Can the unemployed borrow? Implications for public insurance

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The views expressed herein are those of the authors and not necessarily those of the Federal Reserve or Census.

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This paper: Link credit reports to earnings

i Job losers can replace 39% of prior income with unused credit

ii Job losers maintain credit access, limits decline marginally

iii Constrained delever and default, unconstrained borrow $\rightarrow$ *both* smooth with credit

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Quantitative contribution:

- Develop labor search model with defaultable credit lines that...
    1. matches current U.S. credit access levels
    2. replicates empirical facts including non-responsive limits
- Compute optimal transfers to unemployed in steady state, show gains along transition

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- In 2000s, 78% have credit access $\rightarrow$ optimal transfers replace 49.6% of lost income
- Counterfactually shut down credit (0% access) $\rightarrow$ replace 50.5% of lost income

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- In 2000s, 78% have credit access $\rightarrow$ optimal transfers replace 49.6% of lost income
- Counterfactually shut down credit (0% access) $\rightarrow$ replace 50.5% of lost income
- Credit and transfers are complements in GE despite being substitutes at HH level in PE
- If transfers cut too much, defaults rise & credit market endogenously contracts

Data and Empirical Strategy

LEHD linked to TransUnion Credit Reports: 11 states that cover 1/3 of US pop, 2002-2012

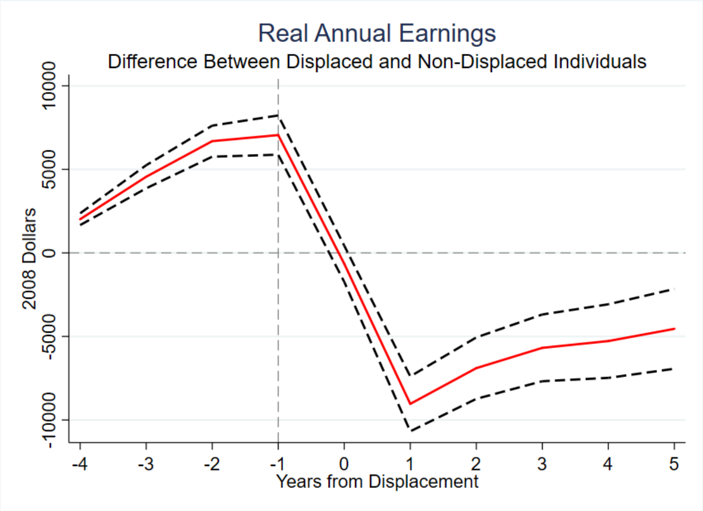
Empirical Approach:

- ID mass displacements as in Jacobson, LaLonde, & Sullivan (1993)
- Compare displaced workers (*treatment*) to non-displaced (*control*)
- Focus on revolving credit limits (*stock of credit*), and credit scores (*marginal cost of new credit*)
- Estimate 'distributed lag' specifications:

$$Y_{i,t} = \alpha_i + \gamma_t + \sum_{j=-4}^{5} \beta_j D_{j,i,t} + \Gamma X_{i,t} + \epsilon_{i,t}$$

▸ Details ▸ Summary Stats

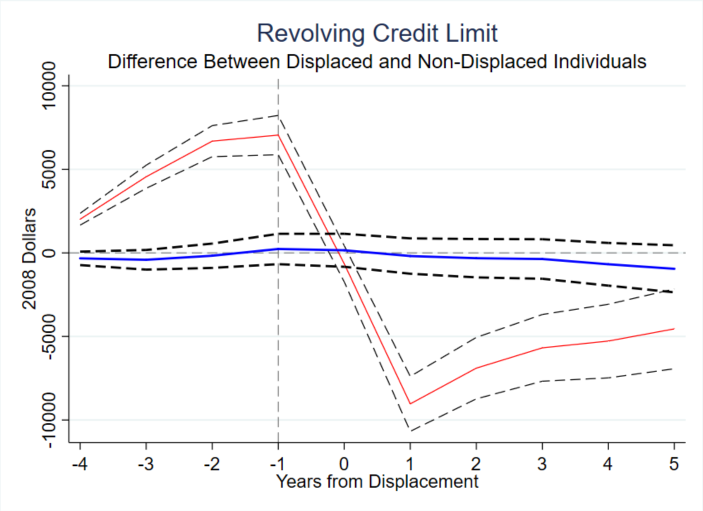
Earnings After Layoff



Pre-layoff mean earnings: $51,340

Braxton, Herkenhoff & Phillips, “Can the unemployed borrow?”

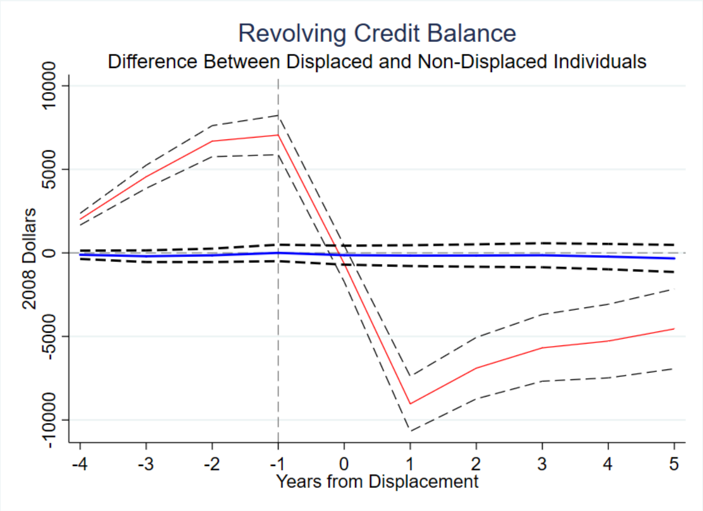
Credit Limit After Layoff



Revolving credit limit 1-yr. prior to layoff: $29,780

Braxton, Herkenhoff & Phillips, “Can the unemployed borrow?”

Credit Balance After Layoff



Revolving credit balance 1-yr. prior to layoff: $11,300

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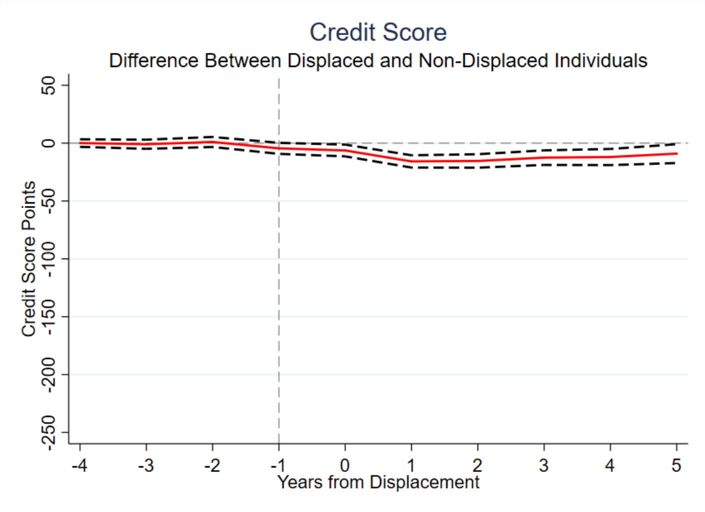
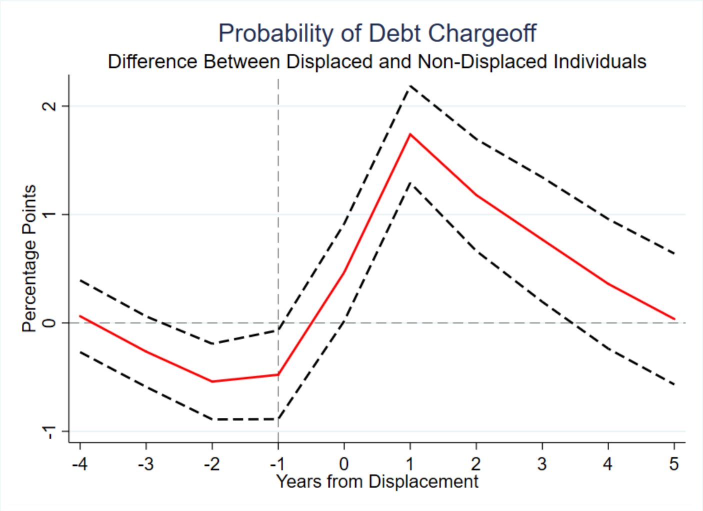
Credit Score After Layoff



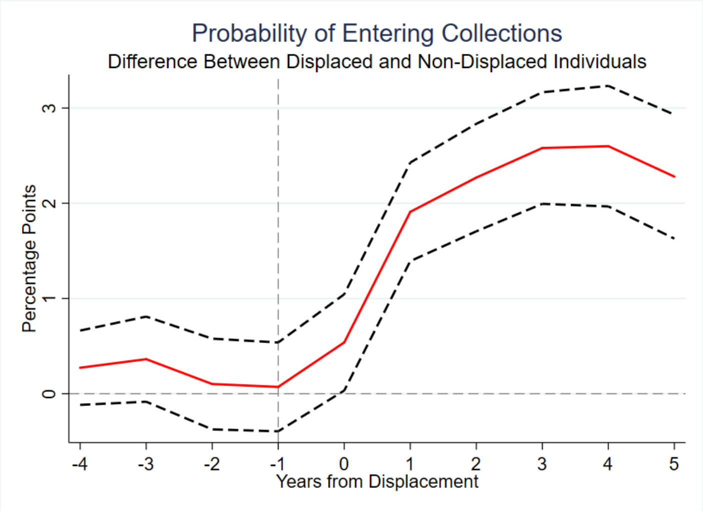
Credit score 1-yr. prior to layoff (Scale 0 to 1000): 427 (average), 267 (SD)

Debt Chargeoff After Layoff



Chargeoff rate 1-yr. prior to layoff: 9%

Debt Collections After Layoff



Collections 1-yr. prior to layoff: 17%

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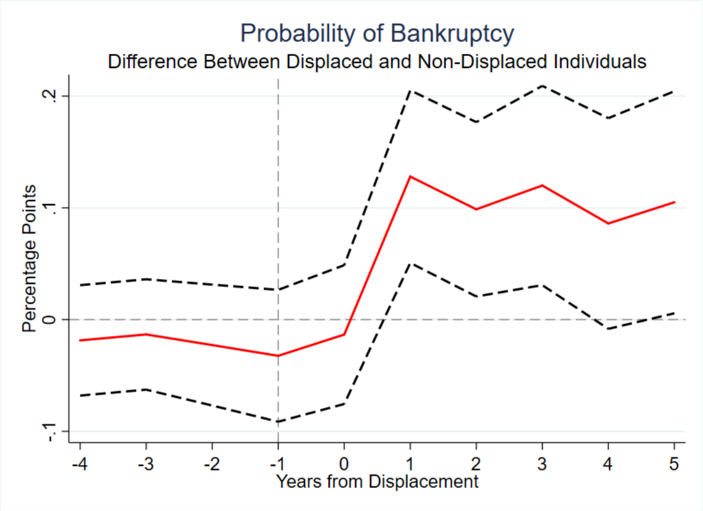
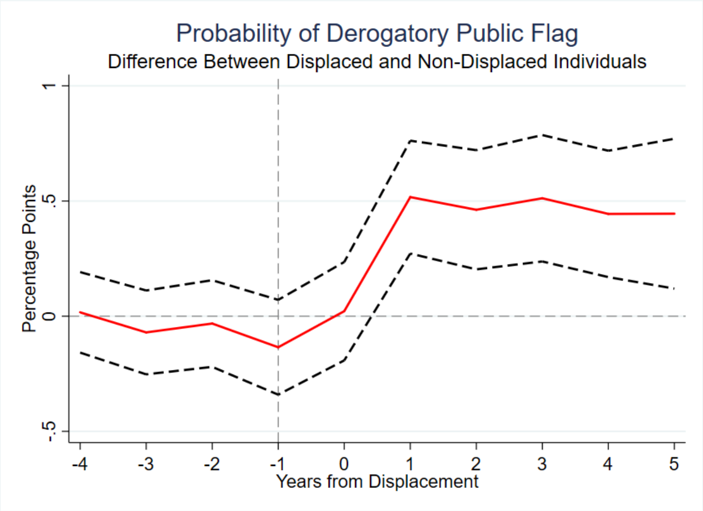
Bankruptcies After Layoff



