Sectoral Shocks, Reallocation, and Labor Market Policies

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These views are those of the authors and not necessarily those of the Board of Governors or the Federal Reserve System.

Motivation

+ Recent recessions had heterogeneous sectoral effects
+ Ongoing policy debate: support employment vs reallocation
+ Different policy instruments: unemployment insurance (UI) vs wage subsidies (WS)

Questions:

1) How do sector-specific shocks transmit across different labor markets?
2) How useful are policies in fighting sectoral shocks and fostering reallocation?

This paper

What we do

+ Search model of the labor market with sector-specific shocks with:
  - Sectoral reallocation, recall option, job-specific human capital, wage rigidity.
  - Calibration: flexible and rigid labor market.
+ Policy evaluation: UI vs WS in a short-lived (COVID-like) sectoral recession.

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Main findings

- *Flexible*: UI preferred - improves reallocation even though job creation distorted.
- *Rigid*: WS preferred - preserves human capital in a low job-finding rate market.
- As shock gets more persistent, distortion to job creation under UI more costly.

▸ Related Literature

Sectoral reallocation: cross-country evidence

Measuring reallocation: Chodorow-Reich and Wieland (CRW) index

Measurement: employment dispersion index

+ Reallocation between t and $t+j$ (I industries):

$$R_{t,t+j} = \frac{1}{2} \sum_{i}^{I} s_{i,t} \left| \frac{1 + g_{i,t,t+j}}{1 + g_{t,t+j}} - 1 \right|$$

+ g is employment (e) growth, with $s_i = \frac{e_i}{e}$

+ $R_{t,t+j} = 0$: $g_i = g \ \ \forall i$ between t and $t+j$

+ $R_{t,t+j} = 1$: all $e_i > 0$ at t disappears by $t+j$

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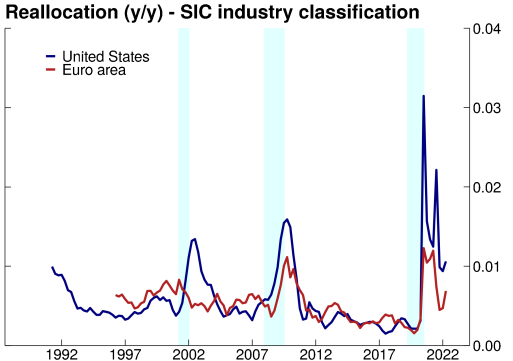
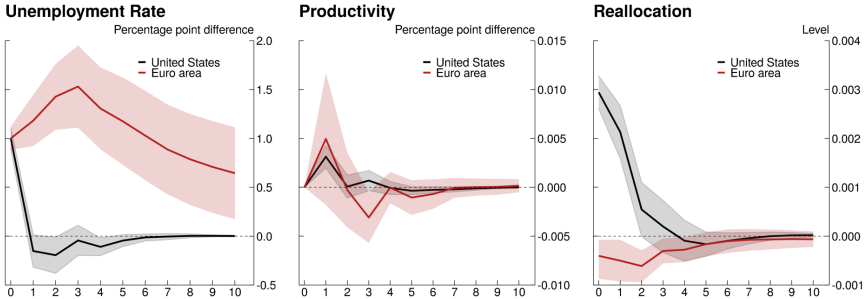


▸ More evidence

SVAR: Productivity, Unemployment, and Reallocation

- SVAR (Cholesky) with 2 lags, U.S. 1990Q3-2022Q2; EA 1995Q3-2022Q2
- U.S.: Quick reversion of unemployment, significant reallocation and productivity

Figure: Impulse Responses to 1 pp Unemployment Shock



Note: Shading represents the 90% confidence interval. Productivity is defined as output per employee and reallocation is constructed following Chodorow-Reich and Wieland's (2020) methodology.

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- U.S.: Quick reversion of unemployment, significant reallocation and productivity
- E.A.: Persistent unemployment, non-significant productivity, reallocation decreases.

