Political Distribution Risk and Aggregate Fluctuations

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Motivation

> *"A popular framework for thinking about labor law is to consider a* **pendulum that can range from strong bargaining power for labor** *. . .* **to strong bargaining power for companies** *. . . ."*
> *Budd (2012), 'Labor Relations – Striking a Balance,' 4th ed.*

We stress the role that changes in

1. statutory labor law (including executive orders),
2. case law (courts and NLRB), and
3. political climate

have on business cycles, income shares, and asset prices.

What we do

1. International evidence: Political redistribution risk after political events.

2. U.S. states: Right-to-work legislation.

3. U.S. time series: Proxy-VAR to identify redistribution shocks.

4. RBC model with labor market frictions and bargaining: Political distribution risk as shocks to workers' bargaining power.

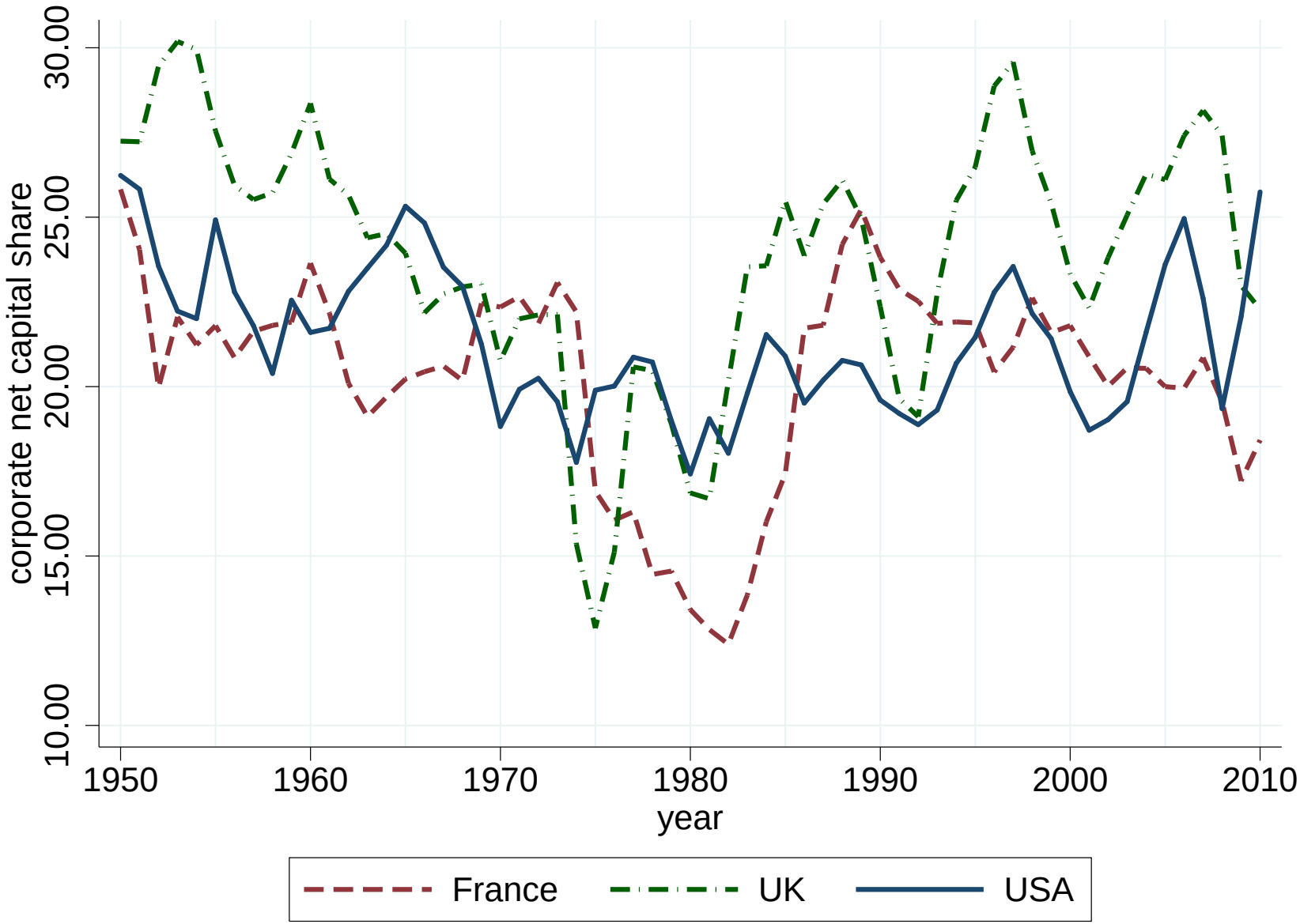
What we find: Data

- Large fluctuations of capital shares over modern history following political changes in six case studies.
- Systematic international evidence confirms this point.
- Substantial changes in labor regulations in the U.S.
  - Evidence suggests that capital shares increase following a firm-oriented shift (U.S. states).
  - From Proxy-VAR: a redistribution shock decreases capital share and output and increases unemployment.

What we find: Model

- We back out a time-series for bargaining shock that agrees with historical narrative evidence $\Rightarrow$ Partial filter.
- Model replicates near acyclicality of wages and pro-cyclicality of the capital share in U.S. data.
- The bargaining shocks account for around 34% of the volatility of output and nearly all of the model-generated volatility of capital shares.
- Capital shares drop by 0.1 p.p. following one-s.d. distribution shock, output by 0.6%.
- Increasing volatility by the UK-US difference (+40%), would increase volatility in U.S. output by 20% percent and lower welfare by 0.9 p.p.

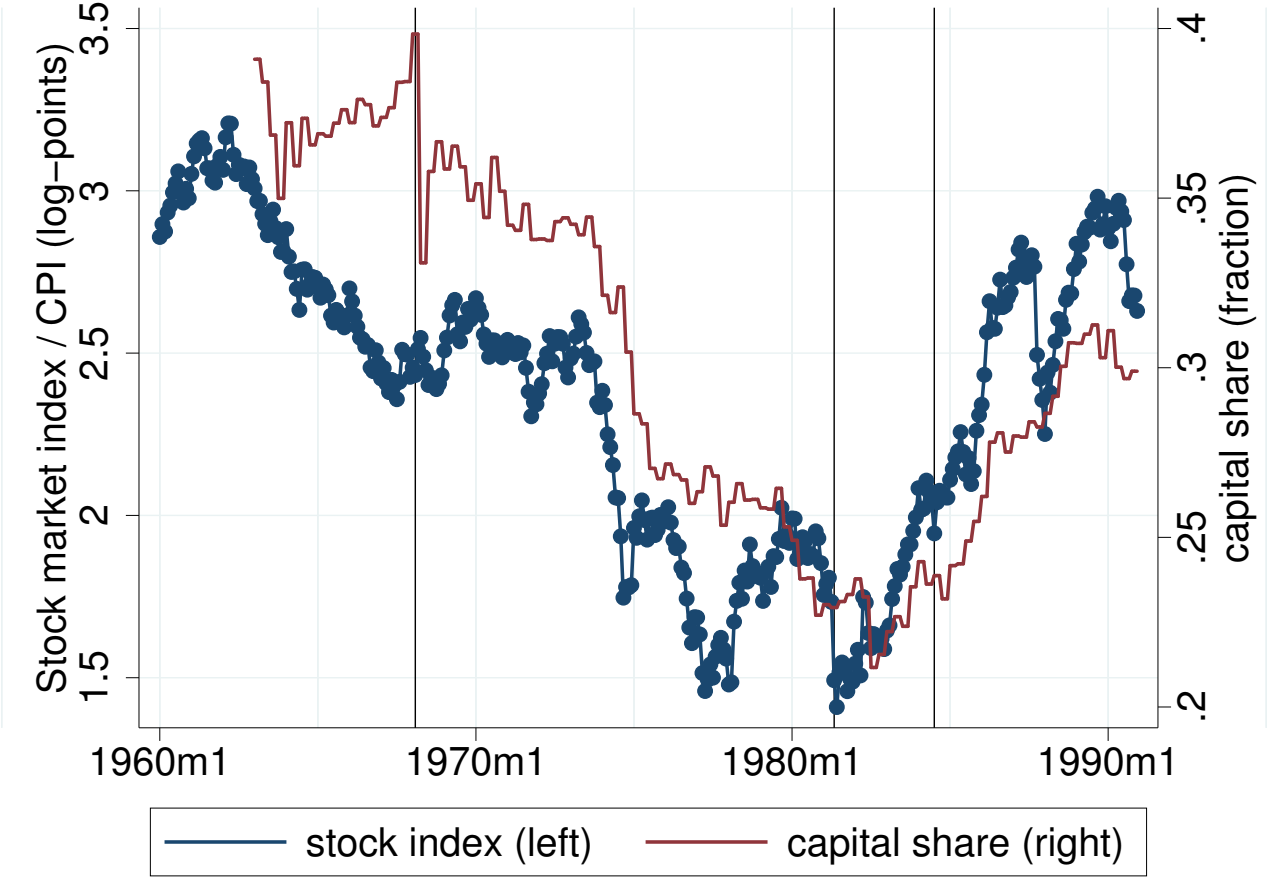
Fluctuations in income shares



Data from Piketty and Zucman (2014)

International case studies

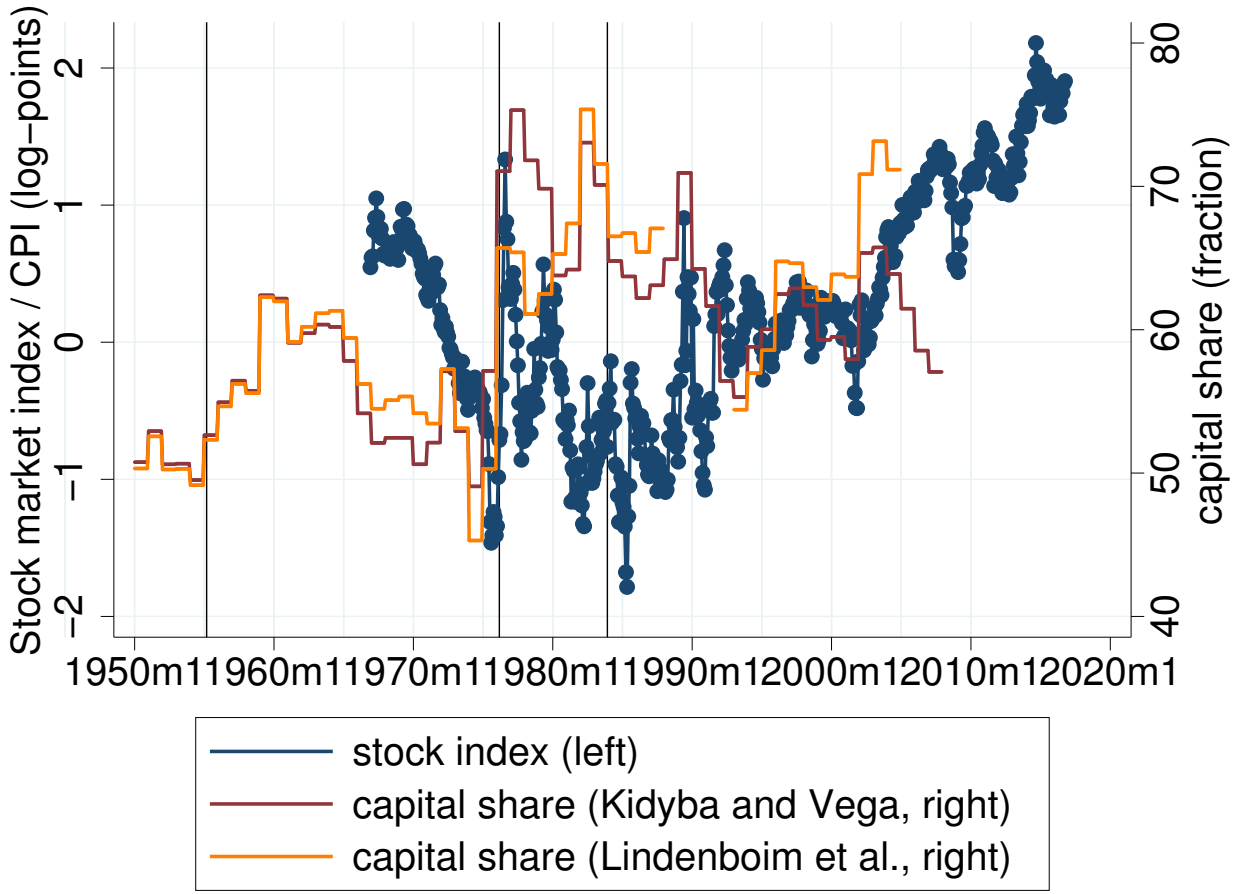
France: Strikes, Mitterrand's election and turn



Capital share, stock market indices, and major government changes

International case studies

Argentina: Anti J.&I. Perón coups, democratic transition



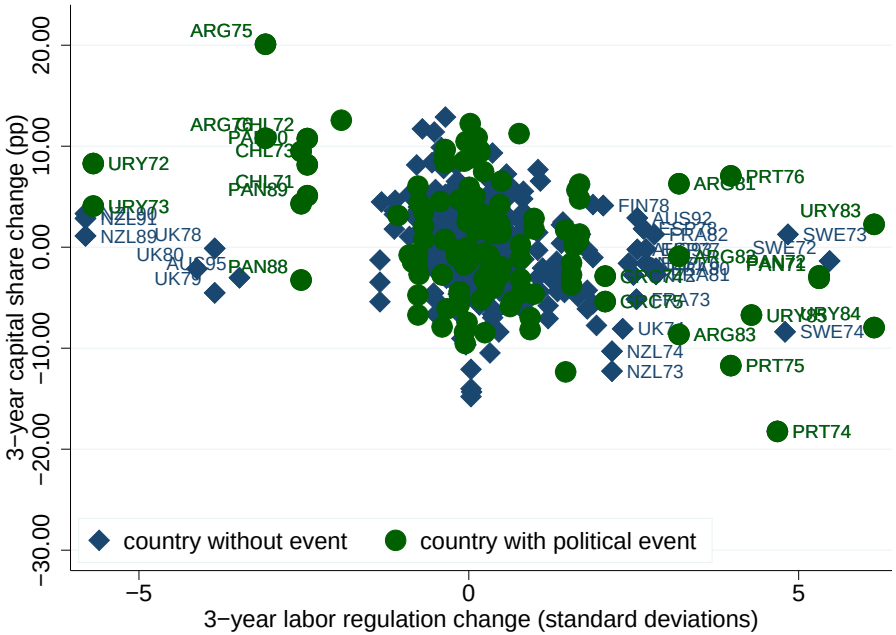
Capital share, stock market indices, and major government changes

International labor law

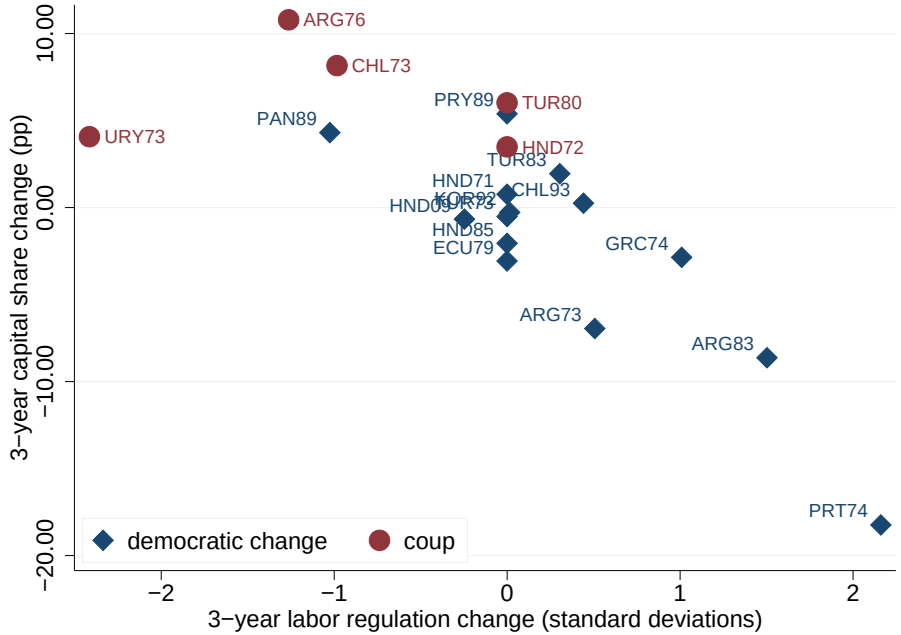
- CBR Leximetric data on labor law (Adams *et al.*, 2016)
  - 117 countries, 1970–2013.
  - Measure the degree of worker protection in $[0, 1]$.
  - 40 variables covering 5 areas: (1) contracts, (2) working time, (3) dismissals, (4) employee representation, (5) collective action.
  - Statutory and case law.
- Instrument with large political events: Coups and democratic transitions.
  - Successful coup according to Powell and Thyne (2011): -1.
  - Democratic transition: the first free legislative election in a parliamentary system or a presidential election in a semi-parliamentary or presidential system after a dictatorship according to Bormann and Golder (2013): $+1$.
- Placebo effect regressions.

