

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

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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 has **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: due to recall hiring
  - ▶ Workers in  $U_{TL}$  return to work faster than workers in  $U_{JL}$
  - ▶ Stabilizing force of temporary layoffs vs. permanent separations
  - ▶ Primary focus of existing literature
- ▶ Destabilizing “indirect” effect: due to loss-of-recall
  - ▶ Workers in  $U_{TL}$  may lose their recall option and move to  $U_{JL}$
  - ▶ They do so at a higher rate during recessions
  - ▶ We estimate  $U_{JL\text{-from-TL}}$  to be countercyclical and highly volatile
  - ▶ Contributes to countercyclical duration dependence

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? Requires structural model
- ▶ Our findings: Large monthly reductions in  $u_{JL}$  due to PPP
  - ▶  $\approx 2$  p.p. in short-run,  $\geq 1$  p.p. thru May 2021
  - ▶ Achieved by preventing loss-of-recall

# Plan

- ▶ Empirics of temporary-layoff unemployment and loss-of-recall
- ▶ 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: Total (U), jobless (JL), and temporary-layoff (TL) unemployment, 1978–2019

	$U =$		
	$JL + TL$	$JL$	$TL$
mean( $x$ )	6.2	5.4	0.8
std( $x$ )/std( $Y$ )	8.5	8.6	9.7
corr( $x$ , $Y$ )	−0.86	−0.82	−0.87

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

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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			
	<i>E</i>	<i>TL</i>	<i>JL</i>	<i>N</i>
<i>E</i>	0.955	0.005	0.011	0.029
<i>TL</i>	0.435	0.245	0.191	0.129
<i>JL</i>	0.244	0.022	0.475	0.259
<i>N</i>	0.043	0.001	0.027	0.929

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$\Pr(\text{TL-to-E}) > \Pr(\text{JL-to-E})$  due to recall

► Recall hazards from SIPP

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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

	X	Pr(X to E)
(a)	JL	0.244
(b)	TL	0.420
(c)	JL (TL distr.)	0.213
(d)	TL–JL	0.264

Note: Transition probabilities not adjusted for time aggregation.

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

Table: Cyclical properties, gross worker flows

	$\rho_{E,TL}$	$\rho_{E,JL}$	$\rho_{TL,E}$	$\rho_{JL,E}$	$\rho_{TL,JL}$
std( $x$ )/std( $Y$ )	11.325	5.257	6.266	6.650	10.119
corr( $x$ , $Y$ )	-0.494	-0.683	0.620	0.784	-0.301

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

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



# Empirics of Loss-of-Recall

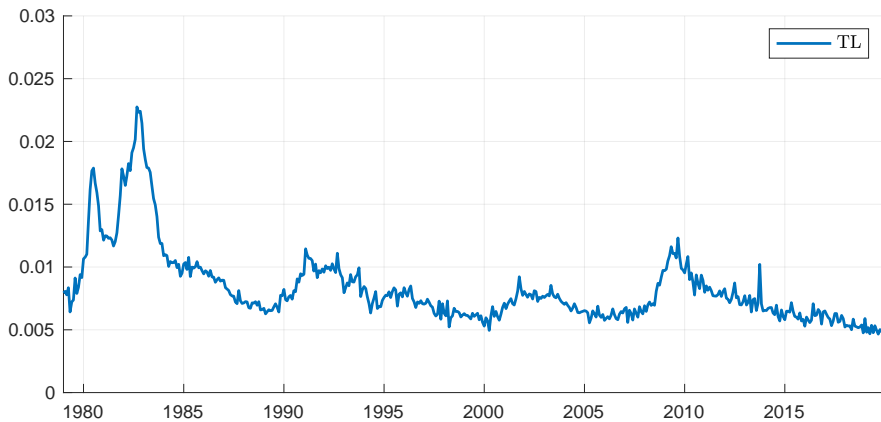
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  - 4.3 More workers move from  $u_{TL}$  to  $u_{JL}$  (loss-of-recall)
5. We develop methods to estimate the *indirect effect*, i.e. JL-from-TL