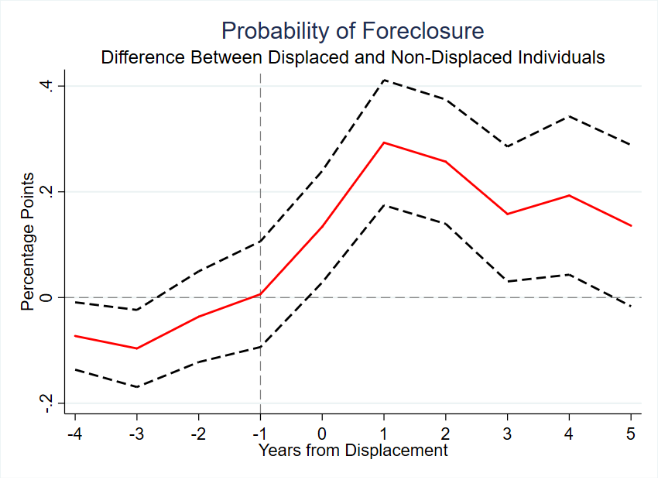
Bankruptcies 1-yr. prior to layoff: .9% per annum

Derogatory Flag After Layoff



New derogatory flag 1-yr. prior to layoff: 2.9% per annum

New Foreclosures After Layoff



Foreclosures 1-yr. prior to layoff: .5% per annum

Anticipation | Temporary Shocks | Earnings Distribution

Heterogeneous borrowing responses

- Cross-section: 56,000 laid off in year t with earnings loss from $t-1$ to $t+1$, positive limit
- Define replacement rate to be $RR_{i,t} = \frac{-(debt_{i,t+1} - debt_{i,t-1})}{earnings_{i,t+1} - earnings_{i,t-1}}$

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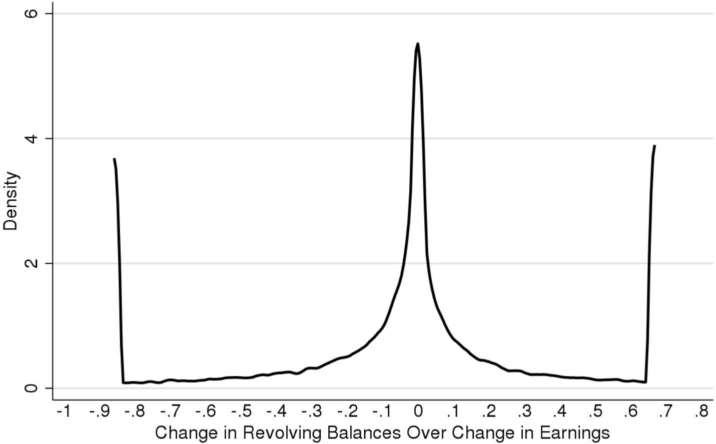

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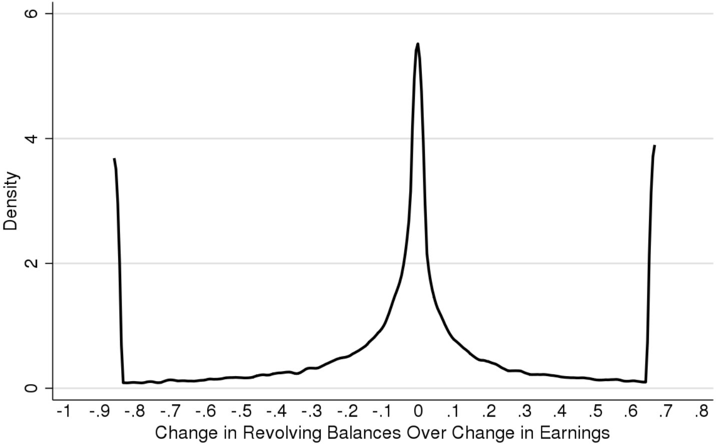

Delevering: 23% have a chargeoff, 46% have delinquency Dist. Inc. Sum Stats With zero limit

What drives heterogeneous borrowing responses?

- Split into quintiles by unused credit share $= \frac{\text{Limit minus balance}}{\text{Limit}}$, high value is unconstrained
- Let $C_{j,i,t-1}$ be a dummy for unused credit quintile j, prior to layoff
- Estimate the following cross-sectional regression:

$$RR_{it} = \lambda_1 + \lambda_2 C_{2,i,t-1} + \lambda_3 C_{3,i,t-1} + \lambda_4 C_{4,i,t-1} + \lambda_5 C_{5,i,t-1} + \gamma_t + \Phi X_{it} + \epsilon_{it}$$

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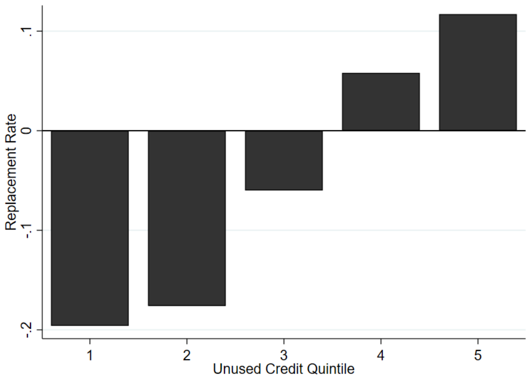


What drives heterogeneous borrowing responses?

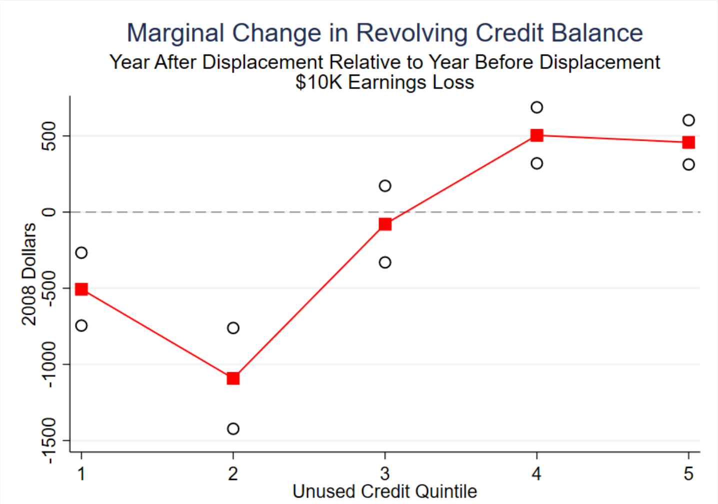
- Use cross-section to measure role of earnings losses *within* credit access quintile
- Let $\Delta e_{i,t}$ denote earnings loss in 2008 dollars from $t-1$ to $t+1$
- Let $C_{j,i,t-1}$ be a dummy for unused credit quintile j, prior to layoff
- Estimate specifications of the following form:

$$Y_{i,t} = \gamma_t + \eta + \mu \Delta e_{i,t} + \sum_{j=2}^{5} \left(\eta_j C_{j,i,t-1} + \mu_j C_{j,i,t-1} \times \Delta e_{i,t} \right) + \Psi X_{i,t} + \epsilon_{i,t}$$

- Coefficient $\mu + \mu_j$ is marginal change in borrowing for each dollar lost *within* jth unused credit quintile.

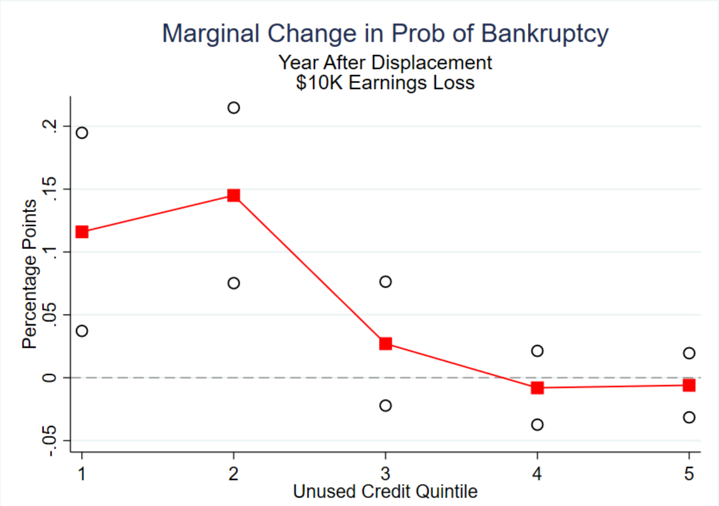
Other graphs & Regression Table

Revolving Credit



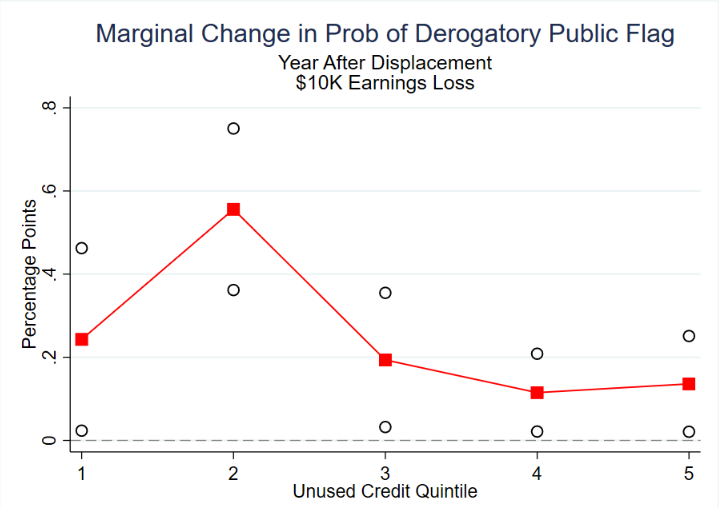
Constrained delever -10 cents on dollar, unconstrained borrow +5 cents on dollar

Bankruptcy



Constrained have new bankruptcy (\$10k loss $\rightarrow$ 20% increase relative to samp avg.)

Derogatory flags



Constrained have new derog. public flag ($10k loss→ 20% increase relative to samp avg.)

Summary of empirical findings

Main take-aways:

i. Unemployed maintain credit access - limits & balances do not respond to job loss

ii. Constrained default and delever, unconstrained borrow

iii. Unemployed transfer resources across time and states of world using credit

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Main take-aways:

i. Unemployed maintain credit access - limits & balances do not respond to job loss

ii. Constrained default and delever, unconstrained borrow

iii. Unemployed transfer resources across time and states of world using credit

Follow up questions:

- What features of credit markets allow job losers to borrow?
- Can credit serve as substitute for public insurance to the unemployed?

