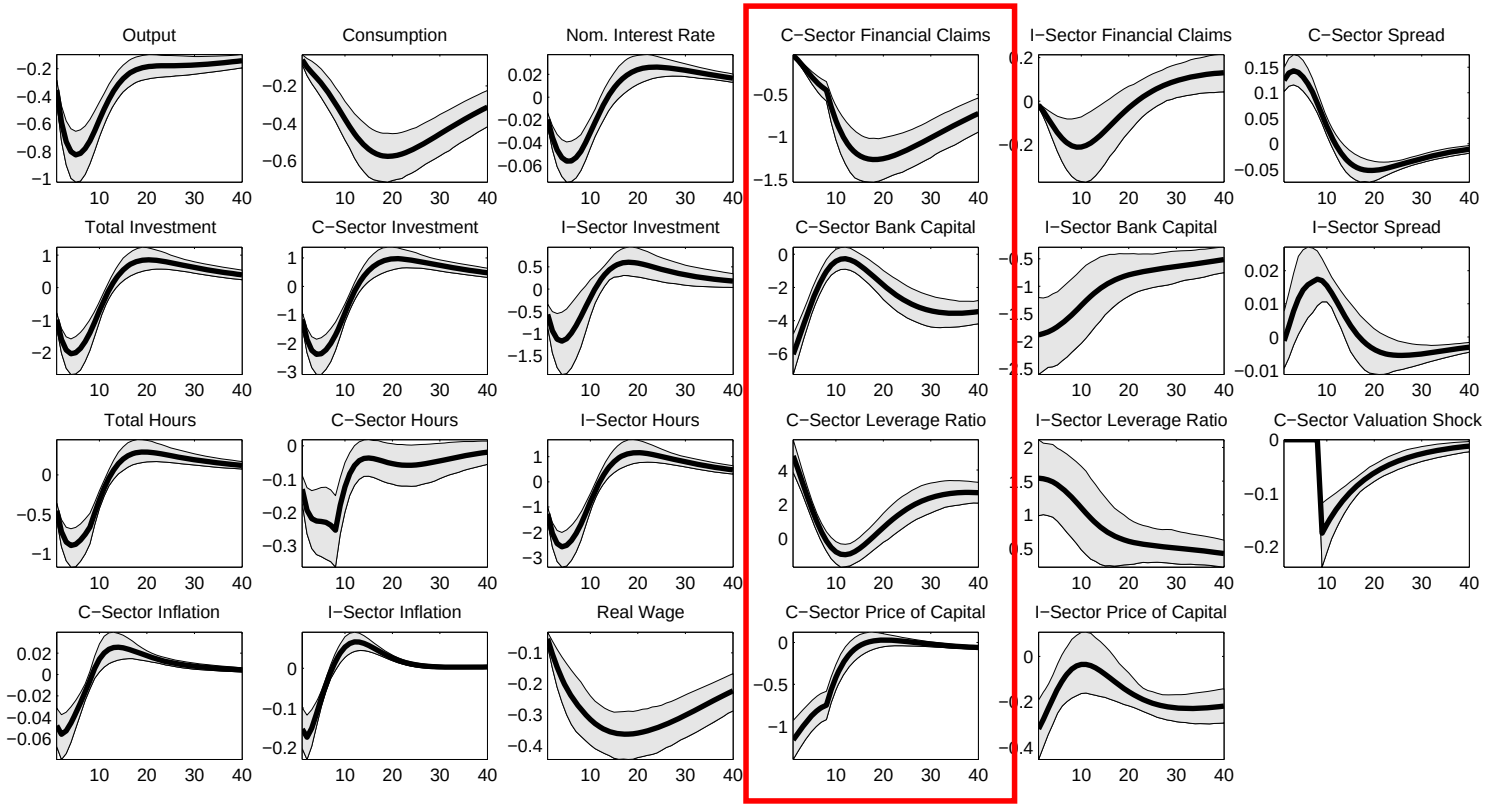
- **Asset value news shock: aggregate and sectoral co-movement**
- **Spreads move countercyclically $\rightarrow$ amplification**



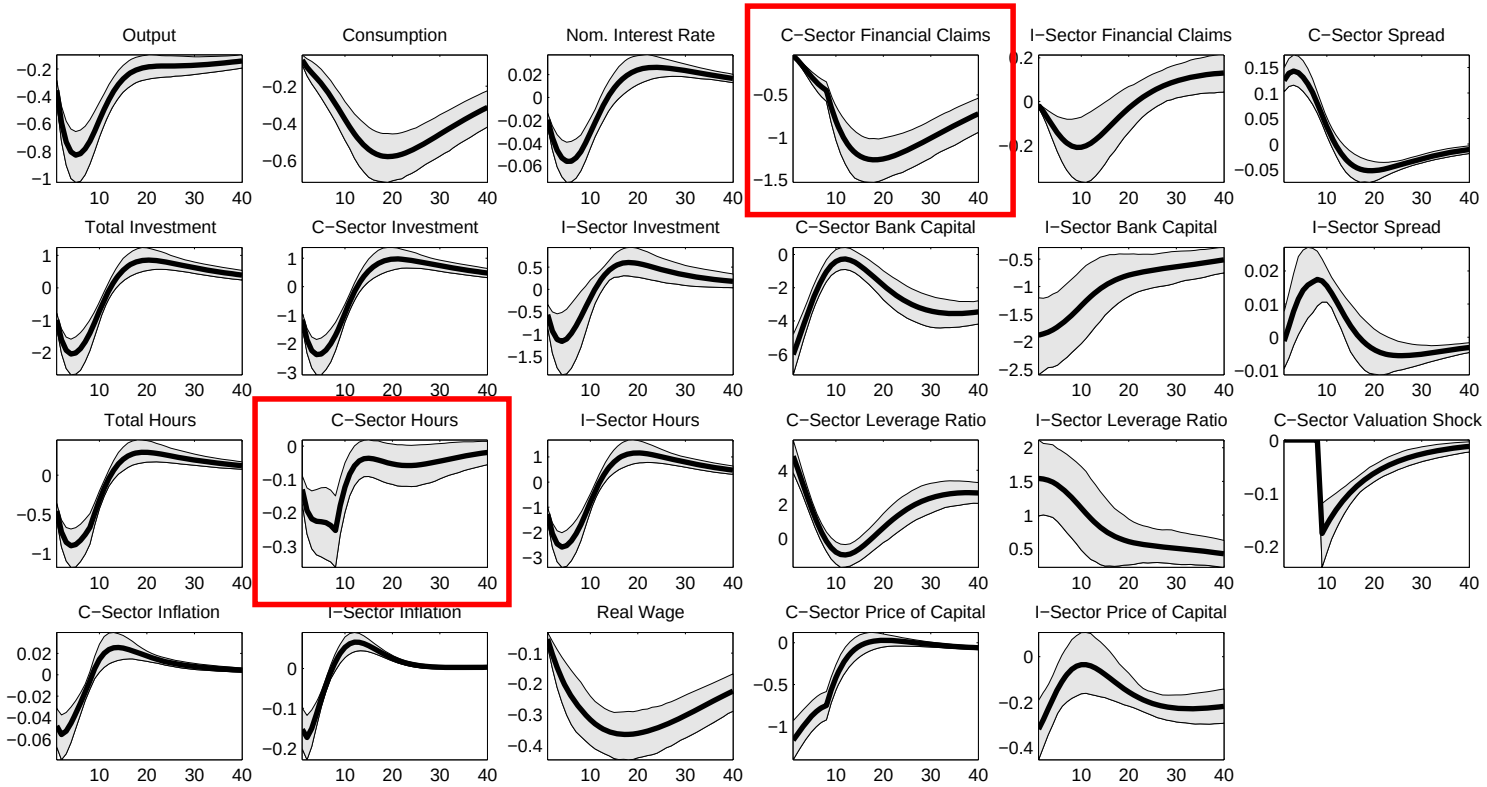
- **Initial effect**: Unfavorable asset value news → initial decline in the value of assets held by banks

$$Q_{C,t} = \frac{\xi^K_{C,t+1}\left(\frac{R^K_{C,t+1}}{P_{C,t+1}}u_{C,t+1} + Q_{C,t+1}(1-\delta_C) - a(u_{C,t+1})A_{t+1}V_{t+1}^{\frac{a_C-1}{1-a_i}}\right)}{R^B_{C,t+1}}.$$

