Optimal Short-Time Work Policy in Recessions

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Motivation

The Great and Covid-19 recessions renewed interests in key labor econ questions

1. How do we prevent workers from unemployment?
2. How do we insure workers from income losses?

Policy makers in Europe relied on two policy instruments

1. Unemployment insurance (UI) system
2. Short-time work (STW) system

What is UI and STW?

UI partially replaces income when workers become unemployed

STW is a subsidy scheme to combat job losses

1. **Benefits:** Replaces part of worker's wage if hours reduced
2. **Eligibility:** Hours worked fall below a certain level

In recessions

- STW systems became more generous
- UI systems unaltered

Research Question

Natural question to ask

Why and how should we use STW and UI together?

Literature

- Extensive literature on optimal UI but not on STW
- Interplay between STW and UI conceptually nebulous (Cahuc 2024)
- No theory on how to adjust STW over the business cycle

This paper

- Derives expression for optimal combination of STW and UI in SaM
- Allows STW to adjust optimally over the business cycle

Results

Optimal Interplay STW and UI

- The UI system provides income insurance
- The STW system combats distortions of UI system
  $\Rightarrow$ STW allows UI to provide more generous benefits

Reaction of STW to a recession

- STW benefits shall increase (consistent with actual policy)
- Eligibility condition must be tightened (contrasts actual policy)

Problem: STW cannot reach social planner solution

- Cannot influence job-finding rates
- Subsidizes reduction of working hours
  $\Rightarrow$ trade-off between employment stabilisation and stabilisation of working hours

Model

Assumptions

Canonical search and matching model (DMP) augmented with

1. Risk averse workers
2. Flexible hours choice
3. Endogenous separations (caused by idiosyncratic productivity shocks)
4. Lay-off costs (wasteful)
5. Aggregate productivity shocks (cause the recession)
6. Rigid-salaries (counter-cyclical bargaining power of workers)

Policy measures

1. Unemployment insurance
2. Short-time work
3. Production tax
   (finances UI and STW system, balanced budget every period)

Additional Model Slides

Firm Side

Value of firm producing regularly

$$J_t(\epsilon) = y_t(\epsilon, h_t(\epsilon)) - w_t(h_t(\epsilon)) - \tau_{J,t} + E_t\left[Q^f_{t,t+1} \cdot \mathcal{J}_{t+1}\right]$$

ϵ : idiosyncratic productivity (i.i.d.)

Production Technology   Formel $\mathcal{J}_t$, $\mathcal{V}_t$

Eligibility condition $h_t(\epsilon) < D_t$, with STW threshold $h_t(\epsilon_{stw,t}) = D_t$
Value of firm on STW

$$J_{stw,t}(\epsilon) = y_t(\epsilon, h_{stw,t}(\epsilon)) - \underbrace{w_t(h_{stw,t}(\epsilon))}_{\text{Less working hours, less pay}} - \tau_{J,t} + E_t\left[Q^f_{t,t+1} \cdot \mathcal{J}_{t+1}\right]$$

Separations: $\epsilon < \epsilon_{s,t}$, lay-off costs F, severance payments $w_{eu,t}$ plus taxes $\tau_{J,t}$.

Firm Side

Job-creation condition (vacancy posting)

$$\underbrace{\frac{k_v}{q_t}}_{\text{Expected Recruitment Costs Worker}} = \underbrace{E_t\left[Q^f_{t,t+1} \cdot \mathcal{J}_{t+1}\right]}_{\text{Expected Value of a Worker for a Firm}}$$

$\mathcal{J}_t$: value firm before the idiosyncratic productivity threshold realized

Worker Side

Value of an employed worker outside STW

$$V_t(\epsilon) = u\Big(w_t(h_t(\epsilon)) - v(h_t(\epsilon))\Big) + \beta \cdot E_t\left[\mathcal{V}_{t+1}\right] \quad \text{with} \quad u'(.) > 0, \; u''(.) < 0$$

Value of an employed worker on STW

$$V_{stw,t}(\epsilon) = u\Big(\underbrace{w_t(h_{stw,t}(\epsilon))}_{\text{Reduced Income from Firm}} + \underbrace{(\bar{h} - h_{stw,t}(\epsilon)) \cdot \tau_{stw,t}}_{\text{Net Transfer STW}} - v(h_{stw,t}(\epsilon))\Big) + \beta \cdot E_t[\mathcal{V}_{t+1}]$$

