Temporary Layoffs, Loss-of-Recall, and Cyclical Unemployment Dynamics

Mark Gertler[1], Christopher Huckfeldt[2], Antonella Trigari[3]

[1]New York University, NBER
[2]Cornell University
[3]Bocconi University, CEPR, and IGIER

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Macroeconomics of Labor Markets

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What We Do (1/2)

▶ Document the contribution of temporary layoffs (TL) to unemployment dynamics, from 1978 onwards

▶ Study contribution of "loss-of-recall" to the cyclicality of unemployment

▶ Develop model of unemployment fluctuations that distinguishes between temporary and permanent separations …

What We Do (2/2)

- Model allows for two types of unemployment:
    - Jobless unemployment (JL): search for new job
    - Temporary-layoff unemployment (TL): wait for recall

    Worker in u_{TL} moves to u_{JL} if prior job is destroyed (i.e., loss-of-recall)

- Calibrate model to dynamics of jobless and temporary-layoff unemployment using CPS, 1979-2019

- Adapt the model to study the Covid-19 labor market

Why We Do It (1/2)

Revisit recessionary impact of temporary layoffs

- ▶ Stabilizing "direct" effect: recalls $\downarrow \Rightarrow u_{TL} \uparrow$
    - ▶ Workers in u_{TL} return to work faster than workers in u_{JL}
    - ▶ Thus, TL's are stabilizing relative to permanent separations
    - ▶ Traditional view

- ▶ Destabilizing "indirect" effect: loss-of-recall $\uparrow \Rightarrow u_{JL} \uparrow$
    - ▶ Workers move from u_{TL} to u_{JL} at a higher rate during recessions
    - ▶ We estimate JL-from-TL to be countercyclical and highly volatile

Note: recall and loss-of-recall are endogenous and thus *policy-dependent*

Why We Do It (2/2)

- ▶ Onset of Covid-19 pandemic: surge of temporary layoffs
  - ▶ First month: 15% of employed workers move to u_{TL}
  - ▶ u_{TL} remains persistently high thereafter (across all sectors)

- ▶ Fiscal response: Paycheck Protection Program (PPP)
  - ▶ Forgivable loans for firms to recall workers
  - ▶ $953-billion program— larger than 2009 Recovery Act

- ▶ What role did PPP play in shaping employment recovery?
  - ▶ What is the no-PPP counterfactual? Require structural model

- ▶ Our findings: Large monthly reductions in u_{JL} due to PPP
  - ▶ ≈ 2 p.p. in short-run, ≥ 1 p.p. thru May 2021
  - ▶ Achieved by preventing loss-of-recall

Plan

- Empirics of temporary-layoff unemployment
- Model (three stocks, five flows)
- Model evaluation

and then

- Application to Covid-19 Recession

Empirics of
Temporary-Layoff Unemployment & "Loss-of-Recall"

Empirics of Loss-of-Recall

1. u_{TL} comprises just 1/8 of total unemployment (u)

Table: Unemployment, jobless unemployment, and temporary-layoff unemployment

	$U =$		
	$JL + TL$	JL	TL
mean(x)	0.062	0.054	0.008
std(x)/std(Y)	8.518	8.532	10.906
corr(x, Y)	-0.848	-0.810	-0.788

CPS, 1978-2009. For second and third row, series are taken as (1) quarterly averages of seasonally adjusted monthly series, (2) logged, (3) HP-filtered with smoothing parameter 1600

Empirics of Loss-of-Recall

1. u_{TL} comprises just 1/8 of total unemployment (u)
2. But look at flows: E-to-TL's account for 1/3 of all separations to u

Table: Gross worker flows, 1978–2019

From	To			
	E	TL	JL	I
E	0.955	0.005	0.011	0.029
TL	0.435	0.245	0.191	0.129
JL	0.244	0.022	0.475	0.259
I	0.043	0.001	0.027	0.929

Empirics of Loss-of-Recall

1. u_{TL} comprises just 1/8 of total unemployment (u)
2. But look at flows: E-to-TL's account for 1/3 of all separations to u
3. And, JL-from-TL's return to employment at substantially lower rate

Table: Transitions from JL, TL, and JL-from-TL (1978–2019)

From	To			
	E	*TL*	*JL*	*I*
JL, unconditional	0.244	0.022	0.475	0.259
TL, unconditional	0.435	0.245	0.191	0.129
JL-from-*TL*	0.271	0.000	0.556	0.173

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4. E-to-TL's are particularly important during recessions:

Table: Cyclical properties, gross worker flows

	$p_{E,TL}$	$p_{E,JL}$	$p_{TL,E}$	$p_{JL,E}$	$p_{TL,JL}$
std(x)/std(Y)	11.264	4.962	6.609	7.126	10.084
corr(x, Y)	-0.393	-0.674	0.599	0.803	-0.192

CPS, 1978-2009. Series are taken as (1) quarterly averages of seasonally adjusted monthly series, (2) logged, (3) HP-filtered with smoothing parameter 1600

Empirics of Loss-of-Recall

1. u_{TL} comprises just $1/8$ of total unemployment (u)

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   4.3 More workers move from u_{TL} to u_{JL} (loss-of-recall)

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Direct effect: $p_{E,TL} \uparrow$ & $p_{TL,E} \downarrow \Rightarrow u_{TL} \uparrow$

Indirect effect: $p_{E,TL} \uparrow$ & $p_{TL,JL} \uparrow \Rightarrow u_{JL\text{-from-}TL} \uparrow$

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   4.2 Fewer workers from u_{TL} are recalled to employment
   4.3 More workers move from u_{TL} to u_{JL} (loss-of-recall)

5. We develop methods to estimate the *indirect effect*, i.e. JL-from-TL

$$\text{Direct effect: } p_{E,TL} \uparrow \& p_{TL,E} \downarrow \Rightarrow u_{TL} \uparrow$$

$$\text{Indirect effect: } p_{E,TL} \uparrow \& p_{TL,JL} \uparrow \Rightarrow u_{JL\text{-from-}TL} \uparrow$$