► Estimation equations

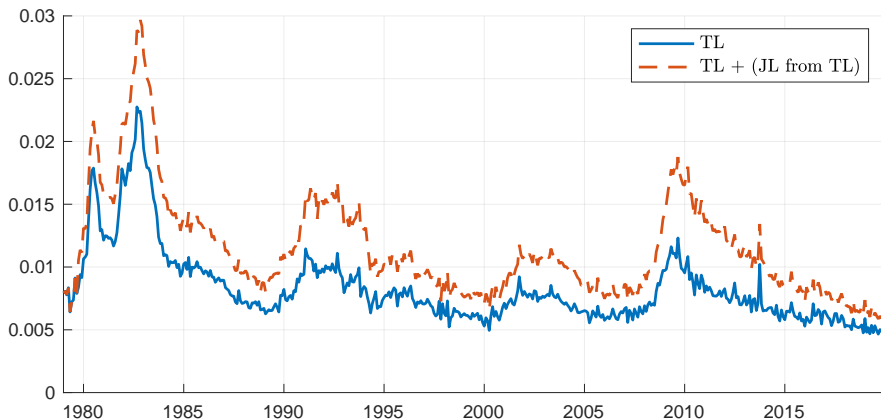
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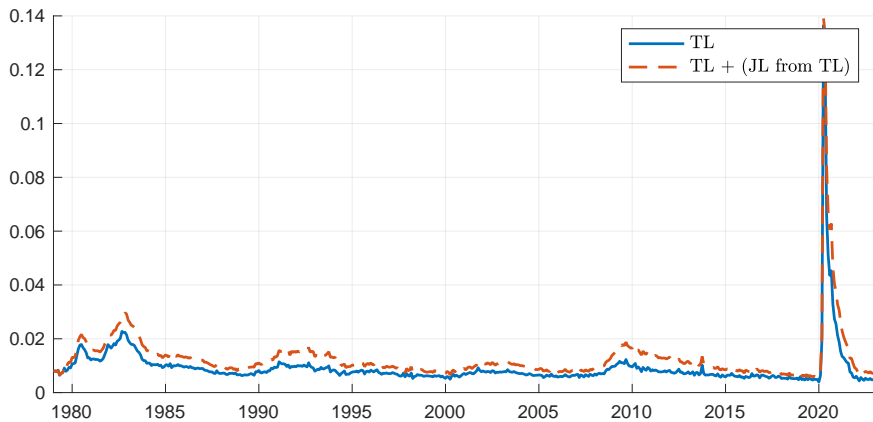
## Temporary-Layoff Unemployment $u_{TL}$ : 1979-2019



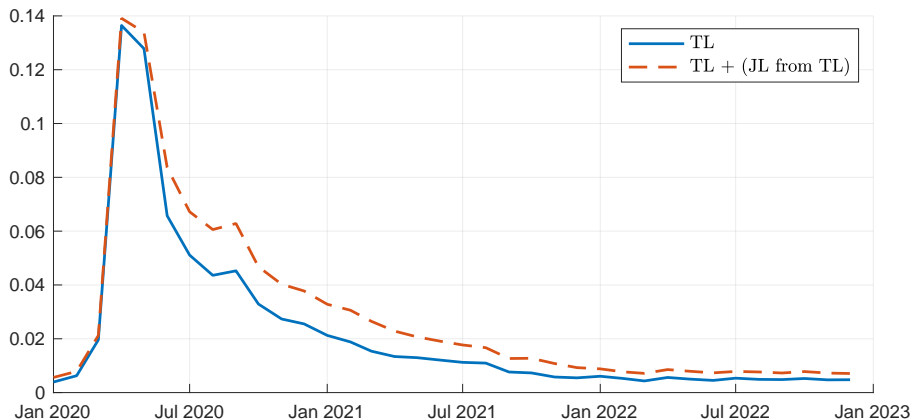
## Temporary-Layoff Unemployment $u_{TL}$ + “ $u_{JL}$ from $u_{TL}$ ”: 1979-2019