Answer by developing search model with defaultable credit lines Concl. Opt. UI

Model Overview

Environment:

- Heterogeneous, risk averse, finitely-lived agents
- Permanent observable discount factors, $\beta_i \in \{\beta_H, \beta_L\}$
- Direct search for jobs
- Direct search for credit lines (interest rate and limit)
- Agents can default on credit lines Model details

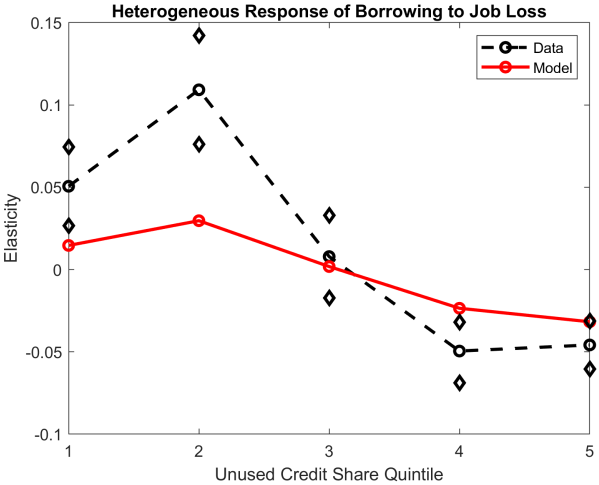
Mapping model to data

- Quarterly calibration, $r_f = 4\%$, Discount factor of 'low' default type $\beta_L = .99$
- Other standard parameters from literature
- Remaining parameters estimated to match moments

Variable	Value	Target	Model	Data	Source
z	0.322	Transfer to Income Loss	41.2%	41.2%	PSID 2001-2013
κ	0.535	Unemployment Rate	5.2%	5.7%	BLS, 24-54yo, 2002-2012
κ_C	2.084×10^{-5}	New Borrower Credit Finding Rate	51.2%	51.4%	LEHD-TU 2002-2012
κ_S	1.622×10^{-3}	Share of Individuals w/ Credit Access	77.7%	77.9%	LEHD-TU 2002-2012
ψ	21.449	Peak Derog. Flag Rate	0.005	0.006	LEHD-TU 2002-2012
$p_{\tilde{h},L}$	0.759	Earnings Loss 5 Yr. After Layoff	8.9%	8.6%	LEHD-TU 2002-2012
$p_{\tilde{h},H}$	0.043	Earnings Gain With Age	0.69%	0.94%	LEHD-TU 2002-2012
$p_{\epsilon,L}$	0.047	Share of Indiv. w/ 9.5% Wage Decline	4.1%	7.65%	KM (2017)
$p_{\epsilon,H}$	0.488	Share of Indiv. w/ 9.5% Wage Increase	10.3%	19.0%	KM (2017)
λ_H	2.348	P75-P25 Residual Log Wage Ratio, 25-29yo	0.471	0.662	LEHD-TU 2002-2012
α	0.399	Consumption After Benefit Expiration	88.8%	88.0%	GN (2015)
g	0.389	Consumption After Layoff	94.5%	93.8%	PSID 2005-2013
$\underline{B}$	-1.392	P50 Unused Credit to Income	11.9%	8.2%	LEHD-TU 2002-2012
β_H	0.832	Q2 Unused Credit Share	36.2%	31.1%	LEHD-TU 2002-2012
π_L	0.689	Share of Individuals Borrowing Around Job Loss	28.6%	35.0%	LEHD-TU 2002-2012
δ_c	0.024	Credit Separation Rate	5.3%	5.3%	TU 2002-2012

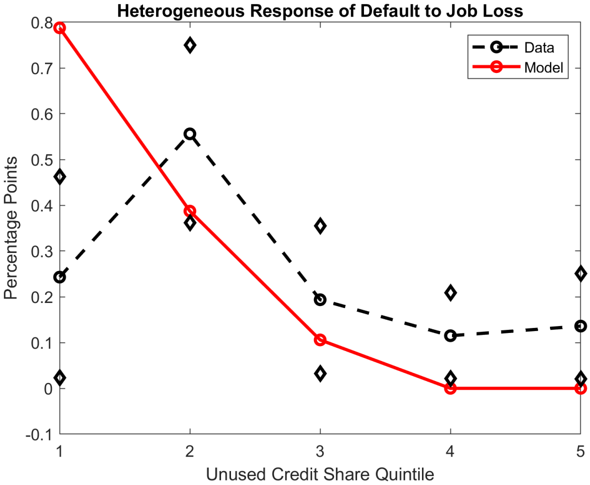
Model Fit: Borrowing by credit constraint

Replicate regressions of borrowing on earnings loss using model simulated data



Model Fit: Default by credit constraints

Replicate regressions of default on earnings loss using model simulated data



Optimal Public Insurance

- Search for public transfer z that maximizes utilitarian welfare in Steady State

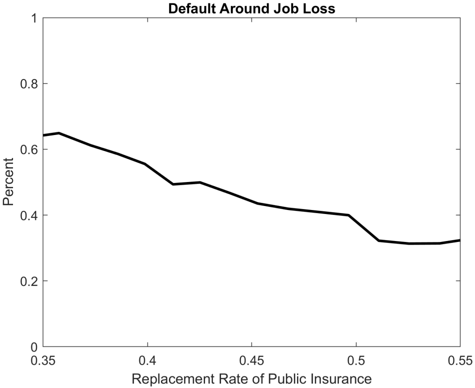
	(1) Baseline	(2) Optimal Policy w/ Credit	(3) Optimal Policy w/o Credit	(4) Lender of Last Resort
Transfer/Income Loss	41.2%	49.6%	50.5%	41.2%
Mean Welfare Chg.	-	0.070%	0.100%	0.035%
Consumption Loss After Job Loss	94.5%	96.2%	96.5%	94.5%
Unemployment Rate	5.2%	6.2%	6.3%	5.2%
Fraction of Ind. w/ Credit Access	77.7%	77.5%	-	77.8%
Credit Finding Rate	42.9%	45.8%	-	48.9%
Marginal Tax rate	1.31%	1.83%	1.89%	1.32%

Small difference in optimal policy between economy with/without credit $\rightarrow$ limited substitutability of public/private insurance

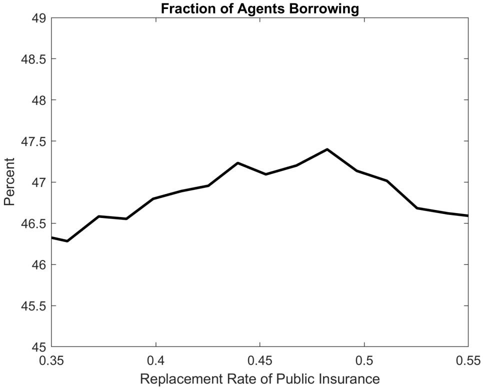
Why is credit a poor substitute for UI?

- Micro Substitutes in PE: borrow more if transfers are cut
- Macro Complements in GE: default more if transfers are cut, credit market contracts

(A) Defaults



(B) Fraction Borrowing



Conclusion

Three contributions:

1. Unemployed maintain their access to credit following job loss
   - Unconstrained borrow
   - Constrained default and delever
   - Either mechanism implies unemployed use credit markets to smooth consumption

2. Develop labor search model of credit lines

3. Show credit acts as a *limited* substitute for public unemployment insurance
   - Credit and UI are macro complements, thus optimal policy involves high replacement rate of 49.6% despite well developed credit market

Appendix

Model Overview

- Labor Market: Directed search for jobs
  - Submarket indexed by human capital $\vec{h}$, age t and wage piece rate ω
  - Produce $f(\vec{h})$, pay worker fraction ω of output
  - Workers accumulate human capital on-the-job
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  - Unemployed ($\omega = 0$) receive public insurance transfer z, home production g
- Credit Market: Directed search for credit lines
  - Credit lines specify interest rate r and limit $\underline{b}$
  - Submarkets indexed by all of agent's state variables as well as requested credit line
  - Agents can default on credit lines, lose access $(\underline{b}, r) = (0, 0)$
  - Allow for on-the-contract search

Preferences and Choices

Preferences:

$$u(c) - \psi_D(b)D - \kappa_S S$$

Choices:

- Tomorrow's assets b'
  - Credit contract w/ limit $\underline{\text{b}}$: $b' \geq \underline{\text{b}}$
  - Without credit contract: $b' \geq 0$
- Choose to default ($D = 1$) or repay ($D = 0$)
  - Defaulting terminates credit contract
- Those with and without credit may search for credit ($S = 1$) or not ($S = 0$)
- Unemployed choose wage submarket ω to search in

Value functions

Credit contract choice:

$$V^A_{i,t}(\omega, b, \vec{h}; \underline{b}, r) = \max_{(\tilde{\underline{b}}, \tilde{r})} p(\theta^c_{i,t}(\omega, b, \vec{h}; \tilde{\underline{b}}, \tilde{r}))V_{i,t}(\omega, b, \vec{h}; \tilde{\underline{b}}, \tilde{r}) + \left(1 - p(\theta^c_{i,t}(\omega, b, \vec{h}; \tilde{\underline{b}}, \tilde{r}))\right) V_{i,t}(\omega, b, \vec{h}; \underline{b}, r)$$

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Consumption savings:

$$V_{i,t}(\omega, b, \vec{h}; \underline{b}, r) = \max_{b' \geq \underline{b}} \; u(c) + \beta_i \mathbb{E}\left[V^L_{i,t+1}(\omega, b', \vec{h}'; \underline{b}, r)\right]$$

subject to the budget constraint and bond price,

$$c + q(b', r)b' \leq w(\omega, \vec{h}) + b, \qquad q(b', r) = \mathbb{I}\{b' < 0\}\frac{1}{1+r} + \mathbb{I}\{b' \geq 0\}\frac{1}{1+r_f}$$

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where income and human capital depends on whether unemployed ($\omega = 0$)

$$w(\omega, \vec{h}) = \begin{cases} z + g & \text{if } \omega = 0 \\ (1-\tau)\omega f(\vec{h}) & \text{if } \omega \neq 0 \end{cases} \qquad \vec{h}' = \begin{cases} H_-(\vec{h}) & \text{if } \omega = 0 \\ H_+(\vec{h}) & \text{if } \omega \neq 0 \end{cases}$$

Labor Market, Default, and Credit Search

Labor market: unemployed ($\omega = 0$) direct search, employed lose job with pr. δ:

$$V^L_{i,t}(\omega, b, \vec{h}; \underline{b}, r) = \begin{cases} \max_{\tilde{\omega}} p(\theta_t(\tilde{\omega}, \vec{h}))V^D_{i,t}(\tilde{\omega}, b, \vec{h}; \underline{b}, r) + (1 - p(\theta_t(\tilde{\omega}, \vec{h}))V^D_{i,t}(0, b, \vec{h}; \underline{b}, r)) & \text{if } \omega = 0 \\ (1 - \delta)V^D_{i,t}(\omega, b, \vec{h}; \underline{b}, r) + \delta V^L_{i,t}(0, b, \vec{h}; \underline{b}, r) & \text{if } \omega \neq 0 \end{cases}$$

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Default: lose credit if default, or exogenously with prob. δ_C:

$$\begin{aligned} V^D_{i,t}(\omega, b, \vec{h}; \underline{b}, r) = \delta_C \max\{&V_{i,t}(\omega, 0, \vec{h}; 0, 0) - \psi_D(b); V_{i,t}(\omega, b, \vec{h}; 0, 0)\} \\ + (1-\delta_C)\max\{&\underbrace{V_{i,t}(\omega, 0, \vec{h}; 0, 0) - \psi_D(b)}_{\text{Default}}; V^C_{i,t}(\omega, b, \vec{h}; \underline{b}, r)\} \end{aligned}$$

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Credit application: pay utility cost to apply

$$V^C_{i,t}(\omega, b, \vec{h}; \underline{b}, r) = \max\{V^A_{i,t}(\omega, b, \vec{h}; \underline{b}, r) - \kappa_S, V_{i,t}(\omega, b, \vec{h}; \underline{b}, r)\}$$

Lenders and Government

Lenders:

- Risk neutral and obtain funds at risk-free rate r_f
- Pay κ_c to post contract in submarket indexed by agent's states and requested contract
- Free entry requires

$$\kappa_C \geq p_f^c\left(\theta_{i,t}^c(\omega, b, \vec{h}; \underline{b}, r)\right) \Pi_{i,t}(\omega, b, \vec{h}; \underline{b}, r)$$

where $\Pi_{i,t}(\omega, b, \vec{h}; \underline{b}, r)$ denotes lender's profits (tractable due to finite lifecycle)

Lenders and Government

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where $\Pi_{i,t}(\omega, b, \vec{h}; \underline{b}, r)$ denotes lender's profits (tractable due to finite lifecycle)

Government:

- Finance transfer z with proportional tax τ on earnings

Firm Problem Equilibrium

Equilibrium

RCE: *(1) individual decision rules are optimal, (2) free entry holds in credit and labor market, (2) government balances its budget, and (4) distribution of agents consistent with decision rules.*