Temporary-layoff unemployment u_{TL}: 1979 to 2019

Temporary-layoff unemployment u_{TL} + "u_{JL} from u_{TL}": 1979 to 2019
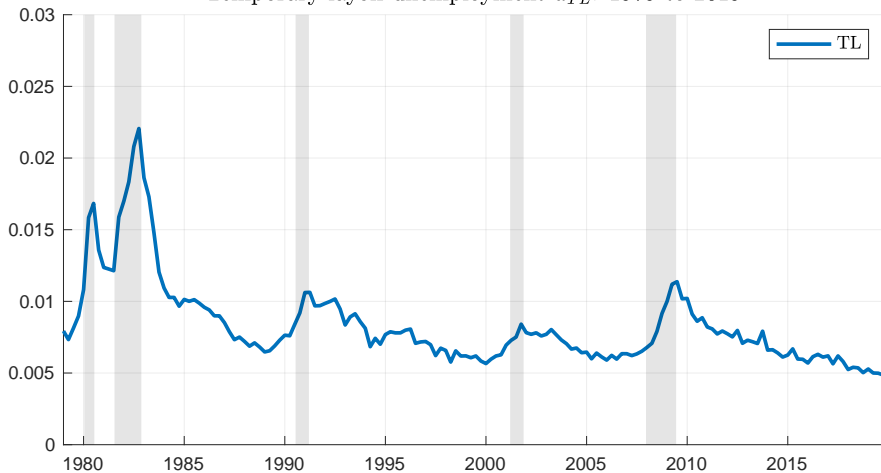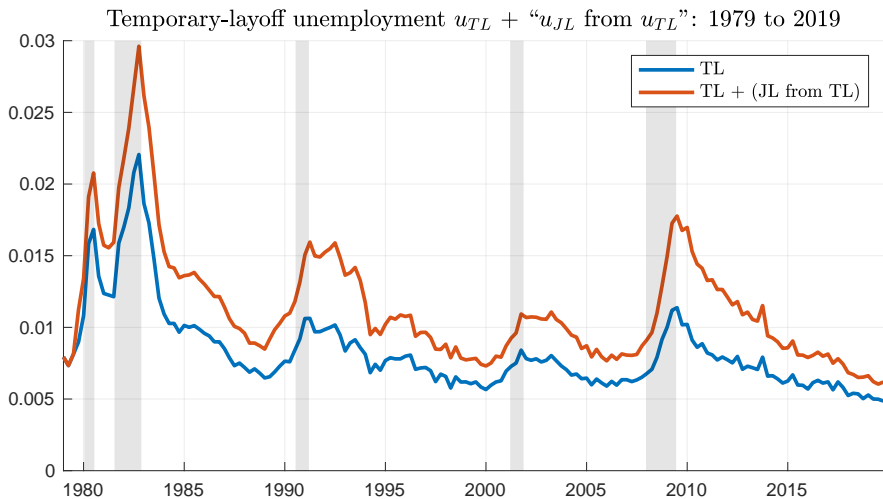
Temporary-layoff unemployment u_{TL} + "u_{JL} from u_{TL}": 1979 to present
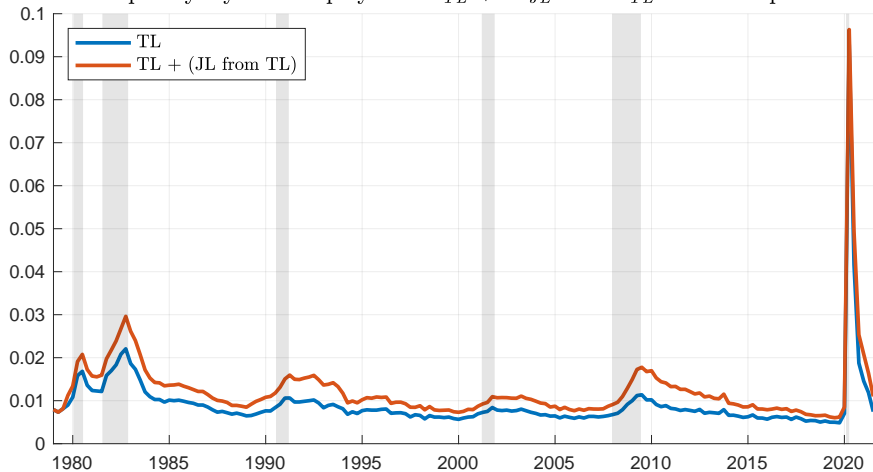
Model
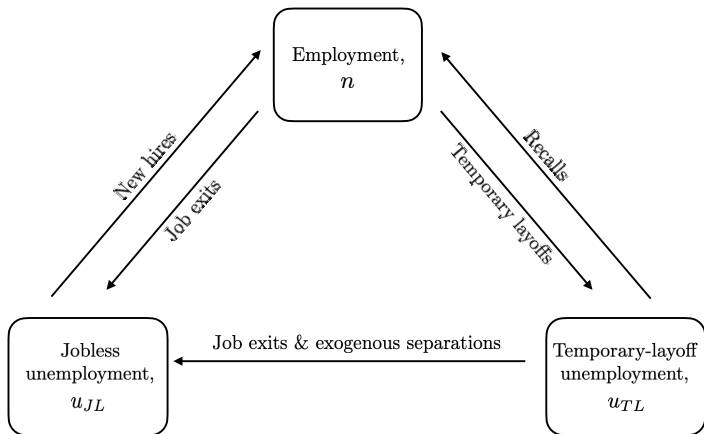
Model

Starting point: RBC model with search and matching

▶ Perfect consumption insurance

▶ Wage rigidity via staggered Nash wage bargaining

Key variations:

▶ Endog. separations into temporary-layoff unemp.