Labor law changes and political transitions

(a) Any labor regulation change

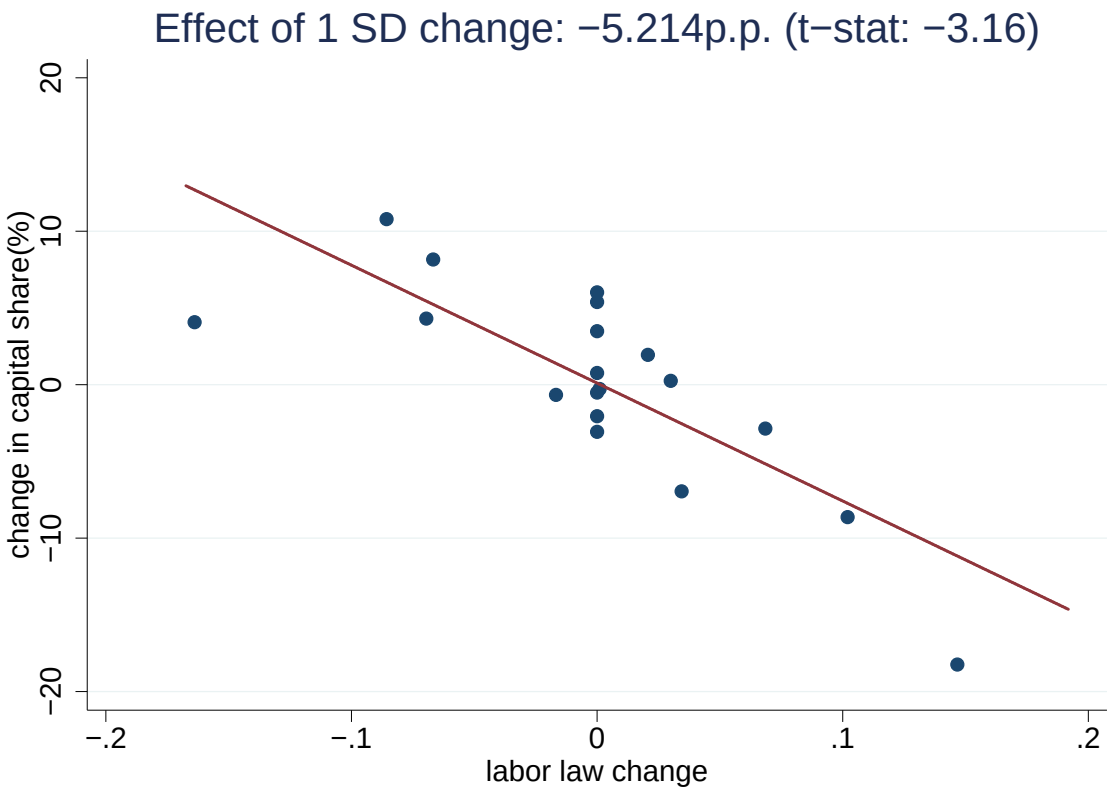


(b) Any political transition



Regression results

OLS

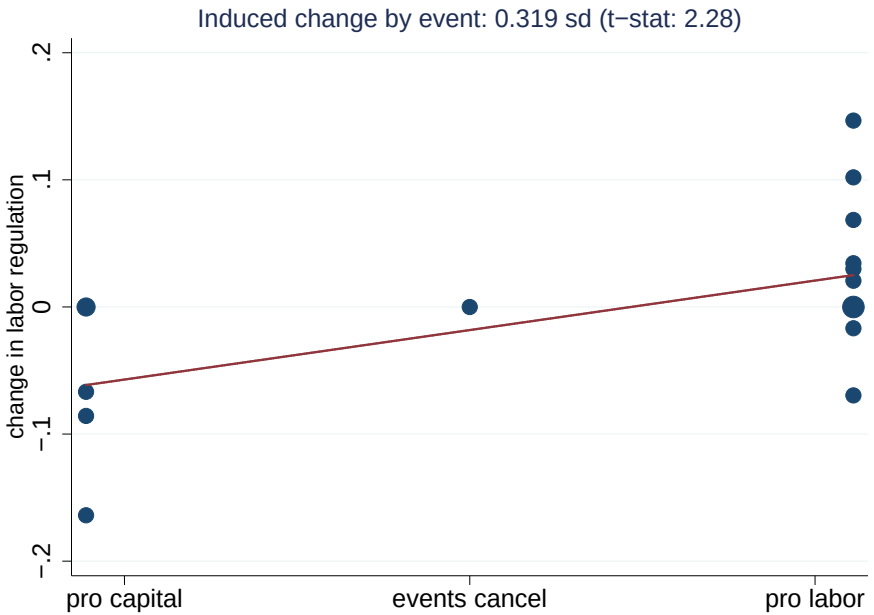


Political events and labor regulation changes

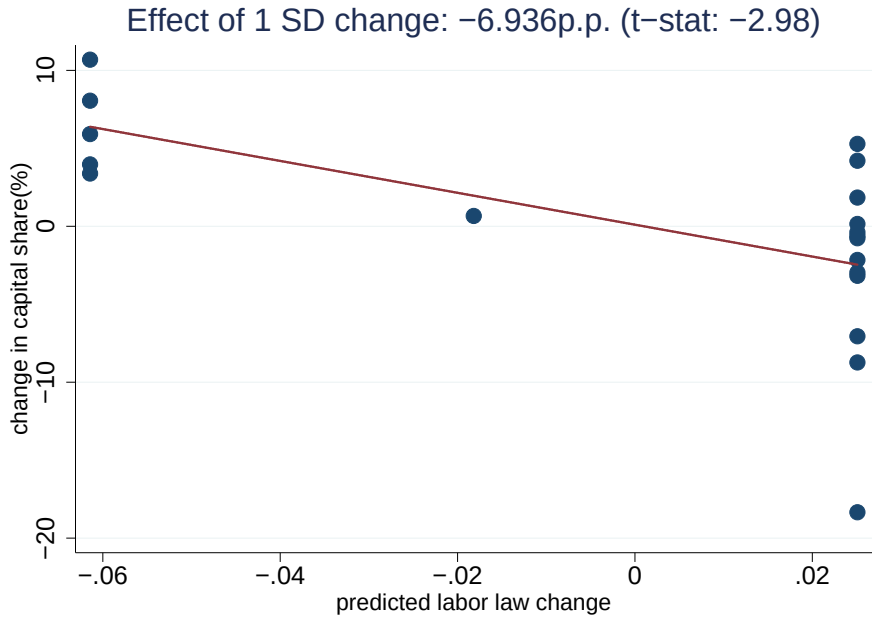
▸ Placebo

Regression results

2SLS: First stage



2SLS: Second stage



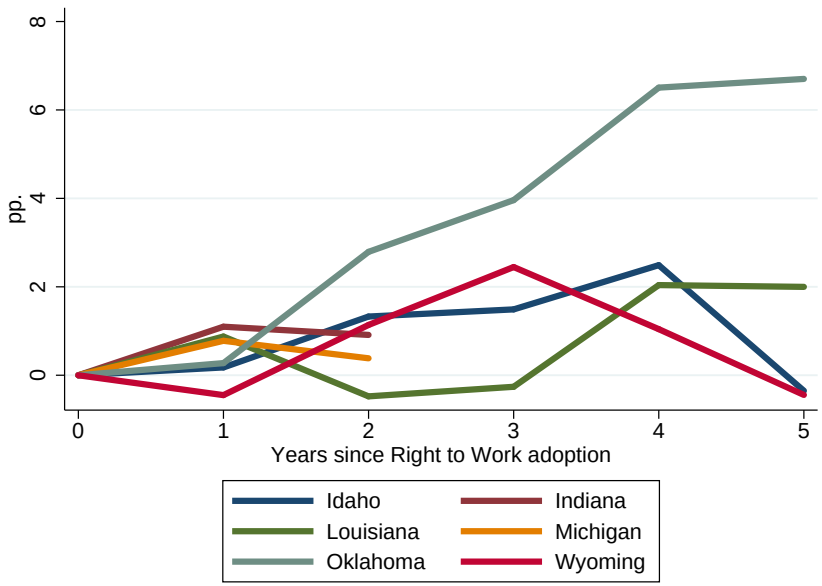
Political events and labor regulation changes

▸ Placebo

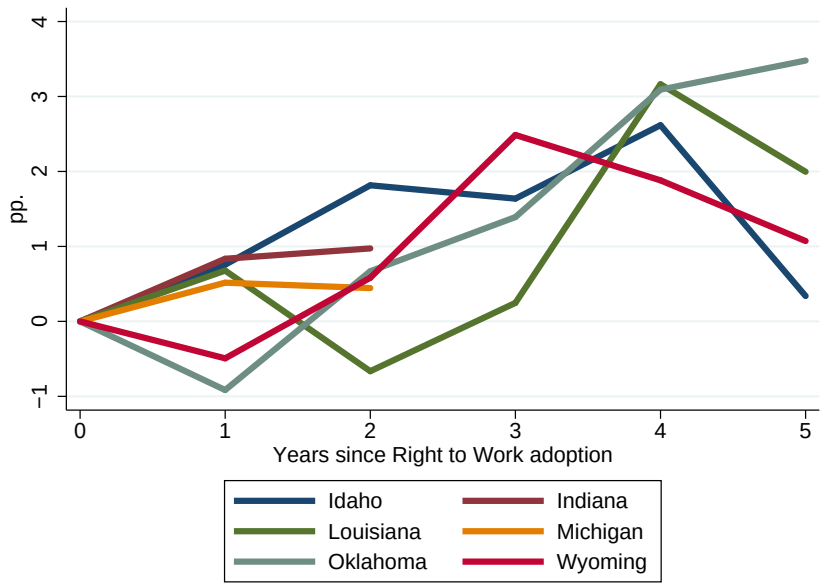
Evidence from right-to-work (I)

Cumulative change in gross capital shares

raw change



change relative to the US



Change in state private industry capital shares after right-to-work adoption.

Evidence from right-to-work (II)

Federal Reserve Bank of Philadelphia

State-Industry panel regression: Right-to-work laws and gross capital share

Controlling for census region FE, year FE, and industry FE

	Level	1y change	2y change	3y change	4y change	5y change
Right to Work	1.38					
	(0.00)					
Change in RtW		0.77	0.88	1.04	1.35	1.53
		(0.48)	(0.34)	(0.22)	(0.12)	(0.07)

Controlling for state FE, and industry FE

	Level	1y change	2y change	3y change	4y change	5y change
Right to Work	-0.20					
	(0.85)					
Change in RtW		0.61	1.24	1.86	1.78	1.64
		(0.59)	(0.19)	(0.04)	(0.04)	(0.06)

- Before 1997: Private SIC industries. From 1997: Private NAICS industries.
- Standard errors clustered by state and industry. 2-sided p-values in parentheses.

Proxy-VAR

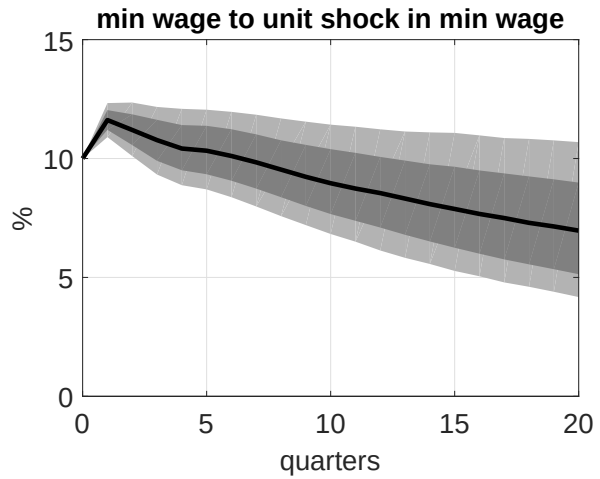
- Proxy-VAR (Stock and Watson, 2012; Mertens and Ravn, 2013):
  - Identify shock under IV assumptions instead of zero or sign restrictions.
  - Use Bayesian version in Drautzburg (2016).
- VAR variables:

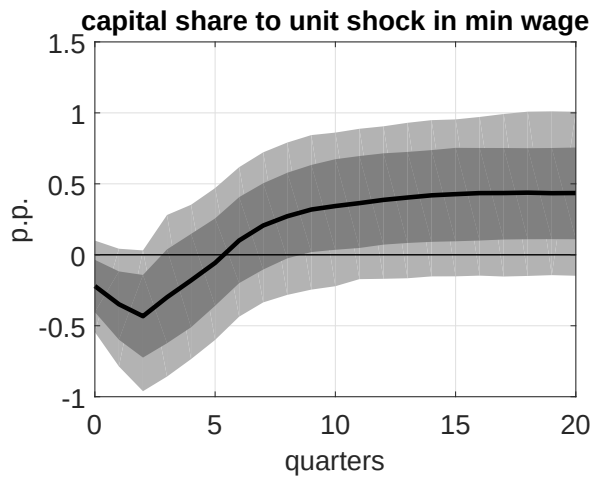
  (1) Real Fed. minimum wage, (2) net capital share, (3) unemployment rate, (4) real gross value added.
- Proxy: Changes in statutory minimum wage, converted to \$2000 (federal and/or state level).
- Spillover effects: Autor, Manning, and Smith (2016).
- Sample period: 1951q1 to 2014q2.
- Robustness exercises.

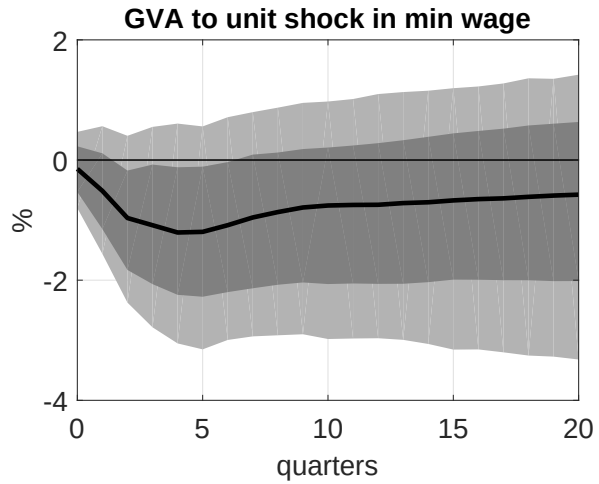
Capital share vs. proxy variable

Impulse-responses

- Quadratic trend







posterior median 68% posterior CS 90% posterior CS

Model

- RBC model with search and matching frictions. (Andolfatto, 1996; Merz, 1995; Shimer, 2010)
  - Household with a continuum of members. Members are either employed or unemployed.
  - Household insures members against idiosyncratic employment risk.
  - Competitive firms that choose recruiting intensity.
  - Government.
  - Complete markets.
- Standard competitive equilibrium.
- Bargaining power subject to persistent redistribution shocks.

