Measuring Valuation of Liquidity with Penalized Withdrawals

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Disclaimer: The views expressed in this presentation are those of the authors and do not necessarily reflect the views of the Treasury or the U.S. government.

Motivation

- First best → marginal utility smoothing across time
  - deviations capture the household's **equilibrium** valuation of liquidity

- Understanding the determinants of the valuation of liquidity (e.g. individual or local market shocks) is crucial for effective policy design
  - the goal is to direct the marginal $ to individuals with high valuation

- Yet, inference is challenging. Obstacles: preferences, consumption data (scale economies), lagged timing, state dependence in preferences

This Paper

- Revealed preference approach to study valuation of liquidity
- Basic insight: borrowing with a high interest rates reveals a high MRS b/w consumption today and tomorrow $\Rightarrow$ high valuation of liquidity
- The ideal product for the revealed preference approach has
  1. wide availability to households
  2. uniform and observable price

$\Rightarrow$ **Penalized withdrawals from savings accounts are close to ideal**

- Penalized withdrawals observed from U.S. tax records to characterize valuation of liquidity across time and space

Data and Institutional Details

Penalized Withdrawals

- Many savings instruments require that money is held for a specified period or until a certain date
  - Retirement savings acc. (IRA/401(k)); Health Savings Accounts (HSAs)
- Account holders may withdraw earkt, but with a penalty
  - e.g., 10% penalty for 401(k)/IRA withdrawals before age 59.5
- Some early withdrawals are exempt from tax penalties
  - Rollovers
  - Death/disability
  - Funds used for higher education
  - Unreimbursed medical costs over 10% of AGI
  - First time homebuyer
  - Separation from employment for those over age 55

Data

- Tax records of 10% sample of U.S. population from 1999-2018
- Aggregate at the household level (primary filer + partner if any)
- Restrict sample to ages 45-59 (by household head) to focus on prime-age households for whom this tool is more relevant
  - leads to a total sample of 10.5 million households
- Key outcomes aggregated to the household level
  - penalized withdrawals (dummy + amounts);
  - employment, earnings, income, employer ID, IRA balances

Motivating Facts

Four Motivating Facts

- Evidence to shed light on how people use penalized withdrawals

1. Most households have access to retirement accounts
   - almost 90% of households in our age range have an account
2. Penalized withdrawals are widely used, but infrequently
   - $\sim$ 10% per year; almost $\frac{1}{2}$ of households at least once; few many times
3. Sizable withdrawn amounts, yet accounts are not fully depleted
   - median amount: \$5000; IRA accounts not depleted after withdrawal
4. Penalized withdrawals are associated with income losses
   - hhs that withdraw are twice as likely to have large income losses ($> 50\%$)

$\Rightarrow$ Evidence supports that households optimize on the margin and use penalized withdrawals to mitigate short run liquidity needs

- less consistent w/ behavioral interpretation (e.g. myopia or narrow bracketing)

Fact 1 Fact 2 Fact 3 Fact 4 Takeaways

Simple Framework

Two-Period Problem of Marginal Utility Smoothing

- Household i in region z chooses how much to borrow/save, solving

$$\max_{b} u(c_{i,z,t}) + \beta_i E\left[u(c_{i,z,t+1})\right]$$

subject to:

$$\begin{aligned} c_{i,z,t} &= y_{i,z,t} + b \\ c_{i,z,t+1} &= y_{i,z,t+1} - (b + \rho_{i,z,t}(b))(1 + r) \end{aligned}$$

- $\rho_{i,z,t}(b)$ is a borrowing *wedge*, which takes into account the optimal borrowing choice across alternative sources of funds
  - i. $\rho_{i,z,t}(b)$ may depend on local supply (e.g. proximity to banks and the interest rate they charge) and households characteristics (e.g. credit score)
  - ii. $\rho_{i,z,t}(b) = 0.1b$ for individuals making a penalized withdrawal

Valuation of Liquidity and Withdrawals

- We define the **equilibrium** valuation of liquidity:

$$\underbrace{\theta_{i,z,t}}_{\text{Excess Valuation of Liquidity}} \equiv \underbrace{\frac{u'(c_{i,z,t})}{Eu'(c_{i,z,t+1})}}_{\text{MRS}} \underbrace{\frac{1}{\beta_i(1+r)}}_{\text{Compound Discount Factor}} - 1$$

- Taking the FOC we find that

$$\theta_{i,z,t} \geq \rho'_{i,z,t}(b)$$

$\Rightarrow$ benchmark with perfect markets (i.e. $\rho'_{i,z,t}(b) = 0$, no wedge) $\rightarrow \theta_{i,z,t} = 0$

$\Rightarrow$ households that make a penalized withdrawal: $\theta_{i,z,t} \geq 10\%$