## Temporary-Layoff Unemployment $u_{TL}$ + “ $u_{JL}$ from $u_{TL}$ ”: 1979+

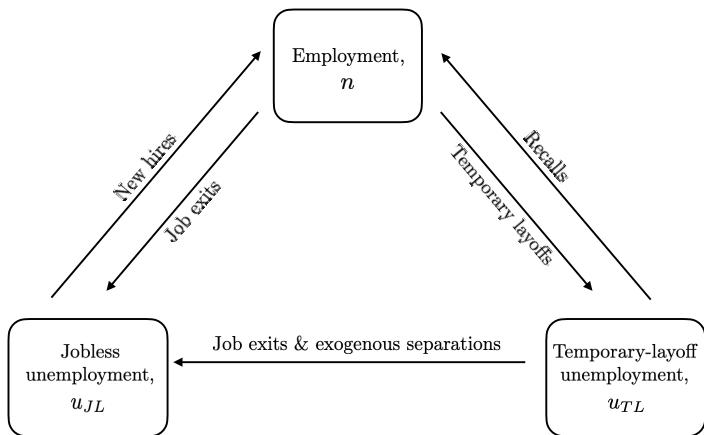


## Temporary-Layoff Unemployment $u_{TL}$ + “ $u_{JL}$ from $u_{TL}$ ”: 2020+



Model

# 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**: avoid inefficient separations
  - ▶ Permanent sep. triggers  $u_{TL} \rightarrow u_{JL}$  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 ▶ Searchers, Matching and Recalls
- ▶ Firms, w/ CRS technology in labor and capital, draws cost shocks
  - ▶ Worker-specific overhead costs  $\Rightarrow$  separations to TL
  - ▶ Overhead costs to entire firm  $\Rightarrow$  separations to JL and JL-from-TL
    - ▶ Production technology
    - ▶ Overhead Costs
- ▶ After separations: firms rent capital, hire from JL, and recall from TL
  - ▶ Separate hiring costs: recalls less expensive than new hiring
    - ▶ Timing
    - ▶ Hiring and recalls
    - ▶ Temporary Layoffs
    - ▶ Firm Exits
- ▶ Base wages set via staggered Nash bargaining
  - ▶ But temporary paycuts avoid inefficient exit ▶ Workers Problem ▶ Nash Bargaining

# 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 18 parameters
  - ▶ Inner loop: long-run moments
  - ▶ Outer loop: business cycle features

▶ Assigned Parameters

▶ Estimated Parameters - Inner Loop

▶ Estimated Parameters - Outer Loop

- ▶ 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. regular-TL)
  - ▶ Allow for different rate for loss-of-recall (vs. regular-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 & parameters to match stocks & flows [▶ Details](#) [▶ Estimates](#)
  - ▶ 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

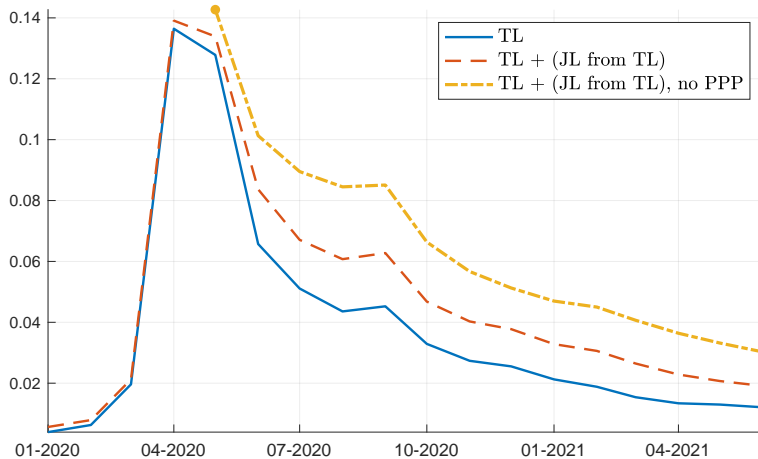
A: Saved a lot of worker/job matches!

- ▶ Average monthly employment gains of  $\approx 2.14$  p.p. in first 6 months
- ▶ Doubled cumulative 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

## Three 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

### 3. Employment policies in the EA

- ▶ EA has similar labor market institutions to “US-TL” (but recorded as emp)
- ▶ Similarly aggressive policies to stabilize “EA-TL”
- ▶ A rose by another name?

# 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.

$$\begin{aligned}x_{t-m,t-j} &= \tilde{P}_t x_{t-m,t-j-1} \\ x_{t-m,t-m} &= e_{TL} \cdot (n_{t-m-1}^E \cdot p_{t-m}^{E,TL})\end{aligned}$$

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

Model: Full Slides

# Searchers, Matching and Recalls

## ▶ Jobless unemployment (DMP matching market)

- ▶ New hires  $m$  from  $JL$  unemployment

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

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

$$p = \frac{m}{u_{JL}}, \quad q = \frac{m}{v}, \quad x = \frac{m}{\mathcal{F}n}$$

## ▶ Temporary-layoff unemployment

- ▶ Recalls  $m_r$  from  $TL$  unemp., recall probability  $p_r$ , recall hiring rate  $x_r$

$$m_r = p_r u_{TL}, \quad x_r = \frac{m_r}{\mathcal{F}n}$$

- ▶ Workers in  $TL \rightarrow JL$  w/ prob.  $1 - \rho_r$  or if firm exits, w/ prob.  $1 - \mathcal{G}$

# Firms (or plants, shifts, production units, etc.)

- ▶ Firms are “large”, i.e., hire a continuum of workers
  - ▶ Firm, or establishment, or assembly line, etc.
- ▶ CRS technology

$$y = zk^{\alpha}(\mathcal{F}n)^{1-\alpha}$$

- ▶  $n \equiv$  beginning of period employment
  - ▶  $\mathcal{F} \equiv$  fraction of workers not on temporary layoff
- ▶ 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:

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

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

- ▶ Temporary layoffs: each worker draws  $\vartheta$ 
  - ▶ Workers w/  $\vartheta \geq \vartheta^*$  (endog. thresh.) go on temporary layoff
- ▶ Permanent layoffs: firms draw  $\gamma$ 
  - ▶ Firm operates if  $\gamma < \gamma^*$  (endog. thresh.); otherwise exits

# Timing of Events

1. Firm enters period with stock of workers  $n$
2. Aggregate shock 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  $\gamma$  revealed
  - ▶ If  $\gamma \geq \gamma^* \rightarrow$  firm exits, employed 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

## Firm Problem (at non-exiting firms w/ TL policy $\vartheta^*$ )

$$J(\mathbf{w}, \gamma, \mathbf{s}) = \max_{\mathbf{x}, \mathbf{x}_r, \check{k}^*} \left\{ z \check{k}^{\alpha} [\mathcal{F}(\vartheta^*)]^{1-\alpha} - \omega(\mathbf{w}, \gamma, \mathbf{s}) \mathcal{F}(\vartheta^*) - r \check{k}^* \right. \\ \left. - (\iota(\mathbf{x}) \mathcal{F}(\vartheta^*) + \iota_r(\mathbf{x}_r) \mathcal{F}(\vartheta^*)) - \varsigma(\vartheta^*, \gamma) \right. \\ \left. + \mathcal{F}(\vartheta^*) (1 + \mathbf{x} + \mathbf{x}_r) \mathbb{E} \left\{ \Lambda(\mathbf{s}, \mathbf{s}') \mathcal{J}(\mathbf{w}', \mathbf{s}') |, \mathbf{w}, \mathbf{s} \right\} \right\}$$

with

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

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

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

# Hiring and Recall (at non-exiting firms w/ TL policy $\vartheta^*$ )

- ▶ FOC's for hiring and recall:

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

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

- ▶ Calibrated model (and data):

$$\underbrace{\frac{\chi}{\kappa_r \cdot \mathbf{x}_r}}_{\text{Recall elasticity}} > \underbrace{\frac{\chi}{\kappa \cdot \mathbf{x}}}_{\text{New hire elasticity}}$$

- ▶ Relation of  $\{\mathbf{x}, \mathbf{x}_r\}$  to job-finding/recall probabilities  $\{p, p_r\}$ :

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

# 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  $\vartheta$  determines TL threshold  $\vartheta^*$ :

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

- ▶  $\mathcal{J}(w, \mathbf{s}) \equiv$  expected job value
- ▶  $\Gamma \equiv \int^{\gamma^*} \gamma d\mathcal{G}(\gamma)$
- ▶  $\Theta \equiv \int^{\vartheta^*} \vartheta d\mathcal{F}(\vartheta)$

# Firm Exits

- ▶ Given cost shock  $\gamma$  and base wage  $w$ , allow temp. paycuts to avoid exit
- ▶ Shutdown threshold  $\gamma^*$  solves  $J(\underline{w}, \gamma^*, \mathbf{s}) = 0$ 
  - ▶  $J(w, \gamma, \mathbf{s}) \equiv$  job value
  - ▶  $\underline{w} \equiv$  reservation wage
- ▶ Payout threshold  $\gamma^\dagger \in (0, \gamma^*)$  solves  $J(w, \gamma^\dagger, \mathbf{s}) = 0$ 
  - ▶ Payout wage keeps zero firm surplus for  $\gamma \in (\gamma^\dagger, \gamma^*)$
- ▶ Firm's active labor force + workers on  $TL$  go to  $JL$  upon exit



# Workers (1/2)

- ▶ Value of work

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

with

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

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

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

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  $\gamma$ 
  - ▶ 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

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

and to wage cut policy



# Model Evaluation: Full Slides

# Calibration: Assigned Parameters

Parameter values		
Discount factor	$\beta$	$0.997 = 0.99^{1/3}$
Autoregressive parameter, LP	$\rho_z$	$0.99^{1/3}$
Standard deviation, LP	$\sigma_z$	0.007
Elasticity of matches to searchers	$\sigma$	0.5
Bargaining power parameter	$\eta$	0.5
Matching function constant	$\sigma_m$	1.0
Renegotiation frequency	$\lambda$	8/9 (3 quarters)