Model: Households

- Recursive problem of the head of household:

$$V(a, n_{-1}) = \max_{a', n, c} \frac{c^{1-\sigma}(1 + (\sigma - 1)\gamma n_{-1})^{\sigma} - 1}{1 - \sigma} + \beta \mathbb{E}[V(a', n)]$$

with

$$c \equiv c_e n_{-1} + c_u(1 - n_{-1})$$

- Budget constraint:

$$c + \mathbb{E}[m' * a'] = (1 - \tau_n) w n_{-1} + T + a$$

with stochastic discount factor m.

- Law of motion of employment:

$$n = (1 - x) n_{-1} + f(\theta)(1 - n_{-1}),$$

with job finding rate $f(\theta) = \xi \theta^{\eta}$.

Model: Firms

- Firm produces output y using effective capital uk_{-1} and production workers $(1-\nu)n_{-1}$:

$$y = \left(\alpha^{\frac{1}{\varepsilon}}(uk_{-1})^{1-\frac{1}{\varepsilon}} + (1-\alpha)^{\frac{1}{\varepsilon}}(z(1-\nu)n_{-1})^{1-\frac{1}{\varepsilon}}\right)^{\frac{\varepsilon}{\varepsilon-1}},$$

  Fraction ν workers devoted to recruiting activities.

- Laws of motion for employment and capital:

$$n = n_{-1}(\nu\mu(\theta) + 1 - x)$$

$$k = (1-\delta(u))k_{-1} + I\left(1 - \frac{1}{2}\kappa\left(\frac{I}{k_{-1}} - \tilde{\delta}\right)^2\right)$$

  where $\mu(\theta) = f(\theta)/\theta$ is hiring probability per recruiter.

- Firm value:

$$J(n_{-1}, k_{-1}) = \max_{n,k,\nu}(1-\tau_k)(y - wn_{-1}) - I + \tau_k\delta(\bar{u})k_{-1} + \mathbb{E}\left[m' * J(n,k)\right]$$

Model: Wage determination

- Generalized Nash bargaining between firms and households.
  - Workers have bargaining power ϕ.
  - Exogenous shifts in ϕ capture political shocks to bargaining process (Binmore *et al.*, 1986).
  - Other bargaining protocols? (Hall and Milgrom, 2008).
- Equilibrium wage solves

$$w = \arg\max_{\tilde{w}} \tilde{V}_n(\tilde{w})^{\phi} \tilde{J}_n(\tilde{w})^{1-\phi},$$

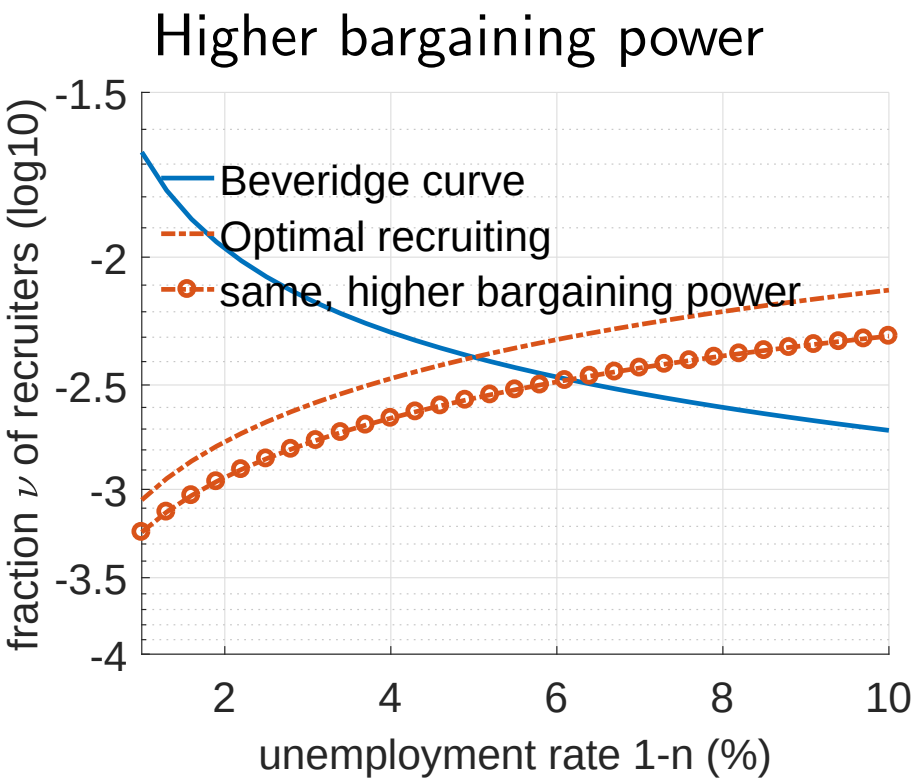
  where $\tilde{V}_n$ and $\tilde{J}_n$ are marginal values of employment for households and firms given an arbitrary wage $\tilde{w}$.
- Equilibrium wage along the balanced growth path:

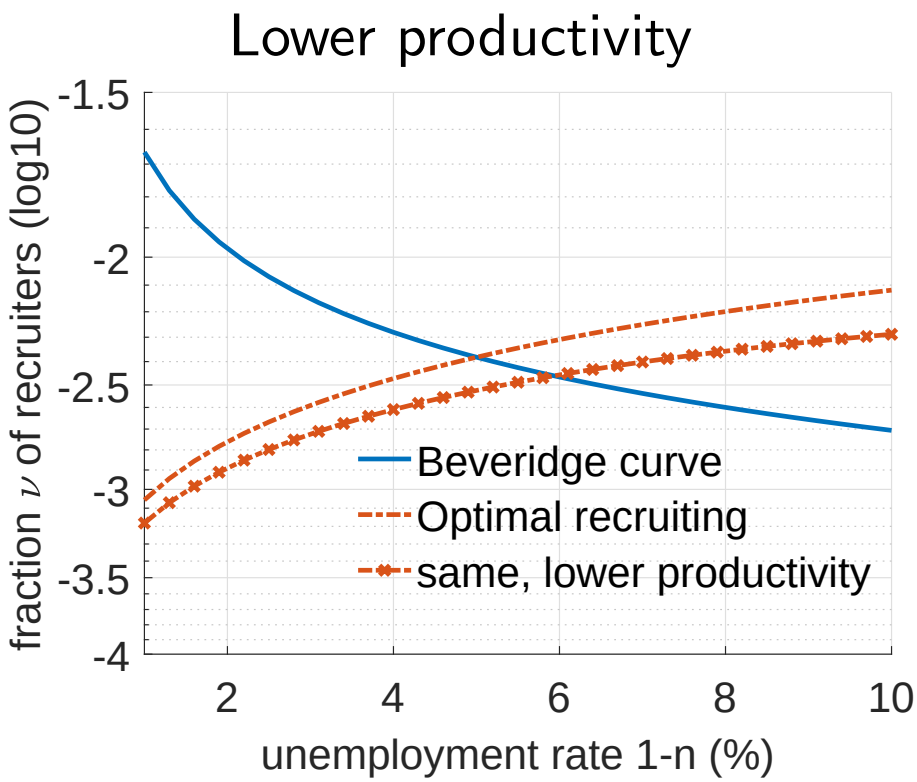
$$\bar{w} = \bar{\phi} \times (1 + \bar{\theta})\overline{mpl} + (1 - \bar{\phi}) \times \frac{\sigma}{1 - \tau_n} \left(\frac{\gamma \bar{c}}{1 + (\sigma - 1)\gamma \bar{n}} \right).$$

Exogenous processes

- Two exogenous AR(1) shocks:
  1. Labor productivity z_t.
     - Half-life of 3.5 years.
  2. Nash bargaining power ln $\frac{\phi_t}{1-\phi_t}$:
     - Baseline: half-life shocks of 8.5 years $\approx$ average control of presidency/house/senate after WWII.
     - Middle-run: half-life shocks of 20 years $\approx$ medium-term in Comín and Gertler (2006).
     - Short run: half-life of 3.5 years.

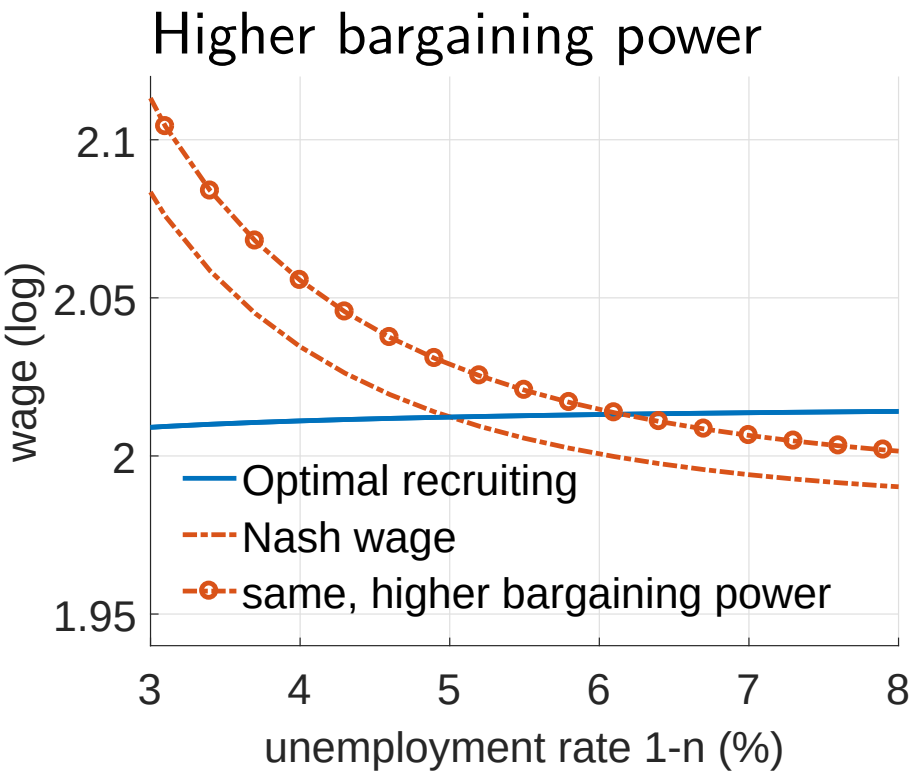
Identification (I)

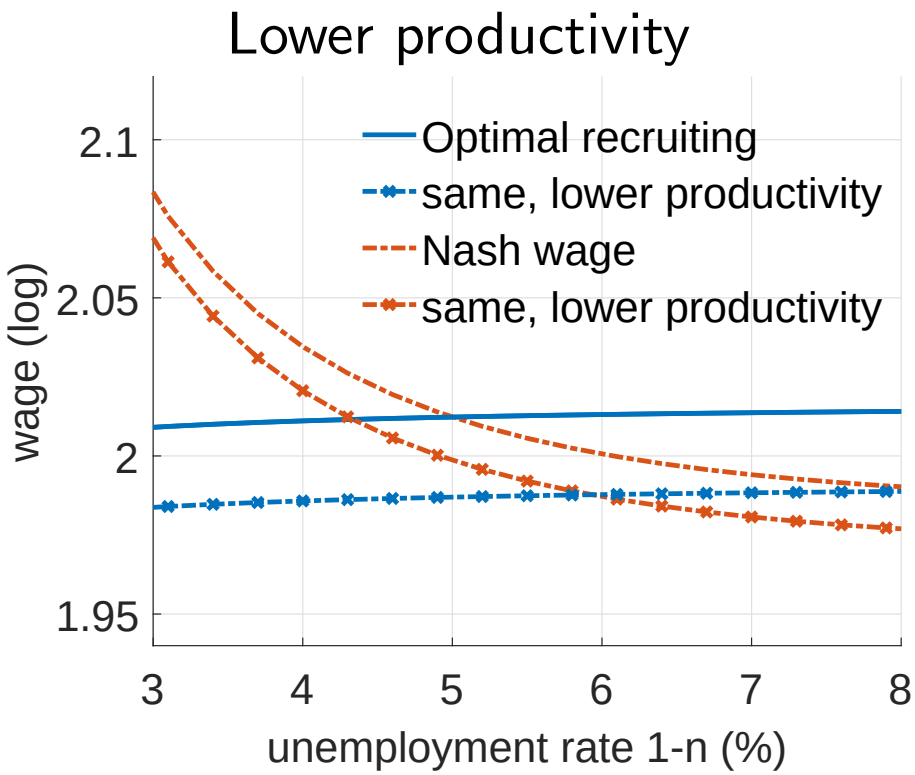




No constant consumption

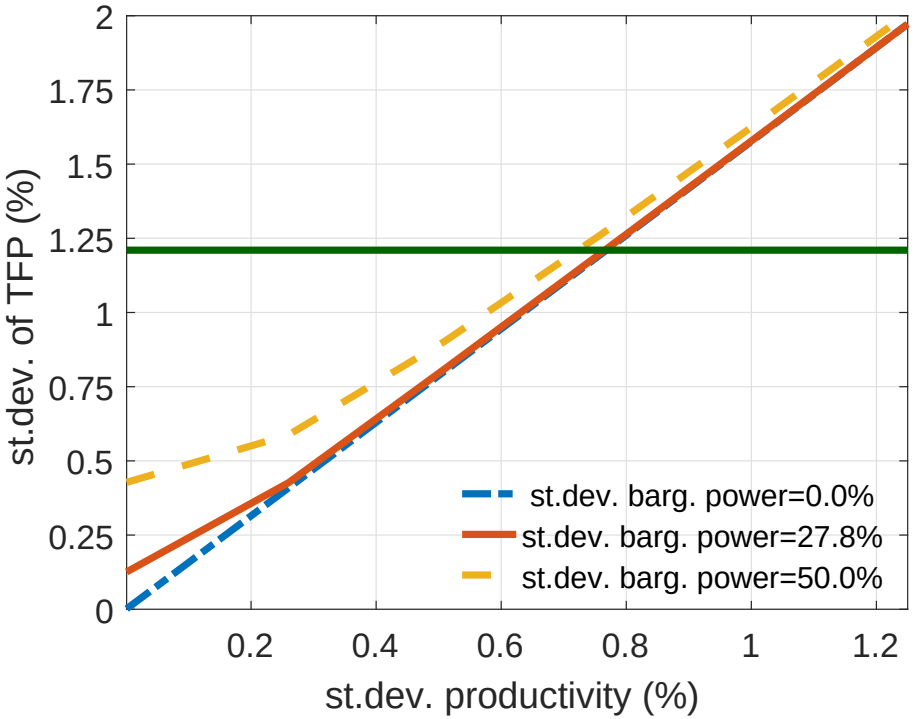
Identification (II)



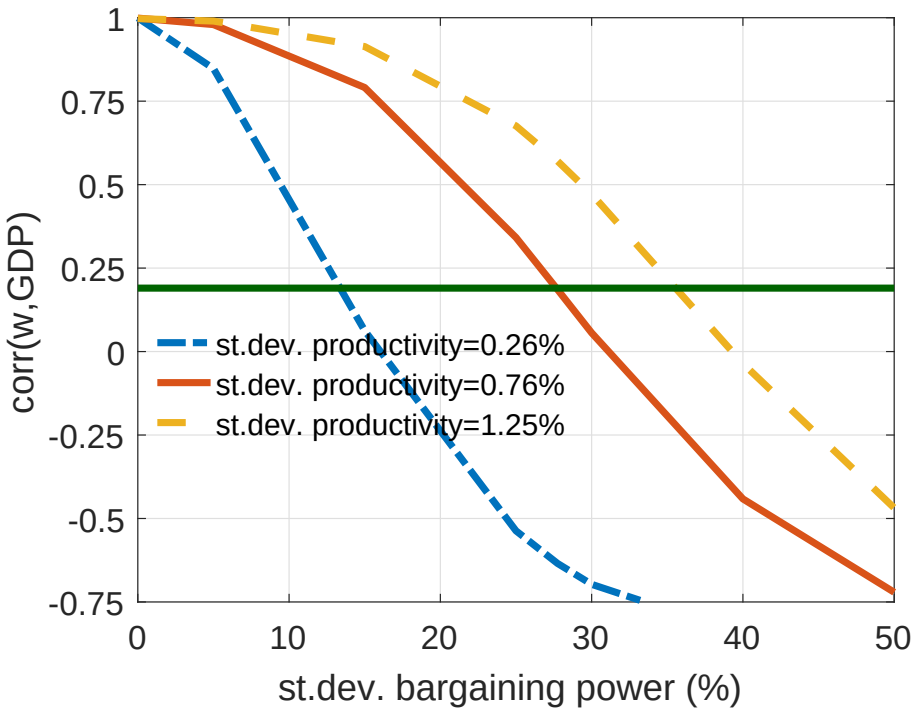


Identification (III)

Volatility of measured TFP



Cyclicality of wages



▸ Investment adj. costs

Moment matching (I)

- Solve using pruned 3rd-order approximation (Andreasen *et al.*, 2017).
- Select β, δ_0, α, and τ_k to match moments from corporate non-financial business sector:
  1. 31.2% gross capital share.
  2. 12.7% gross depreciation share.
  3. 29.9% share of taxes in net surplus.
  4. 2.3 annual K/Y ratio.
- Match labor market statistics following Shimer (2010).
- Parametrized productivity and bargaining power process to match:
  1. 1.6% annual labor productivity growth.
  2. Volatility of measured TFP given persistence $0.95^{1/3}$.
  3. Cyclicality of wages.
  4. Relative standard deviation of investment I relative to Y.

