Short-time work and precautionary savings

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Introduction

- Two world-wide deep economic crises in the last 15 years
  - With monetary policy at the zero lower bound, strong interest in fiscal policy
- Short-time work (STW) is a fiscal tool that has been used (mostly) in Europe to fight rising unemployment
  - “Part-time” unemployment instead of firing
  - Income reduction of workers affected by STW is partly compensated by the government
- April 2020: Italy 40%, France 33%, Austria 30%, UK 25%, Germany 18% of employees affected

STW data

Why could STW be useful to stabilize the business cycle?

1. Firm (supply) channel
   - Search and firing cost (Balleer *et al.*, 2016; Cooper *et al.*, 2017)
2. Demand channel
   - Aggregate demand effects from stabilizing precautionary savings
     - As in Ravn and Sterk (2021) or Challe (2020) higher unemployment risk in recessions triggers precautionary savings and deepens the recessions
     - STW can dampen this effect

Related literature

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Related literature

This paper

1. We estimate the **consumption risk** due to unemployment and STW from German household survey data
   - Unemployment is associated with on average around 40% lower consumption, only 5-10% for STW (mostly insignificant)
2. We integrate STW in a New Keynesian general equilibrium model with heterogeneous workers, incomplete asset markets and labor market frictions
   - A shock that increases the unemployment rate by 4 pp's would only increase unemployment by 3 pp's with STW (**stabilization of 25%**)
     - 1/5 from demand stabilization
   - Increasing **STW compensation** in a discretionary way is ineffective as STW MPCs are small

Empirical evidence

Data

- Bundesbank Online Panel-Households (BOP-HH): monthly online survey of 2,000-7,500 German households, runs continuously since April 2020
- Survey has information on labor market status (employed, STW, unemployed), consumption, wealth, and several sociodemographic variables
  - Data can be used to shed light on the consumption-saving behavior of households in different labor market states

Descriptives

Estimation strategy

- Aim: Quantify the consumption risk of different labor market states, including STW

$$\log C_{i,t} = \gamma_e + \gamma_u D^u_{i,t} + \gamma_{stw} D^{stw}_{i,t} + \beta \mathbf{X}_{i,t} + \epsilon_{i,t}$$

  - $C_{i,t}$: consumption expenditure on non-durables and services, excludes spending on durables and housing
  - $D^u_{i,t}, D^{stw}_{i,t}$: indicator variables for unemployment and STW
  - $\mathbf{X}_{i,t}$: age and age squared, gender, education, household size and household size squared, region, city size, home-ownership interacted with city size, wealth of the household and time-region fixed effects

Consumption drop in different labor market states

	(1)	(2)	(3)	(4)	(5)
γ_u	-0.47^{***}	-0.44^{***}	-0.42^{***}	-0.42^{***}	-0.35^{***}
	(-8.53)	(-7.99)	(-7.75)	(-7.68)	(-4.68)
γ_{stw}	-0.08^{**}	-0.05	-0.04	-0.04	-0.07
	(-2.57)	(-1.62)	(-1.43)	(-1.49)	(-1.43)
Skill		$\times$	$\times$	$\times$	$\times$
Homeown			$\times$	$\times$	$\times$
Homeown $\times$ city size				$\times$	$\times$
Wealth/debt					$\times$
Observations	9,476	9,468	9,464	9,464	4,924

Dependent variable is log consumption expenditure. $t-$statistics are in parentheses, standard errors are clustered at household level, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

Fixed effects | hours reduction | pre covid

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Skill		×	×	×	×
Homeown			×	×	×
Homeown × city size				×	×
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The model

The model in a nutshell

- New Keynesian model with **sticky prices** and monopolistic competition
- Monetary policy follows a **Taylor rule**, fiscal authority collects taxes, pays benefits, government debt follows countercyclical rule
- **Search and matching** labor market with endogenous separations, firing costs and STW (Balleer *et al.*, 2016)
  - Worker-firm matches are hit by idiosyncratic profitability shocks ϵ_t
  - Endogenous firing and STW thresholds
  - Government defines a rule under which STW can be used; firms choose freely their optimal level of hours reduction under STW
  - Real wage rigidity