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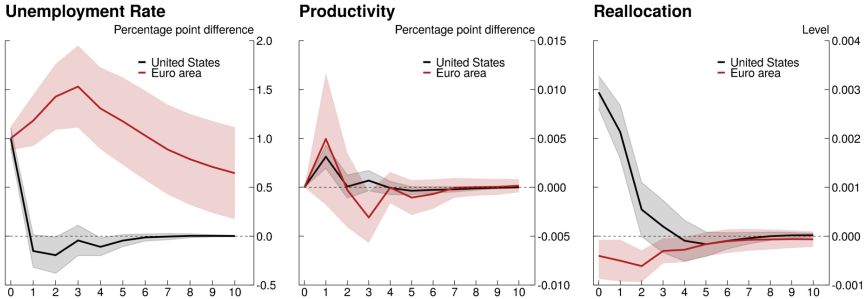

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Model

Model Overview: Two Sectors with Recall and "Sticky" Reallocation

Firms

+ Two sectors, one-worker by firm (match)
  - Output $y = \overbrace{x(s)}^{\text{sector specific}} \quad \overbrace{z}^{\text{match specific}}$
  - Job-specific human capital: $z_0 < \mathbb{E}[z_t]$
  - Wages w are rigid à la Calvo
  - Receive wage subsidy σw
+ Status: Active, Furloughed, Exit
  - Active: produce y, pay w, fixed cost c_o
  - Furloughed: no w, z not lost, recall option
  - Exit: match terminated (endog), z lost

Workers

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Workers

+ Reallocation is "sticky"
  - Workers attached to their last sector
  - Unemployed switch sector w.p. $1 - \pi$
  - Job finding prob f is sector specific
  - Sectoral reallocation: $f \times (1 - \pi)$
+ Active and furloughed workers can quit
+ Unemployed (including furloughed)
  - Can reject job offers
  - Get unemployment benefit

Timing of the model

1. Productivity shocks z and x are realized
2. Unemployed and furloughed workers search for jobs and matching occurs
3. Wage renegotiation (with probability λ)
4. Employed and furloughed workers: stay in the match or quit
5. Remaining matches: active, idle, or exit
6. Production and consumption takes place

▸ Model details

Calibration

Calibration: Steady state for the US and Europe

- Goal: to assess the model's ability to replicate U.S. and Euro labor markets.
- Combination of external (some common) and internal parameters.
- Quantitative model extended with Gumbel shocks in firms' and workers' choices.

Table: External Parameters Flexible and Rigid economies

Parameter	Description	Flex Value	Rigid Value
f	Worker's job contact rate	45%	20%
q	Firm's contact rate	70%	50%
λ	Probability of wage adjustment	1/9	1/13
b	Unemployment insurance	0.40	0.65
s	Wage subsidy to firms	0%	0%

We estimate internally 7 parameters for each labor market (8 moments)

▸ Full calibration

Experiments

Crisis Experiment: Sector-specific Productivity Shock

+ Productivity x in Sector 2 falls by Δ_x and returns at rate $\rho \Rightarrow x_t = (1-\rho)\mu_x + \rho x_{t-1}$
+ Scenario: **Short-lived recession with abrupt start: similar to COVID-19**
  - For each economy, we target the increase in unemployment during crisis episode.
  - $\rho = 0.75$, with $\Delta_x = 0.225$ for the U.S. and $\Delta_x = 0.37$ in EA.