## Calibration: Estimated Parameters (inner loop)

Parameter	Description	Value	Target
$\chi$	Scale, hiring costs	1.1779	Average $JL$ -to- $E$ rate (0.303)
$\varsigma_{\vartheta} \cdot e^{\mu_{\vartheta}}$	Scale, overhead costs, worker	1.8260	Average $E$ -to- $TL$ rate (0.005)
$\varsigma_{\gamma} \cdot e^{\mu_{\gamma}}$	Scale, overhead costs, firm	0.3599	Average $E$ -to- $JL$ rate (0.011)
$1 - \rho_r$	Loss of recall rate	0.3858	Average $TL$ -to- $JL$ rate (0.207)
$b$	Flow value of unemp.	0.9834	Rel. flow value non-work (0.71)

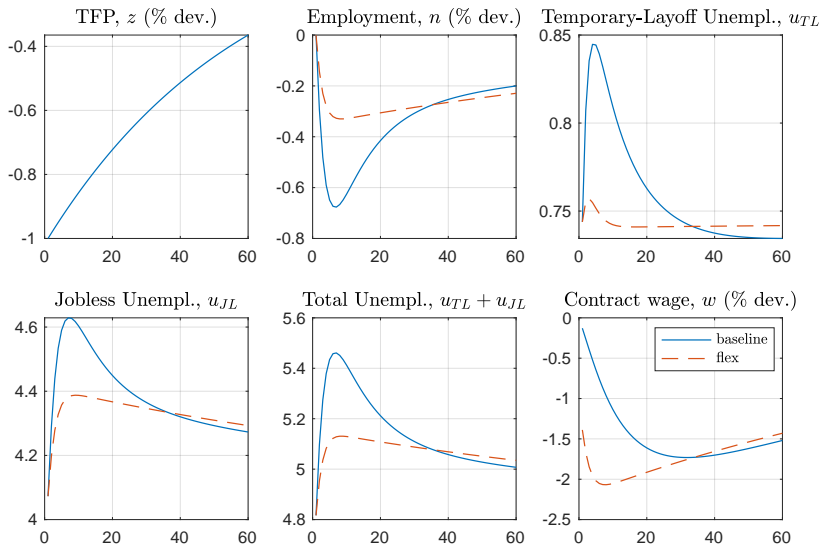


## Calibration: Estimated Parameters (outer loop)

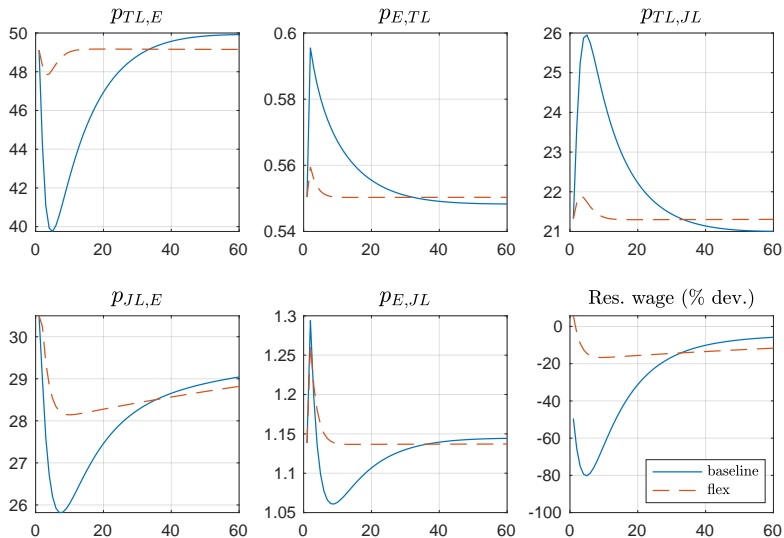
Parameter	Description	Value
$\chi/(\kappa\tilde{X})$	Hiring elasticity, new hires	0.45
$\chi/(\kappa_r\tilde{X}_r)$	Hiring elasticity, recalls	0.94
$\sigma_{\vartheta}$	Parameter lognormal $\mathcal{F}$	1.65
$\sigma_{\gamma}$	Parameter lognormal $\mathcal{G}$	0.37

Moment	Target	Model
SD of hiring rate	3.35	3.32
SD of total separation rate	5.21	4.51
SD of temporary-layoff unemployment, $u_{TL}$	9.71	9.85
SD of jobless unemployment, $u_{JL}$	8.57	9.77
SD of hiring rate from $u_{JL}$ relative to $u_{TL}$	0.47	0.47