Illustration and equations

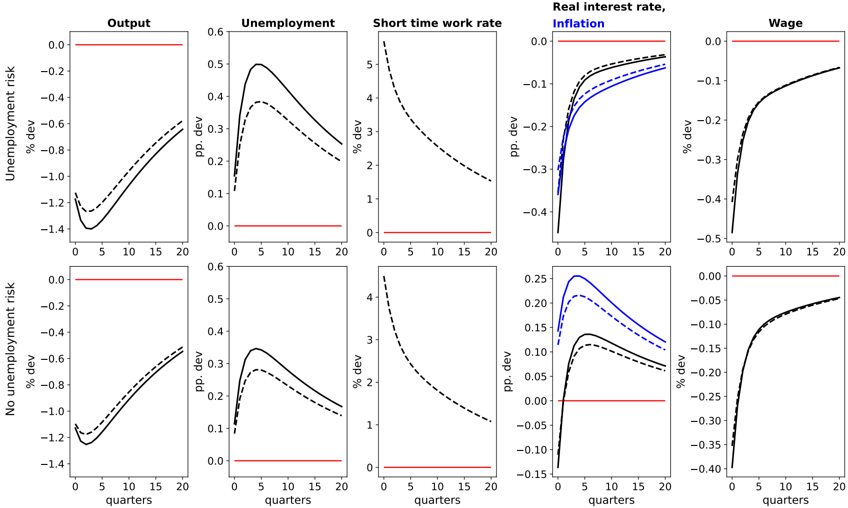
Households, precautionary savings and STW

- **Workers are heterogeneous**: (1) full-time employed, (2) on STW, (3) short-term unemployed or (4) long-term unemployed
- Saving in government bond on **incomplete asset markets** such that workers cannot fully insure against unemployment risk
- Calibrate the model to fit the consumption drop upon unemployment

Household problem Data

Quantitative analysis

Negative productivity shock: German calibration



Calibration
Steady state

Business cycle stabilization

	Difference of standard dev. in % (STW vs. no STW)	
	Unemployment risk	No unemployment risk
Output	-8.397	-5.402
Unemployment	-23.739	-19.351

- Precautionary factor $\frac{-23.74}{-19.35} \approx 1.23$

Discretionary STW policy

	Short-time compensation		Unemployment benefits	
	Unemployment	Output	Unemployment	Output
Horizon	(1)	(2)	(3)	(4)
5	-0.006	0.010	-0.296	0.330
10	-0.008	0.014	-0.369	0.410
Long run	**-0.012**	0.020	**-0.416**	0.462

Table: Fiscal multipliers in response to a discretionary shock equal to an increase of fiscal spending of 1% of GDP. Multipliers for unemployment in percentage points and multipliers for output in percent. The denominator is made up of costs holding the endogenous variables constant at the steady state level.

IRFs Robustness demand shocks

Conclusions

- Empirically, the consumption-saving behavior of workers on STW is rather close to that of the employed, unemployment risk is much higher compared to STW risk
- Quantitatively, the demand channel of STW amplifies business cycle stabilization of STW
- Automatic stabilization comes from reduction in unemployment risk rather than transfers.

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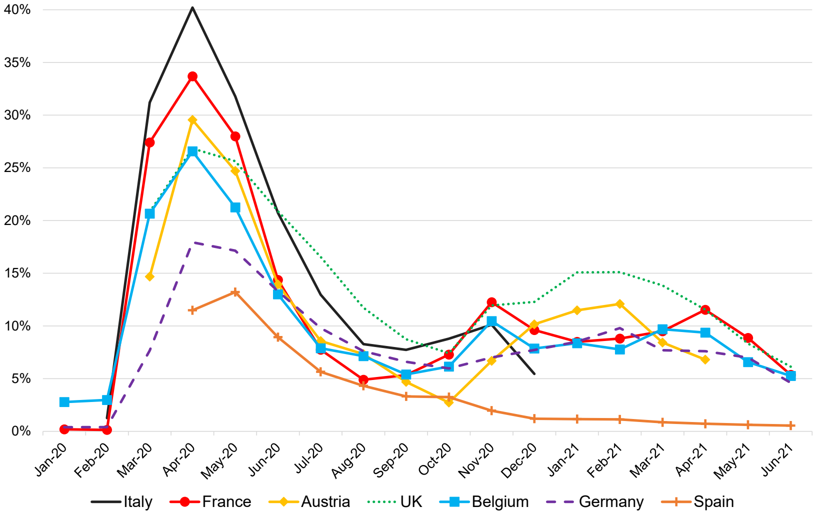
Appendix