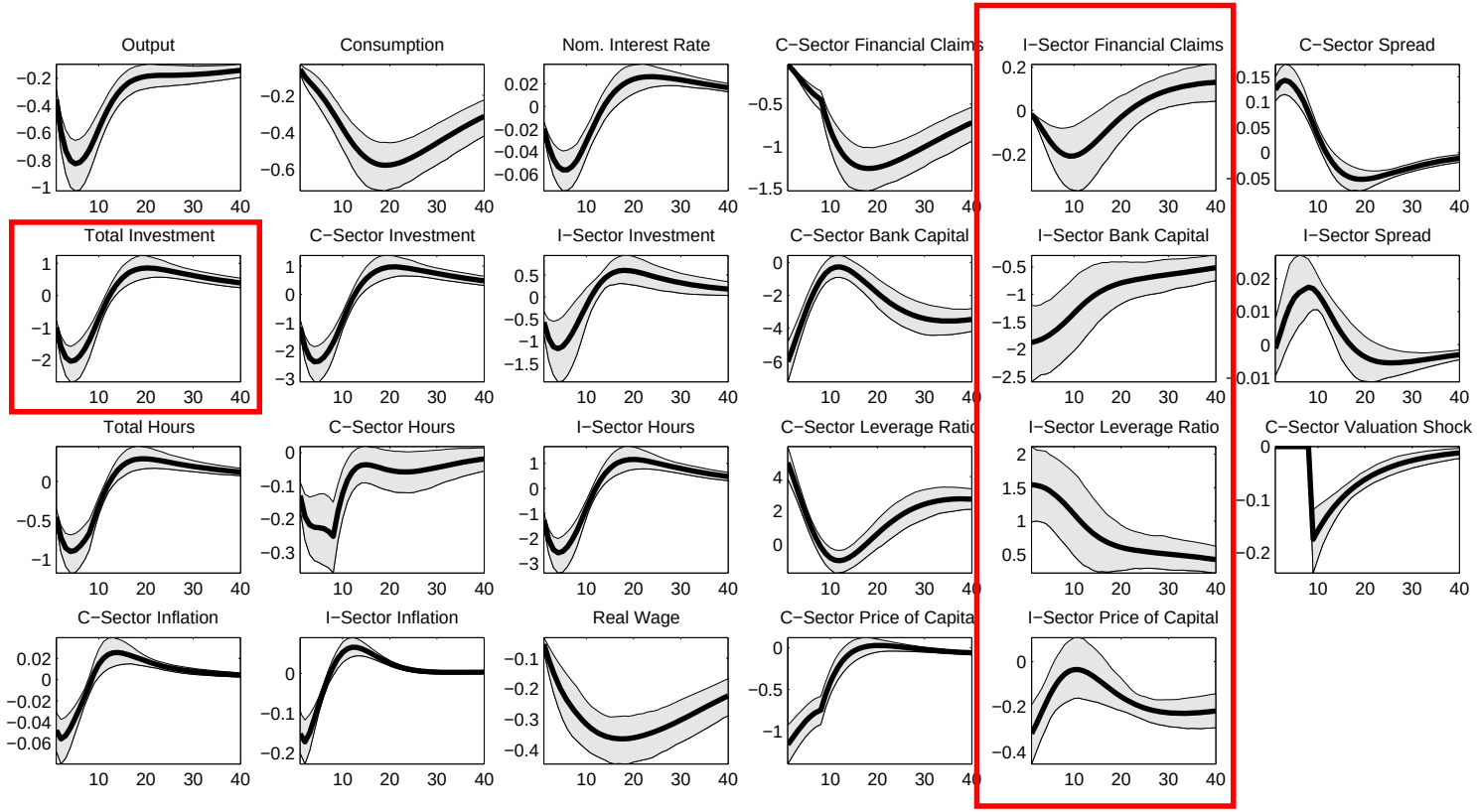
- $Q_{C,t}$ is forward looking → future path of $\xi^K_{C,t+1}$ matters



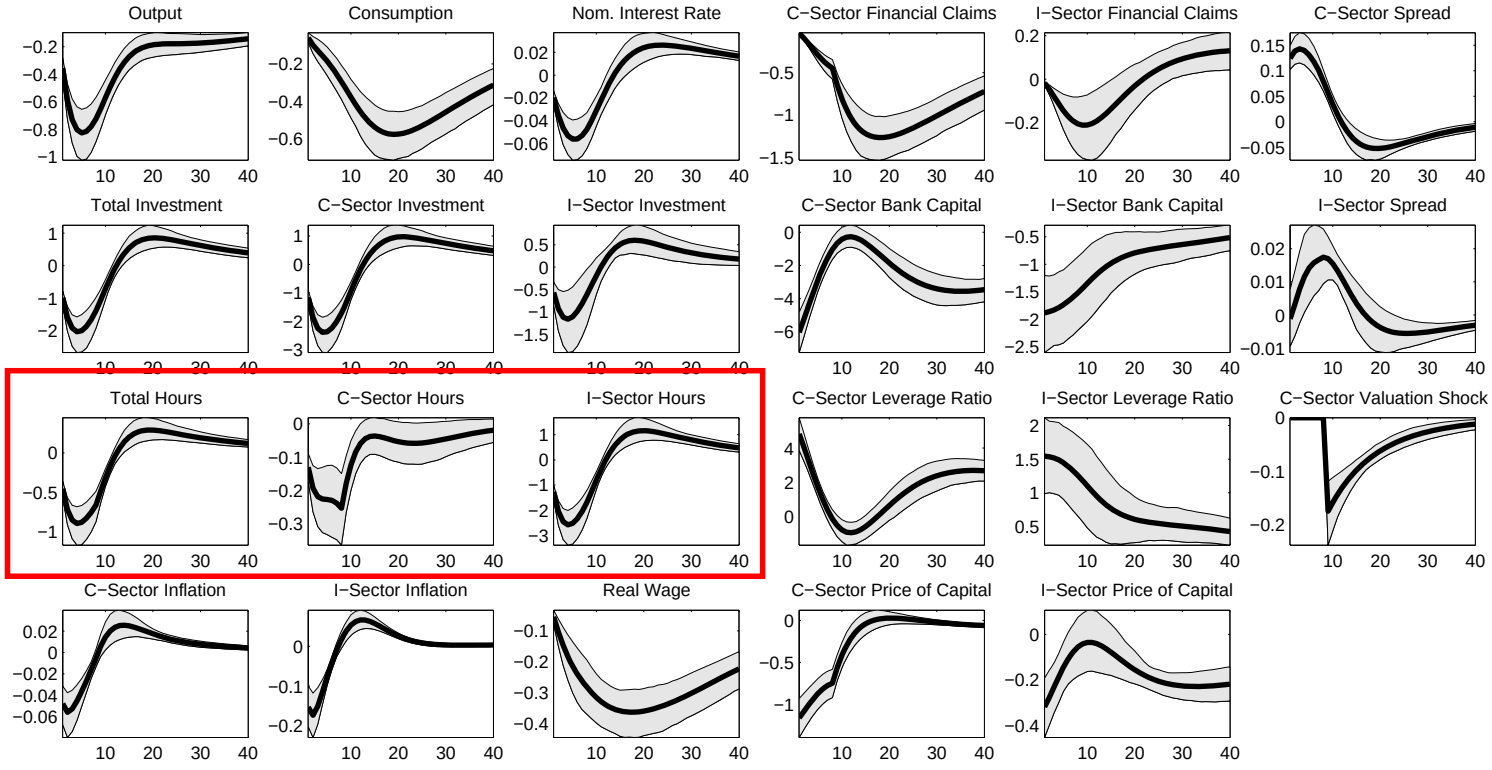
- **Second round effect**: initial decline in the value of capital → de-leveraging through increase of the spread
- Reduction in C sector lending → further decline in the value of capital → further weakening in balance sheets