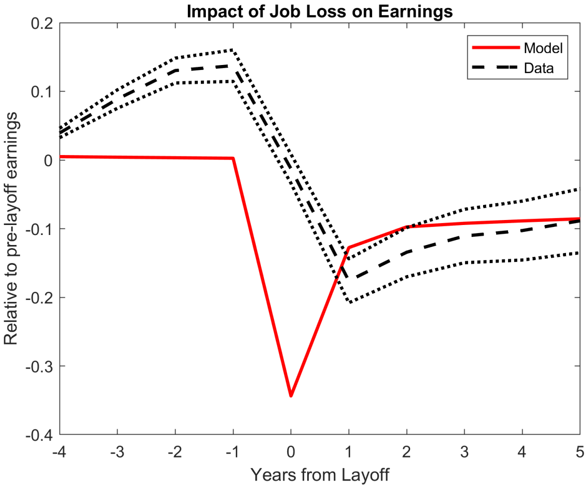
Conditional Block Recursivity: If τ is exogenously given, model is *Block Recursive*

- Distribution doesnt affect prices
- Equilibrium prices and distribution of agents *only* linked by τ

Greatly simplifies transition dynamics, only need to guess path of τ

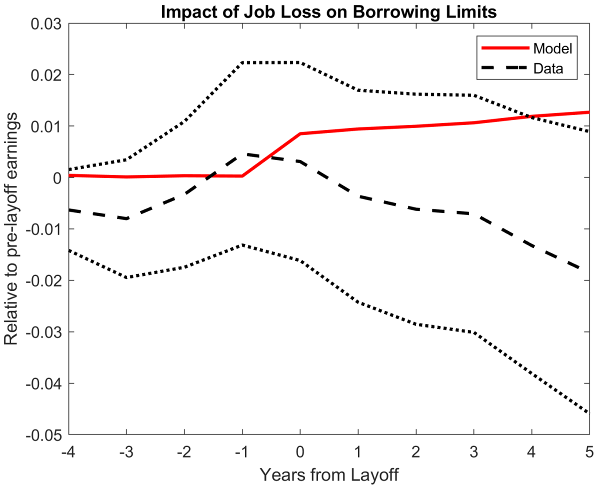
More

Model Fit: Earnings Loss



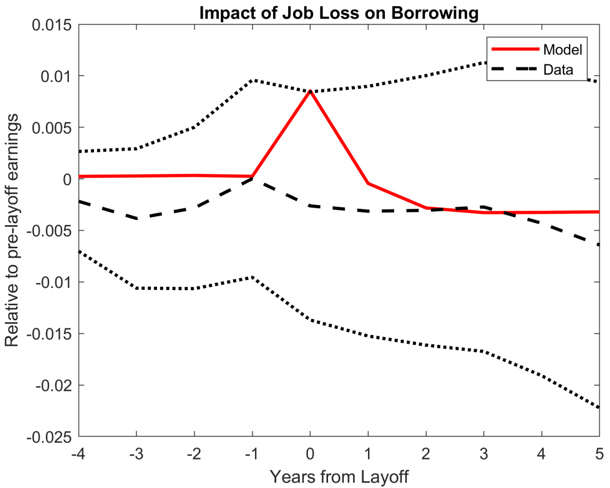
Peak to trough earnings losses of 30% in model and data $\rightarrow$ difficult to match timing

Model Fit: Borrowing Limits



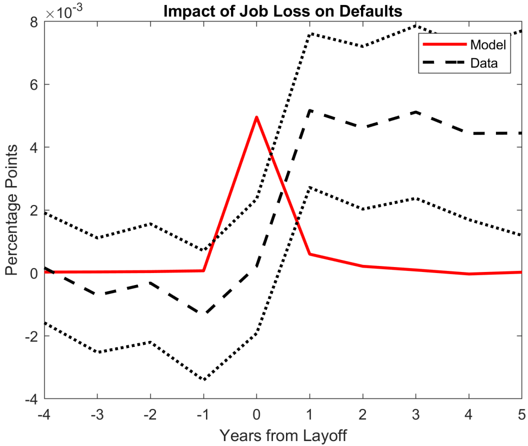
Unemployed maintain access to credit, uptick in measure who take out new credit card

Model Fit: Borrowing



Unemployed borrow small amount on average

Model Fit: Default

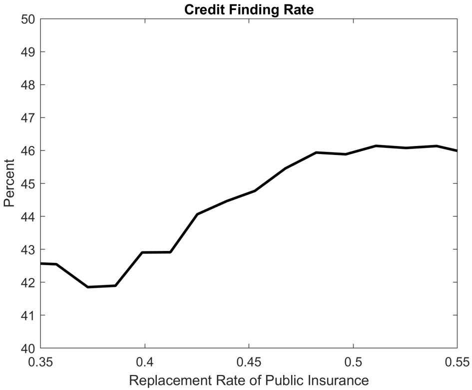


Unemployed default at similar rate to data, earnings trough coincides with peak defaults

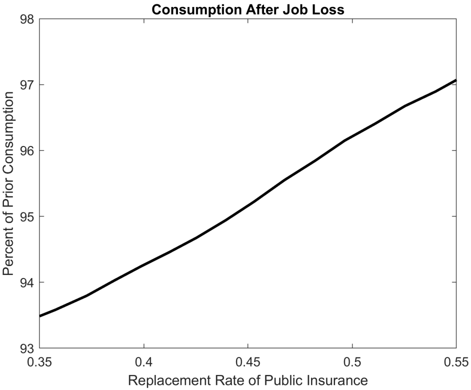
Why is credit a poor substitute for UI?

- Utilitarian government: tradeoff consumption losses (equity) vs. higher taxes (inefficiency)

(A) Credit Finding Rate



(B) Consumption



What about credit constraints?

- Recall, we estimate specifications of the following form:

$$Y_{i,t} = \gamma_t + \eta + \mu \Delta e_{i,t} + \sum_{j=2}^{5} \left(\eta_j C_{j,i,t-1} + \mu_j C_{j,i,t-1} \times \Delta e_{i,t} \right) + \Psi X_{i,t} + \epsilon_{i,t}$$

- Predict replacement and default rate across credit score quintiles holding fixed...
  i. Average earnings loss ($\overline{\Delta e} = \$ - 25,000$ sample avg.)
  ii. Composition of individuals ($\overline{X}$ set to sample avg.)

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  i. Average earnings loss ($\overline{\Delta e} = \$ - 25,000$ sample avg.)
  ii. Composition of individuals ($\overline{X}$ set to sample avg.)
- Let $\widehat{Y}_j$ denote the predicted value in the jth credit access quintile:

$$\widehat{Y}_j = \underbrace{\hat{\eta} + \hat{\eta}_j}_{\text{Credit component}} + \underbrace{\hat{\mu}\overline{\Delta e} + \hat{\mu}_j \overline{\Delta e}}_{\text{Earnings loss component}} + \hat{\Psi}\overline{X}$$

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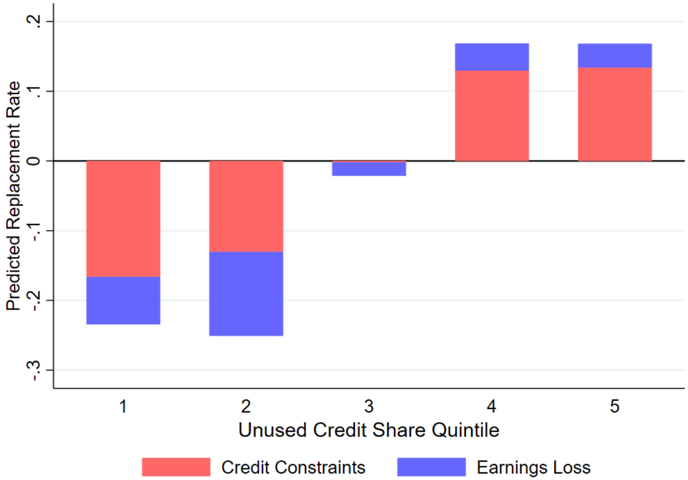
- Predicted responses in model and data include non-job loss related borrowing (e.g. constrained delever regardless of job loss), which model can replicate

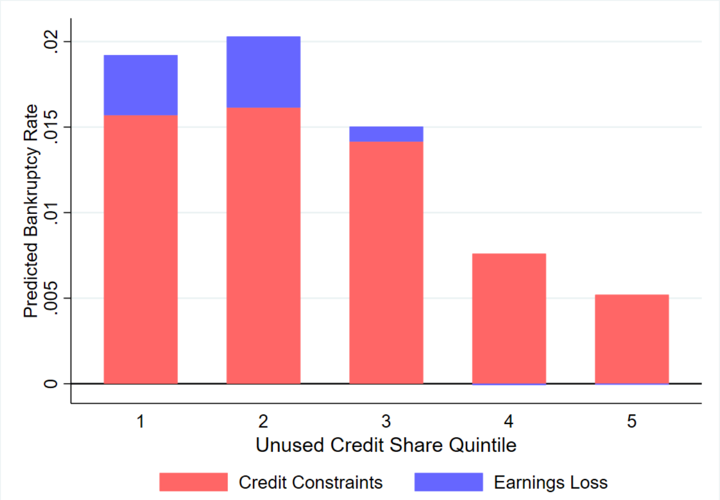
Predicted Replacement Rate

- Holding composition and earnings losses fixed, constrained delever, unconstrained borrow



Predicted Bankruptcy Rate

- Holding composition and earnings loss fixed, constrained default more frequently



Related Literature

- Empirical Job Loss and Borrowing: Sullivan (2008), Hurd & Rohwedder (2010), Baker & Yannelis (2015), Gelman, Kariv, Shapiro & Tadelis (2015), Ganong & Noel (2015)
- GE Search w/ Credit: Krusell, Mukoyama & Sahin (2010), Nakajima (2012), Herkenhoff (2013), Bethune, Rocheteau & Rupert (2013)
- Credit Lines: Mateos-Planas & Seccia (2006), Mateos-Planas & Rios-Rull (2010), Mateos-Planas (2013)
- Optimal UI w/ Assets: Shimer and Werning (2005), Lentz (2009), Kolsrud, Landais, Nilson & Spinnewijn (2015)
- Nonexistence of Private UI: Chiu & Karnia (1998), Hendren (2015)

Back to intro

Appendix: Sample Construction Details

ID Displaced Workers (following Jacobson, LaLonde, & Sullivan (1993)):

1. Employers assigned a State Employment Identification Number (SEIN) in LEHD. This is unit of analysis for mass layoffs.
2. **Mass layoff def'n:** SEIN with at least 20 employees reduces its employment by 20% or more within a quarter and continues operations, or exits in LEHD with contemporaneous plant exit in the LBD.
3. **SPF:** Verify that fewer than 80% of laid-off workers move to any other single SEIN using the Successor Predecessor File (SPF).
4. Removes mergers, firm name-changes, and spin-offs.

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Appendix: Detailed Sample Description

Panel Sample of Displaced Workers:

1. Prime age (24-64), 3+ years of tenure at time of mass layoff, earned $1,000 each quarter at the firm in the prior year
2. **Treatment Group:** 92,000 individuals who were displaced as part of the mass layoff
3. **Control group:** 126,000 individuals who were coworkers of those in the treatment group during the mass layoff but were not displaced
4. If involved in two or more mass layoffs, we only use the first event
5. Require control group to never be displaced as part of a mass layoff episode.
6. Sample covers displacements in the years 2002-2012.

Back to Empirics

Regression Details

- To compare outcomes of displaced and non-displaced, we estimate distributed lag regressions:

$$Y_{i,t} = \alpha_i + \gamma_t + \sum_{j=-5}^{5} \beta_j D_{j,i,t} + \Gamma X_{i,t} + \epsilon_{i,t}$$

where:

- $Y_{i,t}$: outcome of interest
- α_i: individual fixed effect
- γ_t: time fixed effect
- $D_{j,it,}$: indicators denoting individual i is j periods from displacement in period t
- X_i, t: vector of controls - quadratic in age, and proxies for wealth

Back to Empirics Overview

Data Description

Data: LEHD linked to TransUnion

- LEHD: matched employer-employee dataset, includes earnings, employment
- TransUnion: individual credit reports, includes balances, limits, credit score, delinquency status
- Linked sample of individuals with credit reports from the 11 states for which we have LEHD data, 2001-2008
    - Arizona, California, Colorado, Deleware, Iowa, Illinois, Indiana, Maryland, Nevada, Virginia, and Washington.
    - Random sample of credit reports with extra oversampling of bankruptcy, foreclosures, and delinquency.
    - The sample is then reweighted to match aggregate rates of bankruptcy, foreclosure, and delinqueny in those states.