Value of an unemployed worker

$$U_t = u(b_t) + \beta \cdot E_t\left[f_t \cdot \mathcal{V}_{t+1} + (1 - f_t) \cdot U_{t+1}\right]$$

b_t : UI benefits
f_t : job-finding rate

Decisions: Nash-Bargaining

Generalized Nash-Bargaining

Takes place before the temporary productivity ϵ has been revealed:

$$\max_{w_t(h), w_{eu,t}, h_t(\epsilon), h_{stw,t}(\epsilon), \epsilon_{s,t}} (\mathcal{J}_t)^{1-\eta_{t-1}} \cdot (\mathcal{V}_t - U_t)^{\eta_{t-1}}$$

$\mathcal{V}_t$: Value of worker for firm before idiosyncratic productivity is realized

η_t : Bargaining power of the worker

Formel $\mathcal{J}_t$, $\mathcal{V}_t$

Take Away

Contract contigent on the realization of idiosyncratic productivity shock containing:

- Salary
- Working hours
- Separations

Outcome Nash-Bargaining

1. Firms fully insure workers income against idiosyncratic productivity shocks
   Insurance
2. Working hours on STW are downward distorted
   Working Hours
3. STW reduces separations by reducing the salary commitment of firms in bad times
   Separations

Optimal Combination of UI and STW Policy in Steady State

Optimal UI benefits in steady state

$$\underbrace{(1-n)\cdot(u'(b)-u'(\tilde{c}^w))}_{\text{Provide Additional Income Insurance}} = \underbrace{({\color{blue}LV}+{\color{red}LS})\cdot\beta\cdot\left(-\frac{\partial J}{\partial b}\right)}_{\text{Additional Distortions UI}}$$

LV: Additional welfare loss via fewer vacancy postings
LS: Additional welfare loss via more separations

Take away

- UI provides insurance against income losses
- No full insurance $u'(\tilde{c}) \neq u'(b) \rightarrow$ trade-off insurance against distortions
- UI benefits decrease vacancy postings and increase separations
- STW cannot combat social costs form reduced vacancies LV
- STW can reduce social costs form more separation LS

Ramsey Problem Details

Optimal STW benefits in steady state

Optimal STW benefits in steady state

$$\left(\bar{h} - h_{stw}(\epsilon_s)\right) \cdot \tau_{stw} = \underbrace{\frac{\beta \cdot (1-f)}{1-\beta \cdot (1-G(\epsilon_s)) \cdot (1-f)} \cdot \left[b + \frac{1-n}{n} \cdot b\right]}_{\text{Fiscal Externality UI System } > 0}$$

$$- \underbrace{\frac{1}{g(\epsilon_s)} \cdot \left[\frac{\partial \Omega}{\partial \tau_{stw}}\right] \cdot \left[-\frac{1}{\frac{\partial \epsilon_s}{\partial \tau_{stw}}}\right]}_{\text{Additional Welfare Costs of larger STW benefits } > 0} - \underbrace{\tilde{BE}}_{\text{Bargaining Effect}}$$

Take away

- STW reacts on the fiscal externality of UI system $\rightarrow$ less inefficient separations
- STW does not stimulate vacancy postings
- STW does not provide income insurance on the firm

Extended Formula | Welfare Cost Penalty

Optimal STW benefits in steady state

$$\left(\bar{h} - h_{stw}(\epsilon_s)\right) \cdot \tau_{stw} = \underbrace{\frac{\beta \cdot (1 - f)}{1 - \beta \cdot (1 - G(\epsilon_s)) \cdot (1 - f)} \cdot \left[b + \frac{1-n}{n} \cdot b \right]}_{\text{Fiscal Externality UI System} \; > \; 0}$$

$$- \underbrace{\frac{1}{g(\epsilon_s)} \cdot \left[\frac{\partial \Omega}{\partial \tau_{stw}} \right] \cdot \left[- \frac{1}{\frac{\partial \epsilon_s}{\partial \tau_{stw}}} \right]}_{\text{Additional Welfare Costs of larger STW benefits} \; > \; 0} - \underbrace{\tilde{BE}}_{\text{Bargaining Effect}}$$

Take away

- Search costs important via job-finding rate f
- Important influence on optimal STW benefits!

Extended Formula | Welfare Cost Penalty

Impact Job-Finding Rate on optimal STW Benefits

Optimal STW benefits increase when job-finding rates fall

$$-\frac{\partial \tau_{stw}}{\partial f} > 0$$

Intuition

Smaller job-finding rate $\rightarrow$ workers stay unemployed for longer
$\rightarrow$ social costs of separations increase
(workers receive UI benefits for longer)
$\rightarrow$ larger STW benefits

Optimal STW Benefits in Steady State

Optimal STW benefits in steady state

$$\left(\bar{h} - h_{stw,t}(\epsilon_{s,t})\right) \cdot \tau_{stw} = \underbrace{\frac{\beta \cdot (1-f)}{1 - \beta \cdot (1 - G(\epsilon_s)) \cdot (1-f)} \cdot \left[b + \frac{1-n}{n} \cdot b\right]}_{\text{Fiscal Externality UI } > 0}$$

$$- \underbrace{\frac{1}{g(\epsilon_s)} \cdot \left[\frac{\partial \Omega}{\partial \tau_{stw}}\right] \cdot \left[-\frac{1}{\frac{\partial \epsilon_s}{\partial \tau_{stw}}}\right]}_{\text{Additional Welfare Costs of larger STW benefits } > 0} - \underbrace{\tilde{BE}}_{\text{Bargaining Effect}}$$

Take away

- Ramsey planner faces trade-off:

  reduction of inefficient separations vs. inefficient reduction in working hours.