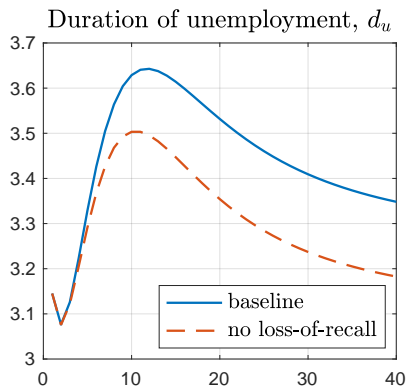
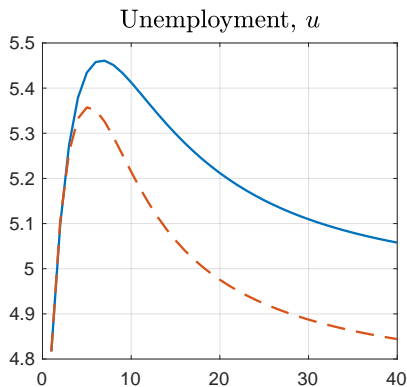
# TFP Shock: Employment, Unemployment and Wages



# TFP Shock: Transition Probabilities



## TFP Shock: Shut off $u_{JL}$ from $u_{TL}$



- Loss of recall increases response of unemployment and generates duration dependence

# Application to Covid-19 Recession: 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

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

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

# Recession Experiment

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

# Recession Experiment, cont.

- ▶ Estimate by SMM:
  - ▶  $T$  months of pandemic w/ 3 waves
    - ▶  $(5 \cdot T + 1)$  moments to match
    - ▶  $(T + 6)$  parameters to estimate
  - ▶ Overidentified system



# Parameter and Shock Estimates

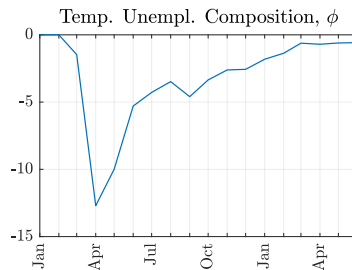
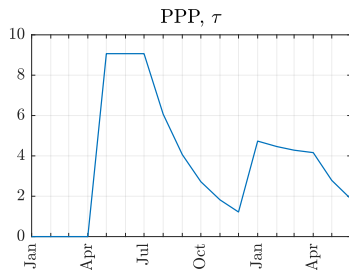
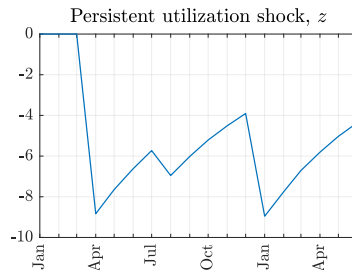
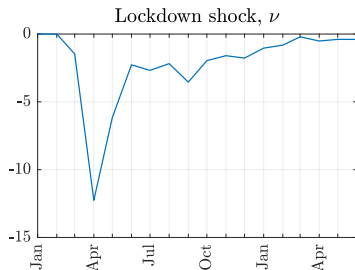
## Parameters

Variable	Description	Value
$\rho_z$	Autoregressive coefficient for persistent utilization shocks	0.866
$\xi$	Adjustment costs for workers on lockdown	0.499
$1 - \rho_{r\phi}$	Probability of exogenous loss of recall for workers in temporary unemployment	0.384

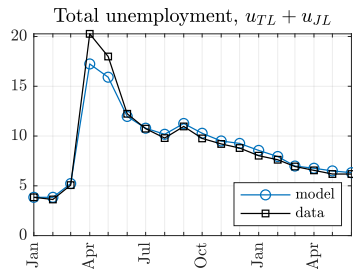
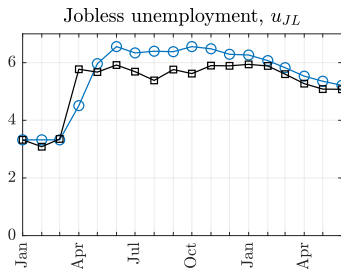
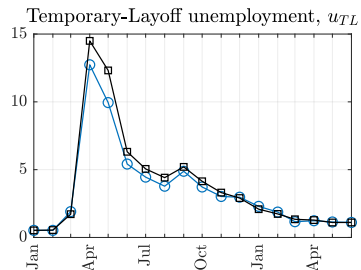
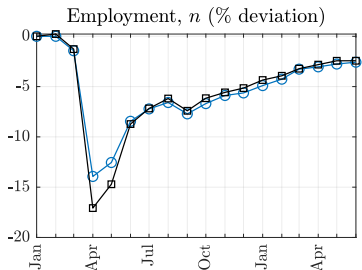
## Shocks

Description	Value
Persistent utilization shock, April 2020	-8.83%
Persistent utilization shock, September 2020	-1.99%
Persistent utilization shock, January 2021	-5.58%