Back to strategy

Appendix: TransUnion Variable Description

The unused revolving credit limit ratio is defined as,

$$\frac{\text{Total Revolving Credit Limit - Total Revolving Balance}}{\text{Lagged Annual Earnings}}$$

i. 'Total Revolving Credit Limit' corresponds to the TransUnion variable 'Revolving High Credit/Credit Limit.'

ii. 'Revolving High Credit/Credit Limit' is constructed as the sum of the 'High Credit/Credit Limit' across all types of revolving debt.

iii. The 'High Credit/Credit Limit' is defined as the actual credit limit if such a limit is recorded or the highest historical balance if no credit limit is recorded.

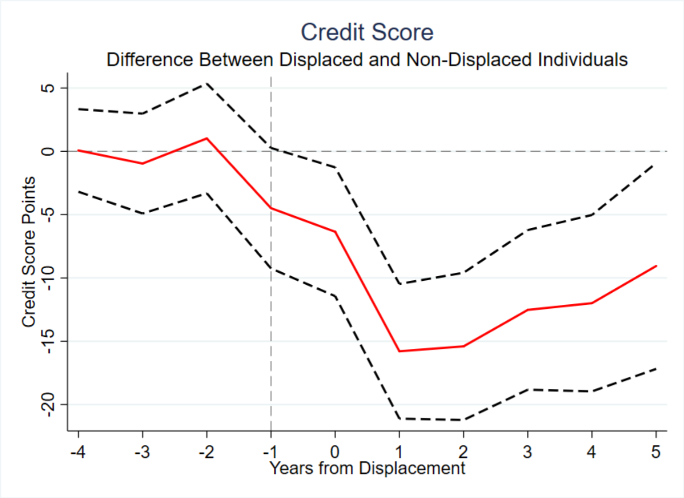
Back

Appendix: JLS Regression Results

	(1) Earnings	(2) Credit Score	(3) Revolving Credit Limit	(4) Revolving Credit Balance
4 Years Before Displacement	1,169***	0.0699	-217.5	39.66
	(167.2)	(1.664)	(232.3)	(149.9)
3 Years Before Displacement	2,757***	-0.964	-363.8	-49.26
	(220.1)	(2.013)	(334.7)	(202.9)
2 Years Before Displacement	5,049***	1.019	-365.1	-36.50
	(262.8)	(2.210)	(403.0)	(240.8)
1 Year Before Displacement	5,157***	-4.488*	-347.4	47.28
	(296.8)	(2.427)	(473.4)	(281.0)
Year of Displacement	-2,850***	-6.352**	-996.4*	-473.2
	(353.5)	(2.595)	(533.7)	(315.8)
1 Year After Displacement	-13,830***	-15.79***	-1,738***	-583.7*
	(410.6)	(2.714)	(572.3)	(336.9)
2 Years After Displacement	-9,735***	-15.40***	-1,503**	-455.1
	(429.0)	(2.966)	(624.8)	(368.3)
3 Years After Displacement	-7,246***	-12.52***	-1,223*	-211.5
	(446.3)	(3.216)	(693.2)	(414.8)
4 Years After Displacement	-5,293***	-11.99***	-1,423*	-186.9
	(491.2)	(3.554)	(783.8)	(474.0)
5 Years After Displacement	-3,081***	-9.055**	-1,667*	-653.4
	(556.1)	(4.146)	(889.9)	(552.1)
Individual Fixed Effects	Y	Y	Y	Y
Year Fixed Effects	Y	Y	Y	Y
Age and Wealth Controls	Y	Y	Y	Y
R-squared	0.153	0.019	0.026	0.017
Indiv-Yr Obs.	472000	472000	472000	472000
No. of Indiv	61000	61000	61000	61000

*Notes: Clustered SE in parenthesis, where the clustering is performed at the level of the firm where the worker was displaced.***$p < 0.01$, **$p < 0.05$,*$p < 0.1$. Age and wealth controls include a quadratic in age, and deciles for lagged cumulative earnings. The set of variables "K Years Before (After) Displacement" are dummy variables equal to one when an individual is K years before (after) displacement, and equal to zero otherwise. Annual earnings, revolving credit balance and revolving credit limit are in 2008 dollars. Credit score refers to the TransUnion bankruptcy score.*

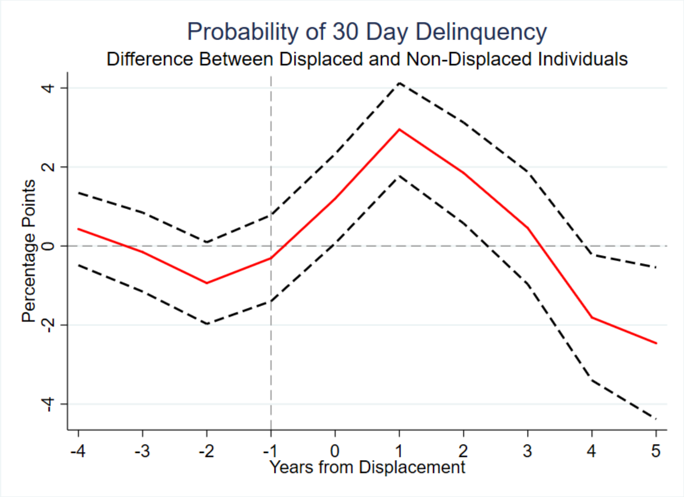
Credit Score After Layoff Relative to Control Group



Pre-layoff credit score (Scale 0 to 1000): 427 (average), 267 (SD)

Return to JLS Graphs · Return to Empirics Summary · Return to Credit Limits

30 Day Delinquency



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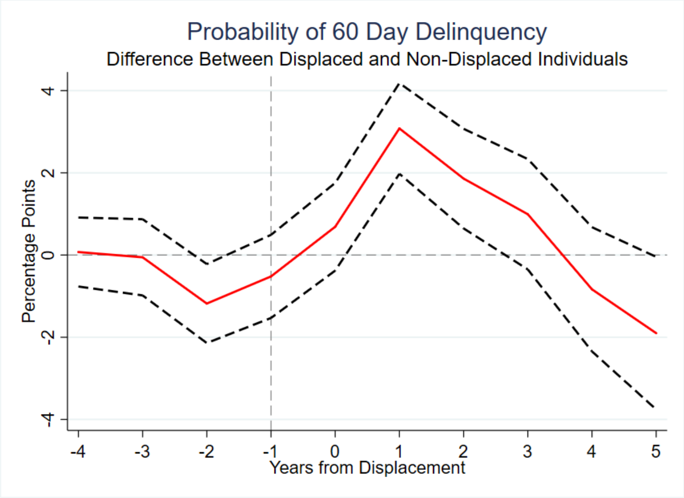
60 Day Delinquency



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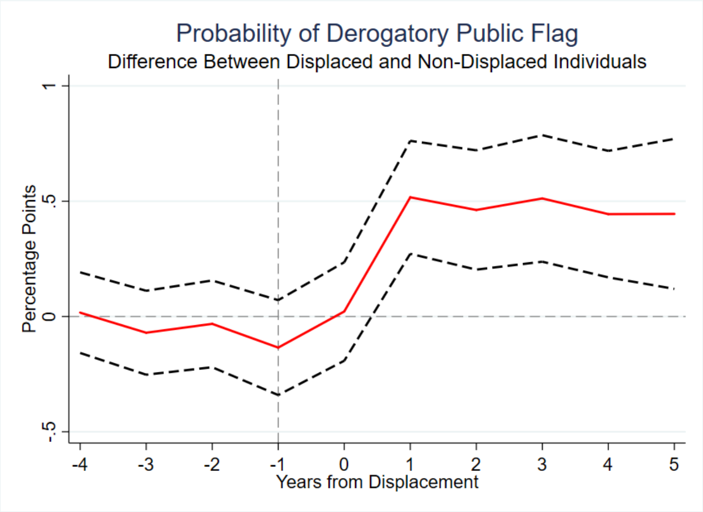
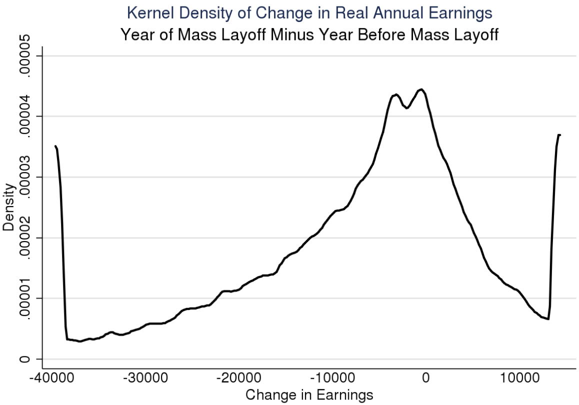
New Derogatory Flag After Layoff



Return

Heterogeneous earnings losses

- Non-responsiveness of mean borrowing masks heterogeneity
- Job loss is permanent shock for some, temporary for other



Return to Heterogeneous Borrowing Return JLS

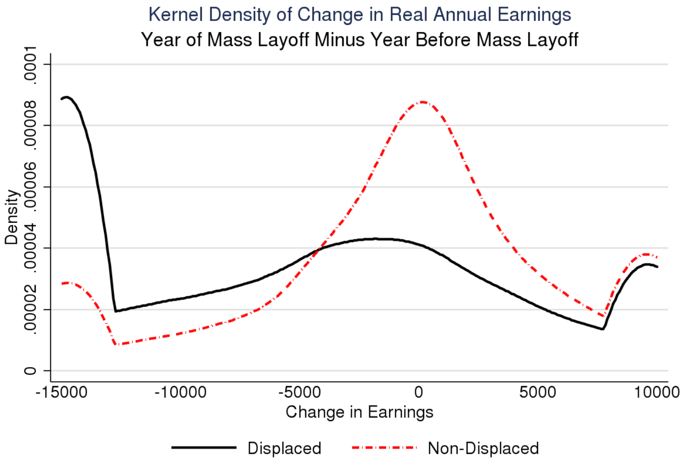
Summary Statistics: Delevering

Table: The Fraction of Displaced Workers who Delever or Default in the Year of Layoff

Fraction of Displaced Workers with...	
Decline in Revolving Credit Balances	0.533
Decline in Revolving Credit Balances and 60-day Delinquency	0.246
Decline in Revolving Credit Balances and Debt Chargeoff	0.122

Return

Employed v. Unemployed



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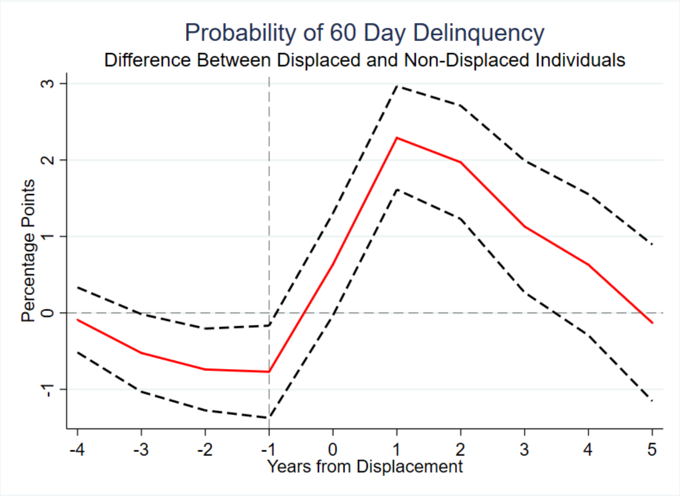
Appendix: Delinquency After Layoff Relative to Control Group