- Ramsey planner prevents not all inefficient separations → smaller STW benefits

Optimal Eligibility Condition in Steady State

Optimal eligibility condition on separation threshold without STW

$$y(h_{stw}^{-1}(D), D)) - v(D) + \frac{k_v}{q} + (1 - f) \cdot \beta \cdot \frac{\mathcal{V} - U}{u'(\tilde{c}^w)} = 0$$

Why this eligibility condition?

- *Looser eligibility condition:* Hours distortions spread, no matches rescued → not optimal!
- *Tighter eligibility condition:* Lose most productive matches on STW → not optimal!

Take away

- Eligibility condition restricts number of firms on STW
  → keeps distortionary effects of STW low

Optimal Eligibility Condition in Steady State

Optimal eligibility condition on separation threshold without STW

$$y(h_{stw}^{-1}(D), D)) - v(D) + \frac{k_v}{q} + (1 - f) \cdot \beta \cdot \frac{\mathcal{V} - U}{u'(\tilde{c}^w)} = 0$$

Take away

- Also job-finding rate crucial determinant of eligibility condition!

Impact Job-Finding Rate on optimal Eligibility Condition

Optimal eligibility condition falls if the job-finding rate falls

$$-\frac{\partial D}{\partial f} < 0$$

Intuition

Smaller job-finding rate $\rightarrow$ harder for workers to find a new job
$\rightarrow$ workers accept cut in working hours and thus salary
$\rightarrow$ matches can survive on lower working hours without STW
$\rightarrow$ stricter eligibility to keep hours distortions low

Optimal STW Policy, Applied to a Recession

Distortionary Effects of UI grow in Recessions.

Negative productivity shock + wage-rigidity

→ fall in job-finding rate

→ UI distortions grow

→ inefficient separations

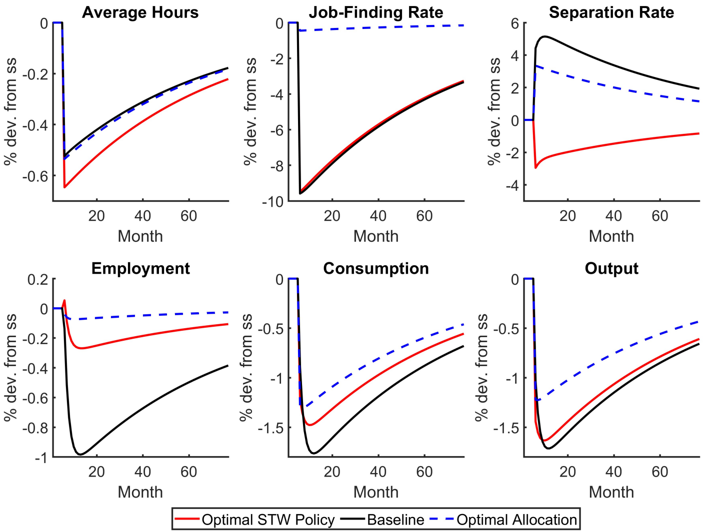
→ Deviation from Planner

Compared to Data

Optimal STW Benefits grow, Eligibility falls in Recessions

- STW benefits react to more distortions of UI
- Firms and workers choose lower working hours: thus, more eligible for STW
- STW system keeps self financing

Optimal STW Policy stabilizes the Business Cycle



Policy:

1. Job-finding rate cannot be stabilized
2. Separation rate oversteers

Allocation:

+ Consumption and employment stabilized
– STW distorts hours and reduces stabilization consumption

Fixed STW System

Influence Hours Distortion

Conclusion

Conclusion

1. **STW is a complement, not a substitute to the UI system**
   - STW internalizes fiscal externality of UI System
   - STW reduces fiscal costs
2. **Search frictions matter: variation in job-finding rate require STW to adjust**
   - Optimal STW benefits increase in recessions
   - Optimal eligibility condition must be tightened in recessions
3. **STW cannot reach the social planner solution**
   - Destabilizes working hours
   - Cannot stabilize job-finding rate

Thank you for your Attention!