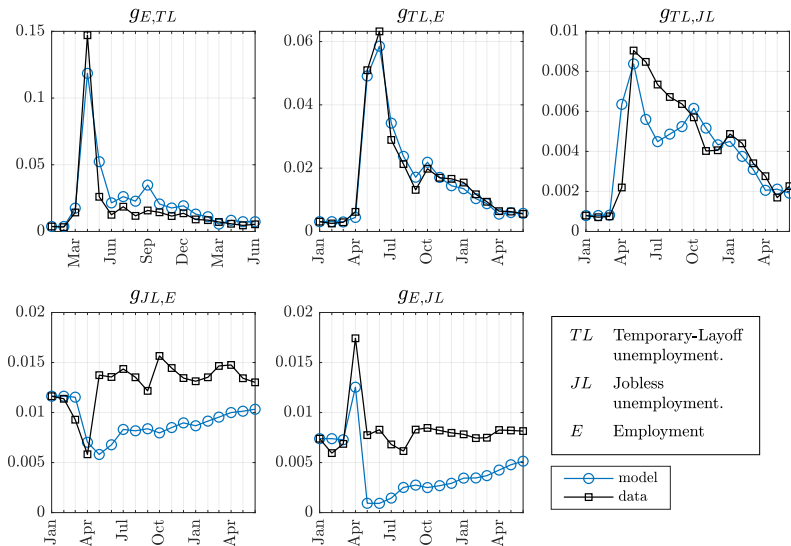
# Parameter and Shock Estimates, cont.



# Covid Onset, Stocks

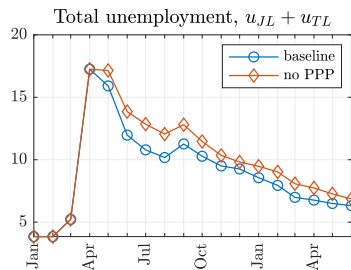
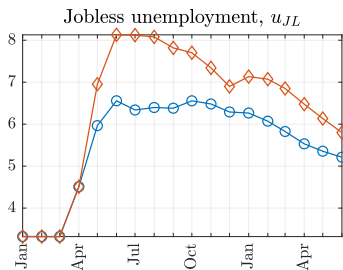
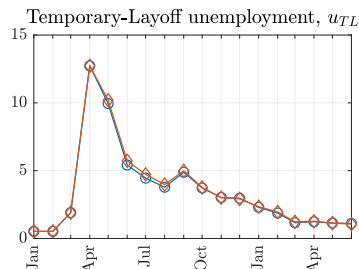
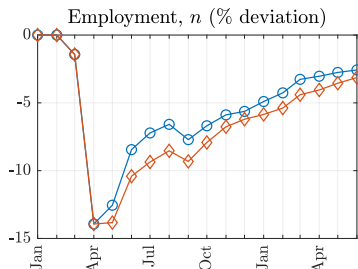