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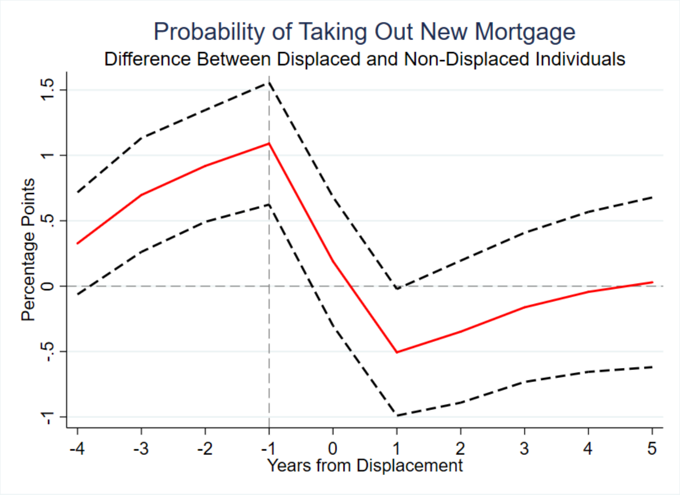
Appendix: Types of Credit

Not all credit works the same: first mortgages mean outflow of money (for downpayment)



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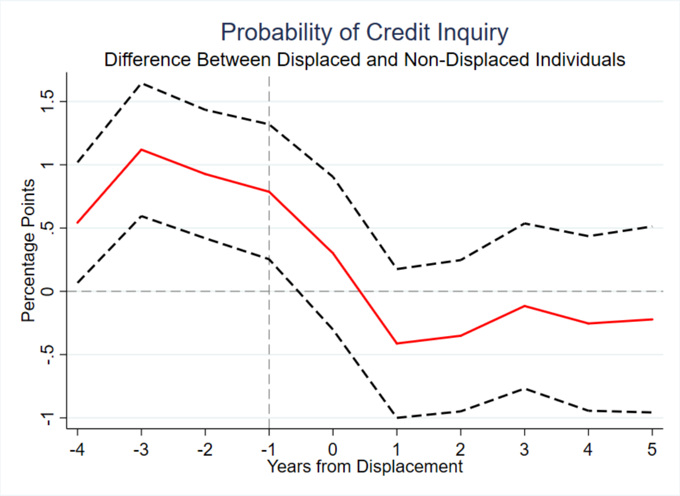
Appendix: Anticipation Effects

Anticipation effects? Some anticipation coming from inquiries



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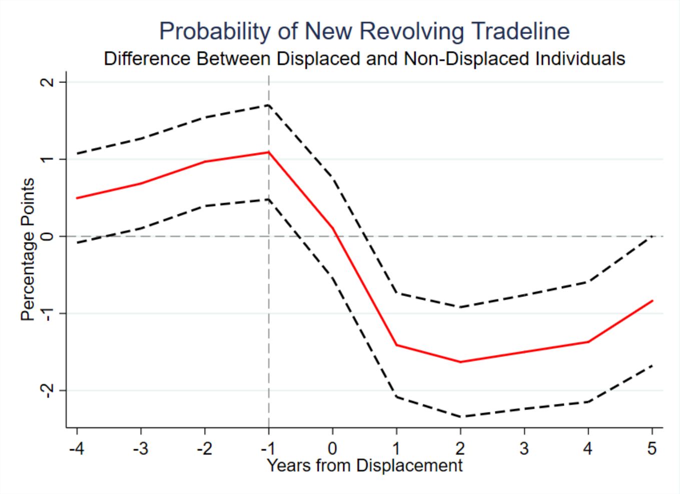
Appendix: New Tradelines

Anticipation effects? Some anticipation coming from revolving account openings

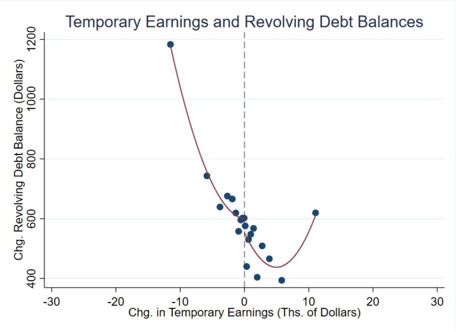


Return

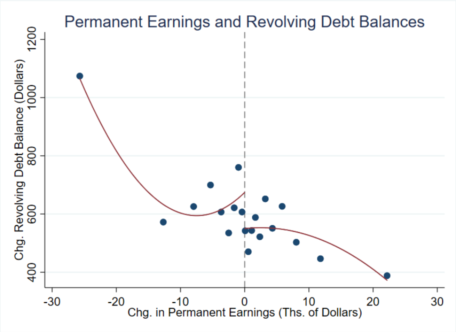
Kalman Filter

- Kalman Filter 120,000 individuals' quarterly earnings from 1998-I to 2008-IV (transitory is iid, persistent AR(1))
- For each individual, we have a permanent and transitory income shock
- Measure response of debt to permanent and transitory earnings losses

(A)



(B)



Return

Figure: Response of Bankruptcy to Changes in Temporary and Permanent Earnings

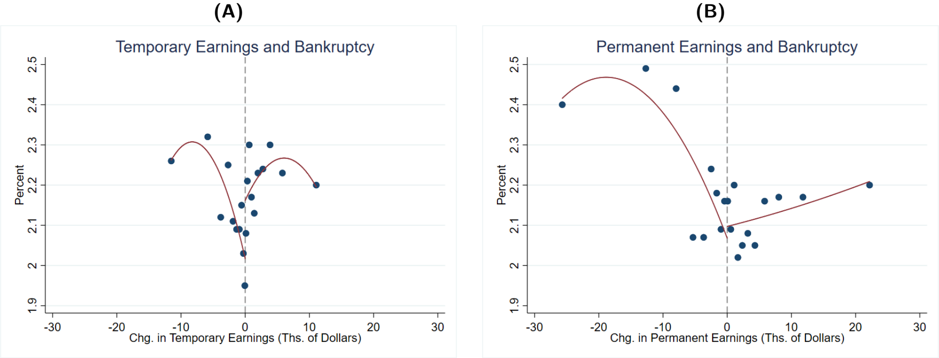


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Figure: Response of Chargeoffs to Changes in Temporary and Permanent Earnings

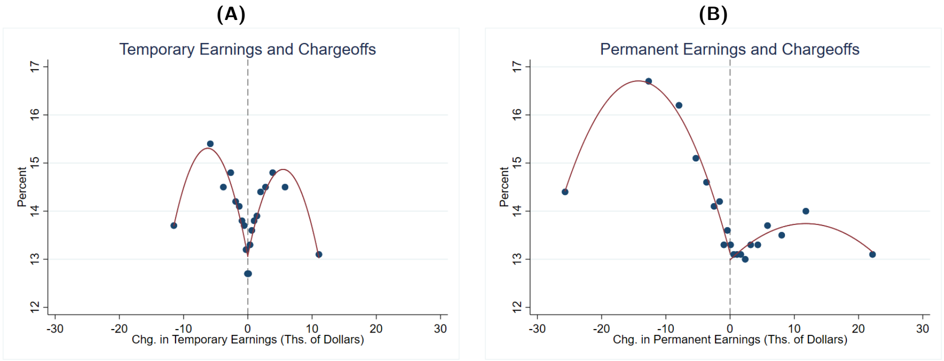

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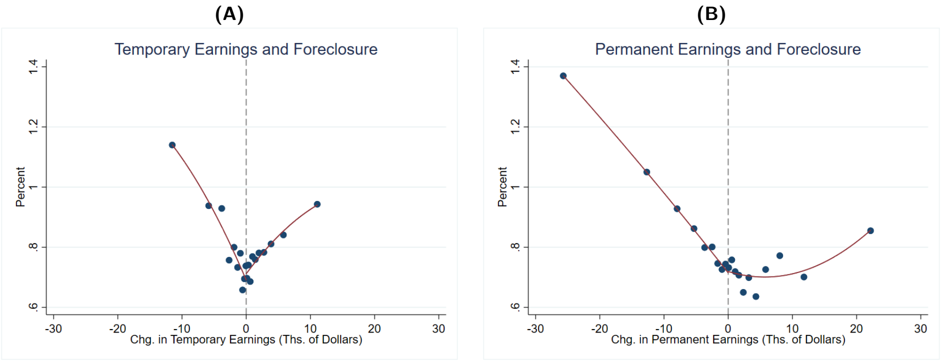
Figure: Response of Foreclosure to Changes in Temporary and Permanent Earnings



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Appendix: Temporary Shocks

- Filter earnings process to obtain deviations from trend (temporary shocks) and movements in the trend (permanent shock)
- Random 10% subsample of TU-LEHD individuals

Table: Transitory vs. Permanent Shock

	Chg. Revolving Credit	Debt Charge-off (d)	Bankruptcy (d)
Chg. Temp. Earnings	**-0.0121*** **	-2.63e-08	2.66e-08*
	(0.00133)	(3.52e-08)	(1.60e-08)
Chg. Perm. Earnings	-0.00264	-2.19e-06***	**-3.47e-07*** **
	(0.00567)	(1.50e-07)	(6.83e-08)
Individual Fixed Effects	Y	Y	Y
Controls	Y	Y	Y
R-Square	0.001	0.002	0.001
No Obs.	799000	799000	799000
No Indiv.	124000	124000	124000

Return

Heterogeneous borrowing responses

- Sample: 19,000 displaced worker with earnings loss from t-1 to t+1
- Define replacement rate to be $RR_{it} = \frac{-(debt_{i,t+1} - debt_{i,t-1})}{earnings_{i,t+1} - earnings_{i,t-1}}$

Heterogeneous borrowing responses

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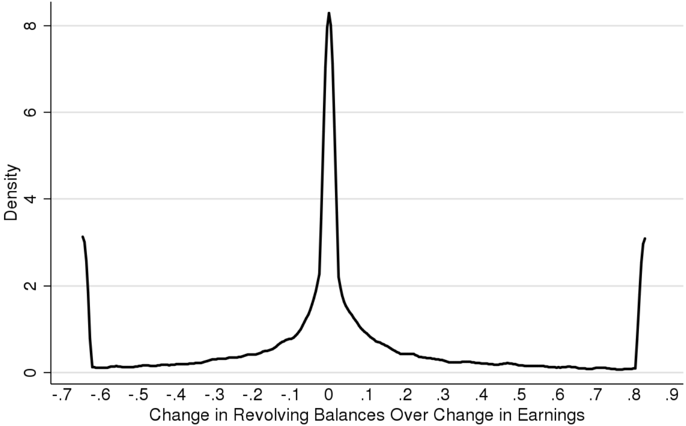

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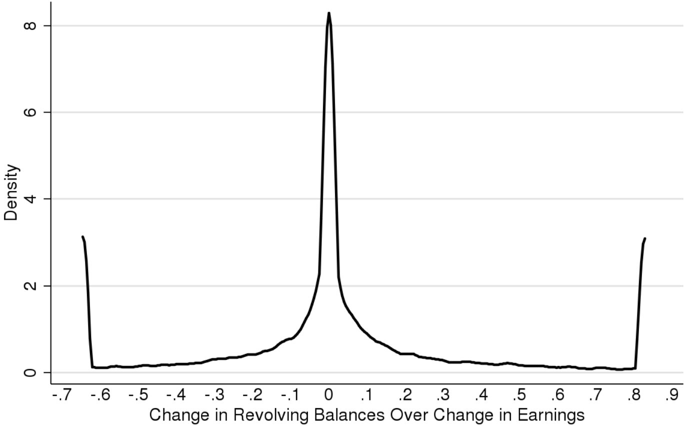


Delevering: 21% have a chargeoff, 44% have delinquency Back

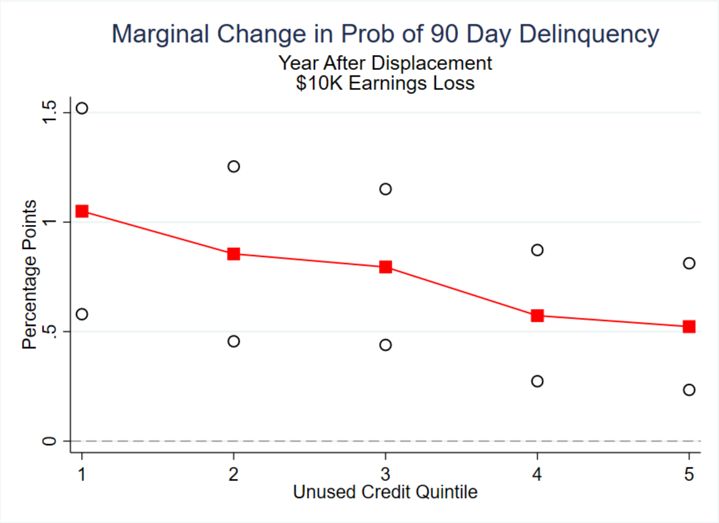
Table: Replacement Rates of Revolving Credit by Credit Score Quintile (Year of Displacement)