Share of employees affected by STW in 2020/21



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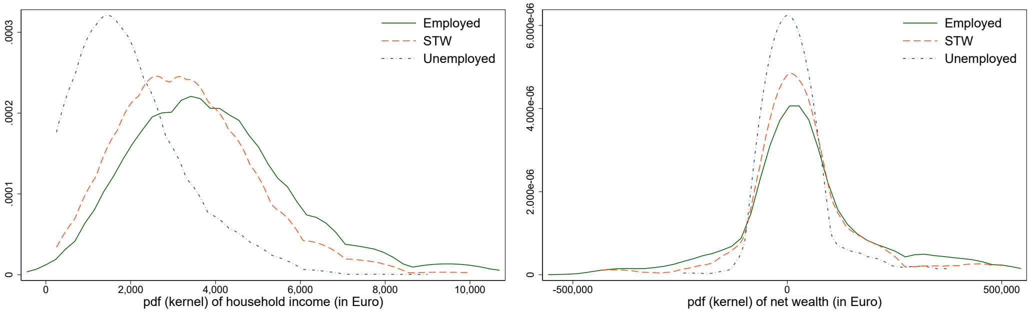
Descriptive evidence



Empirical distributions of net wealth and household income by labor market state in Germany. Source: Bundesbank Household Online Panel, 2021 waves. Weighted according to sampling weights.

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Consumption regression with household fixed effects

	(1)	(2)	(3)	(4)	(5)
γ_u	-0.65^{**}	-0.66^{**}	-0.65^{**}	-0.65^{**}	-0.66^{**}
	(-2.48)	(-2.55)	(-2.54)	(-2.55)	(-2.55)
γ_{stw}	-0.10	-0.10	-0.09	-0.08	-0.07
	(-1.17)	(-1.16)	(-0.99)	(-0.96)	(-0.90)
Household size, region, city size		×	×	×	×
Skill			×	×	×
Homeown				×	×
Homeown × city size					×
Individual-fixed effect	×	×	×	×	×
Observations	9,495	9,476	9,468	9,464	9,464

Dependent variable is log consumption expenditure. $t-$statistics are in parentheses, standard errors are clustered at household level, $^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$.

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More granular consumption regression

	(1)	(2)	(3)	(4)	(5)
γ_u	-0.55^{***}	-0.52^{***}	-0.49^{***}	-0.48^{***}	-0.43^{***}
	(-3.80)	(-4.03)	(-3.85)	(-3.68)	(-2.94)
$\gamma_{stw,strong}$	-0.26^{*}	-0.26^{*}	-0.27^{*}	-0.27^{*}	-0.29^{*}
	(-1.67)	(-1.68)	(-1.80)	(-1.70)	(-1.76)
$\gamma_{stw,median}$	0.03	0.10	0.09	0.10	0.10
	(0.15)	(0.54)	(0.48)	(0.52)	(0.46)
$\gamma_{stw,low}$	-0.05	0.02	0.01	-0.02	-0.12
	(-0.20)	(0.10)	(0.03)	(-0.09)	(-0.48)
Skill		×	×	×	×
Homeown			×	×	×
Homeown × city size				×	×
Wealth/debt					×
Observations	1,337	1,335	1,334	1,334	1,127

Table: Consumption expenditure across labor market states including STW affectedness. The parameter γ_u (γ_{stw}) gives the log difference of the consumption of an unemployed (short-time) worker compared to an employed worker. The estimation uses the Bundesbank Household Online Panel that covers monthly data for 2020/2021, wave 20.