▶ Recall hiring from temporary-layoff unemployment

▶ Endogenous separations into jobless unemployment
  ▶ Allow for temporary paycuts: no inefficient separations
  ▶ Permanent sep. triggers $u_{TL} \to u_{JL}$ for some workers

▶ Hiring from jobless unemployment

Details of Model

- Unemployed are either in
  - JL: Searching for work in a DMP-style matching market
  - TL: Waiting for recall or loss-of-recall

- Firms, w/ CRS technology in labor and capital, draws cost shocks
  - Overhead costs to entire firm ⇒ separations to JL and JL-from-TL
  - Worker-specific overhead costs ⇒ separations to TL

- After separations: firms rent capital, hire from JL, and recall from TL

- Base wages set via staggered Nash bargaining
  - But temporary paycuts avoid inefficient exit

▸ Model: full slides

Firm's Problem

▶ Start of period, aggregate & worker shocks revealed.

▶ Then,

  1. Temporary layoffs: Firms assigns $1 - \mathcal{F}(\vartheta^*)$ workers to u_{TL}

  2. Permanent separations: Common shock γ within firm

     ▶ Firm exits if $\gamma \geq \gamma^*$, workers and TL's move to u_{JL}
     ▶ Otherwise, firm continues

  3. Continuing firms operate:

     ▶ Rents capital and produces output
     ▶ Hires workers from u_{JL}, recalls workers from u_{TL}
     ▶ Possibility of temporary paycuts, i.e. remitted wages $\omega < w$

▶ Solve backwards

Firm Problem (at non-exiting firms w/ TL policy ϑ^*)

Let $J(w, \gamma, \mathbf{s})$ be firm's value per worker after TL's and exits. Then,

$$J(w, \gamma, \mathbf{s}) = \max_{k, x, x_r} \left\{ z\mathcal{F}(\vartheta^*)\check{k}^{\alpha} - \omega(w, \gamma, \mathbf{s})\mathcal{F}(\vartheta^*) - r\mathcal{F}(\vartheta^*)\check{k} \right.$$
$$- \left(\iota(x)\mathcal{F}(\vartheta^*) + \iota_r(x_r)\mathcal{F}(\vartheta^*)\right) - \varsigma(\vartheta^*, \gamma)$$
$$\left. + \mathbb{E}\left\{\Lambda(\mathbf{s}, \mathbf{s}')\mathcal{J}(w', \mathbf{s}')|, w, \mathbf{s}\right\}\right\},$$

with
$$\varsigma(\gamma, \vartheta^*) = \varsigma_\gamma \gamma + \varsigma_\vartheta \int^{\vartheta^*} \vartheta d\mathcal{F}(\vartheta)$$

$$\iota(x) = \chi x + \frac{\kappa}{2}(x - \tilde{x})^2 \quad \iota_r(x_r) = \chi x_r + \frac{\kappa_r}{2}(x_r - \tilde{x}_r)^2$$

$$\mathcal{J}(w, \mathbf{s}) = \max_{\vartheta^*} \int^{\gamma^*} J(w, \gamma, \mathbf{s}) d\mathcal{G}(\gamma)$$

Hiring and Recall (at non-exiting firms w/ policy ϑ^*)

► FOC's for hiring and recall:

$$\chi + \kappa\,(x - \tilde{x}) = \mathbb{E}\left\{\Lambda(\mathbf{s}, \mathbf{s}')\mathcal{J}\left(w', \mathbf{s}'\right)|w, \mathbf{s}\right\}$$

$$\chi + \kappa_r\,(x_r - \tilde{x}_r) = \mathbb{E}\left\{\Lambda(\mathbf{s}, \mathbf{s}')\mathcal{J}\left(w', \mathbf{s}'\right)|w, \mathbf{s}\right\}$$

► Calibrated model (and data):

$$\underbrace{\left(\frac{\chi_r}{\kappa_r \tilde{x}_r}\right)}_{\text{Recall elasticity}} > \underbrace{\left(\frac{\chi}{\kappa \tilde{x}}\right)}_{\text{Hiring elasticity}}$$

► Relation of $\{x, x_r\}$ to job-finding/recall probabilities $\{p, p_r\}$:

$$x = \frac{p u_{JL}}{\mathcal{F}(\vartheta^*)n}, \quad x_r = \frac{p_r u_{TL}}{\mathcal{F}(\vartheta^*)n}$$

Firm Exits (and Temporary Paycuts)

▶ Given cost shock γ and base wage w, allow temp. paycuts to avoid exit

▶ Shutdown threshold γ^* solves $J(\underline{w}, \gamma^*, \mathbf{s}) = 0$
  ▶ $\underline{w} \equiv$ reservation wage

▶ Paycut threshold $\gamma^\dagger \in (0, \gamma^*)$ solves $J(w, \gamma^\dagger, \mathbf{s}) = 0$
  ▶ Zero firm surplus for $\gamma \in (\gamma^\dagger, \gamma^*)$

▶ Firm's active laborforce $+$ workers on TL go to u_{JL} upon exit

Temporary layoffs

▶ Firm must pay overhead costs to continue to operate:

$$\varsigma(\gamma, \vartheta^*) = \varsigma_\gamma \gamma + \varsigma_\vartheta \int^{\vartheta^*} \vartheta d\mathcal{F}(\vartheta)$$

▶ FOC for optimal θ^* determines TL threshold:

$$\underbrace{\mathcal{J}(w, \mathbf{s}) + \varsigma_\gamma \Gamma + \varsigma_\vartheta \mathcal{G}(\gamma^*) \Theta}_{\text{Job value net of period overhead costs}} = \varsigma_\vartheta \vartheta^* \mathcal{F}(\vartheta^*) \mathcal{G}(\gamma^*)$$

with $\Gamma \equiv \int^{\gamma^*} \gamma d\mathcal{G}(\gamma)$ and $\Theta \equiv \int^{\vartheta^*} \vartheta d\mathcal{F}(\vartheta)$.