	OLS		Predicted Values
	(1)	(2)	(3)
	Replacement Rate	Replacement Rate	Replacement Rate
Credit Score Quin 1 (d)			-0.0540***
			(0.00630)
Credit Score Quin 2 (d)	0.00302	0.00192	-0.0521***
	(0.00944)	(0.00945)	(0.00720)
Credit Score Quin 3 (d)	0.0769***	0.0811***	0.0271***
	(0.0110)	(0.0110)	(0.00903)
Credit Score Quin 4 (d)	0.185***	0.192***	0.138***
	(0.0118)	(0.0119)	(0.0100)
Credit Score Quin 5 (d)	0.248***	0.262***	0.208***
	(0.0118)	(0.0121)	(0.0102)
Constant	-0.0492***	-0.163***	
	(0.00620)	(0.0553)	
Year FE	N	Y	Y
Age and Wealth Controls	N	Y	Y
R square	0.030	0.034	
No Obs.	21000	21000	21000

Notes: Robust SE in parenthesis. $^{***}p < 0.01$, $^{**}p < 0.05$,$^{*}p < 0.1$. Replacement rate is the negative of the change in revolving credit balance over the change in earnings for individuals with an earnings loss in year of displacement. Credit score quintiles are based upon an individuals TransUnion bankruptcy score in the year prior to displacement. Age and wealth controls include a quadratic in age, and deciles for lagged cumulative earnings. The replacement rate used in the estimation is winsorized at the top and bottom at the 10 percent level. Column (3) reports predicted values of the replacement rate by credit score quintile implied by the results of Column (2), where the control variables are evaluated at their sample means.

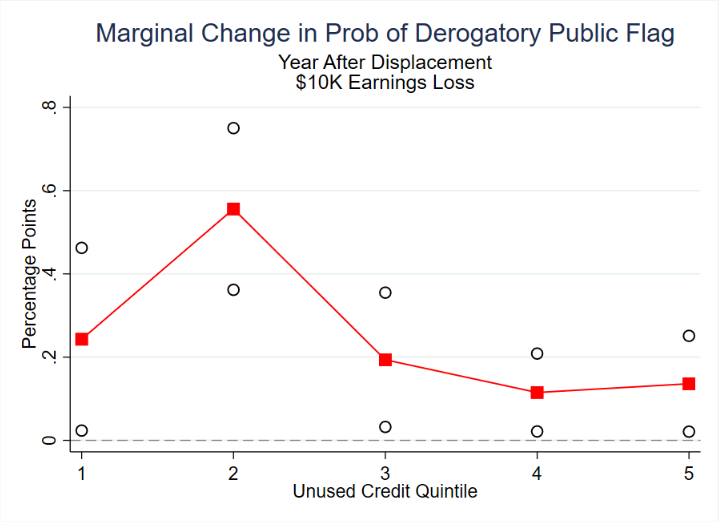
Return

90 Day Delinquency



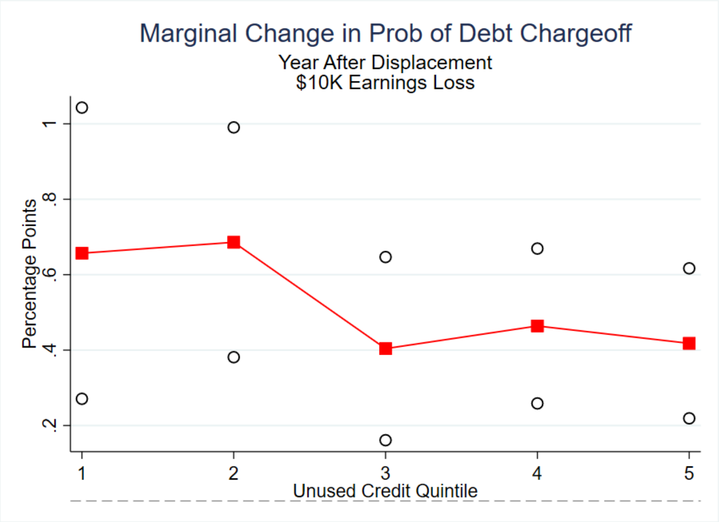
Return to Heterogeneous Replacement Rates

Derogatory Flag



Return to Heterogeneous Replacement Rates

Chargeoffs (t-1 to t+1)



Return to Heterogeneous Replacement Rates

Table: Revolving Credit Balances by Credit Score

Back

	(1) 2 Yr. Chg. Revolving Bal.	(2) 2 Yr. Chg. Revolving Bal.	(3) 2 Yr. Chg. Revolving Bal.
2 Yr. Chg. Earnings	0.0187***	0.0680***	0.0506***
	(0.00575)	(0.0126)	(0.0122)
2 Yr. Chg. Earnings x Credit Access Quin 2		0.0523***	0.0586***
		(0.0183)	(0.0182)
2 Yr. Chg. Earnings x Credit Access Quin 3		-0.0488***	-0.0427**
		(0.0181)	(0.0180)
2 Yr. Chg. Earnings x Credit Access Quin 4		-0.107***	-0.101***
		(0.0155)	(0.0152)
2 Yr. Chg. Earnings x Credit Access Quin 5		-0.102***	-0.0964***
		(0.0139)	(0.0139)
Constant	1.409	-4,297***	565.0
	(158.6)	(329.6)	(1,434)
Credit Access Quin 2 (d)		684.4	766.0
		(536.0)	(531.0)
Credit Access Quin 3 (3)		4,240***	4,237***
		(524.8)	(519.4)
Credit Access Quin 4 (d)		7,905***	7,847***
		(460.3)	(445.1)
Credit Access Quin 5 (d)		7,974***	8,085***
		(416.5)	(409.2)
Year Fixed Effects	N	N	Y
Age and Wealth Controls	N	N	Y
R-square	0.001	0.068	0.085
Number of Individuals.	56000	56000	56000
P-Value Chg. Earn Quin 2		0	0
P-Value Chg. Earn Quin 3		0.131	0.538
P-Value Chg. Earn Quin 4		3.05e-05	7.91e-08
P-Value Chg. Earn Quin 5		2.23e-06	6.61e-10

*Notes: Clustered SE in parenthesis, where the clustering is performed at the level of the firm where the worker was displaced. ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Age and wealth controls include a quadratic in age, and deciles for lagged cumulative earnings.*

Lenders Profits

- Let $\vec{s} = (\omega, b, \vec{h}; \underline{b}, r)$
- Lenders make profits from spread above risk free rate $r - r_f$ subject to default risk

$$m_{i,t}(\omega, b, \vec{h}; \underline{b}, r) = \beta_{lf}\left[b^{'}_{i,t}(\vec{s})\right]\left(\frac{(r_f - r)}{1+r} + \hat{D}_{i,t+1}(\vec{s})\right) \times \mathbb{I}\{b^{'}_{i,t}(\vec{s}) < 0\}$$

- Their continuation values are given by,

$$\Pi_{i,t}(\omega, b, \vec{h}; \underline{b}, r) = m_{i,t}(\omega, b, \vec{h}; \underline{b}, r) + \beta_{lf}\mathbb{E}\left[\Gamma_{i,t+1}(\omega^{'}, b^{'}, \vec{h}^{'}; \underline{b}, r)\Pi_{i,t+1}(\omega^{'}, b^{\prime}, \vec{h}^{'}; \underline{b}, r)\right]$$

  where $\Gamma_{i,t+1}(\omega^{'}, b^{'}, \vec{h}^{'}; \underline{b}, r)$ is the probability a match continues.
- *Note: finite lives make this problem tractable, no fixed point required*
- Free entry is given by,

$$\kappa_C \geq p^c_f\left(\theta^c_{i,t}(\omega, b, \vec{h}; \underline{b}, r)\right)\Pi_{i,t}(\omega, b, \vec{h}; \underline{b}, r)$$

Return to Lenders Profits

Closing the economy

Matched firm:

$$J_t(\omega, \vec{h}) = (1-\omega) f(\vec{h}) + \beta_{lf} \mathbb{E}\left[(1-\delta) J_{t+1}(\omega, \vec{h}')\right] \quad \forall t \leq T$$

subject to the law of motion for human capital for employed individuals,

$$\vec{h}' = H(\vec{h}, W)$$

Hiring firm: Pay κ to post vacancy in submarket $(\omega, \vec{h}, t)$. Free-entry:

$$\kappa \geq p_f\left(\theta_t(\omega, \vec{h})\right) J_t(\omega, \vec{h}) \tag{1}$$

Government:

- Finance transfer z with proportional tax τ on earnings where $\vec{s} = (\omega, b, \vec{h}; \underline{b}, r)$

$$z \sum_{(i,t)} \sum_{\vec{s}} \left(\hat{u}_{i,t}(\vec{s}) + \gamma \hat{n}_{i,t}\right) = \sum_{(i,t)} \sum_{\vec{s}} \tau \left(\omega f(h) \hat{e}_{i,t}(\vec{s})\right) \tag{2}$$

Return to Lenders Profits

Equilibrium Definition

Notation:

- $\mu : \{e, a, i, \omega, b, \vec{h}, \underline{b}, r, t\} \to [0, 1]$ is distribution of agents
- Let $\vec{x}$ summarize the state vector of a individual

Definition. A recursive equilibrium in this economy is a set of individual policy functions for savings and borrowing $\{b'_{i,e,t}(\vec{x})\}_{t=1}^{T}$, credit applications $\{S_{i,e,t}(\vec{x})\}_{t=1}^{T}$, bankruptcy $\{D_{i,t}^{a,e}(\vec{x})\}_{t=1}^{T}$, job search choice $\{\hat{\omega}_{i,t}(\vec{x})\}_{t=1}^{T}$, credit contract choice $\{(r, \underline{b})_{i,e,t}(\vec{x})\}_{t=1}^{T}$, labor market tightness function $\{\theta_t(\omega, \vec{h})\}_{t=1}^{T}$, credit market tightness function $\{\theta_{i,t}^{c,e}(\vec{x})\}_{t=1}^{T}$ for employed $e = W$ and unemployed $e = U$ individuals as well as patient $i = L$ and impatient $i = H$ individuals, a public insurance transfer to the unemployed z, a proportional tax rate τ, and a distribution of individuals across states μ:

i. Households' decision rules are optimal.

ii. The labor market tightness satisfies the free entry condition in the labor market.

iii. The credit market tightnesses satisfy the free entry conditions for lenders.

iv. The distribution of individuals across states μ is consistent with individual policy functions.

v. The tax rate τ balances the government budget.