Approximation quality NIPA mapping

Moment matching (II)

Parameter	Value	
Risk aversion σ	2	Consumption of unemployed
Discount factor β	$0.976^{1/12}$	Corp. non-financial sector
Disutility of working γ	such that $\bar{n} = 0.95$	5% unemployment rate
Capital share α	0.31	Corp. non-financial sector
Elasticity of substitution ε	1	Cobb-Douglas
Depreciation δ_0	$5.5\%/12$	Corp. non-financial sector
Trend productivity growth g_z	$1.016^{1/12}$	Cooley and Prescott '95
Inv. adj. cost κ	$0.0575 \times (\delta_0)^{-2}$	Rel. volatility of I
Capacity util. cost δ_1	such that $\bar{u} = 1$	Normalization
Capacity util. cost δ_2	$2\delta_1$	BGP ela. w.r.t. $\frac{mpk_t}{u_t}$ of $\frac{1}{2}$
Separation rate x	3.3%	Shimer '05
Bargaining power $\bar{\phi}$	0.5	
Matching elasticity η	0.5	
Matching efficiency $\bar{\mu}$	2.3 ($\mu(\bar{\theta}) = 8.4$)	Recruiting efficiency
Income tax rate τ_n	0.4	Prescott '04
Corporate tax rate τ_k	0.3	Corp. non-financial sector
Productivity persistence ρ_z	$0.95^{1/3}$	Cooley and Prescott '95
Productivity s.d. ω_z	0.76%	TFP volatility
Barg. power persistence ρ_ϕ	$0.98^{1/3}$	8 year half-life
Bargaining power s.d. ω_ϕ	27.75%	Wage cyclicality

Partial filter

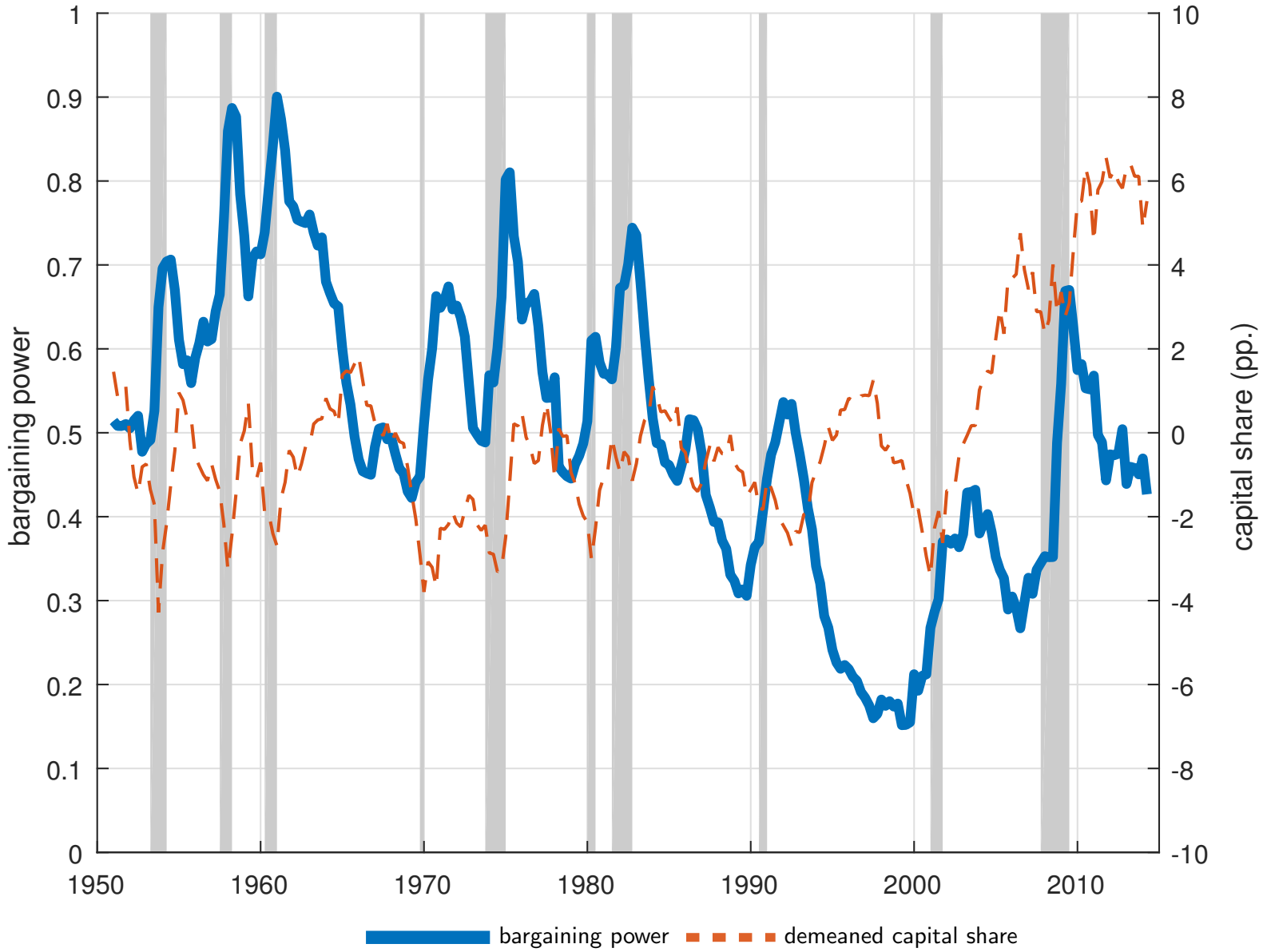
- What is the historical bargaining power implied by our model?
- Standard procedure: Particle filter.
  - Model not designed to fit many observables.
  - Pruned non-linear solution has many state variables.
- *Partial filter*:
  - Replace unobserved expectations in equilibrium conditions with conditional 1st and 2nd moments:

$$\mathbb{E}_t[x, y] = \mathbb{E}_t[x]\mathbb{E}_t[y] + \mathrm{Cov}_t[x, y],$$

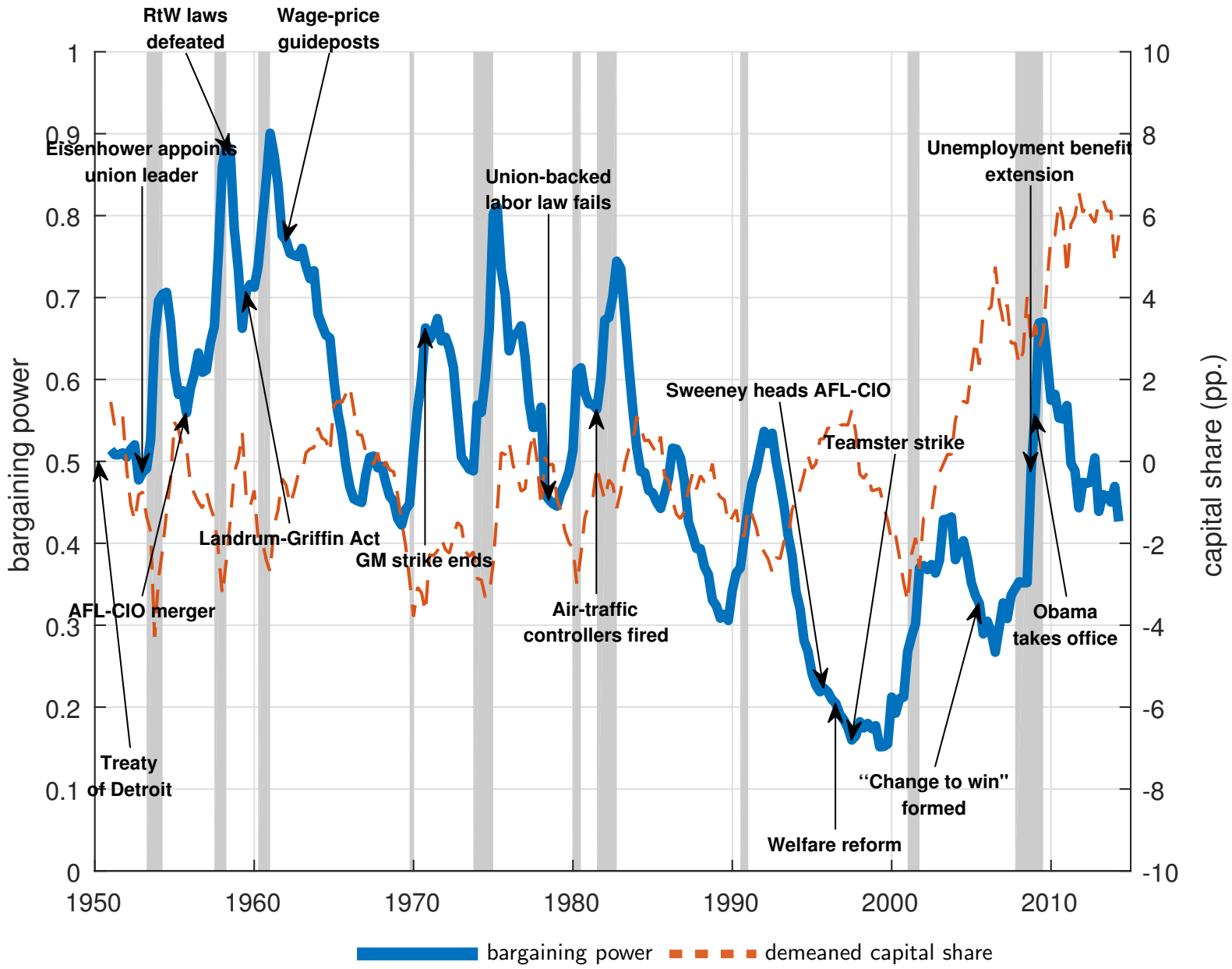
    for random variables x, y.
  - Further simplify first moments using first-order conditions.
  - Use standard statistical model to estimate the conditional moments.

▸ Quality of filter ▸ Details

Historical bargaining power



Historical bargaining power



Business cycle statistics

Federal Reserve Bank of Philadelphia

Standard deviations – 1947Q1–2015Q2

	Y [%]	$\frac{\text{std(I)}}{\text{std(Y)}}$	$\frac{\text{std(C)}}{\text{std(Y)}}$	std(ncs) [pp]	std(cs) [pp]	std(w) [%]	std(TFP) [%]
U.S. data	1.99	3.28	0.58	1.07	0.86	0.95	1.21
Baseline model	2.01	3.28	0.59	0.36	0.17	1.31	1.21
No barg. shock	1.31	3.73	0.49	0.18	0.02	1.14	1.20
RBC model	1.89	3.28	0.60	0.25	0.00	0.92	1.21

- Hansen (1985)-Rogerson(1988): Labor supplied one period in advance, wages set on the spot.
- Also, less interesting, RBC model with α shocks.

alternative RBC

Business cycle statistics

Federal Reserve Bank of Philadelphia

Cyclicality and persistence – 1947Q1–2015Q2

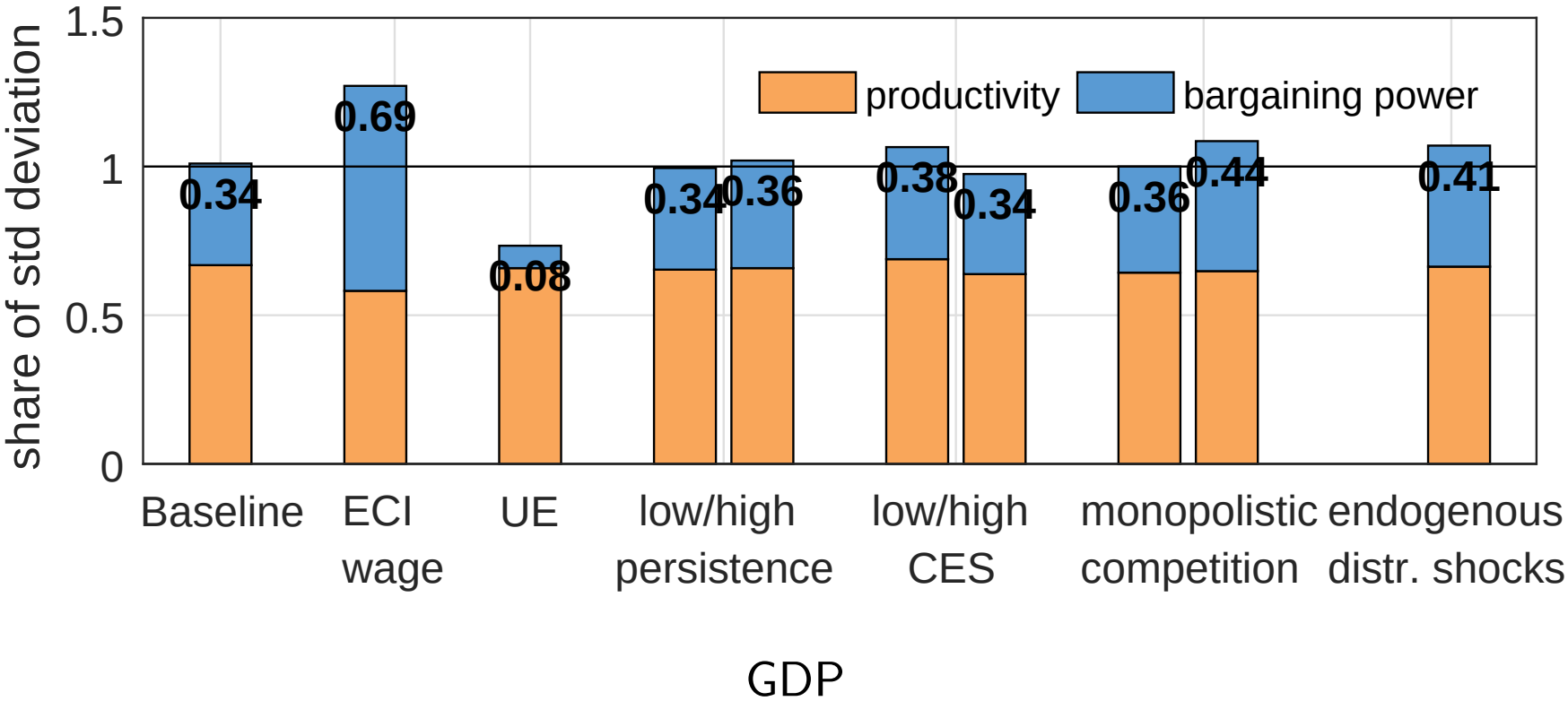
	Y	I	C	ncs	cs	w	TFP
U.S. data: cyclicality	1.00	0.91	0.84	0.57	0.36	0.19	0.78
Baseline model: cyclicality	1.00	0.96	0.98	0.87	0.33	0.19	0.71
No barg. shock: cyclicality	1.00	0.99	0.99	0.97	0.89	1.00	1.00
RBC model: cyclicality	1.00	0.98	0.99	0.98	NaN	0.96	0.99