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Appendix

Literature

Literature

- Braun and Brügemann (2017)
  - Looks at combination of UI and STW in implicit contract model
  - This paper: generalization to SaM allows to derive optimal policy over business cycle
- Balleer et al. (2016), Cooper, Meyer, and Schott (2017)
  - STW in a SaM, business cycle, inflexible hours, STW as flexibilization tool
  - This paper: flexible hours, STW as a state-contingent wage-subsidy, optimal policy.
- Cahuc, Kramarz, and Nevoux (2021)
  - Partial equilibrium model, emphasizes empirical relevance of distortion of working hours
  - This paper: similar modeling of STW, STW as subsidy that increases joint surplus

Appendix:

Model

Back

Labor Market Flows

- Unit mass of workers:
  - Employed n_t or unemployed u_t
  - If employed: either on or off STW
- Law of motion of employment:

$$n_t = (1 - G(\epsilon_{s,t-1})) \cdot n_{t-1} + m_{t-1}$$

  $G(\epsilon_{s,t})$: Endogenous separation rate

- Matching function:

$$m_t = \chi \cdot v_t^{1-\gamma} \cdot (1 - n_t + G(\epsilon_{s,t}) \cdot n_t)^{\gamma}$$

  v_t : vacancies

- Job-finding, job-filling rates and labor market tightness:

$$f_t = \chi \cdot (\theta_t)^{1-\gamma}, \qquad q_t = \chi \cdot (\theta_t)^{-\gamma}, \qquad \theta_t = \frac{v_t}{1 - n_t + G(\epsilon_{s,t}) \cdot n_t}$$

Production Technology

- Production function:

$$y_t(\epsilon, h_t(\epsilon)) = \underbrace{a_t \cdot \epsilon}_{\text{Firm Specific Productivity}} \cdot \underbrace{h_t(\epsilon)^\alpha}_{\text{Hours Worked}} - \underbrace{(\mu_\epsilon - \epsilon) \cdot c_f}_{\text{Resource Cost Shock}}$$

- Idiosyncratic productivity shock ϵ is i.i.d. and follows a log-normal distribution:

$$\epsilon_j \sim \mathcal{LN}(\mu, \sigma^2) \text{ with } \mu_\epsilon = E[\epsilon_j] = \exp(\mu + \frac{1}{2} \cdot \sigma^2)$$

- Aggregate productivity shock follows AR(1)-process

$$a_t = \mu_a + \rho_a \cdot (a_{t-1} - \mu_a) + \zeta_t, \quad \rho_a \in [0, 1), \quad \zeta_t \sim \mathcal{N}(0, \sigma_a^2)$$

back

Costain-Reiter Puzzle

Firm Side

Profits are redistributed towards firm owners

$$V_t^F = \tilde{u}\left(\Pi_t / \nu_t\right) + \beta \cdot E_t\left[V_{t+1}^F\right]$$

ν_t : number of firm owners

Expected Value of Firm and Worker at Nash-Bargaining

- The STW threshold $\epsilon_{stw,t}$ is implicitly defined by: $h_t(\epsilon_{stw,t}) = D_t$
- Expected value of a worker for a firm at Nash-Bargaining:

$$\mathcal{J}_t = \int_{\epsilon_{stw,t}}^{\infty} J_t(\epsilon) dG(\epsilon) + \int_{\epsilon_{s,t}}^{\epsilon_{stw,t}} J_{stw,t}(\epsilon) dG(\epsilon) - G(\epsilon_{s,t}) \cdot (w_{eu,t} + \tau_{J,t} + F)$$

- Expected value of a worker at Nash-Bargaining can be defined by:

$$\mathcal{V}_t = \int_{\epsilon_{stw,t}}^{\infty} V_t(\epsilon) dG(\epsilon) + \int_{\epsilon_{s,t}}^{\epsilon_{stw,t}} V_{stw,t}(\epsilon) dG(\epsilon) + G(\epsilon_{s,t}) \cdot (u(w_t) - u(b_t) + U_t)$$

Back

Rigid Salaries

Introduction of rigid salaries:
Following Jung and Kuester (2015), the bargaining power of workers increases in recessions:

$$\eta_t = \exp(-\gamma_w \cdot a_t), \quad \gamma_w > 0$$

Motivation:
Rigid salaries solve the Shimer Puzzle (see Shimer (2005))

Government Budget Constraint

Government Budget Constraint:

Government finances period expenditure by same period income from taxes (no financial markets).

$$\underbrace{n_t \cdot \tau_{J,t}}_{\text{Tax Income}} = \underbrace{(1 - n_t) \cdot b_t}_{\text{Fiscal Costs UI System}} \underbrace{+ n_t \cdot \int_{\epsilon_{s,t}}^{\epsilon_{stw,t}} \left(\bar{h} - h_{stw,t}(\epsilon)\right) \cdot \tau_{stw,t} dG(\epsilon)}_{\text{Fiscal Costs STW System}}$$

Implication:

UI system gets more expensive in recessions as more workers use the system. This increases the tax the government has to charge.