Literature

- Quantitative macro: Balleer *et al.* (2016), Gehrke *et al.* (2019), Krause and Uhlig (2012), Faia *et al.* (2013), Cooper *et al.* (2017)
- Empirical micro: Giupponi and Landais (2022), Cahuc *et al.* (2018), Kopp and Siegenthaler (2021)
- Empirical macro: Boeri and Bruecker (2011), Gehrke and Hochmuth (2021)
- Incomplete markets and unemployment risk (incomplete): Ravn and Sterk (2017, 2021), Challe (2020)
- Unemployment benefits with incomplete markets: McKay and Reis (2021), Kekre (2022)

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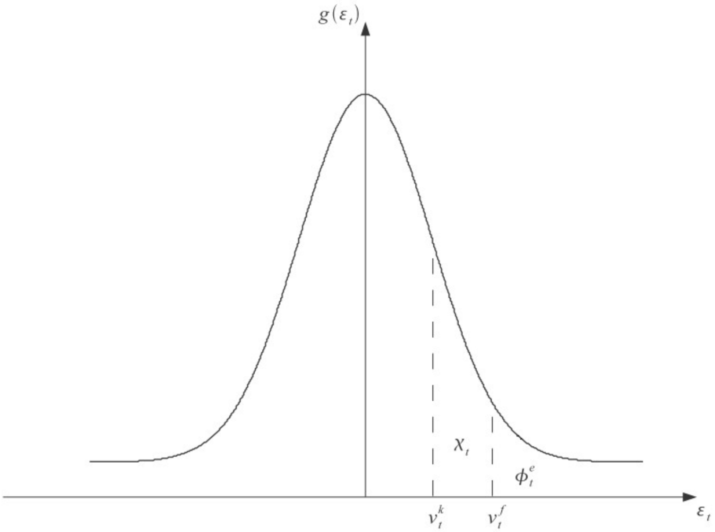
Separations and short-time work



Equations Back

Separations and short-time work

- Worker-firm matches are hit by idiosyncratic profitability shocks ϵ_t
- Government defines eligibility criterion ζ_t for STW

$$a_t p_t^z - w_t - \epsilon_t + \mathbb{E}_t \Lambda_{t,t+1} J_{t+1} < \zeta_t \tag{1}$$

- Firms choose the optimal hours reduction with STW $K^*(\epsilon_t)$

$$\max_{K(\epsilon_t)} \pi_t = K(\epsilon_t)(a_t p_t^z - w_t - \epsilon_t)\big(1 - K(\epsilon_t)\big) - C\big(K(\epsilon_t)\big) \tag{2}$$

- If the shock realization is too large, the worker is fired

$$(a_t p_t^z - w_t - \epsilon_t)\big(1 - K^*(\epsilon_t)\big) - C\big(K^*(\epsilon_t)\big) + \mathbb{E}_t \Lambda_{t,t+1} J_{t+1} < -f \tag{3}$$

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Short-time work in the model

- STW decision:

$$J(\epsilon_t) = p_{z,t}a_t - w_t - \epsilon_t + E_t\Lambda_{t,t+1}J_{t+1} < \zeta_t$$

  - ζ_t: (time-varying) eligibility criterion, in steady state $\zeta = -f$

- Cutoff: $v_t^k = p_{z,t}a_t - w_t - \zeta_t + E_t\Lambda_{t,t+1}J_{t+1}$
- Firms choose optimal hours reduction subject to convex adjustment costs $C(K(\epsilon_t)$:

$$\max_{K(\epsilon_t)} \pi_t = (p_{z,t}a_t - w_t - \epsilon_t)(1 - K(\epsilon_t)) - C(K(\epsilon_t))$$

  - with $0 \leq K(\epsilon_t) \leq 1, \frac{\partial C(K(\epsilon_t))}{\partial K(\epsilon_t)} > 0$, $\frac{\partial C(K(\epsilon_t))^2}{\partial K(\epsilon_t)} > 0$,
  here: $C(K(\epsilon_t)) = \frac{1}{2}c_K K(\epsilon_t)^2$

Wages

- Collective wage bargaining between between representative firm and median worker
  - Inefficient separations (Jäger *et al.*, 2022)

$$w_t^N = \gamma p_{z,t} a_t + (1 - \gamma)\delta_t \quad (4)$$

$$w_t = (w_t^N)^{1-\gamma_w} (w_{ss})^{\gamma_w} \quad (5)$$

- The unemployment benefit δ_t is a fixed share of the wage such that δ_t / w_t is constant
  - Focus on unemployment risk rather than varying income risk due to unemployment (Challe, 2020)