	Y	I	C	ncs	cs	w	TFP
U.S. data: persistence	0.87	0.82	0.78	0.76	0.74	0.67	0.78
Baseline model: persistence	0.83	0.79	0.85	0.78	0.66	0.79	0.78
No barg. shock: persistence	0.79	0.80	0.80	0.78	0.60	0.78	0.78
RBC model: persistence	0.80	0.80	0.80	0.81	NaN	0.76	0.78

alternative RBC

Model variations

- Calibrate to composition-adjusted wage rate post 1980. show
- Match UE volatility instead of wages. show
- Lower and higher persistence of bargaining power shocks.
- Lower and higher elasticity of substitution in CES production. show
- Monopolistic competition with and without fixed cost. show
- Systematic redistribution. show



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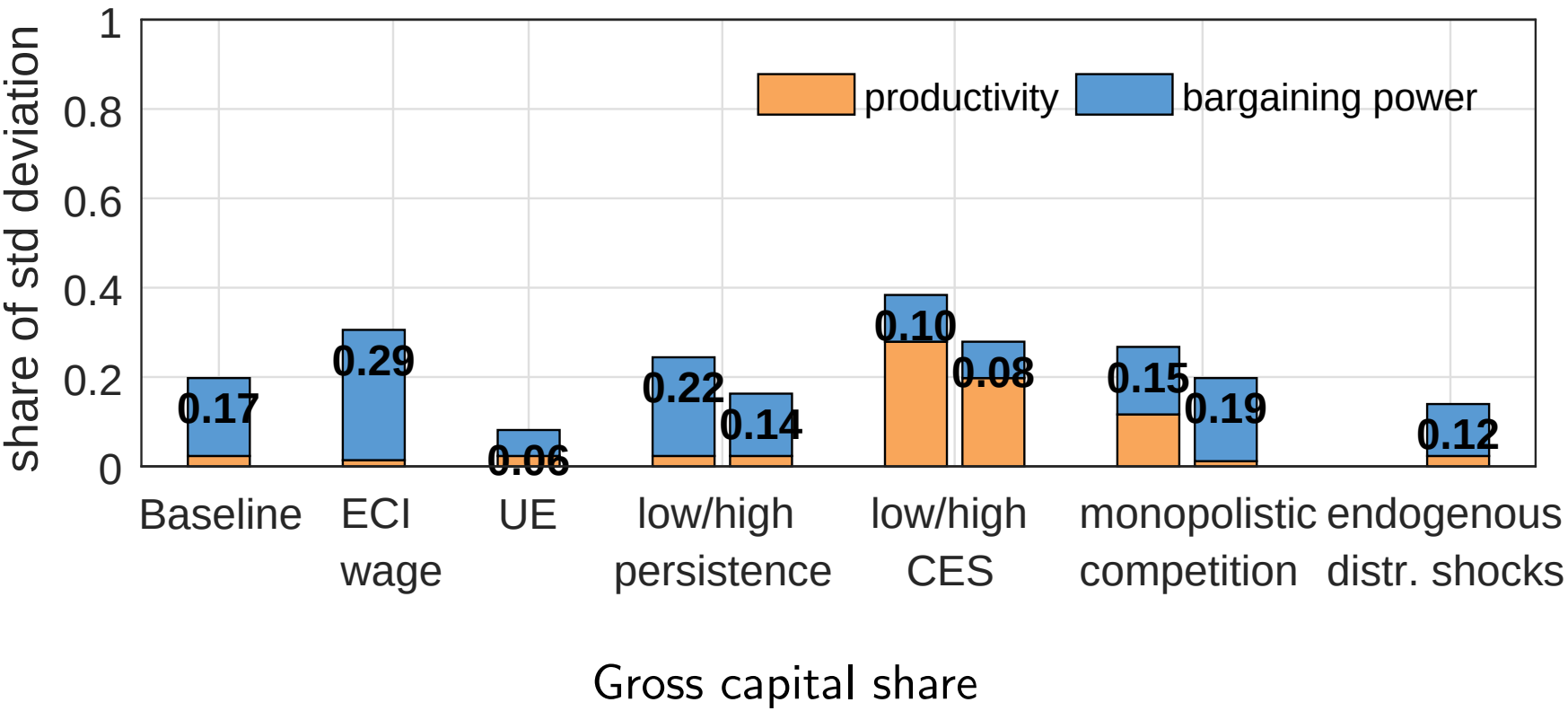
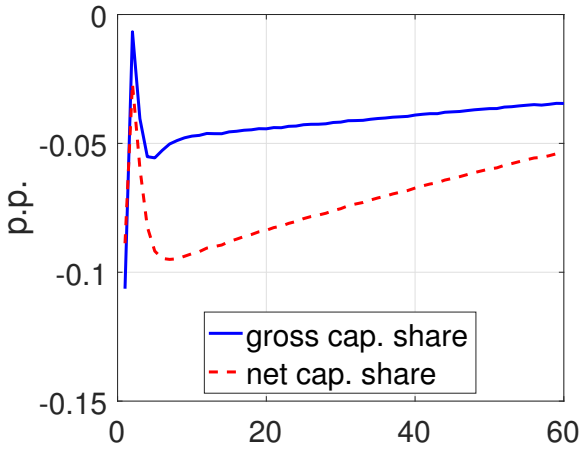
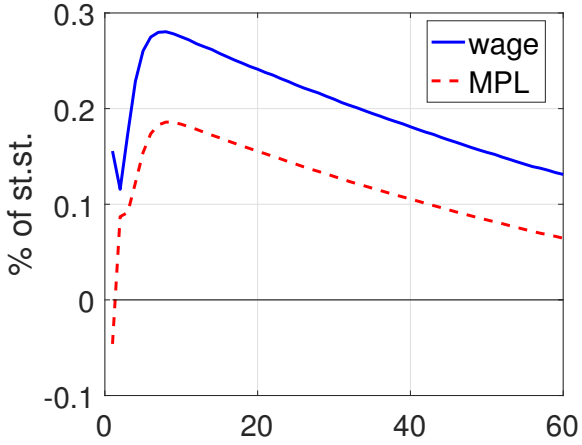


Dynamic effects of bargaining shock

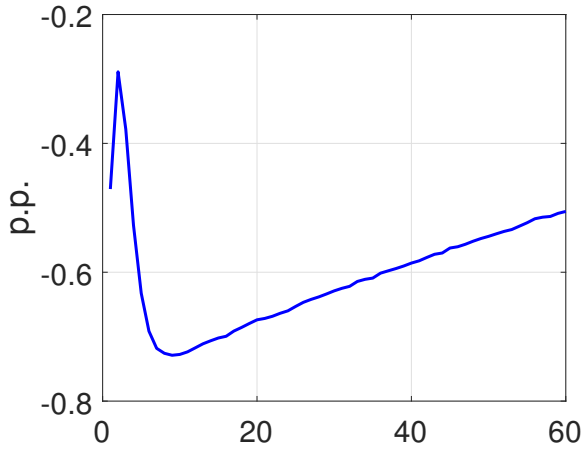
Gross / net capital share *cs*, *ncs*



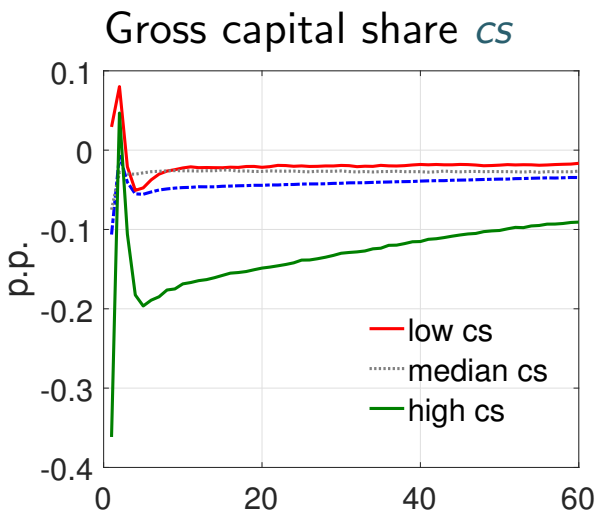
Wages *w* and *MPL*

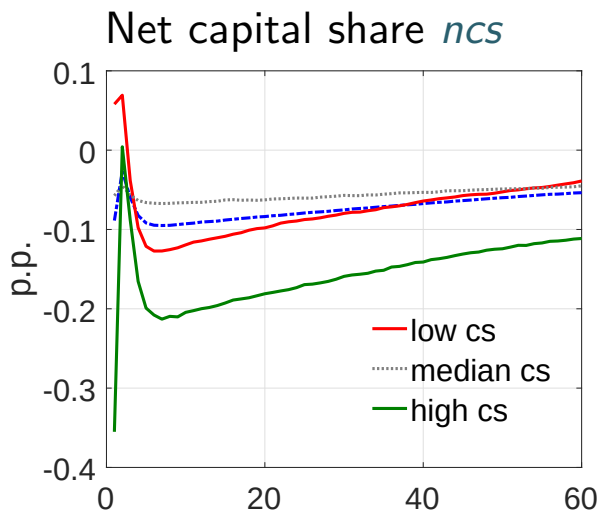


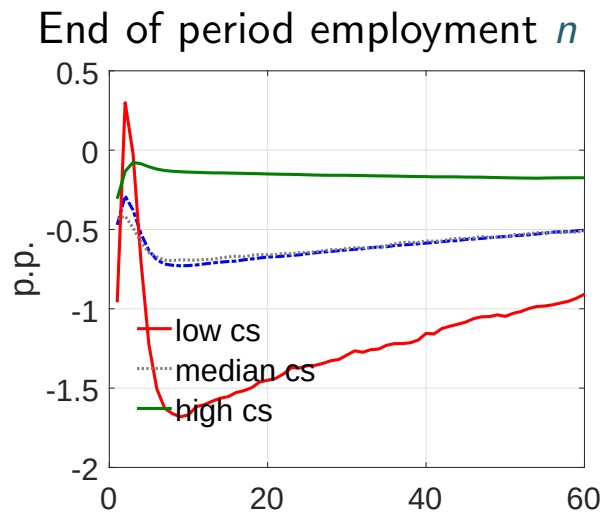
End of period employment *n*



State-dependent dynamics after bargaining shock







Summary

1. Document redistribution between capital and labor after political events
   - Change in government.
   - Right to work.
   - Minimum wages.
2. Quantify potential redistribution risk for U.S. economy
   - Model implies plausible historical bargaining power.
   - 1-s.d. redistribution shock leads to 0.6% contraction and a 0.1 p.p. increase in the labor share.
   - Redistribution risk accounts for 17% of capital share and 34% of output fluctuations.
   - Permanently increasing redistribution risk by 40% (U.S. $\nearrow$ U.K.) lowers welfare by 0.9 p.p. of consumption.
   - Further redistribution more harmful when income distribution polarized.

A final quote

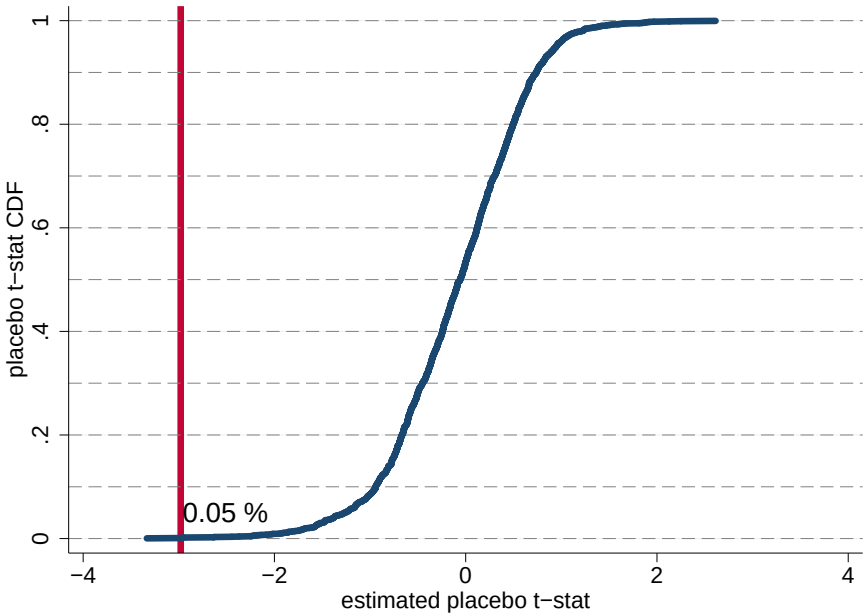
"The suggestion I want to make is that one important reason for the failure of real wages to keep up with productivity is that the division of rent in industry has been shifting against the labor side for several decades. This is a hard hypothesis to test in the absence of direct measurement. But the decay of unions and collective bargaining, the explicit hardening of business attitudes, the popularity of right-to-work laws, and the fact that the wage lag seems to have begun at about the same time as the Reagan presidency all point in the same direction: the share of wages in national value added may have fallen because the social bargaining power of labor has diminished. This is not to say that international competition and the biased nature of new technology have no role to play, only that they are not the whole story. Internal social change and the division of rent matter too."