Appendix

Details Theory

Insurance on the Firm:

Firms insure workers against idiosyncratic productivity shocks:

$$\underbrace{c_t(\epsilon) - v(h_t(\epsilon))}_{\tilde{c}_t} = \underbrace{c_{stw,t}(\epsilon) - v(h_{stw,t}(\epsilon))}_{\tilde{c}_{stw,t}} = c_{eu,t}$$

⇒ Same period utility in and outside STW and from severance payments

⇒ Firms stock-up income on STW

back

Working Hours

Hours worked outside STW:

Outside STW, working hours are set optimally (like in competitive equilibrium)

$$\underbrace{\frac{\partial y(\epsilon, h_t(\epsilon))}{\partial h}}_{\text{Marginal Product of Labor}} = \underbrace{v'(h_t(\epsilon))}_{\text{Marginal Disutility of Labor}}$$

Graph back

Working Hours

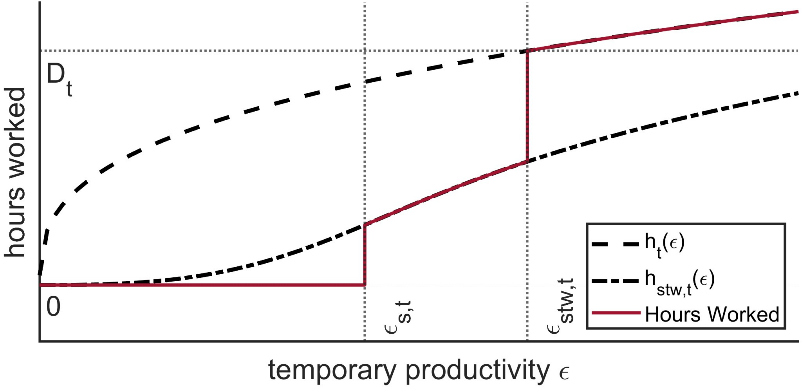
Hours worked on STW:

Are distorted downwards by STW compensation (distortion of working hours)

$$\underbrace{\frac{\partial y(\epsilon, h_{stw,t}(\epsilon))}{\partial h}}_{\text{Marginal Product of Labor}} = \underbrace{v'(h_{stw,t}(\epsilon))}_{\text{Marginal Disutility of Labor}} + \underbrace{\tau_{stw,t}}_{\text{STW Benefits}}$$

Graph back

Working Hours Back



Separations

Separation Threshold is determined by:

$$y_t(\epsilon_{s,t}, h_{stw,t}(\epsilon_{s,t})) + \left(\bar{h} - h_{stw}(\epsilon_{s,t})\right) \cdot \tau_{stw,t} + \frac{k_v}{q_t} + (1 - f_t) \cdot \frac{\beta \cdot E_t\left[\mathcal{V}_{t+1} - U_{t+1}\right]}{u'(\tilde{c}_t)} = 0$$

Intuition:

1. Employed worker's income is insured by firm → don't want to quit
2. STW reduces the costs of salary-commitment in bad times → less likely to fire workers
3. Higher benefits → salaries paid by firms reduced → less separations

back

Ramsey Problem

Planner chooses STW benefits $\tau_{stw,t}$, eligibility condition D_t and UI benefits b_t.

$$W_t^G = \max_{D_t, \tau_{stw,t}, b_t} (1 - n_t) \cdot u(b_t) + n_t \cdot u(\tilde{c}_t^w)$$

$$+ \nu_t \cdot \underbrace{\tilde{u}\left(\left[\int_{\epsilon_{s,t}}^{\infty} y_t(\epsilon) - v(h_t(\epsilon))dG(\epsilon) - n_t \cdot \Omega_t - \tilde{c}_t^w - (1 - n_t) \cdot b_t - v_t \cdot k_v - \rho_t \cdot n_t \cdot F\right] / \nu_t\right)}_{\text{Utility of Firm Owners w/o hours distortion}}$$

$$+ \beta \cdot E_t W_{t+1}^G$$

subject to

Labor Market Equilibrium

Additional Assumption: number of firm owners ν_t are set so $\tilde{c}_t^w = c_t^f$

$\Rightarrow$ no distributional conflicts between firm owners and workers!