- **Effect on consumption sector**: Financing to C sector capital producers declines
- Reduced production of consumption goods $\rightarrow$ reduced hours in consumption sector



- **Effect on investment sector**: Shock spills to investment sector through reduced demand for capital goods.
- Reduction in demand for investment goods $\rightarrow \downarrow$ value of capital in I sector $\rightarrow$ triggers qualitatively similar effects in this sector.
  - Reduced financing in I sector due to INPUT DEMAND CHANNEL: Production of investment goods declines



- **Hours dynamics**: predicts a relatively strong decline in investment sector hours.
  - Reason: Limited capital mobility between sectors
- The behavior of total hours mirrors the behavior of investment sector hours—replicates the sectoral facts about hours worked.

Transmission of shocks

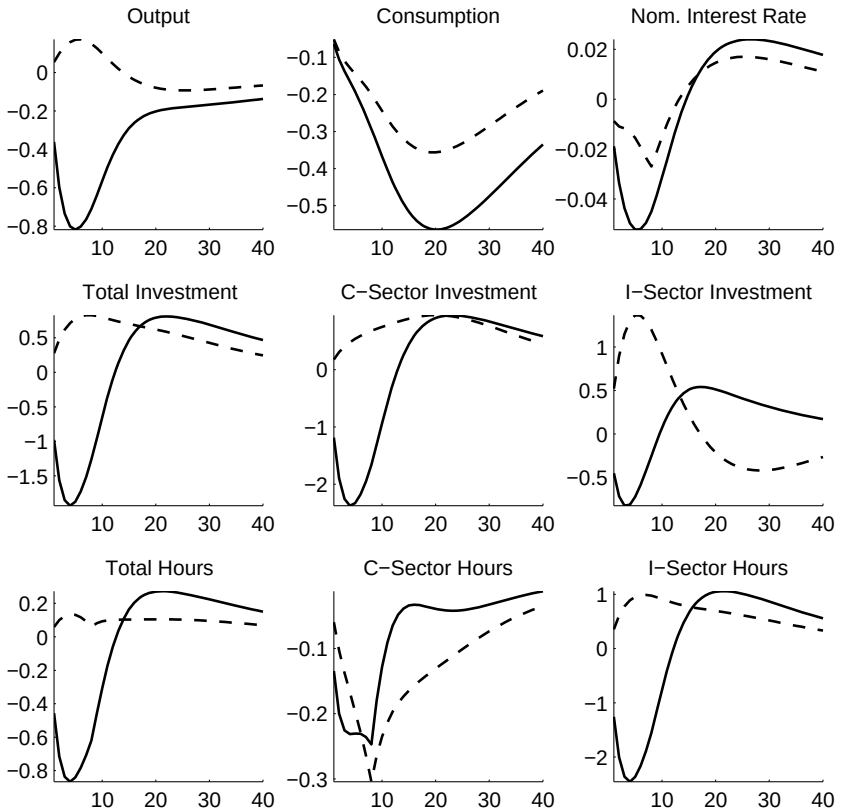


Figure: Responses to a eight quarter ahead consumption sector asset value shock in an economy with (solid line) and without (dashed line) financial frictions.

↪ In absence of financial channel, expected deterioration in C-sector asset values induces higher investment and hours in

A Historical Perspective

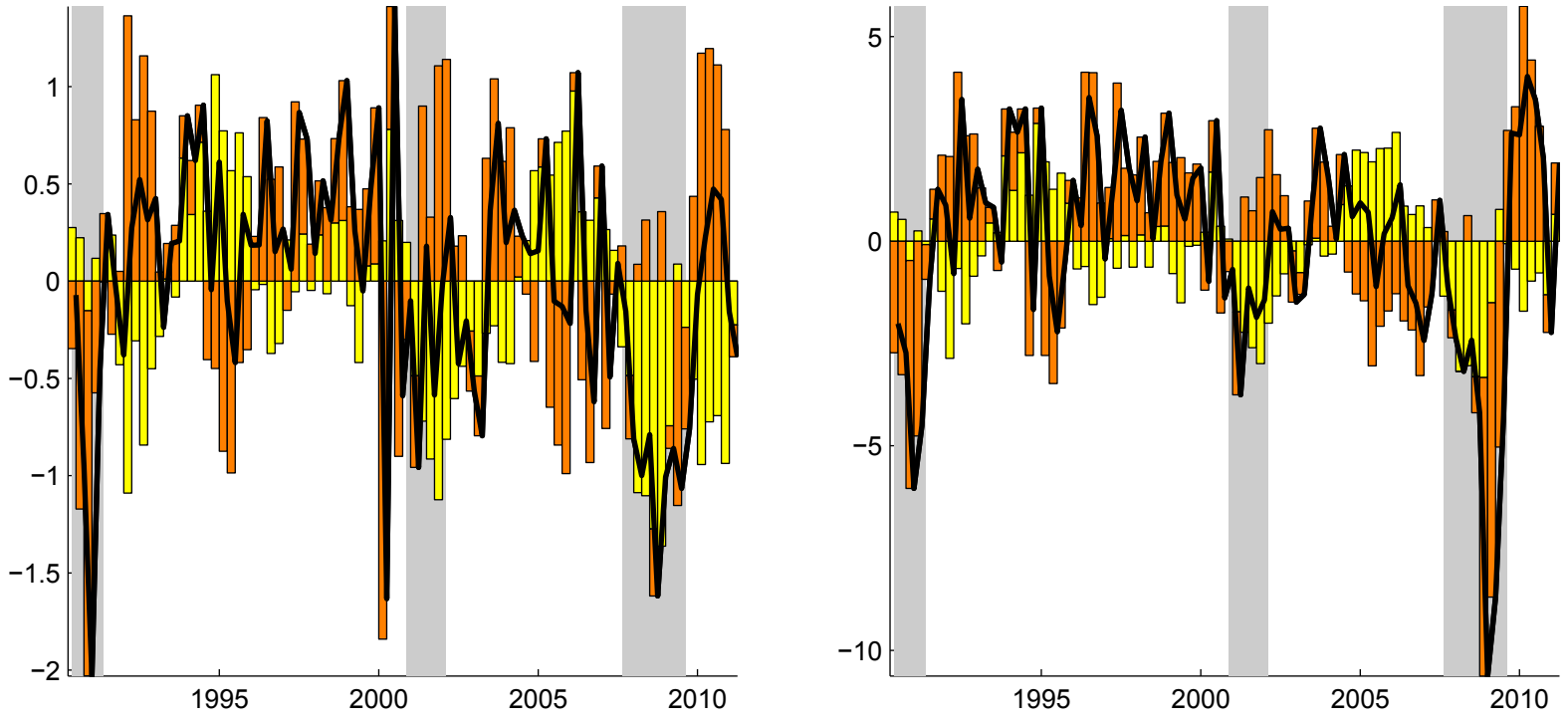


Figure: Historical decomposition: Impact of asset value news shocks and all other shocks on the growth rate of GDP (left) and investment (right).