Model Evaluation

Calibration

- ▶ Calibrate model to match standard labor market stocks and flows…
  - ▶ Plus characteristics of temporary layoff, recall, and loss-of-recall

- ▶ Nested, two-stage estimation of 16 parameters
  - ▶ Inner loop: long-run moments
  - ▶ Outer loop: business cycle features
  - ▶ Parameters and moments

- ▶ Where we tie our hands:
  - ▶ Not a small-surplus calibration
  - ▶ Wage rigidity to match evidence on contract duration
  - ▶ Temporary paycuts can undo wage rigidity

- ▶ Model does well!

▶ Stocks & Wages   ▶ Flows   ▶ Loss-of-Recall

Application to the Covid-19 Recession

Adapting the Model to the Covid-19 Recession

▶ Introduce two shocks:
  ▶ "Lockdown" shocks: workers move to lockdown-TL (MIT shock)
  ▶ Persistent shocks to effective TFP w/ each wave (social distancing)

▶ Add two parameters specific to workers on lockdown-TL:
  ▶ Allow for different recall cost (vs. TL)
  ▶ Allow for different rate for loss-of-recall (vs. TL)

▶ Treatment of PPP:
  ▶ Direct factor payment subsidy, à la Kaplan, Moll, Violante (2020)
  ▶ Pre-announcement: program is unexpected
  ▶ Post-announcement: availability of funds is known

▶ Estimate shocks and parameters to match stocks and flows
  ▶ Model does well! ▸ Stocks, model vs. data ▸ Flows, model vs. data

No-PPP Counterfactual

Q: What did PPP do?

▶ Keep decision rules, parameters, and shocks, but remove PPP

A: Save a lot of worker/job matches!

▶ Average monthly empl. gains of $\approx$ 2.14 p.p. in first 6 months
▶ Doubles number of recalls over the same period
▶ Achieved through reduction of loss-of-recall

▶ Stocks, no-PPP counterfactual

▶ Flows, no-PPP counterfactual

Counterfactual: JL-from-TL without PPP
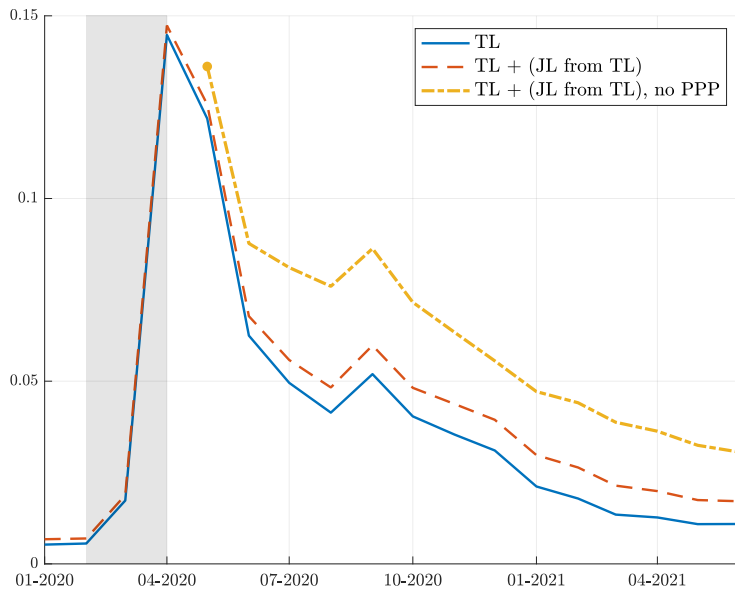
Conclusion

Concluding Remarks

Two Directions for Further Work

1. Match-specific capital
   - Recalls preserve match-specific capital
   - Thus, interesting to consider heterogenous match quality

2. Reallocation
   - Evidence that smaller firms benefited more from PPP
   - PPP might have hindered efficient reallocation

Supplementary Slides

Estimating JL-from-TL

▶ Use accumulation equations:

$$u_{JL\text{-from-}TL,t} = \sum_{j=0}^{T} e'_{JL} x_{t-j-1,t}$$

where $x_{t-j-1,t}$ is the distribution of workers at time t whose last exit from employment was for u_{TL} at time $t-j-1$, s.t.

$$x_{t-m,t-j} = \tilde{P}_t x_{t-m,t-j-1}$$
$$x_{t-m,t-m} = e_{TL} \cdot (n^E_{t-m-1} \cdot p^{E,TL}_{t-m})$$

▶ Relatively small: $u_{JL\text{-from-}TL}$ is 40% of u_{TL}
▶ Highly volatile: twice as volatile as total unemployment, $16\times$ as GDP

Searchers, Matching and Recalls

- ▶ Jobless unemployment (DMP matching market)
  - ▶ New hires m from unemployment

  $$m = \sigma_m (u_{JL})^\sigma (\upsilon)^{1-\sigma}$$

  - ▶ Job finding and hiring probabilities p and q, hiring rate x

  $$p = \frac{m}{u_{JL}}, \quad q = \frac{m}{\upsilon}, \quad x = \frac{p \cdot u_{JL}}{\mathcal{F}(\vartheta^*)n} = \frac{q \cdot \upsilon}{\mathcal{F}(\vartheta^*)n}$$

- ▶ Temporary-layoff unemployment
  - ▶ Recalls m_r from TL unemp., recall hiring rate x_r

  $$m_r = p_r u_{TL}, \quad x_r = \frac{p_r u_{TL}}{\mathcal{F}(\vartheta^*)n}$$

- ▶ Workers in u_{TL} move to u_{JL} with exog. probability $1 - \rho_r$
  - ▶ or if firm exits (with prob. $1 - \mathcal{G}(\gamma^*)$)

Firms (or plants, shifts, production unit, etc.)