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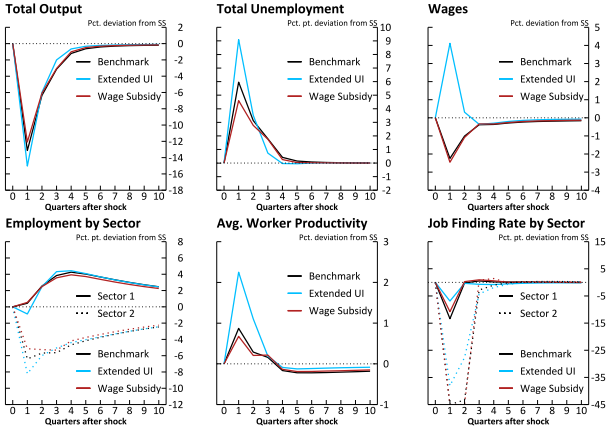
  - $\rho = 0.75$, with $\Delta_x = 0.225$ for the U.S. and $\Delta_x = 0.37$ in EA.
+ Labor Market Polices:
  - In SS: UI always present, no WS
  - In scenario, we calibrate a crisis policy extension:$\approx$ 1% of annual GDP
    - Increase UI to $\approx 2x$ benefits for 3.5 months (US experience)
    - Wage bill subsidy for 12 months only if worker employed (European experience)

▸ Sectoral shock

Effect of Sector-specific Shocks: Flexible economy

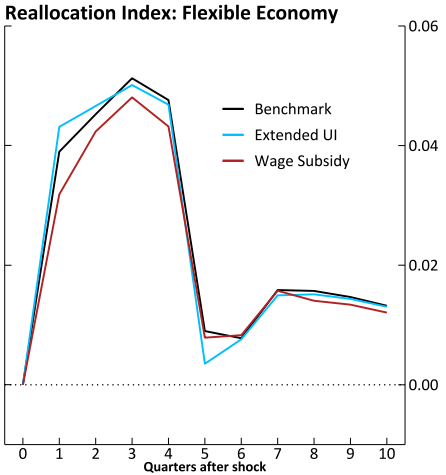


Note: Sector 1 refers to unaffected sector, Sector 2 affected sector by the shock

+ Extended UI leads to stronger output contraction and higher unemployment initially
  - → recovery is faster afterwords

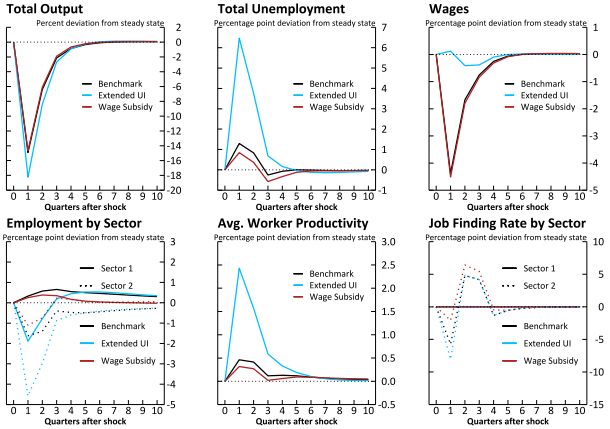
+ Subsidies reduce an initial increase in unemployment at the cost of lower productivity
  - → reallocation to sector 1 is slower

Reallocation in the flexible economy



+ Model reallocation increases in recession just as in the data.
+ Extended UI increases reallocation at the start, as recovery progresses reallocation is smaller.
+ Subsidies dampen total reallocation.

Effect of Sector-specific Shocks: Rigid Economy



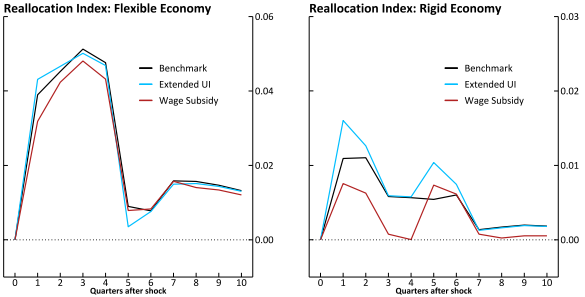
Note: Sector 1 refers to unaffected sector, Sector 2 affected sector by the shock

+ Subsidies succeed to restrain unemployment by preventing permanent separations

+ Extended UI results in stronger contraction but does not produce faster recovery any more...