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Wage bargaining

- The median firm's profit of a match is:

$$F_t = a_t p_{z,t} - w_t + \beta \mathbb{E}_t J_{t+1}$$

- In case of a disagreement, production will come to a halt, and bargaining will resume in the next period. The fall back option of the firm is then:

$$\tilde{F}_t = \beta \mathbb{E}_t J_{t+1}$$

- The median worker's surplus W_t from a match is

$$W_t = u(w_t) + \beta(1-\phi^x)\mathbb{E}_t(1-\phi^e_{t+1}-\chi_{t+1})W_{t+1} + \beta\mathbb{E}_t(1-\phi^x)\chi_{t+1}W^{stw}_{t+1} + \beta\mathbb{E}_t\phi_{t+1}U_{t+1}$$

- The disagreement value is:

$$\tilde{W}_t = u(\delta_t) + \beta(1-\phi^x)\mathbb{E}_t(1-\phi^e_{t+1}-\chi_{t+1})W_{t+1} + \beta\mathbb{E}_t(1-\phi^x)\chi_{t+1}W^{stw}_{t+1} + \beta\mathbb{E}_t\phi_{t+1}U_{t+1}$$

▸ back

The household problem

$$\max_{\{c_t^i, b_t^i\}} \mathbb{E}_t \sum_{s=0}^{\infty} \beta^s u(c_{t+s}^i) \tag{6}$$

$$\text{s.t. } b_t^i + c_t^i = (1 + r_t)b_{t-1}^i + \mathbb{1}_f^i w_t^f + \mathbb{1}_s^i w_t^s + \mathbb{1}_u^i \delta + (1 - \mathbb{1}_f^i - \mathbb{1}_s^i - \mathbb{1}_u^i)\delta_l, \tag{7}$$

$$b_t^i \geq 0 \tag{8}$$

$$\mathbb{E}_t Pr(x_{t+1}^i \mid x_t^i) =$$

$$\mathbb{E}_t \begin{bmatrix} (1-\phi^x)(1-\phi_{t+1}^e-\chi_{t+1}) & (1-\phi^x)\chi_{t+1} & \phi_{t+1} & 0 \\ (1-\phi^x)(1-\phi_{t+1}^e-\chi_{t+1}) & (1-\phi^x)\chi_{t+1} & \phi_{t+1} & 0 \\ \eta_{s,t}(1-\phi^x)(1-\phi_{t+1}^e-\chi_{t+1}) & \eta_{s,t}(1-\phi^x)\chi_{t+1} & (1-\omega_l)(1-\eta_{s,t}(1-\phi_{t+1})) & \omega_l(1-\eta_{s,t}(1-\phi_{t+1})) \\ \eta_{l,t}(1-\phi^x)(1-\phi_{t+1}^e-\chi_{t+1}) & \eta_{l,t}(1-\phi^x)\chi_{t+1} & 0 & 1-\eta_{l,t}(1-\phi_{t+1}) \end{bmatrix}. \tag{9}$$

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Labor market equations: Firm side

- Present value of vacancy

$$V_t = -\kappa + q_t \mathbb{E}_t \Lambda_{t,t+1} J_{t+1} + (1 - q_t)\mathbb{E}_t \Lambda_{t,t+1} V_{t+1}$$

- Value of a filled job

$$J_{t+1} = (1-\phi^x) \int_{-\infty}^{v^k_{t+1}} (a_{t+1} p_{zt+1} - w_{t+1} - \epsilon_{t+1}) g(\epsilon_{t+1}) d\epsilon_{t+1}$$

$$f + (1-\phi^x) \int_{v^k_{t+1}}^{v^f_{t+1}} \left[(a_{t+1} p_{zt+1} - w_{t+1} - \epsilon_{t+1})(1 - K(\epsilon_{t+1})) - C(K(\epsilon_{t+1}))\right] g(\epsilon_{t+1}) d\epsilon_{t+1}$$

$$-(1-\phi_{t+1})c - (1-\phi^x)\phi^e_{t+1} f + (1-\phi_{t+1}) E_{t+1} \Lambda_{t+1,t+2} J_{t+2}$$

with $q_t = \mu \theta_t^{-\alpha}$ and $\Lambda_{t,t+1} = \beta \left(\frac{c_{e,t+1}}{c_{e,t}}\right)^{-\sigma}$