- Firms are "large", i.e hire a continuum of workers
    - Firm, or establishment, or assembly line, etc.
- CRS technology
    - $n \equiv$ beginning of period employment
    - $\mathcal{F} \equiv$ fraction of workers not on temporary layoff
    - $\xi_k, \xi_n \equiv$ factor utilization rates

$$
\begin{aligned}
y &= \check{z}(\xi_k k)^{\alpha}(\xi_n \mathcal{F} n)^{1-\alpha} \\
&= z k^{\alpha}(\mathcal{F} n)^{1-\alpha}
\end{aligned}
$$

- Given CRS technology, firm decisions scale independent

Overhead Costs: Temporary versus Permanent Layoffs

$\gamma \equiv$ *i.i.d* firm specific cost shock

$\vartheta \equiv$ *i.i.d.* worker-specific cost shock

▶ Non-exiting firms ($\gamma < \gamma^*$) pay overhead costs to operate:

$$\varsigma(\gamma, \vartheta^*)n = \left[\varsigma_\gamma \gamma + \varsigma_\vartheta \int^{\vartheta^*} \vartheta d\mathcal{F}(\vartheta) \right] n$$

$$\mathcal{F}(\vartheta^*) = \Pr\{\vartheta \leq \vartheta^*\} \qquad \mathcal{G}(\gamma^*) = \Pr\{\gamma \leq \gamma^*\}$$

▶ Temporary layoff: each worker draws ϑ
  ▶ Workers w/ $\vartheta \geq \vartheta^*$ (endog. thresh.) go on temporary layoff

▶ Permanent layoff: firms draws γ
  ▶ Firm operates if $\gamma < \gamma^*$ (endog. thresh.); otherwise exits

Timing of Events

1. Firm enters period with stock of workers n

2. Aggregate & worker-specific shocks revealed

3. Firms and workers bargain over base wages w

4. Firms assigns $1 - \mathcal{F}(\vartheta^*)$ workers to temporary layoff,

5. Firm-specific shock γ revealed

   ▶ If $\gamma \geq \gamma^* \rightarrow$ firm exits, workers move to u_{JL}
      ▶ Firm's workers in u_{TL} move to u_{JL}

   ▶ If $\gamma < \gamma^* \rightarrow$ firm continues
      ▶ Rents capital and produces output
      ▶ Hires workers from u_{JL}, recalls workers from u_{TL}
      ▶ Possibility of temporary paycuts, i.e. remitted wages $\omega < w$

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Solve backwards

Behind the Timing

▶ Timing accomplishes the following:

  1. Temporary layoff policy ϑ^* independent of γ
     ▶ Tractability

  2. Base wages are independent of γ
     ▶ Tractability

  3. Firm cannot cut wages to avoid temporary layoffs
     ▶ Consistent with data

▶ (1) and (2) achieved by mid-period realization of γ

▶ (3) achieved by separation of temporary layoffs and bargaining

Firm Problem (at non-exiting firms w/ TL policy ϑ^*)

$$J(w, \gamma, \mathbf{s}) = \max_{k, x, x_r} \Big\{ z\mathcal{F}(\vartheta^*)\check{k}^\alpha - \omega(w, \gamma, \mathbf{s})\mathcal{F}(\vartheta^*) - r\mathcal{F}(\vartheta^*)\check{k}$$

$$- (\iota(x)\mathcal{F}(\vartheta^*) + \iota_r(x_r)\mathcal{F}(\vartheta^*)) - \varsigma(\vartheta^*, \gamma)$$

$$+ \mathbb{E}\Big\{ \Lambda(\mathbf{s}, \mathbf{s}')\mathcal{J}(w', \mathbf{s}')|, w, \mathbf{s}\Big\} \Big\},$$

with

$$\varsigma(\gamma, \vartheta^*) = \varsigma_\gamma \gamma + \varsigma_\vartheta \int^{\vartheta^*} \vartheta d\mathcal{F}(\vartheta),$$

$$\iota(x) = \chi x + \frac{\kappa}{2}(x - \tilde{x})^2, \quad \iota_r(x_r) = \chi x_r + \frac{\kappa_r}{2}(x_r - \tilde{x}_r)^2,$$

$$\mathcal{J}(w, \mathbf{s}) = \max_{\vartheta^*} \int^{\gamma^*} J(w, \gamma, \mathbf{s}) d\mathcal{G}(\gamma),$$

Hiring Conditions (at non-exiting firms w/ policy ϑ^*)

- ▶ Let $J(w, \gamma) \equiv F(n, w, \gamma)/n$ be the firm value per worker

$$\chi + \kappa(x - \tilde{x}) = \mathbb{E}\{\Lambda(\mathbf{s}, \mathbf{s}')\mathcal{J}(w', \mathbf{s}') | w, \mathbf{s}\}$$
$$\chi + \kappa_r(x_r - \tilde{x}_r) = \mathbb{E}\{\Lambda(\mathbf{s}, \mathbf{s}')\mathcal{J}(w', \mathbf{s}') | w, \mathbf{s}\}$$

- ▶ $\frac{\chi}{\kappa x}, \frac{\chi}{\kappa_r x_r} \equiv$ elasticities of x, x_r w/r.t. J

- ▶ Link between x_r and recall rate p_r: $x_r = \frac{p_r u_{TL}}{\mathcal{F}(\vartheta^*)n}$

Temporary Layoffs

▶ Temporary layoffs $= (1 - \mathcal{F}(\vartheta^*))\, \mathcal{G}(\gamma^*) n$

▶ TL threshold ϑ^* maximizes $\int^{\gamma^*} J(w, \gamma, \mathbf{s}) d\mathcal{G}(\gamma)$:

$$\mathcal{J}(w, \mathbf{s}) + \varsigma_\gamma \Gamma + \varsigma_\vartheta \mathcal{G}(\gamma^*)\, \Theta = \varsigma_\vartheta \vartheta^* \mathcal{F}(\vartheta^*) \mathcal{G}(\gamma^*)$$

where $\Gamma = \int^{\gamma^*} \gamma\, d\mathcal{G}(\gamma)$ and $\Theta = \int^{\theta^*} \theta\, d\mathcal{F}(\theta)$

Shutdowns (permanent layoffs)