Robert Solow, 2015

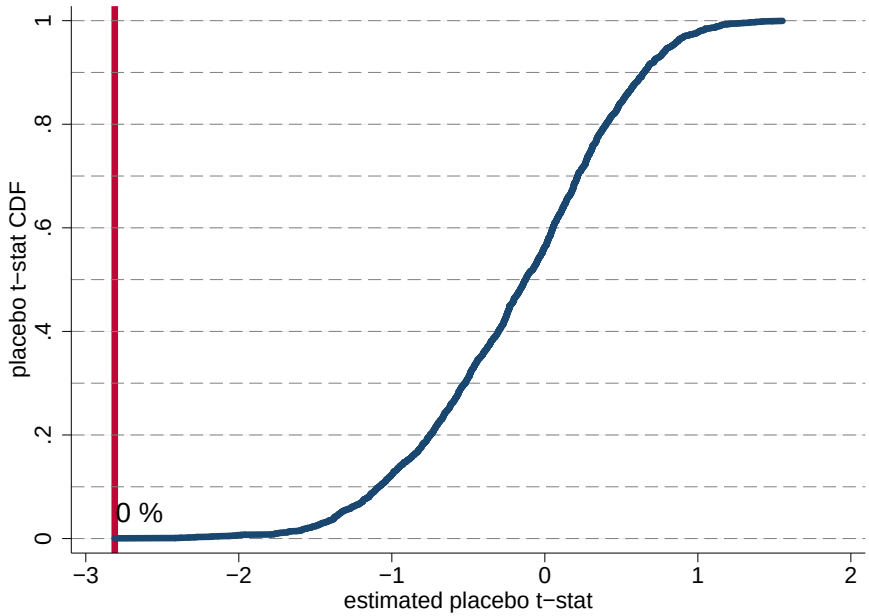
Placebo effects

Federal Reserve Bank of Philadelphia

Event episodes only

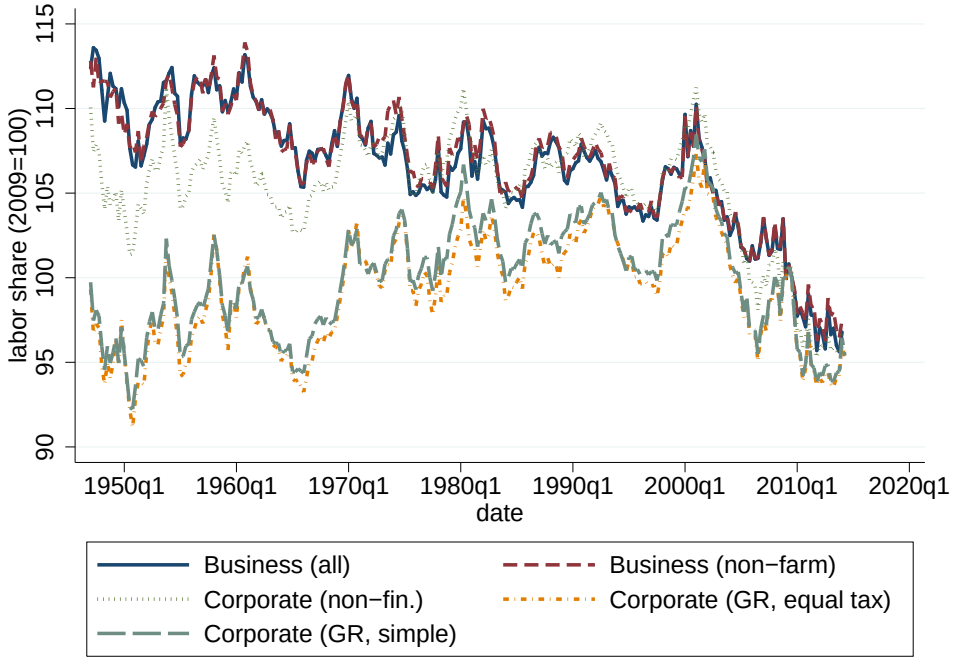


Event countries



back

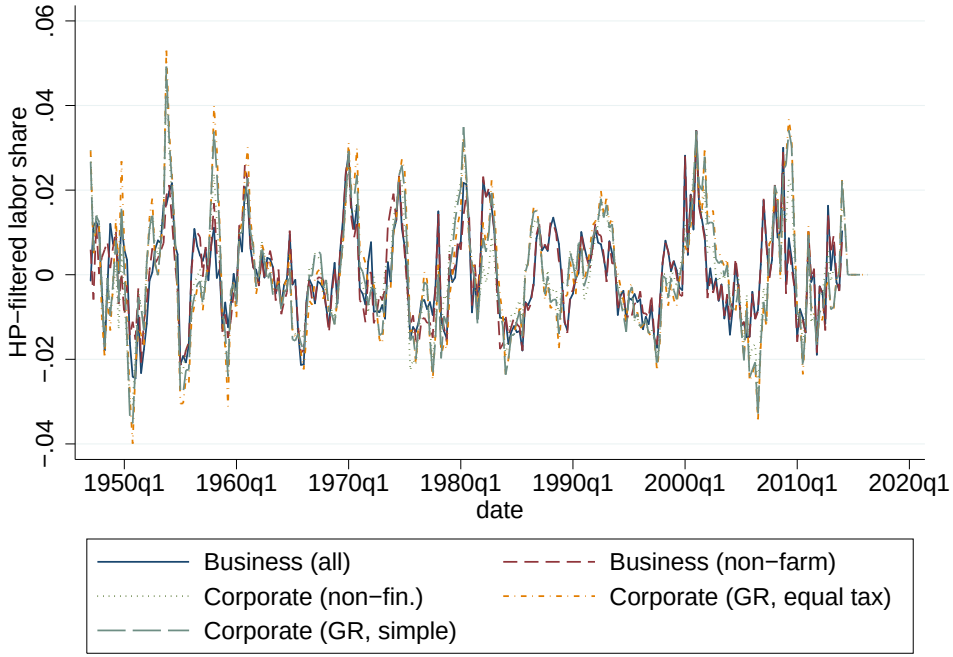
Different sectoral definitions matter little



Sector	std(ln ls_t) Raw	HP-filtered
Business (all)	3.6	1.09
Business (non-farm)	3.49	1.07
Corporate (non-fin.)	3.32	1.2
Corporate (GR, equal tax)	3.29	1.46
Corporate (GR, simple)	3.37	1.36

back

Different sectoral definitions matter little



Sector	std(ln ls_t) Raw	HP-filtered
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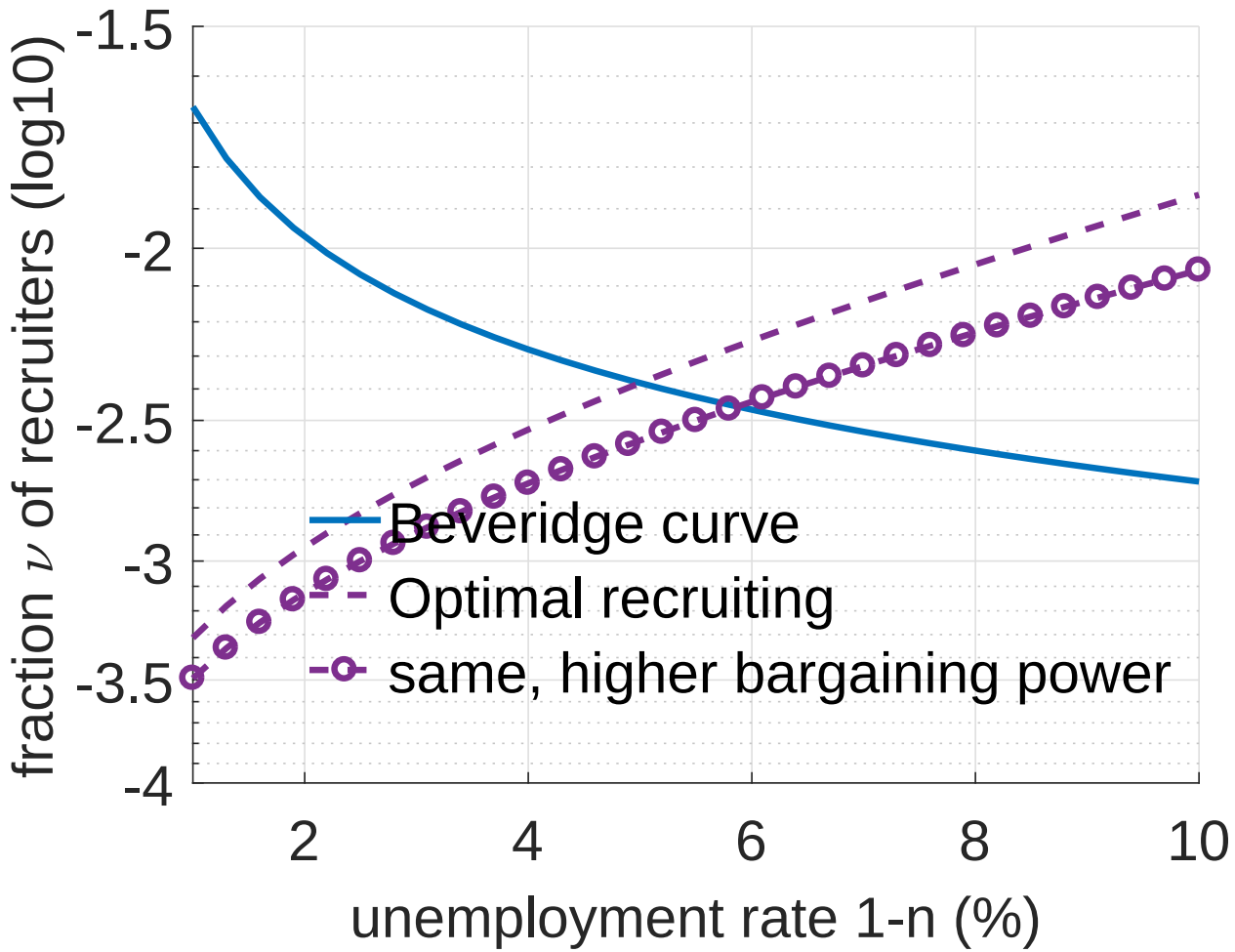
Corporate (GR, simple)	3.37	1.36

back

No constant v. constant consumption

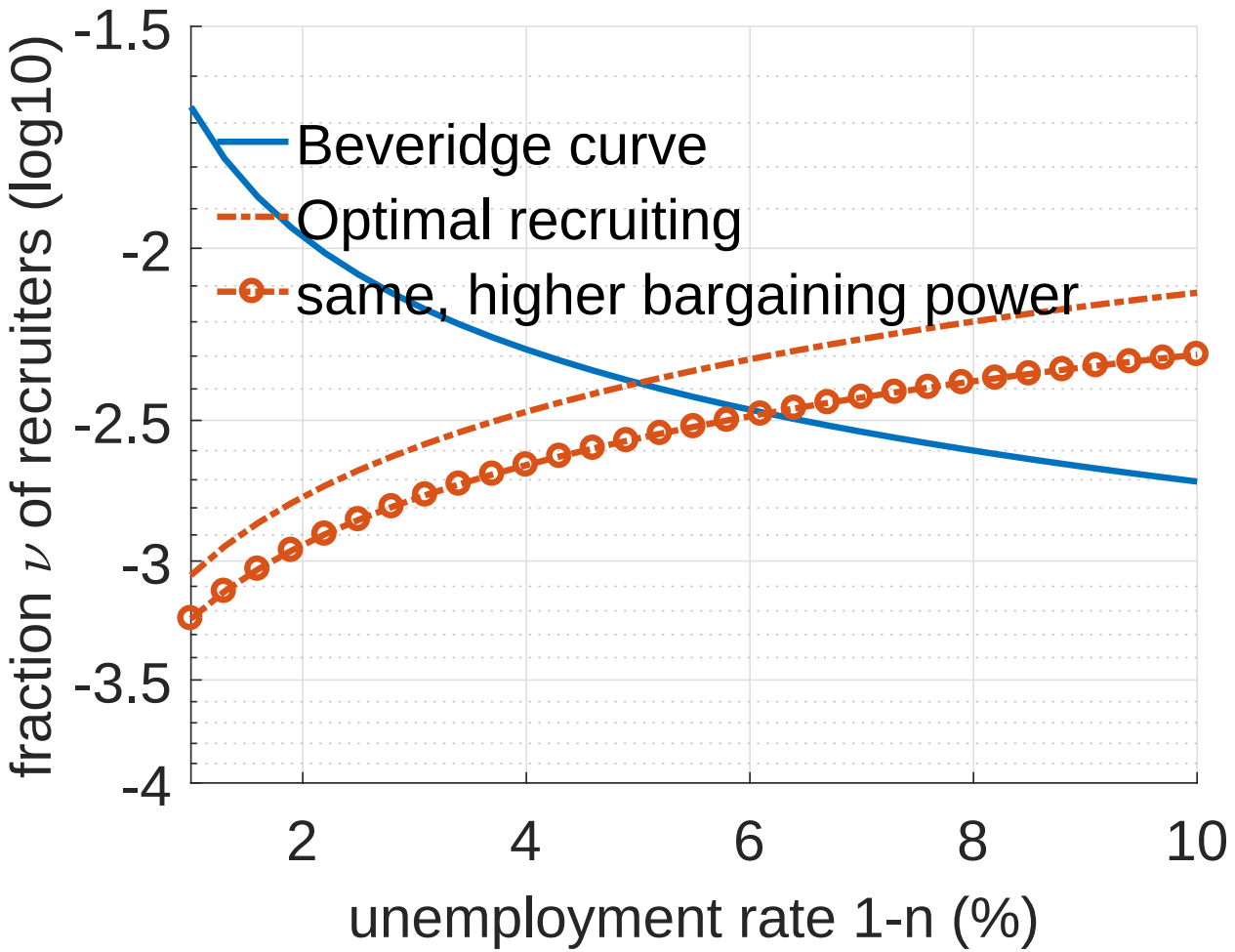
- Here: constant consumption.



back

No constant v. constant consumption

- Here: constant consumption.



back

Approximation quality

$$EE(s_t) = \left| 1 - \frac{u_c^{-1}\left(\mathbb{E}_t\left[\beta_t g_z^{-\sigma} u_c(c(s_{t+1}); n(s_{t+1}))R^i(s_{t+1})\right]; n(s_t)\right)}{c(s_t)} \right|$$

(a) Baseline search and matching model

Euler Equation	Mean	Min	p1	p5	Median	p95	p99	Max
Capital EE	-3.12	-7.67	-5.58	-4.98	-3.86	-2.42	-2.03	-1.56
Recruiting EE	-2.67	-6.38	-4.48	-3.84	-2.79	-2.25	-1.97	-1.55

(b) Search and matching model without bargaining shocks

Euler Equation	Mean	Min	p1	p5	Median	p95	p99	Max
Capital EE	-4.35	-8.87	-6.16	-5.49	-4.42	-3.97	-3.84	-3.64
Recruiting EE	-3.70	-8.04	-5.47	-4.83	-3.78	-3.29	-3.14	-2.87

(c) Hansen-Rogerson RBC model

Euler Equation	Mean	Min	p1	p5	Median	p95	p99	Max
Capital EE	-4.04	-8.41	-6.05	-5.34	-4.29	-3.52	-3.08	-2.53
Labor supply EE	-3.37	-7.51	-5.58	-4.86	-3.76	-2.77	-2.39	-1.86

back

Mapping the model to NIPA

- GDP = Final Goods Production + Recruiting.
- Consumption = Non-durable Goods + Services.
- Investment = Gross Private Domestic Investment + Durable Goods.
- $\frac{\text{Net operating surplus}_t}{\text{GVA}_t - \text{Indirect Taxes}_t}$ of nonfinancial corporate businesses Different sectors.

  $$= \underbrace{cs_t - \bar{\delta}\frac{K_{t-1}}{\text{GDP}_t}}_{\equiv ncs_t}.$$

  $$cs_t = 1 - \frac{n_{t-1}w_t}{yr_t}$$
- Measured TFP $= \widehat{GDP}_t - cs_t\hat{k}_{t-1} - (1 - cs_t)\hat{n}_{t-1}$.

back

Bargaining vs. factor share shock

- Hansen (1985)-Rogerson(1988): Labor supplied one period in advance, wages set on the spot.
- Introduce shock to labor share in production.
- Calibrate factor share volatility and adjustment cost to relative volatility of investment and volatility of GDP.

Standard deviations – 1947Q1–2015Q2

	Y [%]	$\frac{\text{std(I)}}{\text{std(Y)}}$	$\frac{\text{std(C)}}{\text{std(Y)}}$	std(ncs) [pp]	std(cs) [pp]	std(w) [%]	std(TFP) [%]
U.S. data	1.99	3.28	0.58	1.07	0.86	0.95	1.21
Baseline model	2.01	3.28	0.59	0.36	0.17	1.31	1.21
No barg. shock	1.31	3.73	0.49	0.18	0.02	1.14	1.20
RBC model with factor share shock	1.58	3.28	0.60	0.36	0.16	0.83	1.21
RBC without factor share shock	0.10	3.18	0.58	0.01	0.00	0.05	0.06

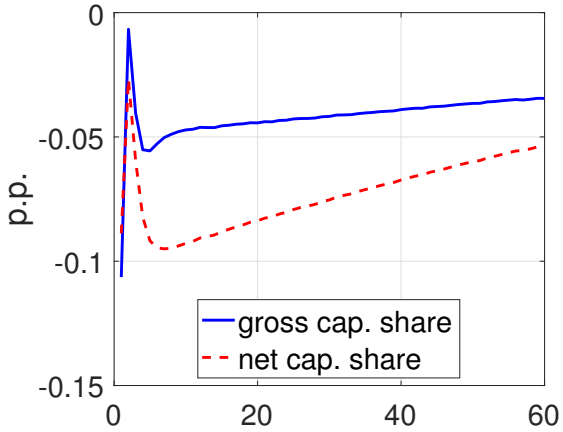
back

Bargaining vs. factor share shock

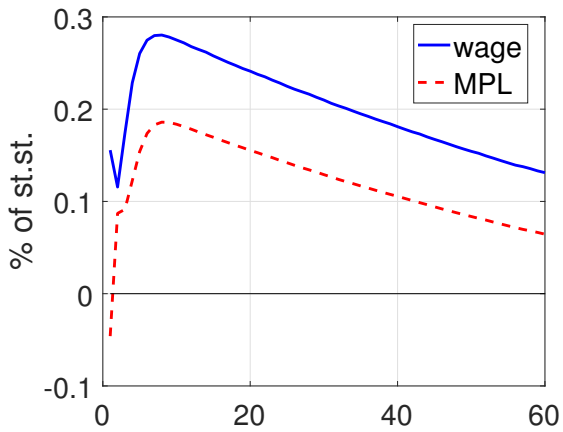
- RBC model: $w_t = (1-\alpha_t)\left(\frac{k}{n}\right)^{\alpha_t} \Rightarrow \frac{\partial \ln w_t}{-\partial \alpha_t} = \frac{1}{1-\bar{\alpha}} - \ln \frac{\bar{k}}{\bar{n}} \approx 1.5 - 5.7 < 0$