+ ...and unemployment takes longer to revert compared to flexible economy

Reallocation in the rigid economy

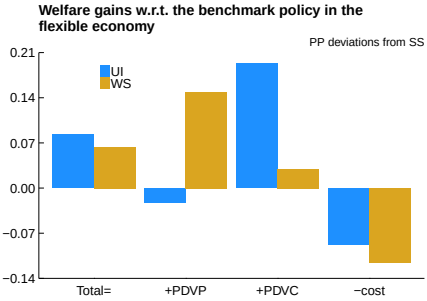


+ Reallocation in the rigid economy increases by less than in the flexible economy.

+ Extended UI increases reallocation while subsidies decrease reallocation.

Welfare analysis: Both the U.S. and EA did right!

- We define total welfare as a sum of:
  - present discounted value of profits (PDVP) for the measure of firms
  - present discounted value of consumption (PDVC) for measure of workers
  - minus present discounted total cost of policies (benchmark + policy alternative)



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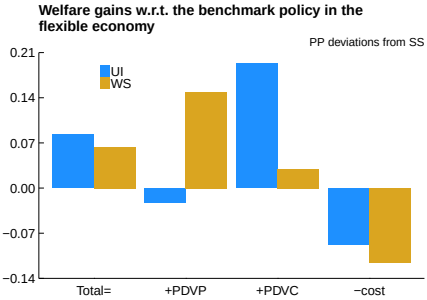
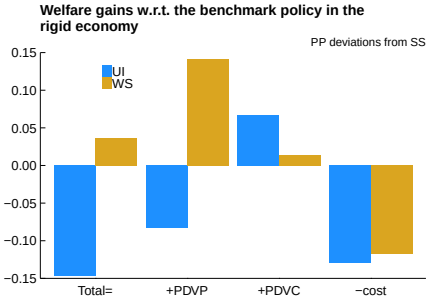
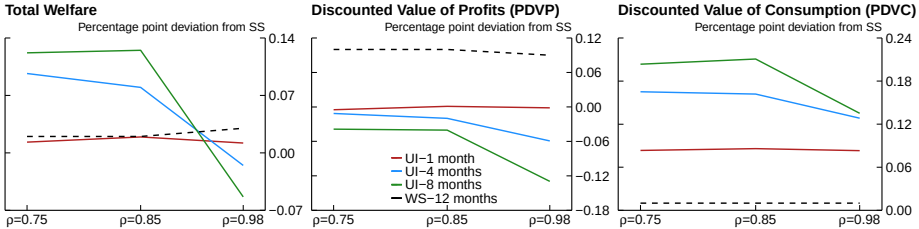




- UI preferred policy in flexible, subsidies in rigid economy

Discussion: Policy effectiveness and persistence of the shock



Note: All values are expressed as percentage point difference in welfare under the UI policy relative to the benchmark policy. Welfare under each policy is calculated as percent deviations from steady state.

+ Front-loading UI is safest option, but small gains.
+ Increasing UI duration welfare improving in short recessions.
+ With persistence: higher consumer gains are offset by larger firms' losses.
+ UI effect on reallocation is ambiguous. ▸ Reallocation ▸ GFC calibration

Taking Stock

1) We use the search model of the labor market to analyze the UI and WS policies in response to sector-specific shocks.

2) We calibrate our model to the U.S. and the euro area economies.

3) In the U.S., UI is preferred as it improves productivity and reallocation as long as it does not distort job creation for too long.

4) In the euro area, WS is preferred as it reduces unemployment and preserves human capital in a low job-finding rate market.