Back

Optimal UI benefits in steady state - given STW system Back

Optimal UI benefits in steady state

$$(1-n)\cdot(u'(b)-u'(\tilde{c}^w)) = (LV+LS)\cdot\frac{u'(\tilde{c}^w)}{1-\eta}\left(-\frac{\partial J}{\partial b}\right)$$

Welfare loss fewer vacancy postings (LV) and more separations (LS):

$$LV = \frac{1}{M}\cdot\underbrace{\frac{\eta-\gamma}{(1-\gamma)\cdot(1-\eta)}}_{\text{Deviation Hosios Condition}} + \frac{1}{M}\cdot\underbrace{\frac{b+\frac{1-n}{n}\cdot b}{1-\beta\cdot(1-f)\cdot(1-G(\epsilon_s))}\Big/\frac{k_v}{q}}_{\text{Fiscal Externality UI System}}$$

$$LS = \frac{1}{M}\cdot\frac{n\cdot(\gamma-f\cdot\eta)}{(1-\gamma)\cdot(1-\eta)\cdot m}\cdot\left(\underbrace{\frac{\beta\cdot(1-f)\cdot\left(b+\frac{1-n}{n}\cdot b\right)}{1-\beta\cdot(1-f)\cdot(1-G(\epsilon_s))}}_{\text{Fiscal Externality UI System}} - \underbrace{\tau_{stw,t}\cdot(\bar{h}-h_{stw,t}(\epsilon_s))}_{\text{STW Subsidy}}\right)$$

Take away:

- STW cannot eliminate low vacancy postings
- STW can eliminate all inefficient separations $\rightarrow$ allows for more generous UI benefits

Optimal UI benefits in steady state - with optimal STW system

Optimal UI benefits in steady state

$$(1-n)\cdot(u'(b)-u'(\tilde{c}^w)) = (LV+LS)\cdot\frac{u'(\tilde{c}^w)}{1-\eta}\left(-\frac{\partial J}{\partial b}\right)$$

Welfare costs vacancy posting and separations (given STW):

$$LV = \frac{1}{M'}\cdot\underbrace{\frac{\eta-\gamma}{1-\eta}}_{\text{Deviation Hosios Condition}} + \frac{1}{M'}\cdot\frac{b+\frac{1-n}{n}\cdot b}{1-\beta\cdot(1-f)\cdot(1-G(\epsilon_s))}/\frac{k_v}{q}$$

$$LS + LSTW = \underbrace{\frac{1}{M'}\cdot\frac{n\cdot(\gamma-f\cdot\eta)}{(1-\gamma)\cdot(1-\eta)\cdot m}\cdot\left(\frac{\partial\Omega}{\partial\tau_{stw}}/\left(\bar{h}-h_{stw}(\epsilon_s)\right)+\frac{\partial\Omega}{\partial\epsilon_{stw}}/\frac{\partial y(\epsilon_{stw},h)}{\partial\epsilon_{stw}}\right)}_{\text{STW cannot combat all inefficient separations due to hours distortions}}$$

Take away:

- Planner decides against eliminating all inefficient separations due to hours distortions!
- Trade-off: Stabilizing employment vs. stabilizing working hours

Optimal STW Benefits back

Bargaining Effect:

$$\tilde{BE} = \frac{\frac{BE \cdot (LS+LV+LSTW)}{n \cdot u'(\tilde{c}^w)}}{1 + \frac{\beta \cdot (1+\eta \cdot BE) \cdot (LS+LV+LSTW)}{n \cdot u'(\tilde{c}^w)}} \cdot \frac{1-f(\theta)}{1-\eta} \cdot \frac{k_v}{q(\theta)}$$

$$\text{with} \quad BE = \frac{\left(-\frac{u''(\tilde{c}^w)}{u'(\tilde{c}^w)}\right) \cdot \frac{u(\tilde{c}^w)-u(b)}{u'(\tilde{c}^w)}}{1 + (1-\eta) \cdot \left(-\frac{u''(\tilde{c}^w)}{u'(\tilde{c}^w)}\right) \cdot \frac{u(\tilde{c}^w)-u(b)}{u'(\tilde{c}^w)}}$$

Sending workers on STW is costly for the firm

→ salary reduction needed, but: MU of workers go up

→ more difficult to reduce wages

→ less vacancies, more separations!

Optimal STW benefits in steady state back

Optimal STW benefits in steady state

$$\left(\bar{h} - h_{stw}(\epsilon_s)\right) \cdot \tau_{stw} = \underbrace{\frac{\beta \cdot (1-f)}{1-\beta \cdot (1-G(\epsilon_s)) \cdot (1-f)} \cdot \left[b + \frac{1-n}{n} \cdot b\right]}_{\text{Fiscal Externality UI } > 0}$$

$$- \underbrace{\frac{1}{g(\epsilon_s)} \cdot \left[\frac{\partial \Omega}{\partial \tau_{stw}}\right] \cdot \left[-\frac{1}{\frac{\partial \epsilon_s}{\partial \tau_{stw}}}\right]}_{\text{Additional Welfare Costs of larger STW Benefits } > 0} - \underbrace{\tilde{BE}}_{\text{Bargaining Effect}}$$

What is the welfare cost penalty?