Towards an Empirical Implementation

- Our empirical implementation is based on a simple model's result:

$$\begin{aligned} Prob_{i,z,t} &= \Pr(\theta_{i,z,t} \geq 10\%) \\ Prob_{i,z,t} &= \underbrace{\mathbb{I}\{b > 0; y_{i,z,t}, y_{i,z,t+1}\}}_{\text{Demand}} \times \underbrace{[1 - G(10\%; \Gamma_{z,t}, \alpha_i)]}_{\text{Supply}}, \end{aligned}$$

- $Prob_{i,z,t}$ is the *observable* probability of a penalized withdrawal
- $G(10\%; \Gamma_{z,t}, \alpha_i)$ is *unobservable* CDF of alternative sources of liquidity $\rightarrow$ $[1 - G(10\%; \Gamma_{z,t}, \alpha_i)]$: Prob that withdraw w/ penalty is cheapest way to borrow

- **Empirics**: characterize the equilibrium liquidity valuation
  1. Determinants of demand: household events $(y_{i,t})$
  2. Determinants of supply: local supply (Γ_z) & hhs access to credit (α_i)
  3. Dynamics in local supply: case study of Great Recession $(\Gamma_{z,t})$

1: Household Events and Valuation of Liquidity

Determinants of Demand

Household-level Increase in the Liquidity Needs

- We estimate an event study equation of the form

$$y_{it} = \sum_{r \neq -2, r=-5}^{r=10} \beta_r \times I_r + x_{it}\lambda + \alpha_i + \varepsilon_{it},$$

y_{it} is an indicator for a penalized withdrawal for household i at time t

r is the year relative to the event timing [unemployment, income drop, job transition]

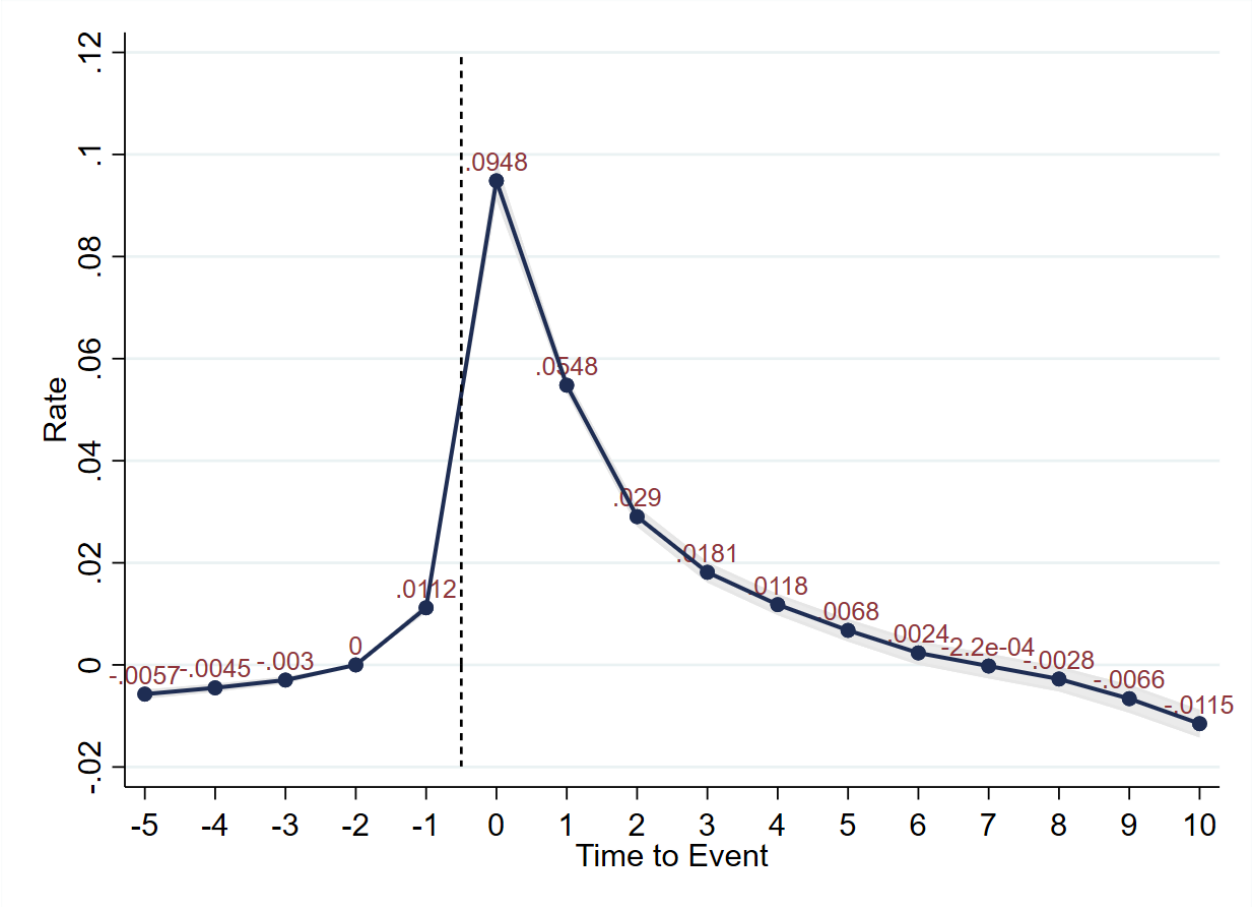
I_r are a set of relative time indicators