S&M

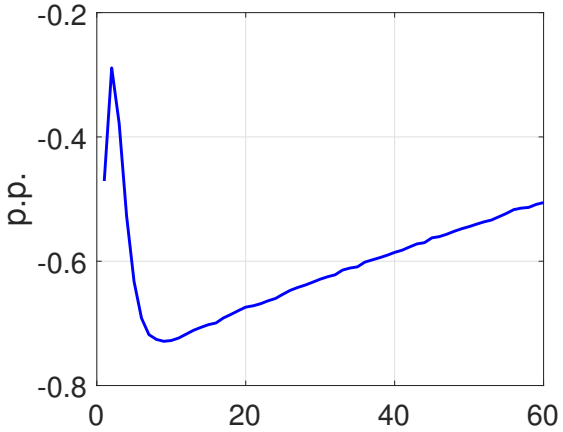
Gross / net capital share *cs*, *ncs*



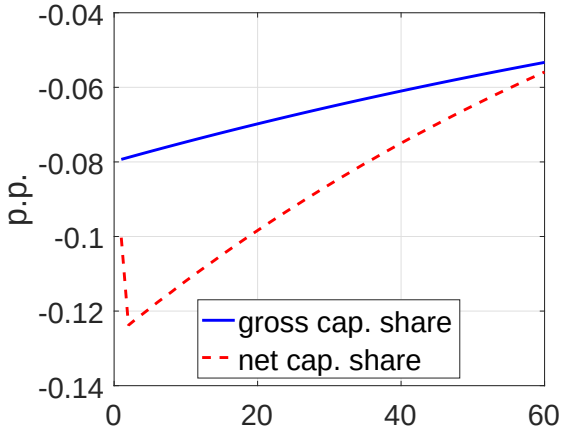
Wages *w* and *MPL*

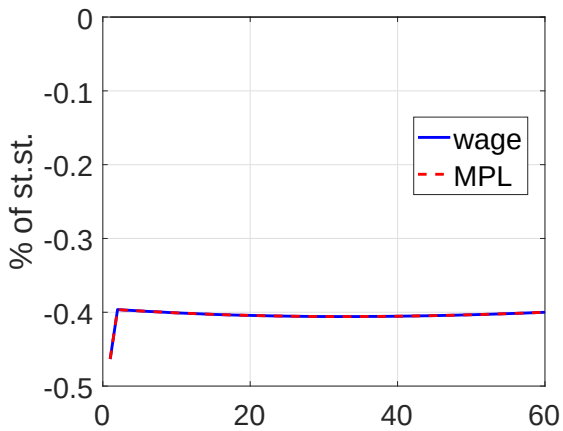


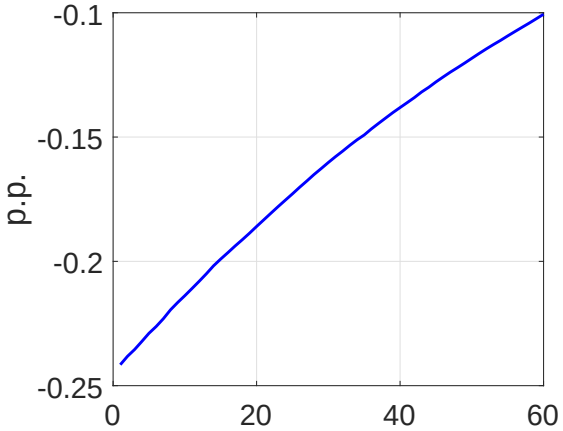
End of period employment *n*



RBC







Bargaining vs. factor share shock

- RBC model: $w_t = (1-\alpha_t)\left(\frac{k}{n}\right)^{\alpha_t} \Rightarrow \frac{\partial \ln w_t}{-\partial \alpha_t} = \frac{1}{1-\bar{\alpha}} - \ln \frac{\bar{k}}{\bar{n}} \approx 1.5 - 5.7 < 0$

Cyclicality and persistence – 1947Q1–2015Q2

	Y	I	C	ncs	cs	w	TFP
U.S. data: cyclicality	1.00	0.91	0.84	0.57	0.36	0.19	0.78
Baseline model: cyclicality	1.00	0.96	0.98	0.87	0.33	0.19	0.71
No barg. shock: cyclicality	1.00	0.99	0.99	0.97	0.89	1.00	1.00
RBC model with factor share shock	1.00	0.98	0.99	0.99	0.99	0.98	0.99
RBC without factor share shock	1.00	1.00	1.00	0.98	NaN	0.98	0.99

	Y	I	C	ncs	cs	w	TFP
U.S. data: persistence	0.87	0.82	0.78	0.76	0.74	0.67	0.78
Baseline model: persistence	0.83	0.79	0.85	0.78	0.66	0.79	0.78
No barg. shock: persistence	0.79	0.80	0.80	0.78	0.60	0.78	0.78
RBC model with factor share shock	0.79	0.79	0.80	0.80	0.78	0.77	0.78
RBC without factor share shock	0.80	0.80	0.80	0.82	NaN	0.76	0.78

back

Match ECI wage and post 1980 sample

Federal Reserve Bank of Philadelphia

Standard deviations – 1980Q2–2015Q2

	Y [%]	$\frac{\text{std(I)}}{\text{std(Y)}}$	$\frac{\text{std(C)}}{\text{std(Y)}}$	std(ncs) [pp]	std(cs) [pp]	std(w) [%]	std(TFP) [%]
U.S. data	1.77	3.06	0.47	0.94	0.72	0.48	0.96
Baseline model	2.01	3.28	0.59	0.36	0.17	1.31	1.21
No barg. shock	1.31	3.73	0.49	0.18	0.02	1.14	1.20
Recalibrated model	2.25	3.06	0.60	0.45	0.22	1.23	0.96
No barg. shock	1.03	3.57	0.48	0.15	0.01	0.90	0.95

back

Match ECI wage and post 1980 sample

Cyclicality and persistence – 1947Q1–2015Q2

	Y	I	C	ncs	cs	w	TFP
U.S. data: cyclicality	1.00	0.95	0.81	0.46	0.21	-0.25	0.68
Baseline model: cyclicality	1.00	0.96	0.98	0.87	0.33	0.19	0.71
No barg. shock: cyclicality	1.00	0.99	0.99	0.97	0.89	1.00	1.00
Recalibrated model: cyclicality	1.00	0.96	0.98	0.84	0.33	-0.25	0.59
No barg. shock: cyclicality	1.00	0.99	0.99	0.97	0.91	1.00	1.00

	Y	I	C	ncs	cs	w	TFP
U.S. data: persistence	0.89	0.86	0.76	0.78	0.74	0.78	0.79
Baseline model: persistence	0.83	0.79	0.85	0.78	0.66	0.79	0.78
No barg. shock: persistence	0.79	0.80	0.80	0.78	0.60	0.78	0.78
Recalibrated model: persistence	0.84	0.78	0.86	0.77	0.67	0.79	0.79
No barg. shock: persistence	0.79	0.80	0.80	0.79	0.61	0.78	0.78

back

Match UE volatility instead of wages volatility

Federal Reserve Bank of Philadelphia

Standard deviations – 1947Q1–2015Q2

	Y [%]	$\frac{\text{std(I)}}{\text{std(Y)}}$	$\frac{\text{std(C)}}{\text{std(Y)}}$	std(ncs) [pp]	std(cs) [pp]	std(w) [%]	std(u) [%]
U.S. data	1.99	3.28	0.58	1.07	0.86	0.95	0.83
Baseline model	2.01	3.28	0.59	0.36	0.17	1.31	1.86
No barg. shock	1.31	3.73	0.49	0.18	0.02	1.14	0.15
Recalibrated model	1.46	3.28	0.57	0.23	0.07	1.19	0.83
No barg. shock	1.31	3.47	0.54	0.18	0.02	1.16	0.14

back

Match UE volatility instead of wages volatility

Cyclicality and persistence – 1947Q1–2015Q2

	Y	I	C	ncs	cs	w	u
U.S. data: cyclicality	1.00	0.91	0.84	0.57	0.36	0.19	-0.76
Baseline model: cyclicality	1.00	0.96	0.98	0.87	0.33	0.19	-0.76
No barg. shock: cyclicality	1.00	0.99	0.99	0.97	0.89	1.00	-0.96
Recalibrated model: cyclicality	1.00	0.98	0.99	0.93	0.38	0.76	-0.57
No barg. shock: cyclicality	1.00	0.99	0.99	0.98	0.87	1.00	-0.96

	Y	I	C	ncs	cs	w	u
U.S. data: persistence	0.87	0.82	0.78	0.76	0.74	0.67	0.90
Baseline model: persistence	0.83	0.79	0.85	0.78	0.66	0.79	0.81
No barg. shock: persistence	0.79	0.80	0.80	0.78	0.60	0.78	0.82
Recalibrated model: persistence	0.80	0.79	0.81	0.78	0.55	0.78	0.84
No barg. shock: persistence	0.79	0.80	0.80	0.78	0.57	0.78	0.82

back

Elasticity of substitution

Federal Reserve Bank of Philadelphia

Standard deviations – 1947Q1–2015Q2

	Y [%]	$\frac{\text{std(I)}}{\text{std(Y)}}$	$\frac{\text{std(C)}}{\text{std(Y)}}$	std(ncs) [pp]	std(cs) [pp]	std(w) [%]	std(u) [%]	std(TFP) [%]
U.S. data	1.99	3.28	0.58	1.07	0.86	0.95	0.83	1.21
				$\varepsilon = .75$				
S&M I	2.12	3.28	0.58	0.43	0.33	1.67	1.92	1.21
S&M II	1.37	3.68	0.50	0.08	0.24	1.47	0.27	1.20
RBC	2.22	3.28	0.61	0.14	0.18	1.04	2.41	1.21
				$\varepsilon = 1.25$				
S&M I	1.94	3.28	0.59	0.41	0.24	1.08	1.81	1.21
S&M II	1.27	3.76	0.48	0.33	0.17	0.93	0.09	1.20
RBC	1.62	3.28	0.59	0.35	0.14	0.83	0.63	1.21

back

Elasticity of substitution

Federal Reserve Bank of Philadelphia

Cyclicality and persistence – 1947Q1–2015Q2

	Y	I	C	ncs	cs	w	u	TFP
U.S. data	1.00	0.91	0.84	0.57	0.36	0.19	-0.76	0.78
				$\varepsilon = 0.75$				
S&M I	1.00	0.97	0.98	0.61	-0.02	0.19	-0.79	0.72
S&M II	1.00	0.99	0.99	-0.79	-0.99	1.00	-0.95	0.99
RBC	1.00	0.97	0.99	0.80	-0.95	0.95	-0.77	0.99
				$\varepsilon = 1.25$				
S&M I	1.00	0.96	0.97	0.84	0.42	0.19	-0.75	0.70
S&M II	1.00	0.99	0.99	0.99	1.00	1.00	-0.96	1.00
RBC	1.00	0.99	0.99	0.99	0.98	0.98	-0.93	0.99

back

Elasticity of substitution

	Y	I	C	ncs	cs	w	u	TFP
U.S. data	0.87	0.82	0.78	0.76	0.74	0.67	0.90	0.78
				$\varepsilon = 0.75$				
S&M I	0.83	0.79	0.85	0.75	0.72	0.78	0.80	0.79
S&M II	0.80	0.80	0.80	0.62	0.79	0.78	0.82	0.78
RBC	0.80	0.80	0.80	0.24	0.75	0.75	0.79	0.79
				$\varepsilon = 1.25$				
S&M I	0.83	0.78	0.84	0.77	0.74	0.79	0.81	0.78
S&M II	0.79	0.79	0.79	0.79	0.78	0.78	0.82	0.78
RBC	0.80	0.80	0.80	0.79	0.78	0.77	0.79	0.78

back

Monopolistic competition

Federal Reserve Bank of Philadelphia

Standard deviations – 1947Q1–2015Q2

	Y [%]	$\frac{\text{std(I)}}{\text{std(Y)}}$	$\frac{\text{std(C)}}{\text{std(Y)}}$	std(ncs) [pp]	std(cs) [pp]	std(w) [%]	std(u) [%]	std(TFP) [%]
U.S. data	1.99	3.28	0.58	1.07	0.86	0.95	0.83	1.21
				Fixed cost				
S&M I	1.99	3.28	0.54	0.49	0.23	1.14	1.66	1.21
S&M II	1.28	3.73	0.41	0.28	0.10	0.99	0.14	1.18
RBC	1.81	3.28	0.54	0.39	0.13	0.78	0.87	1.21
				No fixed cost				
S&M I	2.16	3.28	0.59	0.38	0.17	1.25	1.95	1.21
S&M II	1.29	3.75	0.48	0.18	0.01	1.12	0.15	1.18
RBC	1.89	3.28	0.60	0.25	0.00	0.92	1.06	1.21

back

Monopolistic competition

Federal Reserve Bank of Philadelphia

Cyclicality – 1947Q1–2015Q2

	Y	I	C	ncs	cs	w	u	TFP
U.S. data	1.00	0.91	0.84	0.57	0.36	0.19	-0.76	0.78
				Fixed cost				
S&M I	1.00	0.96	0.96	0.95	0.83	0.19	-0.78	0.79
S&M II	1.00	0.99	0.99	0.99	1.00	1.00	-0.97	1.00
RBC	1.00	0.99	0.99	0.99	1.00	0.97	-0.97	0.99
				No fixed cost				
S&M I	1.00	0.96	0.98	0.87	0.33	0.19	-0.79	0.74
S&M II	1.00	0.99	0.99	0.97	0.88	1.00	-0.96	1.00
RBC	1.00	0.98	0.99	0.98	NaN	0.96	-0.95	0.99

back

Monopolistic competition

Persistence – 1947Q1–2015Q2

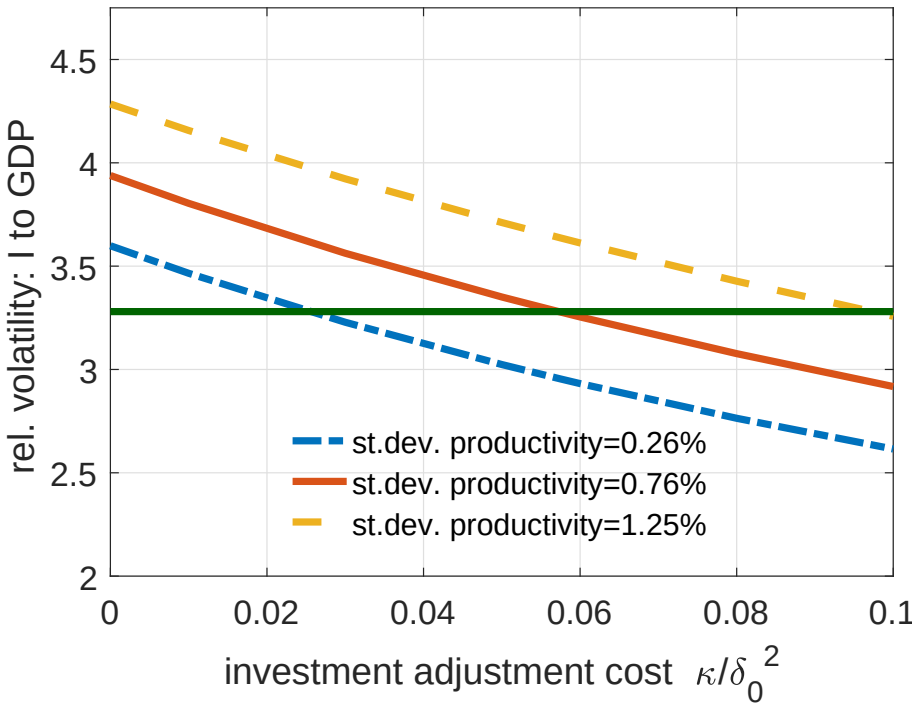
	Y	I	C	ncs	cs	w	u	TFP
U.S. data	0.87	0.82	0.78	0.76	0.74	0.67	0.90	0.78
				Fixed cost				
S&M I	0.83	0.78	0.85	0.83	0.79	0.79	0.82	0.79
S&M II	0.80	0.80	0.80	0.80	0.78	0.78	0.82	0.79
RBC	0.80	0.80	0.80	0.81	0.80	0.77	0.79	0.79
				No fixed cost				
S&M I	0.83	0.79	0.85	0.79	0.64	0.78	0.80	0.79
S&M II	0.80	0.80	0.80	0.79	0.60	0.78	0.82	0.78
RBC	0.80	0.80	0.80	0.81	NaN	0.77	0.79	0.79