- Asset value news shocks can explain a large fraction of the decline in GDP and investment in Great Recession
- Slow down the recoveries following both recessions of the 2000s

Interpretation of asset value shocks

- Previous results suggest that asset value shocks play an important role for aggregate fluctuations.
- How do the estimated asset value shocks from the model compare to financial market indicators?

Comparison of asset value news 8 quarter ahead shock with financial market indicators:

1. Measure of bank lending tightness — Survey of Senior Loan Officers reporting tightening of lending standards for loans (LOOS).
2. Fitch five-year ahead probability of default (all firms).
3. Fitch five-year ahead probability of default (firms in the consumption sector).
4. Gilchrist and Zakrajsek (2012) excess bond premium.

Interpretation of asset value shocks—Lending standards

Survey of Senior Loan Officers reporting tightening of lending standards for loans (LOOS)

- *Over the past three months, how have your bank credit standards for approving loan applications for commercial and industrial loans or credit lines–excluding those to finance mergers and acquisitions–changed? 1. Tightened considerably, 2. tightened somewhat, 3. remained basically unchanged, 4. eased somewhat, 5. eased considerably*
- Survey includes around 70 percent of US business loans and 60% of all US bank loans.
- Lown and Morgan (2006), using a VAR methodology find that innovations to LOOS lending standards predict contractions in loans and output.

Interpretation of asset value shocks—LOOS

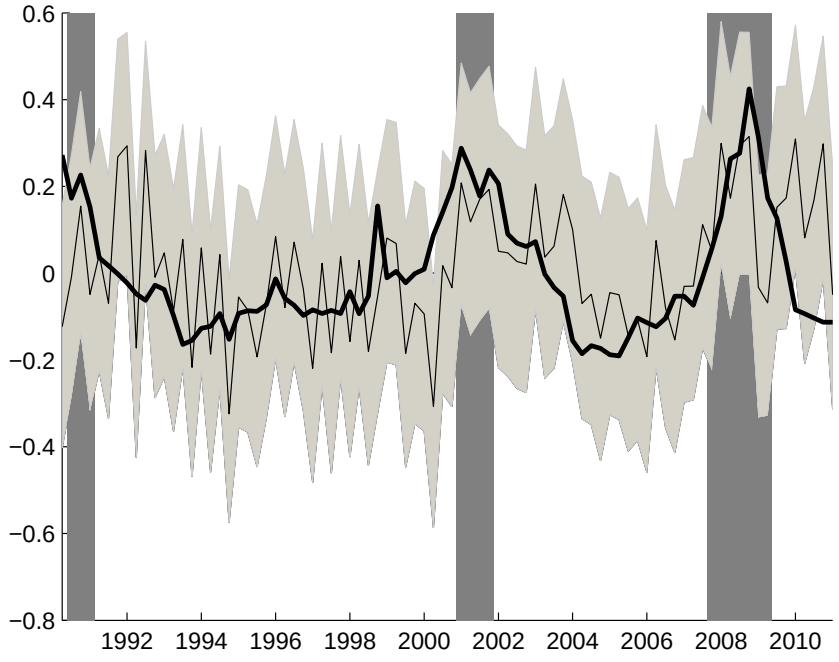


Figure: Asset value news shock (thin line) and Senior Loan Officer Opinion Survey on Bank Lending Practices from Fed Board (thick line). Light grey areas indicate two standard deviation confidence bands of the shock series. Dark grey bars show NBER dated recessions.

- Co-movement between LOOS and C-sector asset value news shock.
- Both series rise sharply before and during recessions.

Interpretation of asset value shocks—Default measures

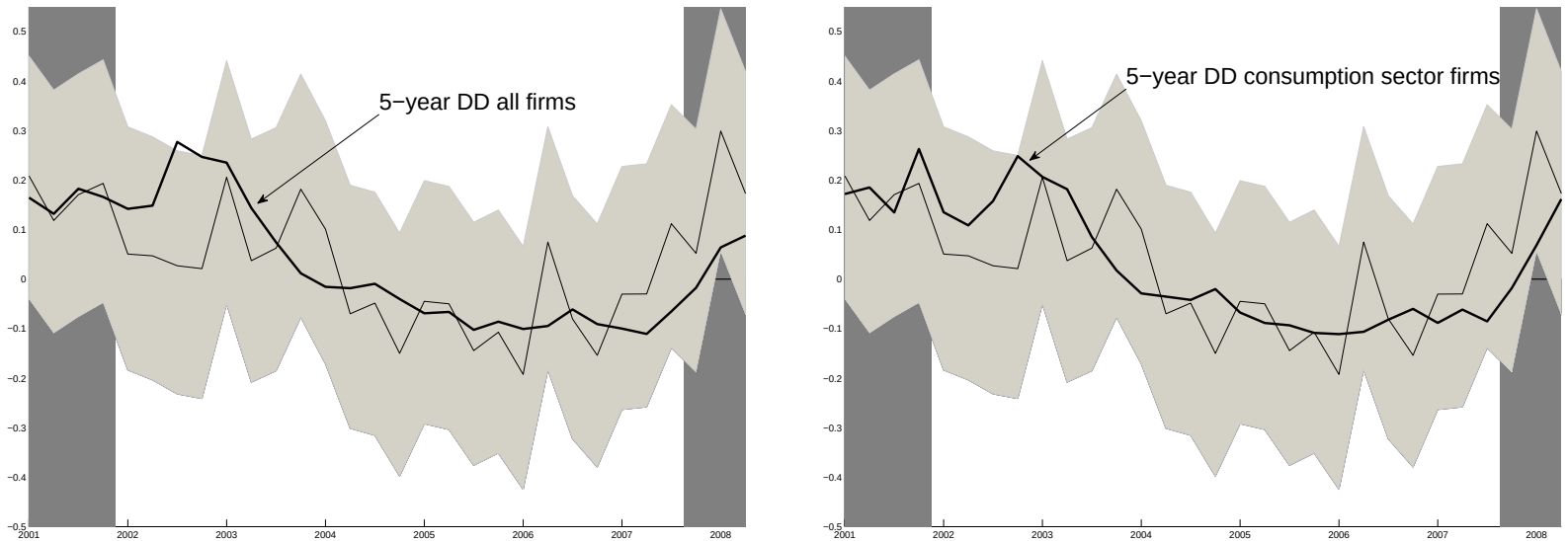


Figure: Asset value news (8 quarter ahead) shock (thin line) and financial market indicators (thick line) — Fitch five-year ahead probability of default–all firms (left panel), Fitch five-year ahead probability of default of companies in the consumption sector (right panel). A positive value for the news shock series indicates unfavorable news. Light grey areas indicate two standard deviation bands of the shock series. Dark grey bars show NBER dated recessions.