▶ Permanent separations from employment = $(1 - \mathcal{G}(\gamma^*))n$

▶ Shutdown threshold γ^* solves

$$J(\underline{w}, \gamma^*, \mathbf{s}) = 0$$

with $\underline{w} \equiv$ reservation wage

▶ Paycut threshold $\gamma^\dagger \in (0, \gamma^*)$ solves

$$J(w, \gamma^\dagger, \mathbf{s}) = 0$$

Paycuts for $\gamma \in (\gamma^\dagger, \gamma^*)$ (firm gets 0 surplus in this region)

Workers (1/2)

▶ Value of work

$$V(w, \gamma, \mathbf{s}) = \omega(w, \gamma, \mathbf{s}) + \mathbb{E}\left\{\Lambda(\mathbf{s}, \mathbf{s}')\,\mathcal{V}(w', \mathbf{s}')|w, \mathbf{s}\right\},$$

with

$$\mathcal{V}(w, \mathbf{s}) = \mathcal{F}(\vartheta^*)\left[\int^{\gamma^*} V(w, \gamma, \mathbf{s})\,d\mathcal{G}(\gamma) + (1 - \mathcal{G}(\gamma^*))\,U_{JL}(\mathbf{s})\right]$$
$$+ (1 - \mathcal{F}(\vartheta^*))\,\mathcal{U}_{TL}(w, \mathbf{s})$$

where

   ▶ $U_{JL}(\mathbf{s})$ is the value of jobless unemployment

   ▶ $\mathcal{U}_{TL}$ is the expected value of temporary-layoff unemployment

   ▶ $\omega(w, \gamma, \mathbf{s})$ are remitted wages

Workers (2/2)

▶ Value of jobless unemployment

$$U_{JL}(\mathbf{s}) = b + \mathbb{E}\left\{\Lambda(\mathbf{s}, \mathbf{s}')\left[p\bar{V}_x(\mathbf{s}') + (1-p)U_{JL}(\mathbf{s}')\right]|\mathbf{s}\right\}$$

where $\bar{V}_x$ is the expected value of being a new hire

▶ Value of temporary-layoff unemployment

$$\begin{aligned}
U_{TL}(w, \mathbf{s}) = b + \mathbb{E}\{\Lambda(\mathbf{s}, \mathbf{s}')[&p_r \mathcal{V}(w', \mathbf{s}') \\
+ &(1-p_r)\rho_r \mathcal{U}_{TL}(w', \mathbf{s}') \\
+ &(1-p_r)(1-\rho_r)U_{JL}(\mathbf{s}')]|w, \mathbf{s}\}.
\end{aligned}$$

with

$$\mathcal{U}_{TL}(w, \mathbf{s}) = \mathcal{G}(\gamma^*)U_{TL}(w, \mathbf{s}) + (1 - \mathcal{G}(\gamma^*))U_{JL}(\mathbf{s}).$$

Staggered Nash Wage Bargaining

▶ Each period, probability $1 - \lambda$ of renegotiating base wage

▶ Parties bargain over surpluses prior to realization of γ

    ▶ Worker surplus: $\mathcal{H}(w, \mathbf{s}) \equiv \mathcal{V}(w, \mathbf{s}) - U_{JL}(\mathbf{s})$

    ▶ Firm surplus: $\mathcal{J}(w, \mathbf{s}) \equiv \max_{\vartheta^*} \int^{\gamma^*} J(w, \mathbf{s}) d\mathcal{G}(\gamma)$

▶ Contract wage w^* solves

$$\max_{w^*} \mathcal{H}(w, \mathbf{s})^\eta \mathcal{J}(w, \mathbf{s})^{1-\eta}$$

subject to

$$w' = \begin{cases} w \text{ with probability } \lambda \\ w^{*\prime} \text{ with probability } 1 - \lambda \end{cases}$$

and to wage cut policy

Model Evaluation: Full Slides

Calibration: Assigned Parameters

Parameter values		
Discount factor	β	$0.997 = 0.99^{1/3}$
Capital depreciation rate	δ	$0.008 = 0.025/3$
Production function parameter	α	0.33
Autoregressive parameter, TFP	ρ_z	$0.99^{1/3}$
Standard deviation, TFP	σ_z	0.007
Elasticity of matches to searchers	σ	0.5
Bargaining power parameter	η	0.5
Matching function constant	σ_m	1.0
Renegotiation frequency	λ	8/9 (3 quarters)

Calibration: Estimated Parameters (inner loop)

Parameter	Description	Value	Target
χ	Scale, hiring costs	1.0567	Average JL, E rate (0.304)
$\varsigma_\vartheta \cdot e^{\mu_\vartheta}$	Scale, overhead costs, worker	0.0893	Average E, TL rate (0.005)
$\varsigma_\gamma \cdot e^{\mu_\gamma}$	Scale, overhead costs, firm	2.0097	Average E, JL rate (0.011)
$1 - \rho_r$	Loss of recall rate	0.3925	Average TL, JL rate (0.210)
b	Flow value of unemp.	0.8848	Rel. value non-work (0.71)

Calibration: Estimated Parameters (outer loop)

Parameter	Description	Value
$\chi/(\kappa \tilde{x})$	Hiring elasticity, new hires	0.3942
$\chi/(\kappa_r \tilde{x}_r)$	Hiring elasticity, recalls	0.8912
σ_ϑ	Parameter lognormal $\mathcal{F}$	1.4140
σ_γ	Parameter lognormal $\mathcal{G}$	0.3215

Moment	Target	Model
SD of hiring rate	3.304	3.253
SD of total separation rate	6.620	4.707
SD of temporary-layoff unemployment, u_{TL}	10.906	10.969
SD of jobless unemployment, u_{JL}	8.532	10.519
SD of hiring rate from u_{JL} relative to SD of recall hiring rate from u_{TL}	0.445	0.442