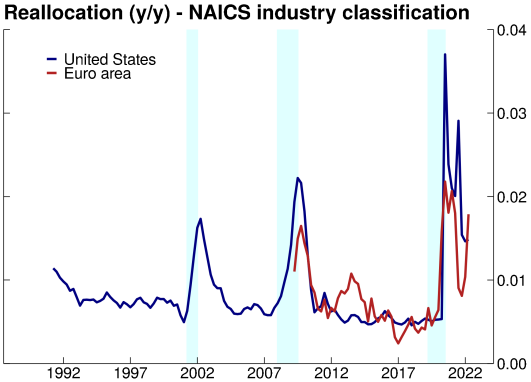
Appendix

Related literature

- **Search and matching:** Shimer (2005), Fujita and Moscarini (2017), Gertler, Huckfeld and Trigari (2020)
- **Sectoral shocks and labor reallocation:** Chodorow-Reich and Wieland (2020), Visschers and Carrilo-Tudela (2021)
- **Role of labor market policies:** Gnocchi, Lagerborg and Pappa (2015), Mitman and Rabinovich (2015), Balleer, Gehrke, Lechthaler and Merkl (2016), Cacciatore and Fiori (2016), Cahuc, Kramarz and Nevoux (2018), Giuponni and Landais (2018)
- **Labor market and COVID-19:** Mitman and Rabinovich (2021), Birinci, Karahan, Mercan and See (2021), Ganong, Greig, Liebeskind, Noel, Sullivan and Vavra (2021), Gertler, Huckfeldt, Trigari (2021)

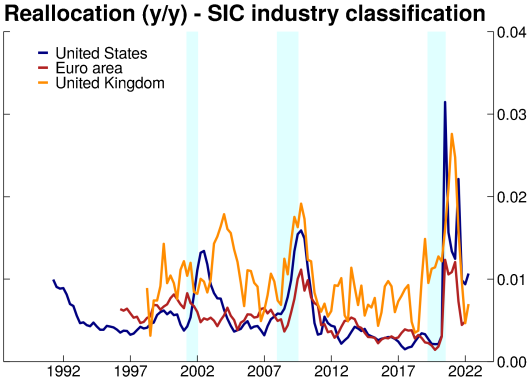
Back

Reallocation during recessions is higher in the US: NAICS



Back

Reallocation is higher in the US and the UK during recessions



Back

Firm's Value Function: Active match

$$J_t(z,w,s) = \Pi + \beta \mathbb{E}_t \left[\left(1 - \eta^a_{t+1}(z',w',s)\right) \max \left\{ J_{t+1}(z',w',s), V_{t+1}(z',w',s), 0 \right\} | z \right]$$

where profits are given by:

$$\Pi = y_t(z,s) - (1-\sigma_t)w - c_o$$

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where profits are given by:

$$\Pi = y_t(z,s) - (1-\sigma_t)w - c_o$$

and wage dynamics are given by:

$$w' = \begin{cases} w & \text{w.p. } \lambda \\ w^*_{t+1}(z',s) & \text{w.p. } 1-\lambda \end{cases}$$

c_o: operating costs, η^a: quit decision, σ_t: wage subsidy

Back

Firm's Value Function: Idle match

$$V_t(z, w, s) = -c_i +$$
$$\beta \mathbb{E}_t \left[\left(1 - f^i_{t+1}(z', w, s)\right) \left(1 - \eta^i_{t+1}(z', w', s)\right) \max \left\{ J_{t+1}(z', w', s), V_{t+1}(z', w', s), 0 \right\} | z \right]$$

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where $f^i_t(\cdot)$ is the probability that a furloughed worker will find and accept a job offer:

$$f^i_t(z,w,s) = \sum_{s'} \pi_F(s,s') \zeta f_t(s') \mathbb{E} \left[\mathbb{I} \left\{ \max\{ \hat{F}_t(z,w,s), U_t(s) \} < W_t(z_0, w^*_{0t}, s') \right\} \right]$$

c_i: operating costs, η^i: quit decision

Back

Worker's Value Functions

- A worker in an active match receives w and decides:
  - Remain at current job (before firm makes firing/furlough decisions)
  - Quit to unemployment (no on-the-job search)

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- A worker under furlough receives b and can:
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  - Decide to quit to unemployment