Interpretation of asset value shocks—Default measures

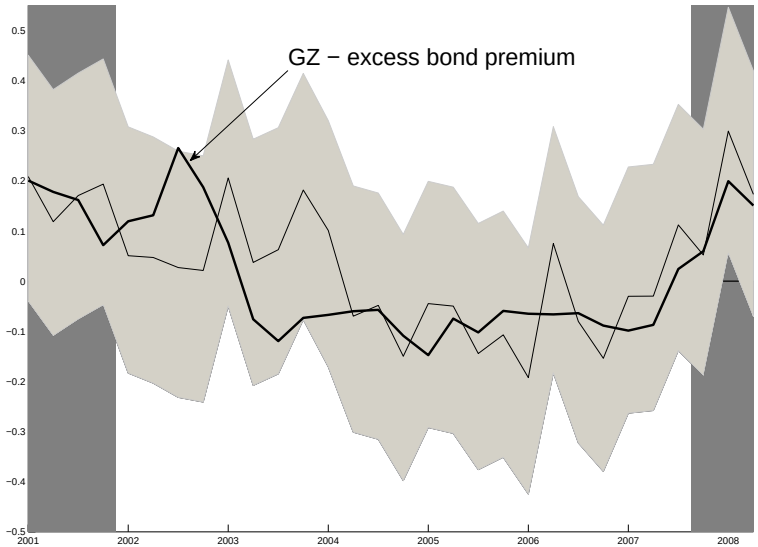


Figure: Asset value news (8 quarter ahead) shock (thin line) and Gilchrist and Zakrajsek (2012) excess bond premium (thick line). A positive value for the news shock series indicates unfavorable news. Light grey areas indicate two standard deviation bands of the shock series. Dark grey bars show NBER dated recessions.

Conclusions

- Asset value shocks are an important driving force of business cycles – especially asset value news shocks. They account for a sizable share of the variance in output, investment and total hours worked at cyclical frequencies.
- Asset value news shocks can generate aggregate and sectoral co-movement.
  - Quite successful at replicating the dynamics of hours worked.
  - Financial frictions are essential for co-movement.
- Asset value news shocks account for a large part of the downturn in GDP and investment growth during the 2001 and 2008 recessions, and slow down recoveries.

Conclusions

Thank you!

Table: Prior and Posterior Distributions

Parameter	Description	Prior Distribution			Posterior Distribution		
		Distribution	Mean	Std. dev.	Mean	10%	90%
h	Consumption habit	Beta	0.50	0.10	0.6864	0.6184	0.7550
ν	Inverse labour supply elasticity	Gamma	2.00	0.75	1.0112	0.2691	1.7312
ξ_w	Wage Calvo probability	Beta	0.66	0.10	0.6536	0.5853	0.7227
ξ_C	C-sector price Calvo probability	Beta	0.66	0.10	0.8188	0.7537	0.8830
ξ_I	I-sector price Calvo probability	Beta	0.66	0.10	0.7744	0.6663	0.8727
ι_w	Wage indexation	Beta	0.50	0.15	0.2608	0.1400	0.3802
ι_{p_C}	C-sector price indexation	Beta	0.50	0.15	0.2360	0.0992	0.3694
ι_{p_I}	I-sector price indexation	Beta	0.50	0.15	0.2689	0.1026	0.4235
χ_I	I-sector utilization	Gamma	5.00	1.00	5.0041	3.3870	6.6031
χ_C	C-sector utilization	Gamma	5.00	1.00	4.0646	2.4370	5.6471
κ	Investment adjustment cost	Gamma	4.00	1.00	2.1795	1.5915	2.7923
ϕ_π	Taylor rule inflation	Normal	1.70	0.30	2.2351	1.8988	2.5653
ρ_R	Taylor rule inertia	Beta	0.60	0.20	0.9036	0.8815	0.9269
$\phi_{\Delta\pi}$	Taylor rule inflation growth	Normal	0.25	0.10	0.1813	0.0314	0.3195
$\phi_{\Delta Y}$	Taylor rule GDP growth	Normal	0.125	0.05	0.2476	0.1636	0.3294
ρ^*	Intratemporal investment adjustmet cost	Beta	0.50	0.20	0.3578	0.1468	0.5834
	Shocks:Persistence						
ρ_z	C-sector TFP	Beta	0.40	0.20	0.1483	0.0148	0.2750
ρ_v	I-sector TFP	Beta	0.40	0.20	0.2585	0.1289	0.3838
ρ_b	Preference	Beta	0.60	0.20	0.8225	0.7588	0.8867
ρ_e	GDP measurement error	Beta	0.60	0.20	0.9741	0.9508	0.9985
$\rho_{\lambda_p^C}$	C-sector price markup	Beta	0.60	0.20	0.2266	0.0670	0.3786
$\rho_{\lambda_p^I}$	I-sector price markup	Beta	0.60	0.20	0.8034	0.6907	0.9269
ρ_{λ_w}	Wage markup	Beta	0.60	0.20	0.3246	0.1583	0.4917
ρ_{ς^C}	C-sector equity capital	Beta	0.60	0.20	0.8047	0.7609	0.8501
ρ_{ς^I}	I-sector equity capital	Beta	0.60	0.20	0.6070	0.4092	0.8002
$\rho_{\xi^K,C}$	C-sector asset value	Beta	0.60	0.20	0.9142	0.8719	0.9570
$\rho_{\xi^K,I}$	I-sector asset value	Beta	0.60	0.20	0.1943	0.0767	0.3050

Table: Prior and Posterior Distributions Continued

Parameter	Description	Prior Distribution			Posterior Distribution		
		Distribution	Mean	Std. dev.	Mean	10%	90%
	Shocks: Volatilities						
σ_z	C-sector TFP	Inv Gamma	0.50	2.0	0.2691	0.1628	0.3744
σ_v	I-sector TFP	Inv Gamma	0.50	2.0	1.4572	1.2343	1.6774
σ_b	Preference	Inv Gamma	0.10	2.0	2.0948	1.3957	2.7869
σ_e	GDP measurement error	Inv Gamma	0.50	2.0	0.4310	0.3649	0.4934
σ_{mp}	Monetary policy	Inv Gamma	0.10	2.0	0.1293	0.1114	0.1473
$\sigma_{\lambda_p^C}$	C-sector price markup	Inv Gamma	0.10	2.0	0.2797	0.2298	0.3290
$\sigma_{\lambda_p^I}$	I-sector price markup	Inv Gamma	0.10	2.0	0.2120	0.1547	0.2686
σ_{λ_w}	Wage markup	Inv Gamma	0.10	2.0	0.3268	0.2582	0.3944
σ_{ς_C}	C-sector equity capital	Inv Gamma	0.10	2.0	0.2744	0.2225	0.3245
σ_{ς_I}	I-sector equity capital	Inv Gamma	0.10	2.0	0.1772	0.1105	0.2436
$\sigma_{\xi^K,C}$	C-sector asset value	Inv Gamma	0.10	2.0	0.0558	0.0250	0.0863
$\sigma^2_{\xi^K,4,C}$	C-sector asset value 4Q ahead	Inv Gamma	$0.1/\sqrt{2}$	2.0	0.0521	0.0186	0.0889
$\sigma^2_{\xi^K,8,C}$	C-sector asset value 8Q ahead	Inv Gamma	$0.1/\sqrt{2}$	2.0	0.1709	0.0951	0.2459
$\sigma_{\xi^K,I}$	I-sector asset value	Inv Gamma	0.10	2.0	2.6620	2.1124	3.2142
$\sigma^2_{\xi^K,4,I}$	I-sector asset value 4Q ahead	Inv Gamma	$0.1/\sqrt{2}$	2.0	0.0632	0.0165	0.1229
$\sigma^2_{\xi^K,8,I}$	I-sector asset value 8Q ahead	Inv Gamma	$0.1/\sqrt{2}$	2.0	0.0548	0.0175	0.1004

The parameter that captures the intratemporal adj. cost for investment, is a transformation of the original parameter, ρ, according to, $\rho^* = 1 + \frac{1}{\rho}$.