TFP Shock: Employment, Unemployment and Wages
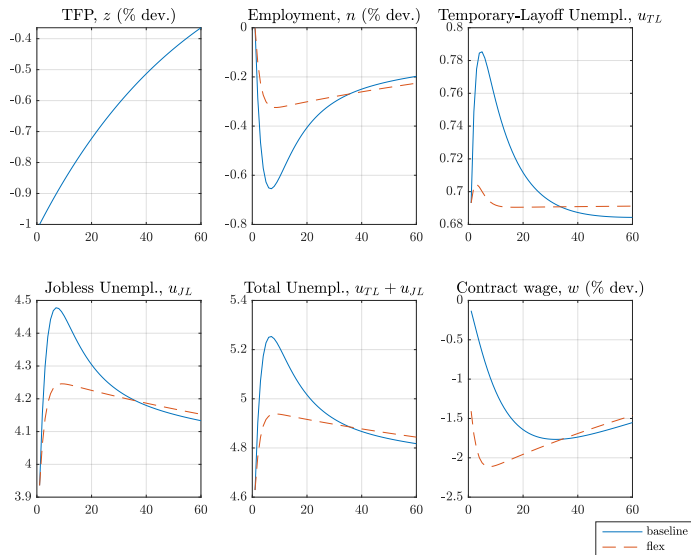
TFP Shock: Transition Probabilities
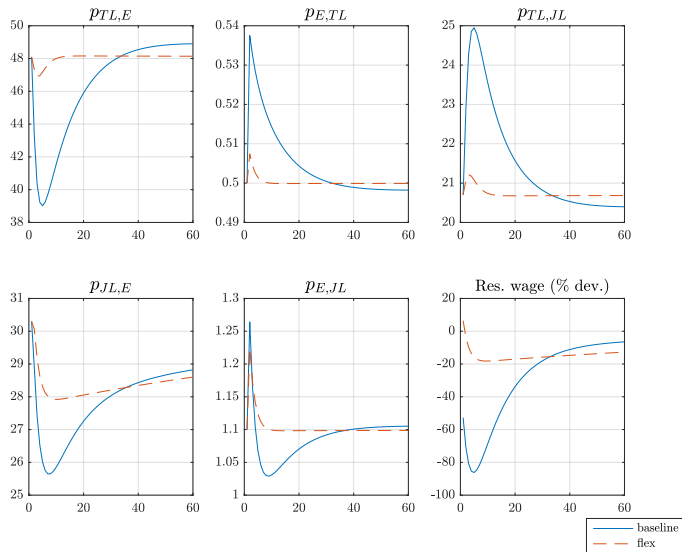
TFP Shock: Shut off u_{JL} from u_{TL}
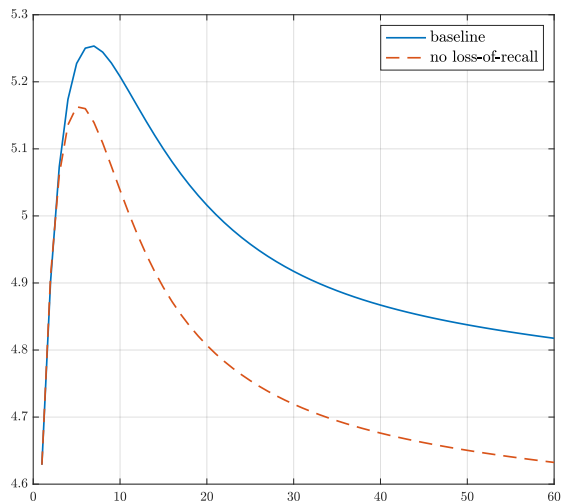
Application to PPP: Full Slides

Adapting the Model to the Covid-19 Recession

Introduce series of shocks and two parameters

1. Shocks:

   - ► "Lockdown" shocks
     - ► Beginning of period: fraction $1 - \nu$ move to TL unemp
     - ► Unanticipated (MIT shock)
   - ► Utilization restrictions on capital and labor
     - ► Transitory shock at start of pandemic
     - ► New persistent shock with each Covid wave
   - ► PPP as factor payment subsidy (as in KMV)
     - ► PPP 2020: 12.5% of quarterly GDP, most payments May-July 2020
     - ► PPP 2021: 5.4% of quarterly GDP, most payments Jan-April 2021

Adapting the Model to the Covid-19 Recession, cont.

...

2. Two parameters:

   ▶ (Possibly) reduced recall costs for workers in lockdown

   $$\chi x_r + \frac{\kappa_r}{2}\left(x_r - \xi \underbrace{\frac{(1-\phi)u_{TL}}{\mathcal{F}(\vartheta^*)n}}_{\text{Workers on lockdown}} - \tilde{x}_r\right)^2$$

      ▶ $0 \leq \xi \leq 1$
   ▶ Different rate of exog. TL-to-JL for workers on lockdown, $\rho_{r\phi}$

Recession Experiment

- ▶ Thus, need to estimate:
  1. Lockdown shocks for each month of pandemic ($+T$)
  2. Size of transitory utilization shock at onset of pandemic ($+1$)
  3. Size of persistent utilization shock for three waves ($+3$)
  4. Autoregressive parameter of persistent utilization shock ($+1$)
  5. Two model parameters ($+2$)

- ▶ Moments to match:
  1. Stocks: $\{u_{TL}, u_{JL}\}_\tau$ since onset of pandemic
  2. Gross flows: $\{g_{E,TL},\ g_{TL,E},\ g_{TL,JL}\}_\tau$ since onset
  3. Inflows into u_{JL}: March-April 2020 only
     - ▶ To discipline size of transitory shock

Recession Experiment, cont.