Additional equations

- Phillips curve:

$$0 = (1-\epsilon) + \epsilon p_{z,t} - \Psi(\Pi_t - 1)\Pi_t \mathbb{E}_t \left\{ \Lambda_{t,t+1} \Psi(\Pi_{t+1} - 1) \frac{y_{t+1}}{y_t} \Pi_{t+1} \right\} \tag{10}$$

- Taylor rule

$$\frac{1+i_t}{1+\bar{r}} = (1+\pi_t)^{\psi_\pi} \tag{11}$$

- Government budget

$$T_t + B = (1+r_t)B + \delta n_t^B (1-\phi^x) \int_{v_t^k}^{v_t^f} K^*(\epsilon_t) g(\epsilon) d\epsilon_t + \delta u_{s,t} + \delta_l u_{l,t} \tag{12}$$

Income changes in different labor market states

Share of respondents	No STW	STW	Unemployed
Income considerably lower	4.93	36.9	54.4
Income somewhat lower	13.28	42.5	10.8
Income unchanged	71.1	12.3	13.9

Table: Household's net income change from February 2020 to May 2020 by worker type in Germany. Unemployed workers are those that report that they lost their job in the Covid-19-crisis. Source: IAB HOPP as provided by the Research Data Center of the Institute for Employment Research (IAB), own calculations based on wave one (weighted).

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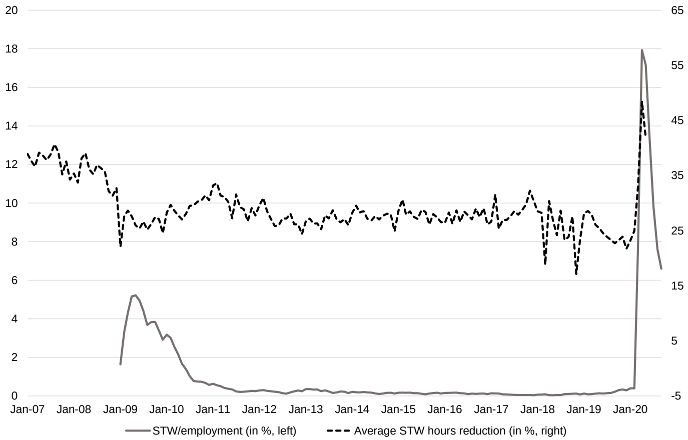

STW as a percentage of total employment (left axis) and average hours reduction in Germany (right axis). Source: Federal Employment Agency.

Calibration

	Description	Value
Parameters		
β	Discount factor	0.98
Ψ	Price adjustment costs	207
ϵ	Elasticity of subst. between varieties	6
ψ_π	Taylor weight on inflation	1.5
σ	Relative risk aversion	1.5
α	Matching elasticity w.r.t. unemployment	0.6
δ/w	Replacement rate	0.6
δ_l/w	Replacement rate for long-term unemployed	0.17
μ	Matching efficiency	0.43
f	Firing costs	2.4
k	Relative search efficiency of the long-term unemployed	1
ω_l	Transition probability to long-term unemployment	0.2
$p^z a - w$	Operating profits	0.05
s	Scale parameter of profitability distribution	1.02
κ	Costs of posting a vacancy	1.18
c_k	Costs of STW usage	19.75
γ_w	Wage rigidity parameter	0.82
γ	Worker bargaining power	0.86
ξ	Home production	0.97
B	Bond supply	1
γ_B	reaction of debt to employment	-0.2
ρ_B	inertia of debt	0.9
Steady state targets		
q	Worker finding rate	0.7
ϕ	Overall job destruction rate (endogenous 1/3, exogenous 2/3)	0.03
η	Job finding rate	0.3
u	Unemployment rate	0.09
χ	STW rate	0.007
Π	Inflation	1
r	Real interest rate (annual.)	1%