Table: Calibrated Parameters

Parameter	Value	Description
δ_C	0.025	Consumption sector capital depreciation
δ_I	0.025	Investment sector capital depreciation
a_c	0.36	Consumption sector share of capital
a_I	0.36	Investment sector share of capital
β	0.9974	Discount factor
π_C	0.6722	Steady state consumption sector inflation
π_I	0.0245	Steady state investment sector inflation
λ_p	0.1	Steady state price markup
λ_w	0.1	Steady state wage markup
g_a	0.001	Consumption sector average TFP growth
g_v	0.004	Investment sector average TFP growth
$p_i \frac{i}{c}$	0.399	Steady state investment / consumption
θ_B	0.96	Fraction of bankers that survive
ϖ	0.00089	Share of assets transferred to new bankers
λ_B	0.3	Fraction of funds bankers can divert
ϱ	5.47	Steady state leverage ratio
$R^B - R$	0.005	Steady state risk premium

Model comparisons

Table: Log marginal data densities for different model setups

	Model Setup	Log Marginal Data Density
	Estimated with full data set	
Benchmark	4 and 8 quarter ahead asset value news shocks in both sectors	-761.15
Model A:	1, 4 and 8 quarter ahead asset value news shocks in both sectors	-763.00
Model B:	4 and 8 quarter ahead TFP news shocks in both sectors	-778.00
Model C:	1, 4 and 8 quarter ahead TFP news shocks in both sectors	-778.00
Model D:	4 and 8 quarter ahead asset value news shocks and TFP news in both sectors	-770.24
Model E:	1, 4 and 8 quarter ahead asset value news shocks and TFP news in both sectors	-772.90
Model F:	Model without any anticipated components	-771.74
	Estimated with restricted data set	
Model G:	Benchmark estimated without spread and equity data as observables	-532.54
Model H:	Model with frictionless financial intermediation estimated without spread and equity data as observables	-533.70

IS shocks

- Relative price of investment in the two-sector model

$$\frac{P_{I,t}}{P_{C,t}} = \frac{\text{mark up}_{I,t}}{\text{mark up}_{C,t}} \frac{1-a_c}{1-a_i} \frac{A_t}{V_t} \left(\frac{K_{I,t}}{L_{I,t}}\right)^{-a_i} \left(\frac{K_{C,t}}{L_{C,t}}\right)^{a_c}$$

- In one sector models, $\frac{P_{I,t}}{P_{C,t}} = \frac{1}{V_t}$
  - Not valid unless, (i) perfectly competitive product markets, (ii) identical production functions (factor intensities) in both sectors, (iii) free factor mobility
- All shocks can affect relative price of investment in the two-sector model. It does not only reflect investment specific shocks.
- In one sector model the investment specific shock is purely identified from the relative price of investment.

Back

Estimation — US Data

- **SECTORAL DEFINITION**: NAICS industrial 2 digit codes from 2005 Input-Output Tables
  - Investment if majority of industry's output used for investment or intermediate uses
  - Consumption if majority of industry's output used for final consumption uses
- INVESTMENT (mining, utilities, transportation and warehousing, manufacturing, information, construction and wholesale trade)
- CONSUMPTION (retail trade, finance, insurance, real estate, rental and leasing, professional and business services, educational services, health care and social assistance, arts, entertainment, recreation, accommodation and food services and other services except government)

back

Results

- Financial (Bank equity and asset value) shocks account for 36%, 28%, 35% in output, investment, hours.

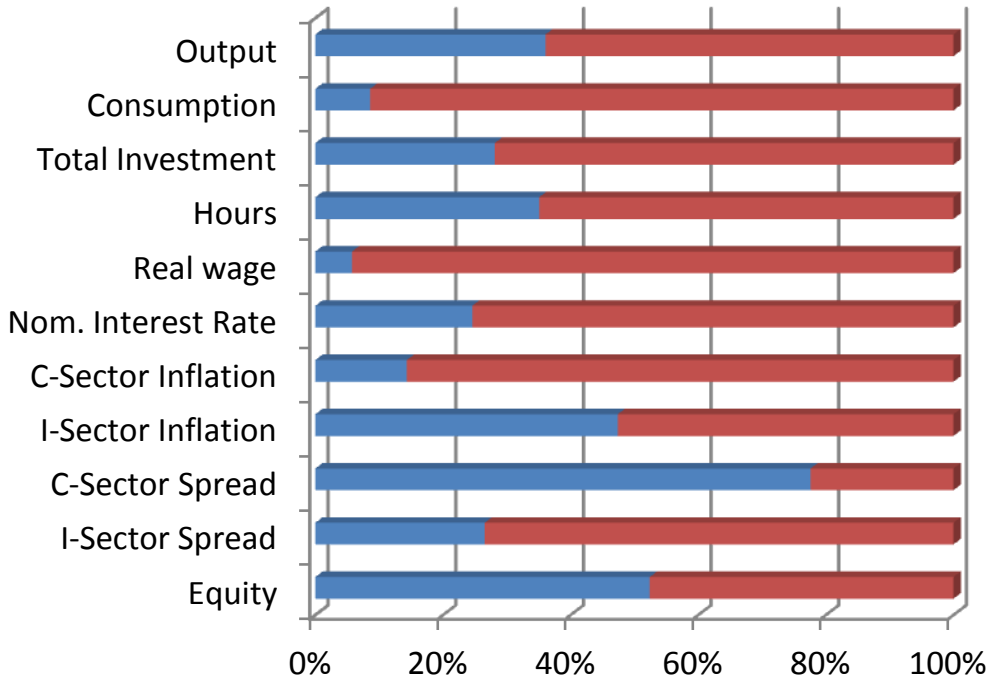


Figure: Variance Decomposition–percentage Share of variance explained by shocks at cyclical frequencies. Financial shocks (contemporaneous and news) and all other shocks.

back

Additional Results

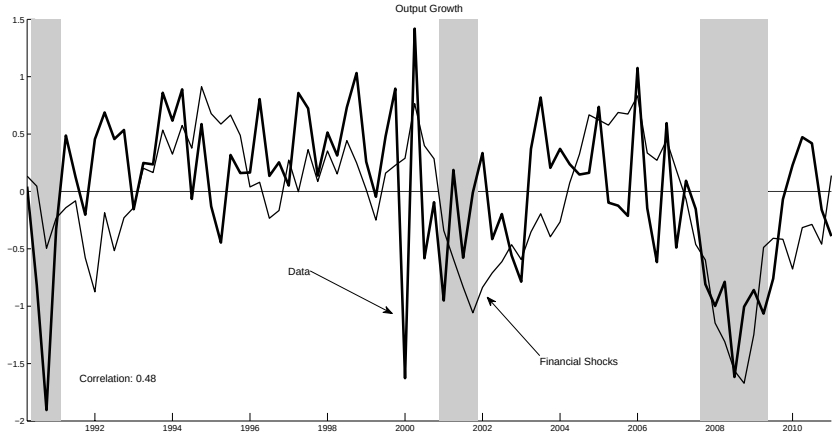
We conduct an additional exercise to better appreciate the role of financial and in particular asset value news shocks in explaining the in-sample variation in the data.

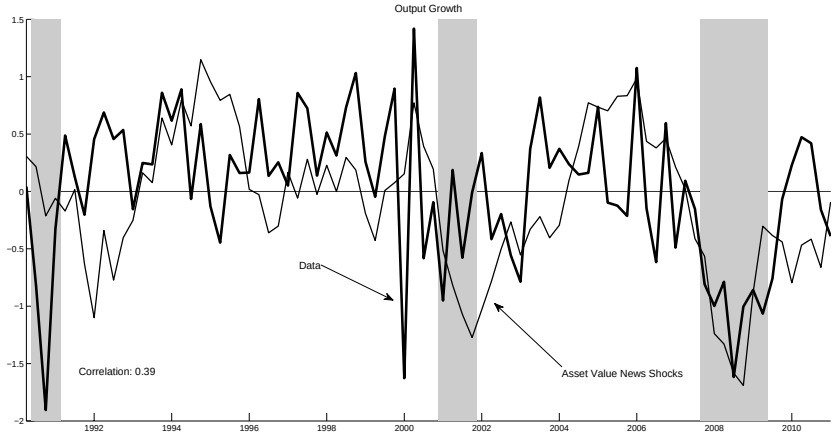
- We compare the sample paths of observables (output growth, investment growth, total hours worked and sectoral credit spreads)...
- and sectoral hours worked (which have not been used as observables in the estimation and hence even a simulation with all shocks active would not be able to perfectly fit the actual sample paths)
- ...with simulation paths generated by the model when either...