- ▶ Estimate by SMM:
  - ▶ T months of pandemic w/ 3 waves (for now)
   - ▶ $(5 \cdot T + 1)$ moments to match
    - ▶ $(T + 7)$ parameters to estimate
  - ▶ System is highly overidentified

Parameter and Shock Estimates

<div align="center">Parameters</div>

Variable	Description	Value
ρ_z	Autoregressive coefficient for persistent utilization shocks	0.7651
ξ	Adjustment costs for workers on lockdown	0.4988
$1 - \rho_{r\phi}$	Probability of exogenous loss of recall for workers in temporary unemployment	0.6329

<div align="center">Shocks</div>

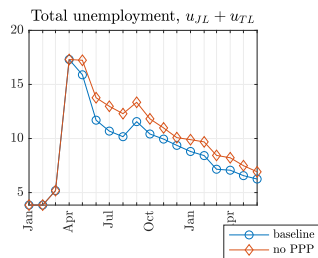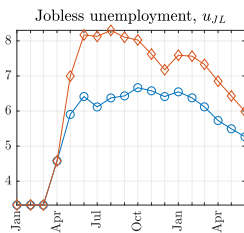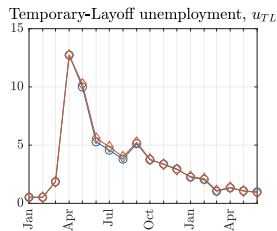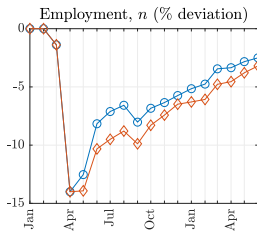| Description	Value
Persistent utilization shock, April 2020	-10.28%
Transitory utilization shock, April 2020	-0.90%
Persistent utilization shock, September 2020	-4.23%
Persistent utilization shock, January 2021	-9.56%

Parameter and Shock Estimates, cont.
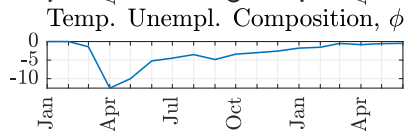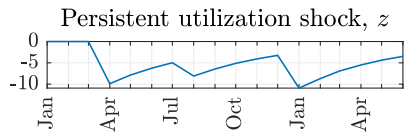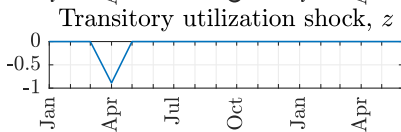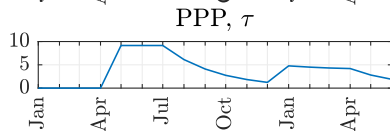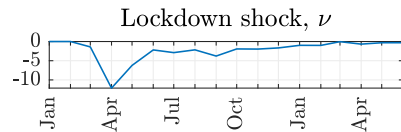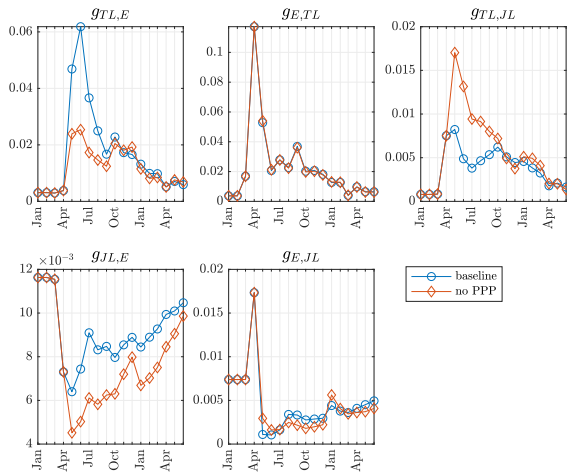
Covid Onset, Stocks
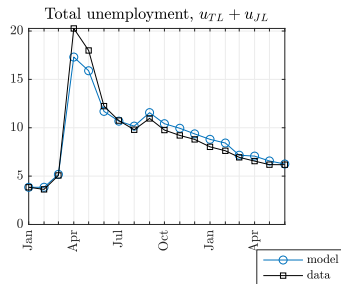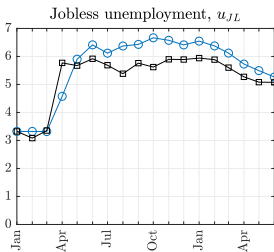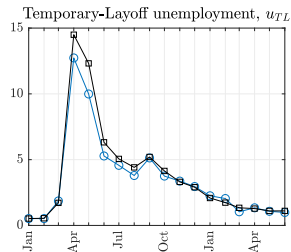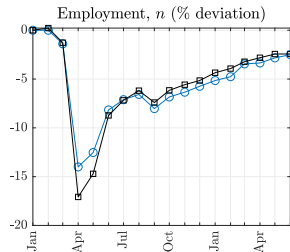
Covid Onset, Gross Flows
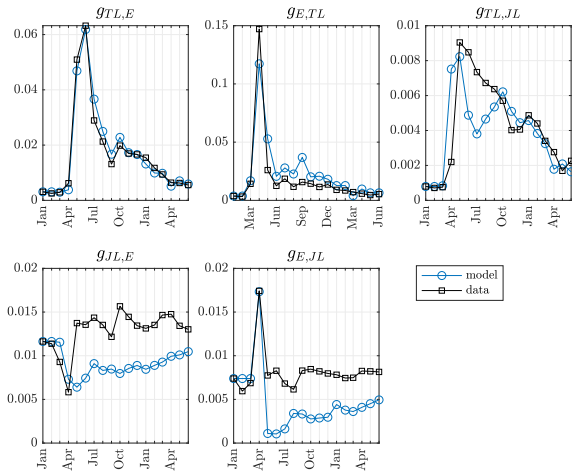
Policy Counterfactual: No PPP, stocks

Policy Counterfactual: No PPP, flows

PPP takeaway

▶ PPP achieved sizeable employment gains

▶ Immediate term: May to September 2020
  ▶ Achieved average monthly employment gains of 2.14%
  ▶ Doubled cumulative recalls

▶ Longer term
  ▶ Smaller persistent employment gains
  ▶ Avg. monthly empl. at least 1% higher through May 2021

▶ Employment gains came from recalls
  ▶ PPP preserved ties btwn firms and workers in u_{TL}
  ▶ Fulfilled mandate