Conditional Block Recursivity

Conditional Block Recursivity

- μ only enters consumer problem through τ
- Path of τ is only object HHs need to know to forecast relevant prices along transition path

Proposition: *Suppose τ is given and the government budget does not need to balance (i.e. equilibrium condition v. is not imposed). Assume that the utility function meets standard conditions ($u^{'} > 0, u^{''} < 0, \lim_{c\to\infty} u^{'}(c) = 0$ and u is invertible), the labor and credit matching functions are invertible and constant returns to scale, and there are compact supports for the choice set of interest rates $r \in \mathcal{R} \equiv [\underline{r}, \bar{r}]$, borrowing limits $\underline{b} \in \underline{\mathcal{B}} \equiv [\underline{B}, 0]$, and the piece rate of wages $\omega \in [0, 1]$, then individual policy functions, the credit market tightness, and the labor market tightness do not depend on the distribution of individuals across states, μ.*

Return

Calibration

Annual period, steady state to match moments from 1995 to 2007

- Annualized risk free rate is 4%
- Discount factor for firms and lenders is set to $\beta_{lf} = 0.99$.
- Low worker type (who generates *low* profits to the lender) has a discount factor $\beta_L = 0.99$.
- Discount factor of high type (who generates high profits for the lender), $\beta_H = .632$, set to match 95th percentile of real credit card interest rates (19.03%)

Return

Calibration, continued

Labor market:

- Set the job destruction rate to a constant 10% per quarter, $\delta = 0.1$
- Matching function $\zeta = 1.6$ (following Schaal 2012):

$$M(u, v) = \frac{u \cdot v}{(u^{\zeta} + v^{\zeta})^{1/\zeta}} \in [0, 1)$$

- $\kappa = .995$ is estimated to target an unemployment rate of 5.0%

Return

Calibration, continued

- Exogenous credit separation rate is 2.6% per quarter, $\delta_c = 0.026$ (Fulford 2015)
- Credit matching function $\zeta_C = 0.37$ (Herkenhoff 2013):

$$M_C(u_C, v_C) = \frac{u_C \cdot v_C}{(u_C^{\zeta_C} + v_C^{\zeta_C})^{1/\zeta_C}} \in [0,1)$$

- Grid of interest rates s.t. $\underline{r}$ is 10.5%, $\bar{r}$ is 22.5% (Agarwal et al. 2014, and P99 SCF).
- $\kappa_C = 2.214 \times 10^{-5}$ is estimated so that the credit finding rate in the model matches the new-borrower credit approval rate of 65.0% (SCF 2007-2009)
- Utility cost of searching for a credit κ_S calibrated to match 69.8% of agents with credit access (SCF 1995-2007).
- $\kappa_S = 1.272 \times 10^{-4}$ is calibrated to match the fact that 69.8% of the population has credit access (SCF 1995-2007)

Return

Calibration, Continued

Human capital process

- Persistent human capital lies on grid:

$$\tilde{h} \in [0.6,\ 0.7,\ 0.8,\ 0.9,\ 1,\ 1.1,\ 1.2]$$

- $\vec{h} = (\tilde{h}, \epsilon)$ where $\tilde{h}$ is persistent, ϵ iid
- Persistent human capital depreciates by $\Delta = 0.1$ at rate $p_{\tilde{h},L}$ while unemployed
- Persistent human capital appreciated by $\Delta = 0.1$ at rate $p_{\tilde{h},H}$ while employed
- Transitory human capital iid, governed by $p_{\epsilon,L}$ and and $p_{\epsilon,H}$
- Size of iid shock is $\Delta_\epsilon(\tilde{h}') = 0.095\tilde{h}'$

Return

Calibration, Continued

Human capital process

- Set $p_{\tilde{h},L} = .651$ to match 5yr earnings loss in LEHD
- Set $p_{\tilde{h},H} = .083$ to match residual age-wage elasticity in CPS (1995-2007)
- Transitory $p_{\epsilon,L} = .111$ and $p_{\epsilon,H} = .252$ to match statistics reported by (Kurmann and McEntarfer (2017))
- Initial persistent human capital drawn from exponential distribution (λ_H).
- Set parameter λ_H to match the P75-P25 earnings ratio of young workers (workers between 25 and 29) in CPS
- We assume the production function is linear in the human capital, $f(\vec{h}) = \tilde{h} + \epsilon$.

Return

Calibration of Transfers

- **Home production:** $g = 0.146$ is calibrated to target the decline in consumption associated with job loss.
  - Using the PSID, we estimate that, on average, individuals who experience at least 1-quarter of unemployment have annual consumption that is 93.8% of their consumption level prior to layoff.

- **Public transfer to unemployed workers:** $z = .327$ is estimated to match the 41.2% public transfer replacement rate (change in public transfers divided by change in annual income) among laid-off workers observed in the PSID between 2001 and 2013

- **Fraction of high-types:** $\pi_H = 1 - \pi_L = .096$, to target the fact that 31.38% of individuals report having a ratio of net liquid assets to annual gross income that is less than 1 percent in the SCF between 1995 and 2007.

Return

Calibration, Continued

- Households preferences over non-durable consumption are given by:

$$u(c) = \frac{c^{1-\sigma} - 1}{1 - \sigma}$$

- We set the risk aversion parameter to a standard value, $\sigma = 2$.

- A worker's life span is set to $T = 120$ quarters (30 years).

- Newborns enter as unemployed workers, exponential draw of h (calibrated to match young wage dispersion), zero assets and without a credit contract.

Return

Table: Model Parameters

Variable	Value	Description
		Non-estimated
Variable	Value	Description
r_f	0.04	Risk free rate
β_{lf}	0.99	Discount factor: lenders and firm
β_L	0.99	Discount factor low worker type
δ	0.1	Exogenous job destruction rate
ζ	1.6	Labor match elasticity
δ_C	0.026	Exogenous credit destruction rate
ζ_C	0.37	Credit match elasticity
$\underline{r}$	10.5%	Minimum (annualized) interest rate
$\overline{r}$	22.5%	Maximum (annualized) interest rate
σ	2	Risk aversion
T	120	Lifespan in quarters
		Jointly-estimated
Variable	Value	Description
z	0.327	Public insurance transfer to unemployed
κ	0.995	Firm entry cost
κ_C	2.214×10^{-5}	Lender entry cost
κ_S	1.272×10^{-4}	Utility penalty of searching for credit
ψ_D	14.771	Utility penalty of default
$p_{\tilde{h},L}$	0.651	Prob. persistent human capital decrease
$p_{\tilde{h},H}$	0.083	Prob. persistent human capital increase
$p_{\epsilon,L}$	0.111	Prob. transitory human capital low
$p_{\epsilon,H}$	0.252	Prob. transitory human capital high
λ_H	2.943	Exponential parameter initial persistent human capital
g	0.146	Home production
$\underline{B}$	-1.149	Lower bound for borrowing limit
β_H	0.632	Discount factor: high worker type
π_L	0.904	Share of low type individuals

Return

Welfare Calculation

Index individuals by j, $i(j)$ is their type

$$\sum_{t=1}^{T}\beta_{i(j)}^{t}\left(\frac{\left(\lambda_j c_t^j\right)^{1-\sigma}-1}{1-\sigma}-\psi_D(b_t^j)D_t^j-\kappa_S S_t^j\right)=\sum_{t=1}^{T}\beta_{i(j)}^{t}\left(\frac{\left(\tilde{c}_t^j\right)^{1-\sigma}-1}{1-\sigma}-\psi_D(\tilde{b}_t^j)\tilde{D}_t^j-\kappa_S\tilde{S}_t^j\right) \tag{3}$$

Solving equation (3) for λ_j returns:

$$\lambda_j=\left[\frac{\sum_{t=1}^{T}\beta_{i(j)}^{t}\left(\frac{\left(\tilde{c}_t^j\right)^{1-\sigma}}{1-\sigma}-\left(\psi_D(\tilde{b}_t^j)\tilde{D}_t^j-\psi_D(b_t^j)D_t^j\right)-\left(\kappa_S\tilde{S}_t^j-\kappa_S S_t^j\right)\right)}{\sum_{t=1}^{T}\beta_{i(j)}^{t}\left(\frac{\left(c_t^j\right)^{1-\sigma}}{1-\sigma}\right)}\right]^{\frac{1}{1-\sigma}} \tag{4}$$

The utilitarian welfare:

$$Welfare_U(p)=\frac{1}{N}\sum_{j=1}^{N}100(\lambda_{j,p}-1)$$

Return

Summary Statistics

Table: Summary Statistics

	Treatment	Control
(A) Panel Sample (Year Prior to Mass Layoff)		
	Treatment	Control
Annual Earnings	\$51,340	\$52,710
Age	40.7	42.15
Revolving Credit Balance	\$11,300	\$11,890
Revolving Credit Limit	\$29,780	\$33,330
Unused Revolving Credit to Income	0.394	0.491
Observations (Rounded to 000s)	92000	126000
(B) Cross Sectional Sample (Year Prior to Mass Layoff)		
	Unused Revolving Credit Share ($= \frac{\text{Limit minus Balance}}{\text{Limit}}$)	
Credit Access Quintile 1	-0.0027	
Credit Access Quintile 2	0.3113	
Credit Access Quintile 3	0.5773	
Credit Access Quintile 4	0.8313	
Credit Access Quintile 5	0.9833	

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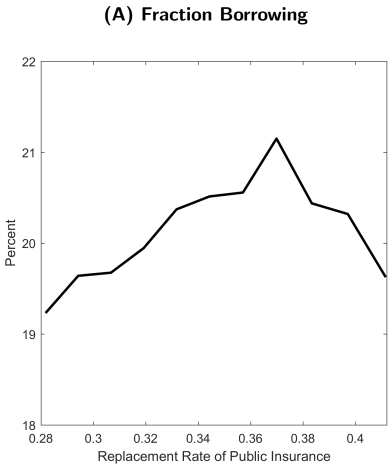
Why is credit a poor substitute for UI?

- Macro Complements when z is low – fewer individuals borrow



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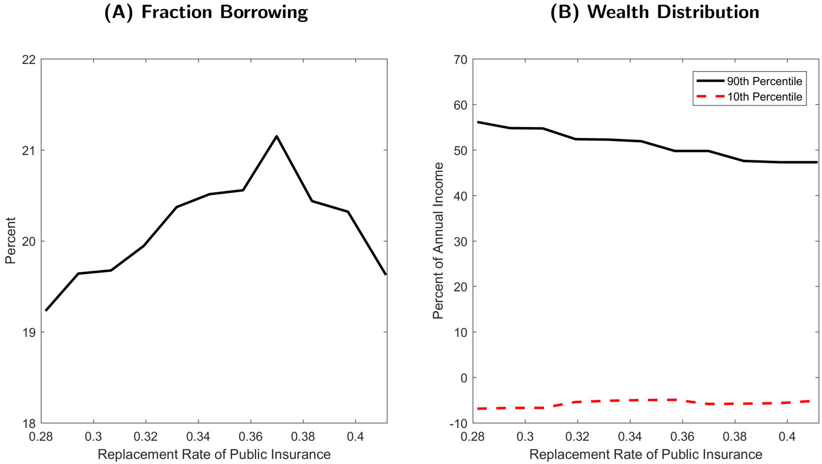
Why is credit a poor substitute for UI?

- Macro Complements when z is low – fewer individuals borrow
- Precautionary motives kick in, more saving



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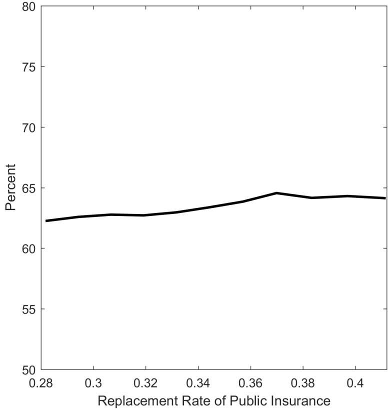
Why is credit a poor substitute for UI?

- Macro complements: Credit finding rate falls



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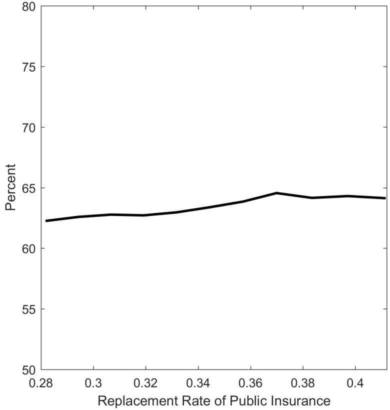
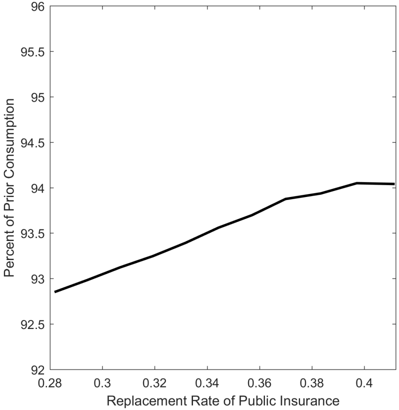
Why is credit a poor substitute for UI?

- Macro complements: Credit finding rate falls
- Consumption losses are monotonically larger





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Transition Path

- z cut unexpectedly, replacement falls from 41.2% to 38.3%
- Thereafter, rational expectations over future path of taxes

(A) Public Transfer z **(B) Tax Rate τ**