Welfare Costs of STW

Welfare costs of STW due to distortion of working hours

$$\Omega_t = \int_{\epsilon_{s,t}}^{\epsilon_{stw,t}} \Big[\underbrace{y_t(\epsilon) - v\left(h_t(\epsilon)\right)}_{\text{No Hours Distortion}} - \underbrace{y_{stw,t}(\epsilon) + v\left(h_{stw,t}(\epsilon)\right)}_{\text{With Hours Distortion}} \Big] dG(\epsilon) \geq 0$$

Difference between output minus disutility from work with and without hours distortion

Welfare Effects Hours Distortion

Eligibility and STW benefits influence welfare costs of STW

$$\underbrace{\frac{\partial \Omega_t}{\partial \tau_{stw,t}}}_{\text{More STW benefits}} > 0, \quad \underbrace{\frac{\partial \Omega_t}{\partial D_t}}_{\text{Looser Eligibility}} > 0, \quad \underbrace{\frac{\partial^2 \Omega_t}{\partial D_t \partial \tau_{stw,t}}}_{\text{both}} > 0$$

Intuition:

1. Larger STW benefits → larger incentive to reduce hours → larger hours distortion
2. Looser eligibility → more workers on STW → larger hours distortion
3. Looser eligibility + larger benefits → even larger hours distortion

Appendix:

Calibration

back

Table 1: Business Cycle Properties US Data

		v	f	ρ	u	θ	$\bar{h}$	p
Standard Deviation		20.13	14.31	8.2	20.49	39.67	0.81	1.91
Autocorrelation		0.95	0.95	0.77	0.95	0.96	0.92	0.9
	v	1	0.85	-0.55	-0.92	0.98	0.55	0.19
	f	-	1	-0.29	-0.93	0.91	0.38	0.09
	ρ	-	-	1	0.6	-0.59	-0.63	-0.4
Correlation	u	-	-	-	1	-0.98	-0.55	-0.23
	θ	-	-	-	-	1	0.57	0.22
	$\bar{h}$	-	-	-	-	-	1	0.46
	p	-	-	-	-	-	-	1

Notes: The table lists the second moments of the US data. u, v, f, $\bar{h}$, and $G(\epsilon_s)$ are expressed as quarterly averages of monthly series. p is the seasonally adjusted average labor productivity in the non-farm business sector. All variables are reported as log-deviations from a HP trend with smoothing parameter 10^5.

Table 2: Business Cycle Properties Baseline Model

		v	f	ρ	u	θ	$\bar{h}$	p
Standard Deviation		19.8	14.31	8.2	21.26	40.88	0.76	1.91
Autocorrelation		0.95	0.97	0.97	0.98	0.97	0.97	0.97
Correlation	v	1	1	-0.99	-0.98	1	1	1
	f	-	1	-1	-1	1	1	1
	ρ	-	-	1	1	-1	-1	-1
	u	-	-	-	1	-1	-1	-1
	θ	-	-	-	-	1	1	1
	$\bar{h}$	-	-	-	-	-	1	1
	p	-	-	-	-	-	-	1

Notes: The table reports the second moments of the model. As in the data, all variables are quarterly averages of monthly series and reported as log-deviations. p denotes the average output per person, that is $p = E[y_t(\epsilon)|\epsilon \geq \epsilon_{s,t}]$.

Costain and Reiter (2008) - Puzzle

Costain and Reiter (2008)-Puzzle:
SaM cannot simultaneously produce realistic business cycle fluctuations and a realistic elasticity of unemployment

Workaround:
wage-rigidity (γ_w calibrated to match s.d. job-finding rate) + large surplus calibration

Problem:
Large continuation value implies no separation incentives with idiosyncratic shocks

Workaround: idiosyncratic resource cost shock, c_f calibrated to match separation rate

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Data - Elasticity of unemployment with respect to UI benefits: 2-3