back

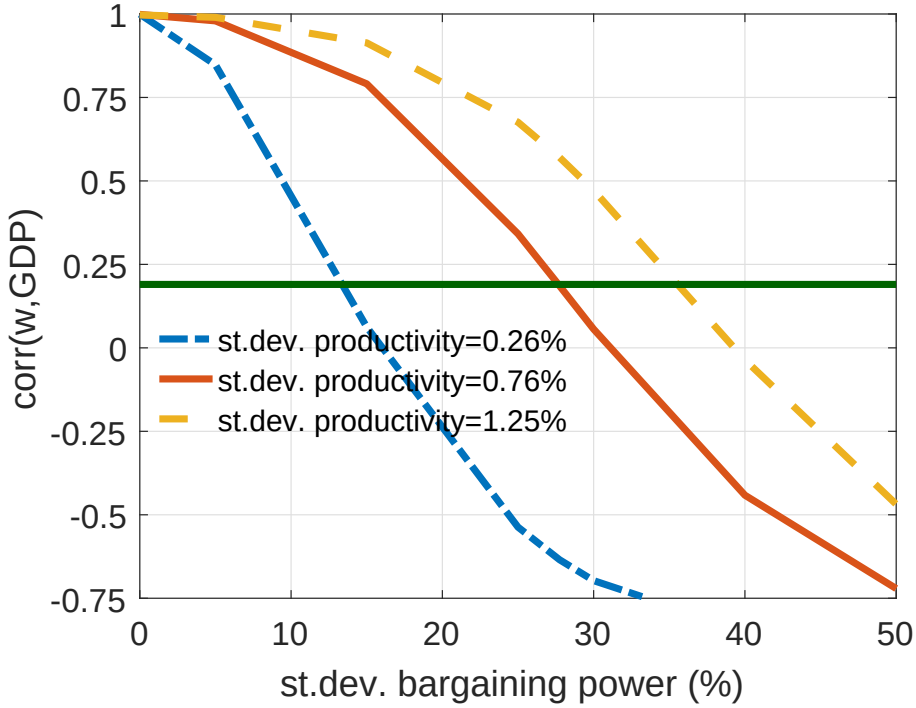
Identification (IV)

Federal Reserve Bank of Philadelphia

Relative volatility of investment



Cyclicality of wages

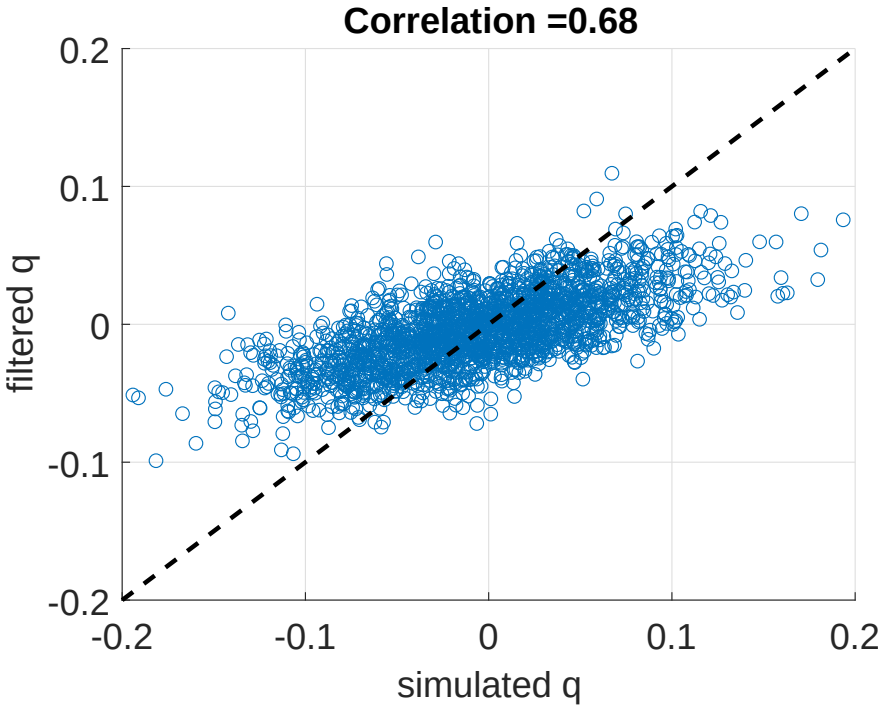


▸ Standard deviations

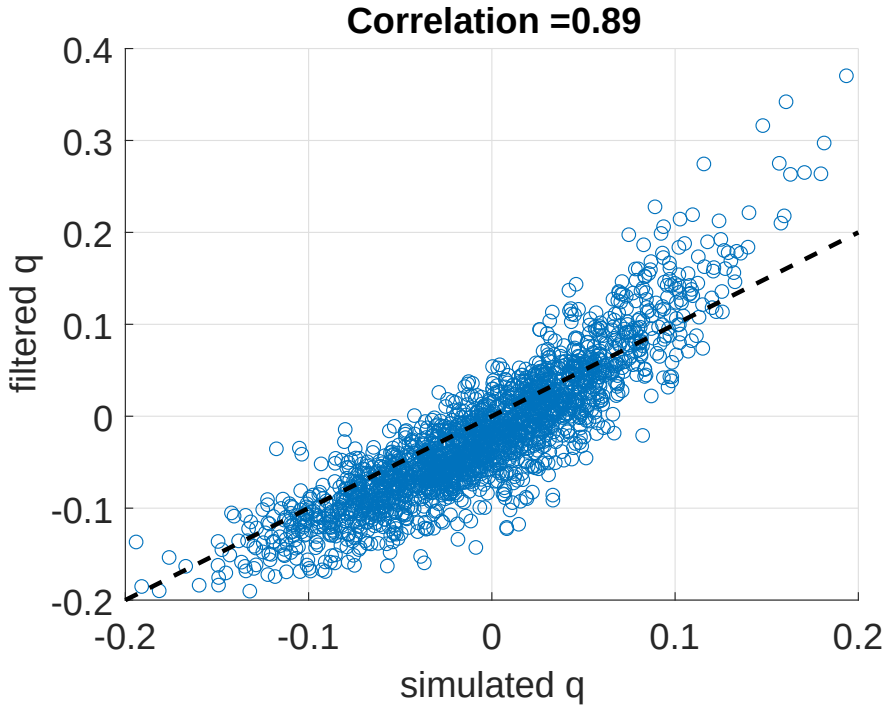
Quality of partial filter

- Solve RBC model with CEE (2005) adjustment costs using pruned 3rd order perturbation.
- Simulate model with four shocks.
- Use data on r_t^f, mpk_t, c_t to filter out Tobin's q_t.

Kalman filter



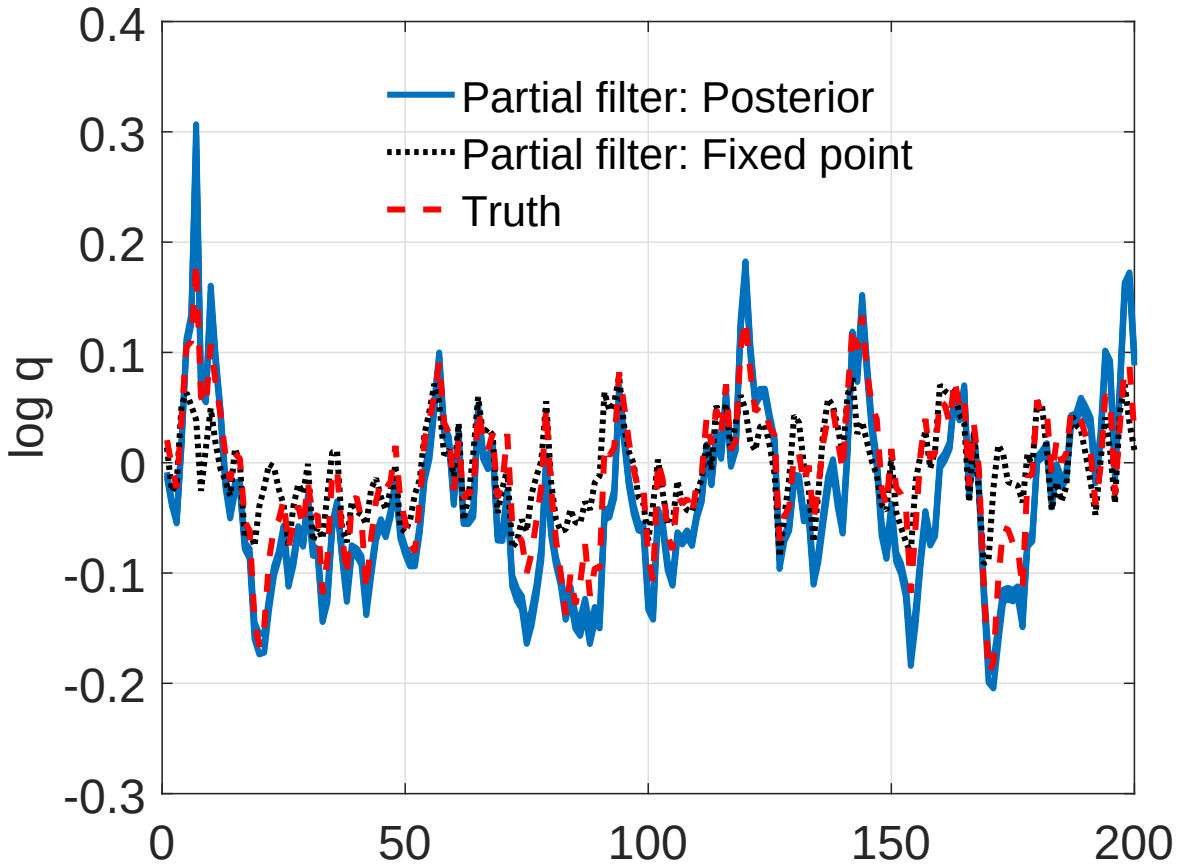
Partial filter



Back to filter

Quality of partial filter

- Solve RBC model with CEE (2005) adjustment costs using pruned 3rd order perturbation.
- Simulate model with four shocks.
- Use data on r_t^f, mpk_t, c_t to filter out Tobin's q_t.



Back to filter

Partial filter

- Bargaining power enters only wage-setting.
- Wage-setting equation implies:

$$
\begin{aligned}
& e^{\ln \frac{\phi_t}{1-\phi_t}} \left(\left(mpl_t \left(1 + \frac{1-x}{\mu(\theta_t))} \right) - w_t \right) \right. \\
& \left. - (1 - x - f_t(\theta_t)) e^{\kappa_\phi + (\rho_\phi - 1) \ln \frac{\phi_t}{1-\phi_t} + \frac{1}{2}\omega_\phi^2} \left(\mathrm{Cov}_t[\circ] + \frac{mpl_t}{\mu(\theta_t)} \right) \right) \\
= & w_t - \frac{1}{1-\tau_n} \left(\frac{c_t}{1 + (\sigma - 1)\gamma n_{t-1}} \right) \gamma\sigma, \qquad \text{where} \\
\mathrm{Cov}_t[\circ] = & \mathrm{Cov}_t \left[\ln \frac{\phi_t}{1-\phi_t}, m_{t+1} \left(mpl_{t+1} \left(1 + \frac{1-x}{\mu(\theta_{t+1})} \right) - w_{t+1} \right) \right].
\end{aligned}
$$

- Given Cov_t, solve for $\ln \frac{\phi_t}{1-\phi_t}$. Iterate in Gibbs-Sampler.

Back

Partial filter: Implementation

- Implement via Gibbs sampler.
- Initialize $\text{Cov}_t = 0$.
- For $d = 1, \ldots, D$, we iterate on the following steps:
  1. Given the previous draw of the bargaining power sequence, draw parameters:
     - 1.1 Draw the covariance term $\text{Cov}_t[\circ]^{(d)}$ from the posterior for a VAR in $\ln\left(\frac{\phi_{t+1}}{1-\phi_{t+1}}\right)^{(d-1)}$, $m_{t+1}\left(mpl_{t+1}\left(1+\frac{1-x}{\mu(\theta_{t+1})}\right)-w_{t+1}\right)$, mpl_t, θ_t, w_t, and c_t.
     - 1.2 Draw $\rho_\phi^{(d)}, \omega_\phi^{(d)}$ from the posterior for the AR(1) process for $\ln\left(\frac{\phi_t}{1-\phi_t}\right)^{(d-1)}$.
  2. Given observables, $\text{Cov}_t[\circ]^{(d)}$, $\rho_\phi^{(d)}$ and $\omega_\phi^{(d)}$, solve wage setting equation period by period for $\left(\frac{\phi_t}{1-\phi_t}\right)^{(d)}$.

Back

Partial filter: Data

- SDF $m_{t+1} = m(c_{t+1}, c_t, n_{t+1}, n_t)$ straight from model.
- For $\epsilon = 1$, $mpl_t \propto \frac{y_t}{n_t}$.
- Adjust job-finding rate for quarterly data frequency.
- Data:
  1. n_t: One minus unemployment rate.
  2. y_t: Real gross value added in non-farm business sector.
  3. w_t: Real hourly compensation in non-farm business sector.
  4. c_t: Non-durable and services PCE per capita.
  5. θ_t: Vacancies / unemployed.

Back

Systematic component of bargaining shocks

$$\phi_t = (1-\rho_\phi)\left(\bar{\phi} + \frac{(1-n_{t-1}) - (1-\bar{n})}{0.01}\omega_\phi\right) + \rho_\phi \phi_{t-1} + \omega_\phi \epsilon_t^\phi.$$

Standard deviations – 1947Q1–2015Q2

	Y [%]	$\frac{\text{std(I)}}{\text{std(Y)}}$	$\frac{\text{std(C)}}{\text{std(Y)}}$	std(ncs) [pp]	std(cs) [pp]	std(w) [%]	std(TFP) [%]
U.S. data	1.77	3.06	0.47	0.94	0.72	0.48	0.96
Baseline model	2.01	3.28	0.59	0.36	0.17	1.31	1.21
No barg. shock	1.31	3.73	0.49	0.18	0.02	1.14	1.20
Recalibrated model	2.13	3.28	0.65	0.34	0.12	1.28	1.21
No barg. shock	1.32	4.03	0.43	0.19	0.02	1.13	1.20

back

Systematic component of bargaining shocks

$$\phi_t = (1-\rho_\phi)\left(\bar{\phi} + \frac{(1-n_{t-1}) - (1-\bar{n})}{0.01}\omega_\phi\right) + \rho_\phi \phi_{t-1} + \omega_\phi \epsilon_t^\phi.$$

Cyclicality and persistence – 1947Q1–2015Q2

	Y	I	C	ncs	cs	w	TFP
U.S. data: cyclicality	1.00	0.95	0.81	0.46	0.21	-0.25	0.68
Baseline model: cyclicality	1.00	0.96	0.98	0.87	0.33	0.19	0.71
No barg. shock: cyclicality	1.00	0.99	0.99	0.97	0.89	1.00	1.00
Recalibrated model: cyclicality	1.00	0.92	0.94	0.91	0.29	0.19	0.72
No barg. shock: cyclicality	1.00	0.99	0.99	0.97	0.92	1.00	1.00

	Y	I	C	ncs	cs	w	TFP
U.S. data: persistence	0.89	0.86	0.76	0.78	0.74	0.78	0.79
Baseline model: persistence	0.83	0.79	0.85	0.78	0.66	0.79	0.78
No barg. shock: persistence	0.79	0.80	0.80	0.78	0.60	0.78	0.78
Recalibrated model: persistence	0.84	0.75	0.86	0.80	0.66	0.78	0.79
No barg. shock: persistence	0.80	0.80	0.80	0.79	0.62	0.78	0.78