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  - Quit to unemployment (no on-the-job search)
- A worker under furlough receives b and can:
  - Find a job with probability $\zeta f(\cdot)$: decision to stay or leave
  - Decide to quit to unemployment
- An unemployed worker receives b and can:
  - Find a job with probability $f(\cdot)$: decision to take it or remained unemployed

Back

Model: Matching and free entry condition

+ Market tightness: $\theta(s) = \frac{v}{n}$
+ Given matching function $m(n, v)$: job finding $f(s) = \frac{m}{n}$ and filling $q(s) = \frac{m}{v}$
+ Free-entry condition for job creation in sector s:

$$\kappa = q_t(s) \left[\int_{z_0} \max \left\{ J_t(z_0, w_{0t}^*, s), 0 \right\} p_t(z_0, s) dG_t(z_0, s) \right]$$

+ Expected probability of finding a job in sector s:

$$\bar{f}_t(s) = \sum_{\tilde{s}} \pi(\tilde{s}, s) f_t(\tilde{s})$$

Back

Model: Wages

- Wages are rigid: renegotiation occurs with parameter λ
- Simple rule to split the per-period flows of profits and unemployment benefits.
- We incorporate expected future paths for productivity and benefits.

$$w_t^*(z,s) = (1-\omega)\bar{\Pi}_t(z,s) + \omega \bar{b}_t$$

where

$$\bar{\Pi}_t(z,s) = \sum_{j=0}^{n} \mathbb{E}_t \left[\Omega_{t+j}(y_{t+j}(z_{t+j},s) - c_o)|z\right] \qquad \bar{b}_t = \sum_{j=0}^{n} \Omega_{t+j} b_{t+j}$$

and weights

$$\Omega_t \geq 0 \quad \textit{and} \quad \sum_{j=0}^{n} \Omega_{t+j} = 1$$

Back

Calibration: Steady state for the US and Europe

- Goal: to assess the model's ability to replicate U.S. and Euro labor markets.
- Combination of external (some common) and internal parameters.
- Quantitative model extended with Gumbel shocks in firms' and workers' choices.

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Functional form choices:

- Match productivity z follows an AR(1) process:

$$\ln z_t = (1 - \rho^z)\bar{z} + \rho^z \ln z_{t-1} + \sigma^z \epsilon_t$$

- Matching function ensures job finding probabilities bounded between 0 and 1:

$$m(s, \mu) = \frac{\phi n v}{\left[n^\eta + v^\eta\right]^{\frac{1}{\eta}}}$$

Calibration: Common parameters across labor markets

Table: Common External Parameters (I)

Parameter	Description	Value
β	Discount factor	$0.99^{1/3}$
δ	Monthly exogenous separation rate: active	0.014
η	Matching function elasticity	1.50
ω	Firm's bargaining power	0.55
π_F	Rate of sectoral persistence: furlough	75%
π_U	Rate of sectoral persistence: unemployed	50%
ψ	Search efficiency idle	0.75
$\bar{\mu}$	Long-run match productivity	2.7
ρ_z	Persistence match productivity	0.995
σ_z	Std. dev match productivity	0.065

Calibration: Parameterization of two distinct labor markets

Table: External Parameters Flexible and Rigid economies

Parameter	Description	Flex Value	Rigid Value
f	Worker's job contact rate	45%	20%
q	Firm's contact rate	70%	50%
λ	Probability of wage adjustment	1/9	1/13
b	Unemployment insurance	0.40	0.65
s	Wage subsidy to firms	0%	0%

We estimate internally 7 parameters for each labor market (8 moments):

- The exogenous separation rate in furlough δ_F and the Gumbel shocks for choices