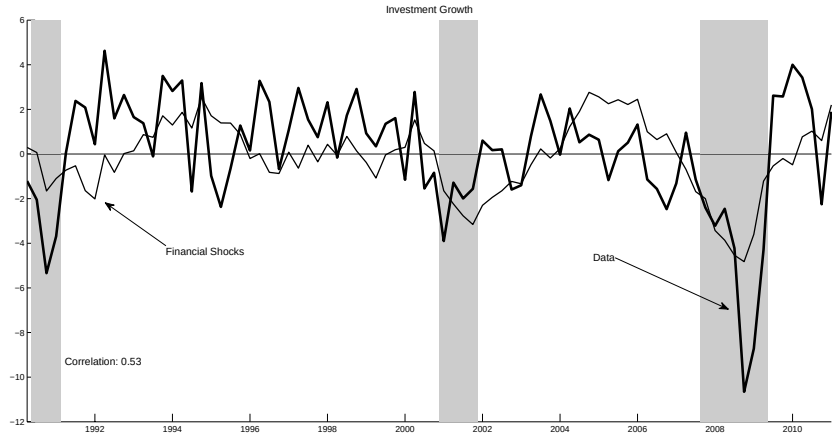
(a) only all financial shocks or

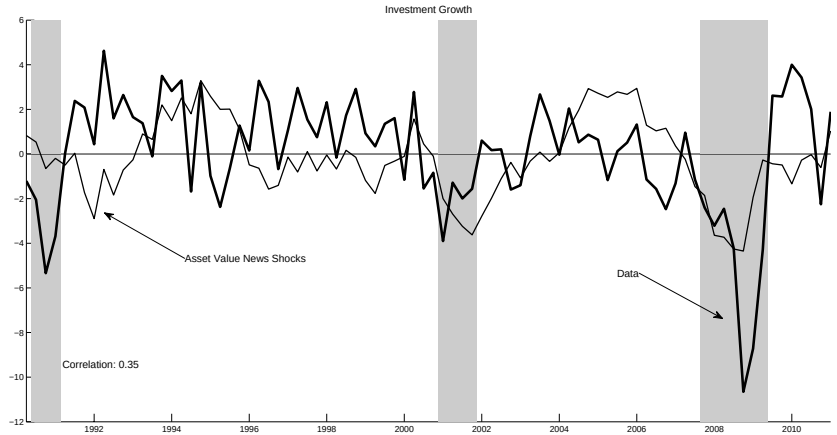
(b) only all asset value news shocks are turned on and all other shocks are set equal to zero.