# Covid Onset, Gross Flows

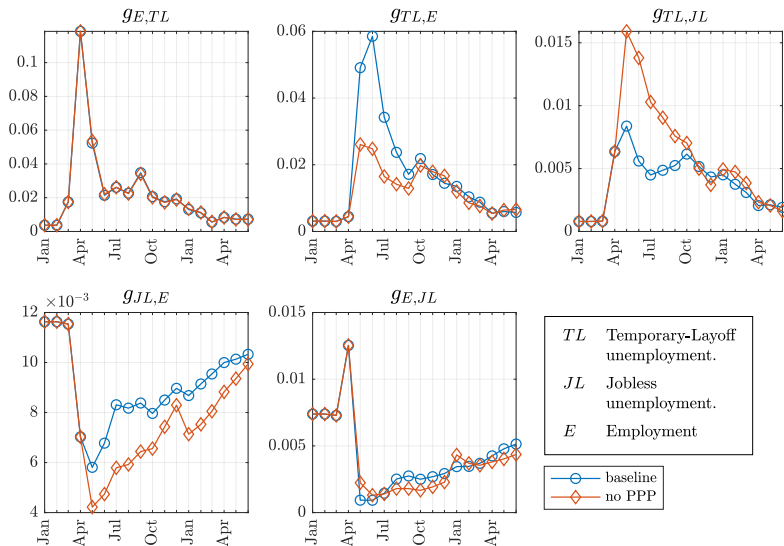




# Policy Counterfactual: No PPP, stocks



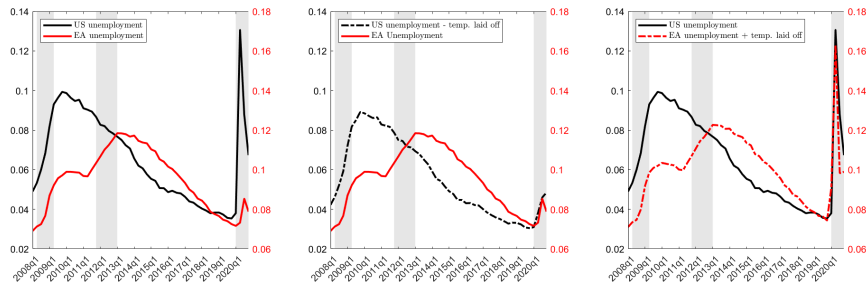
# Policy Counterfactual: No PPP, flows



# 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

# Unemployment during Covid: US vs. EA



- ▶ Unemployment measured differently, e.g. temporary laid off workers
- ▶ **Temporary laid off workers** counted among the **unemployed** in the **US** and among the **employed** in the **EA**
- ▶ 2 counterfactual scenarios:
  1. TL counted among the employed also in the US (middle panel)
  2. TL counted among the unemployed also in the EA (right panel)
- ▶ But differences exist in **TL definitions**: **more attachment to job in EA**

# Recall from TL and PS: Evidence from the SIPP

- ▶ Look at **EUE spells** in 1996+ SIPP w/ U duration  $\leq 4$  months
  - ▶ e.g., **E-U-E**, **E-U-U-E**, **E-U-U-U-E**, & **E-U-U-U-U-E**
- ▶ Compute re-employment hazards for **recall** and **new-job-finding**, & separately for **temporary layoffs (TL)** and **permanent separations (PS)**
- ▶ Recall is **overwhelmingly concentrated** among workers from **TL**:
  - ▶ **76.3%** of TL's end in recall (versus a new job)
  - ▶ **6.4%** of PS's end in recall (versus a new job)

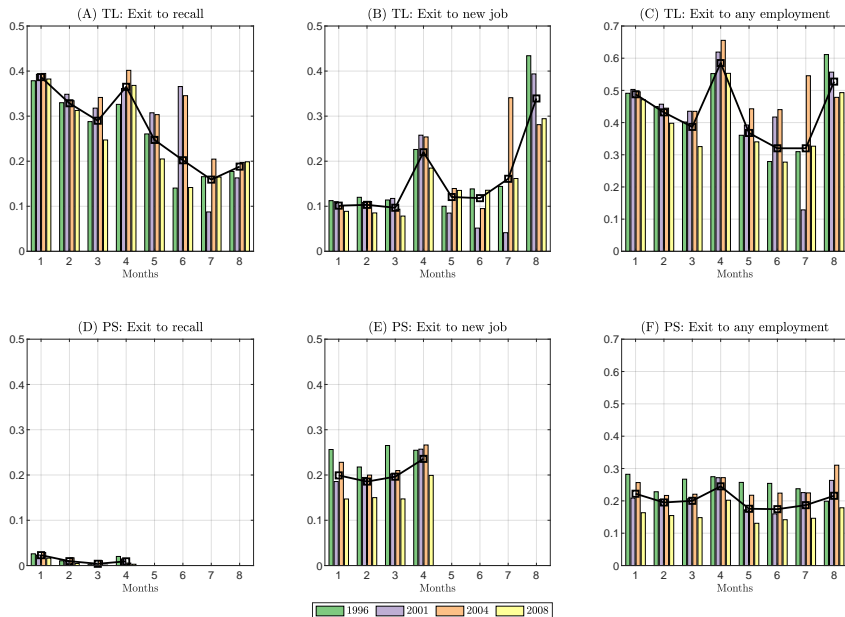
# Recall from TL and PS: Evidence from the SIPP

**Table:** Recall shares from unemployment by reason for job loss

<i>Reason for job loss:</i>	<i>SIPP panels</i>				
	All	1996	2001	2004	2008
Temporary layoff	0.763	0.740	0.754	0.766	0.782
Permanent separation	0.064	0.063	0.068	0.080	0.047

*Note:* Sample consists of workers moving from employment to unemployment via either permanent separation or temporary layoff who (i) return to employment in four months or less, and (ii) actively search for all months that they are non-employed (e.g., are unemployed).

# Recall from TL and PS: Evidence from the SIPP



# JL-from-TL and controls for unemployment duration

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

	(a)	(b)	(c)	(d)	(e)	(f)
$X$	JL	TL	TL–JL	JL, TL distribution	E–JL–JL	E–TL–TL
$\Pr(X \text{ to } E)$	0.245	0.442	0.264	0.213	0.278	0.390