Calibration: Model assessment - Flexible and Rigid labor markets

Table: Model assessment

Moment	Description	Flex Data	Flex Model	Rigid Data	Rigid Model
$U + I$	Total unemployment rate	5.84%	5.82%	9.52%	9.52%
U	Permanent unemployment rate	5.09%	5.11%	9.47%	9.48%
I	Temporary unemployment rate	0.75%	0.71%	0.05%	0.04%
$U - E$	Job acceptance rate	30.00%	45.00%	20.00%	20.00%
$F - E$	Furlough-to-employment rate	48.10%	60.10%	10.00%	15.13%
$F - U$	Furlough-to-unemployment rate	20.70%	22.78%	80.00%	74.70%
$F - F$	Furlough-to-furlough rate	31.20%	17.12%	10.00%	10.17%
Recall	Recall rate from furlough	75.70%	78.48%	75.70%	57.10%

Back

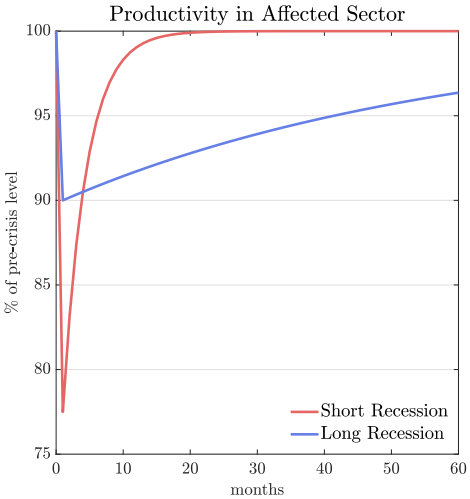
Calibration: Estimated parameters Flexible and Rigid economies

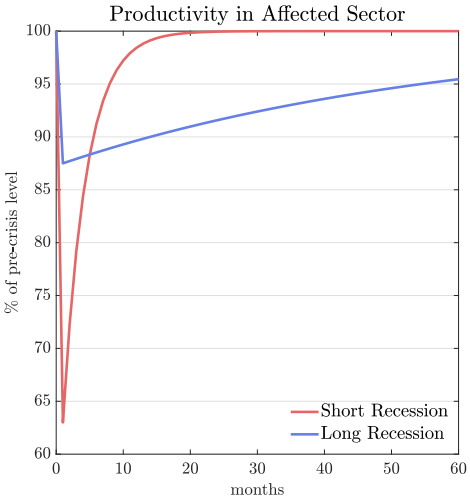
Table: Calibration: Internal parameters

Parameter	Description	Flex Value	Rigid Value
δ_F	Monthly exogenous separation rate: furlough	0.061	0.987
$\rho_{J,V}$	Gumble shock firm: active/inactive	0.075	0.020
$\rho_{M,0}$	Gumble shock firm: remain open/close	0.066	0.071
$\rho_{W,U}$	Gumble shock worker: remain employed/quit	0.078	0.017
$\rho_{F,U}$	Gumble shock worker: remain furloughed/quit	0.120	0.044
ρ_{H,W_0}	Gumble shock worker: remain employed/accept new job	0.073	0.027
ρ_{U,W_0}	Gumble shock worker: remain unemployed/accept new job	0.113	0.027

Back

Sectoral productivity: US (left) vs Europe (right)





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  - minus present discounted total cost of policies (benchmark + policy alternative)

	Benchmark	UI	Subsidies
A) PDVC - Flexible	−0.25%	−0.05%	−0.22%
B) PDVP - Flexible	−0.55%	−0.57%	−0.40%
C) PD Cost - Flexible	0.05%	0.14%	0.17%
Total = A+B-C	−0.85%	−0.77%	−0.79%