Additional Results

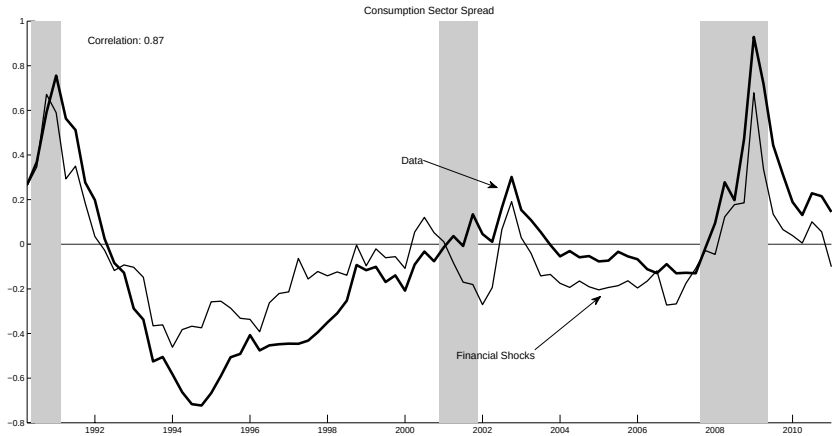


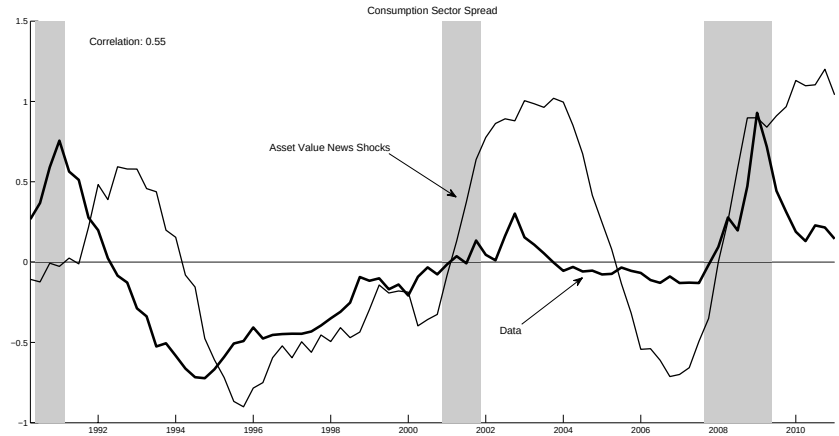


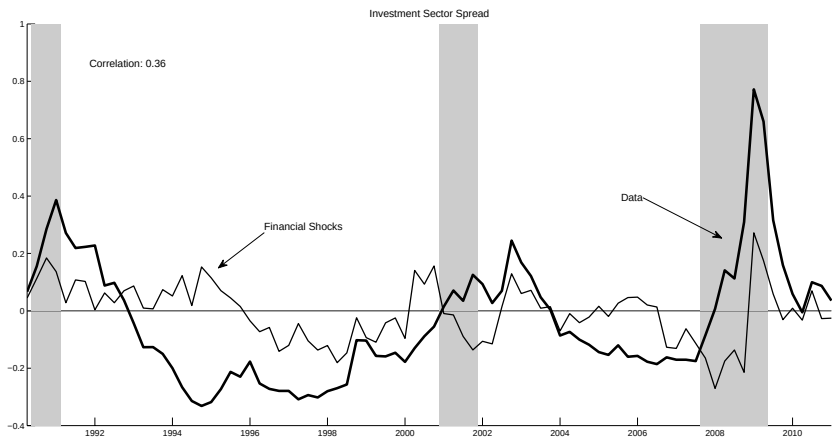


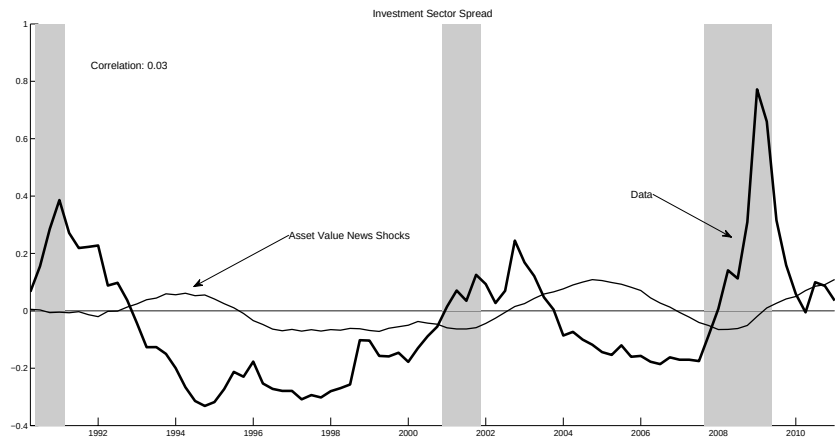


Additional Results

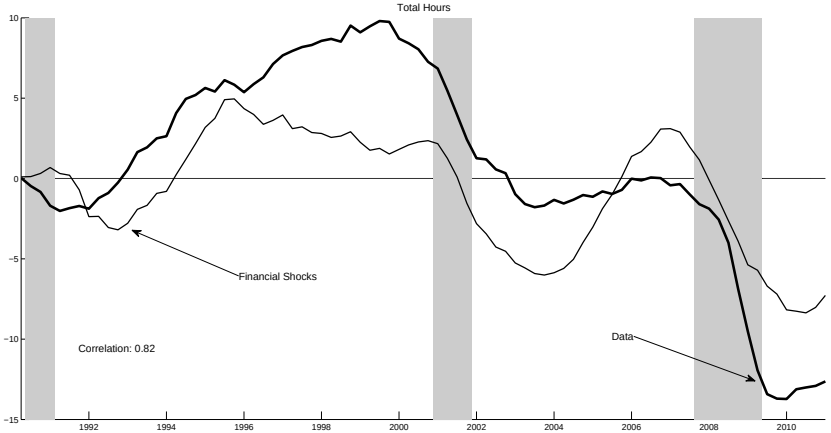


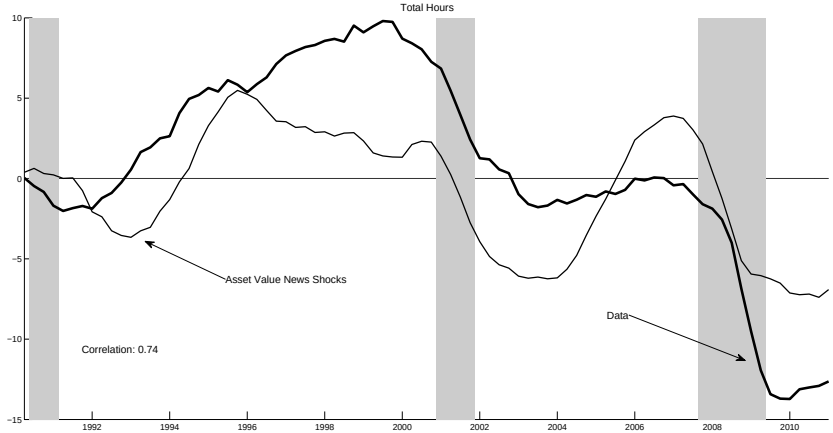


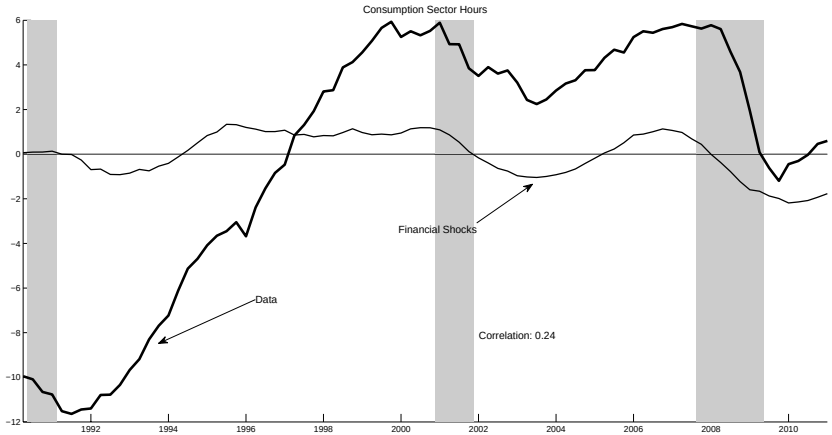


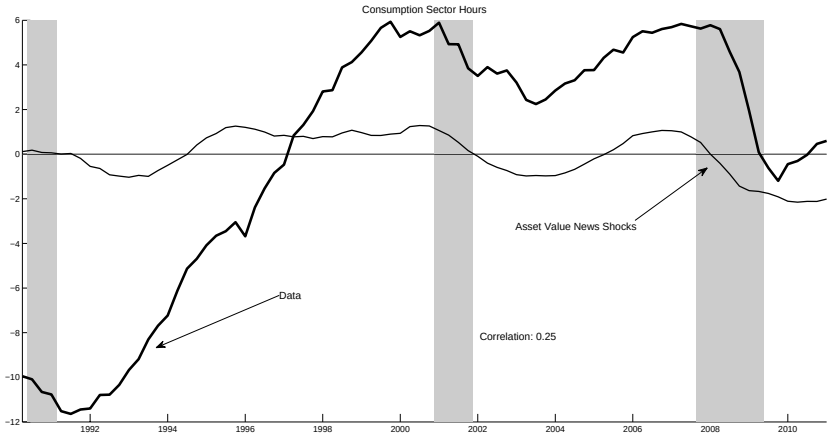


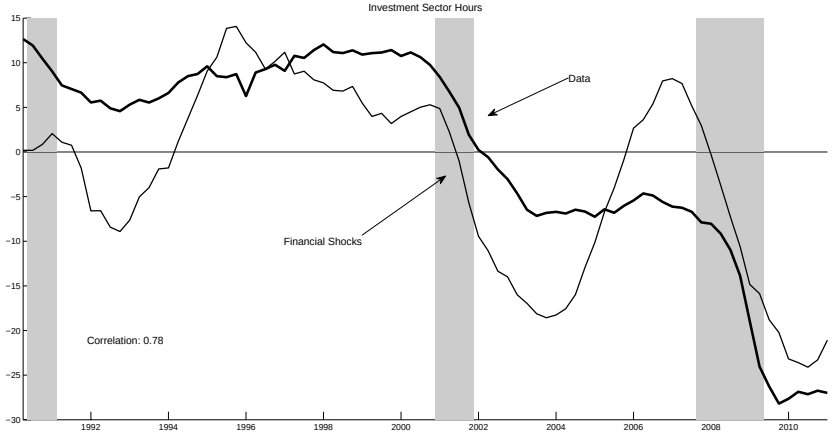
Additional Results

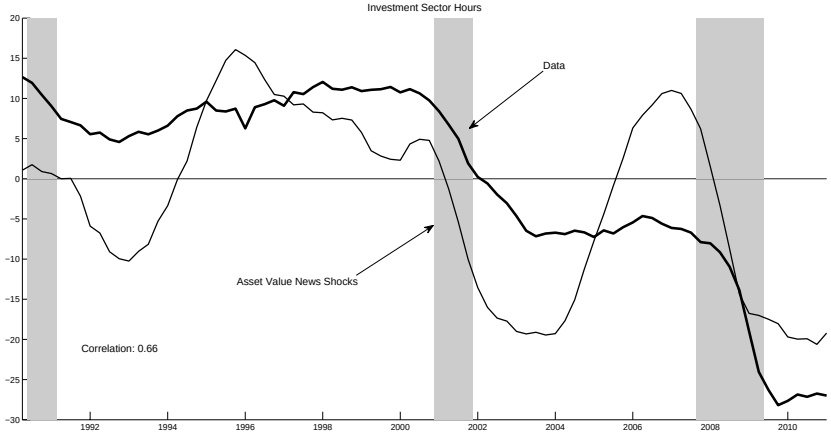





Consumption Sector Hours
Financial Shocks
Data
Correlation: 0.24


Consumption Sector Hours
Asset Value News Shocks
Data
Correlation: 0.25


Investment Sector Hours
Data
Financial Shocks
Correlation: 0.78


Investment Sector Hours
Data
Asset Value News Shocks
Correlation: 0.66