Model - Elasticity of unemployment with respect to UI benefits: 2,73

Table 2: Parameters

Parameter	Description	Value	Reason
ρ	Target ss separation rate	0.03	Data
f	Target ss job-finding rate	0.41	Data
q	Target ss vacancy filling rate	0.338	Haan, Ramey, and Watson (2000)
β	Discount rate	0.996	Jung and Kuester (2015)
ψ	Inverse Frisch-elasticity	1.5	Domeij and Floden (2006)
γ	Elasticity matching function with respect to unemployment	0.65	Shimer (2005).
η	Bargaining power worker	0.65	Implements Hosios-Condition
γ_w	Coefficient reaction bargaining power to productivity shock	15.5	s.d. job-finding rate 14.31 in data
F	Separation costs	1.01	s.d. separation rate of 8.2 in data
b	UI benefits	0.4	40% replacement rate of wage
α	Labor elasticity production function	0.65	Christoffel and Linzert (2010)
$\bar{h}$	"Normal" hours worked	0.834	Mean hours worked in baseline
ρ_a	Autocorr. productivity shock	0.985	Jung and Kuester (2015)
μ_a	Mean aggregate productivity	1.0	Normalization
$\sigma_a \cdot 100$	s.d. aggregate productivity	0.259	s.d. labor prod. of 1.91 in data
μ	Parameter steering mean of lognormal distribution	0.082	Normalize wage to 1
σ	Parameter steering variance of lognormal distribution	0.12	Krause and Lubik (2007)
χ	Matching parameter	0.383	Calculated by target ss
k_v	Vacancy posting costs	0.139	Calculated by target ss
c_f	Strength resource cost shock	10.441	Calculated by target ss

Fixed STW system

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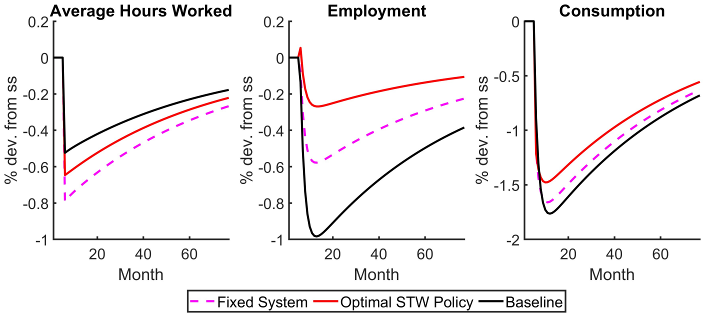
Fixed STW system

How important is it to adjust STW over the business cycle?
Balleer et al. (2016) argue that STW acts as an automatic stabilizer

Assumptions:

1. STW is set optimally in steady state
2. STW is not adjusted over the business cycle

Fixed STW system



Observation:

- – Stabilizes employment but not consumption!
- → No automatic stabilization!
- → Contrasts: Balleer et al. (2016)

Reason:

- – Eligibility condition not adjusted
- → More firms on STW
- → Average hours fall
- → Outweighs employment effect

Appendix:

Optimal STW Policy with and without Moral Hazard

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What influences optimal STW benefits?

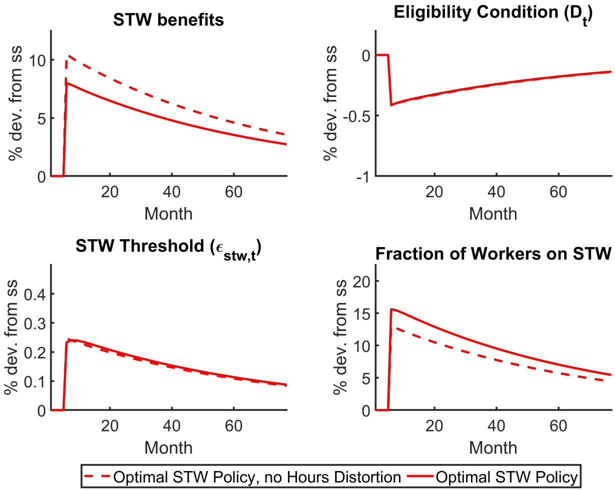
Optimal STW benefits decrease in number of workers on STW:

$$\frac{\partial\left(\bar{h}-h_{stw}(\epsilon_s)\right)\tau_{stw}}{\partial \epsilon_{stw}} = -\frac{\partial^2 \Omega}{\partial \tau_{stw} \partial \epsilon_{stw}} \cdot \left[-\frac{1}{\frac{\partial \epsilon_s}{\partial \tau_{stw}}} + \frac{\partial \tau_{stw}}{\partial n}\right] - \frac{\partial \Omega}{\partial \tau_{stw}} \cdot \left[\frac{1}{\frac{\partial \epsilon_s}{\partial \tau_{stw} \partial \epsilon_{stw}}}\right] < 0$$

Intuition:

Looser eligibility → larger benefits reach more firms
→ larger hours distortion
→ choose smaller benefits to reduce distortion
→ Less effective combating inefficient job losses

Moral Hazard of STW reduces Ability to stabilize Business Cycles



More workers on STW

- → More distortion working hours
- → Smaller STW benefits

Moral Hazard of STW reduces Ability to stabilize Business Cycles

Distortions of STW grows since more firms are on STW

Implication:

- → Set smaller Net-Subsidy
- → Separation rate cannot be oversteered to the optimal level
- → Consumption and employment less well stabilized

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