- UI preferred policy in flexible, subsidies in rigid economy

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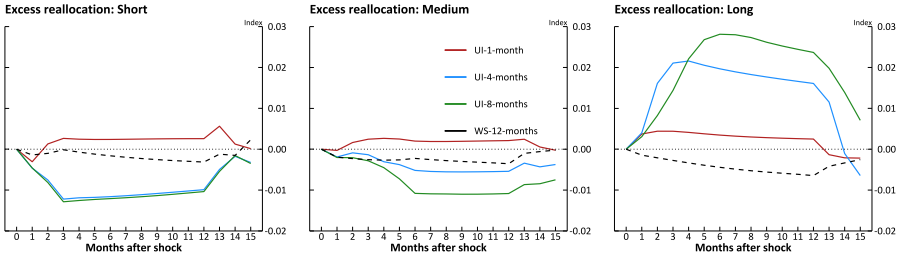
C) PD Cost - Flexible	0.05%	0.14%	0.17%
Total = A+B-C	−0.85%	−0.77%	−0.79%
A) PDVC - Rigid	−0.13%	−0.07%	−0.12%
B) PDVP - Rigid	−0.58%	−0.67%	−0.44%
C) PD Cost - Rigid	0.01%	0.14%	0.13%
Total = A+B-C	−0.73%	−0.87%	−0.69%

- UI preferred policy in flexible, subsidies in rigid economy

Discussion: Policy effectiveness and persistence of the shock



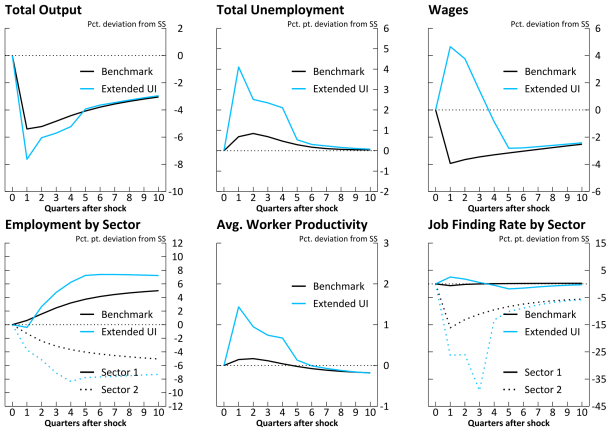
Back

+ UI has an ambiguous effect on reallocation.

+ Reallocation increases when the job finding rate in the affected sector is lower.

+ Higher reallocation does not necessarily lead to higher welfare.

Effect of Sector-specific Shocks: Flexible Economy GFC calibration



Note: Sector 1 refers to unaffected sector, Sector 2 affected sector by the shock

+ UI increases unemployment and leads to a larger contraction in output, but w/o faster recovery.

+ Job posting and finding rates depressed for longer in the affected sector.

+ More rapid and persistent reallocation of labor towards the unaffected sector.

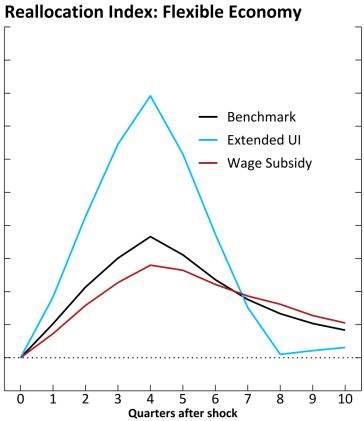
Effect of Sector-specific Shocks: Rigid Economy GFC calibration

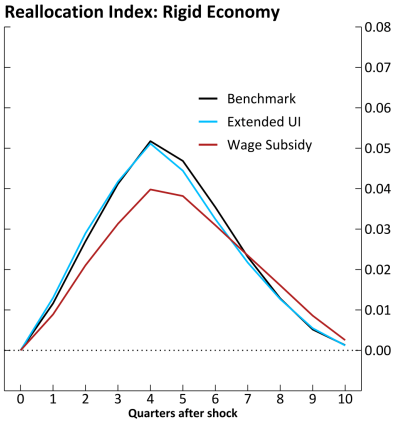
Note: Sector 1 refers to unaffected sector, Sector 2 affected sector by the shock

+ Subsidies limit unemployment, but recession even more persistent due to subdued job finding.

+ Reallocation towards the unaffected sector is more sluggish, relative to the benchmark scenario

Reallocation index: GFC calibration





Back