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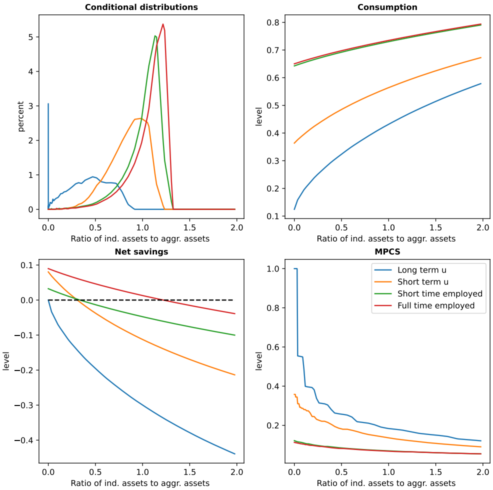
Steady state properties



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Effects of discretionary policy changes

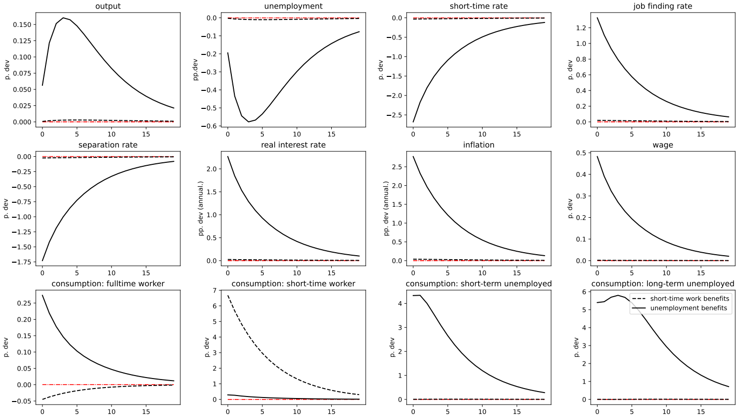

Figure: Impulse responses to an increase in short-time work compensation and an increase in unemployment benefits (normalized to 0.5% of GDP on impact).

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Robustness checks

	Baseline	Replacement rate δ/w (0.6)		Wage rigidity $d \ln w / d \ln a$ (0.2)		Monetary policy ψ_π (1.5)		Taxation Constant debt	Tax rule	Relative search efficiency k (1)
Stabilization (%)		0.5	0.7	0	0.4	1.3	1.7			0.5
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Output	-8.48	-9.83	-7.63	-12.76	-4.78	-9.27	-8.1	-8.56	-8.86	10.83
Unemployment	-23.75	-25.41	-22.60	-25.81	-21.88	-24.55	-23.3	-23.91	-23.13	24.82

Table: This table compares the stabilization of STW across different calibrations in response to productivity shocks.

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Difference of standard dev. in %	Productivity shocks		Demand shocks	
	STW vs no STW Unemployment risk	STW vs no STW No unemployment risk	STW vs no STW Unemployment risk	STW vs no STW No unemployment risk
	(1)	(2)	(3)	(4)
Output	-8.397	-5.402	-25.047	-20.420
Unemployment	-23.739	-19.351	-24.028	-19.361

Table: Difference of standard deviation conditional on productivity shock across different models in percent. We use HP filtered deviations from steady state (smoothing parameter 1,600). For output, we use log-deviations, for unemployment level deviations, since this variable is already denoted in percentage points.

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Pre Covid regression

	(1)	(2)	(3)	(4)	(5)
γ_u	-0.36^{***}	-0.36^{***}	-0.29^{***}	-0.27^{***}	-0.28^{***}
	(-7.36)	(-12.19)	(-4.46)	(-4.10)	(-4.32)
Household size, region, city size		×	×	×	×
Skill			×	×	×
Homeown				×	×
Homeown × city size					×
Individual-fixed effect	×	×	×	×	×
Observations	2,587	2,582	1,793	1,793	1,793

Table: Consumption expenditure across labor market states using household fixed-effects, pre-Covid sample. The parameter γ_u gives the log difference of the consumption of an unemployed worker compared to an employed worker. The estimation uses the Bundesbank Household Online Panel that covers monthly data for 2019, waves 1-3. $t-$statistics are in parentheses, standard errors are clustered at household level, $^{*}p < 0.05, ^{**} p < 0.01, ^{***} p < 0.001$.

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