x_{it} is a full set of age dummies for the primary filer and (cyclical) calendar year dummies

α_i are household fixed effects

Unemployment Event

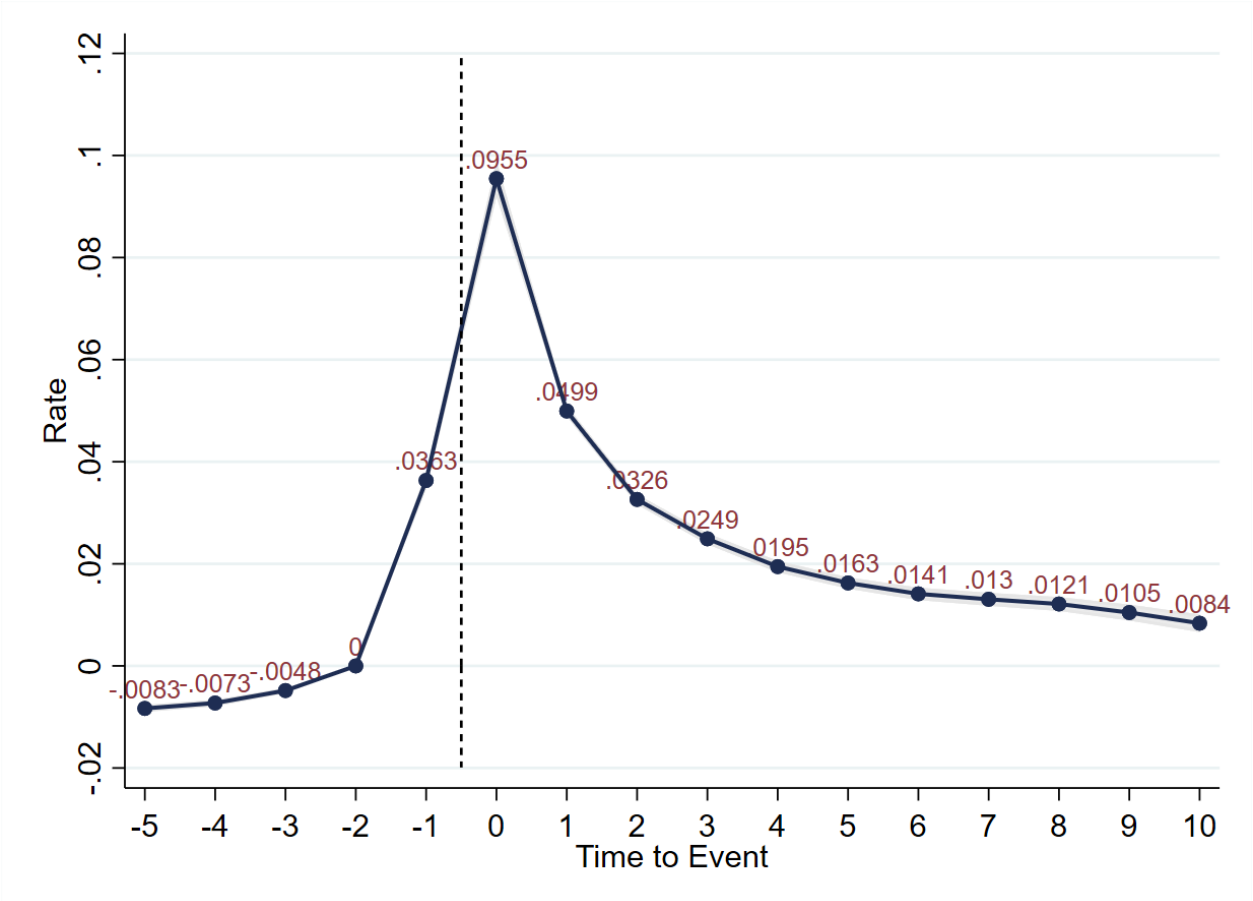
Heterogeneity



- Event: one hh member starts receiving unemployment benefits

$\Rightarrow$ Large and persistent increase in valuation of liquidity: mass of hhs with valuation above 10% more than doubles (rate at $t = -2$ is 0.087)

Large Income Loss Event

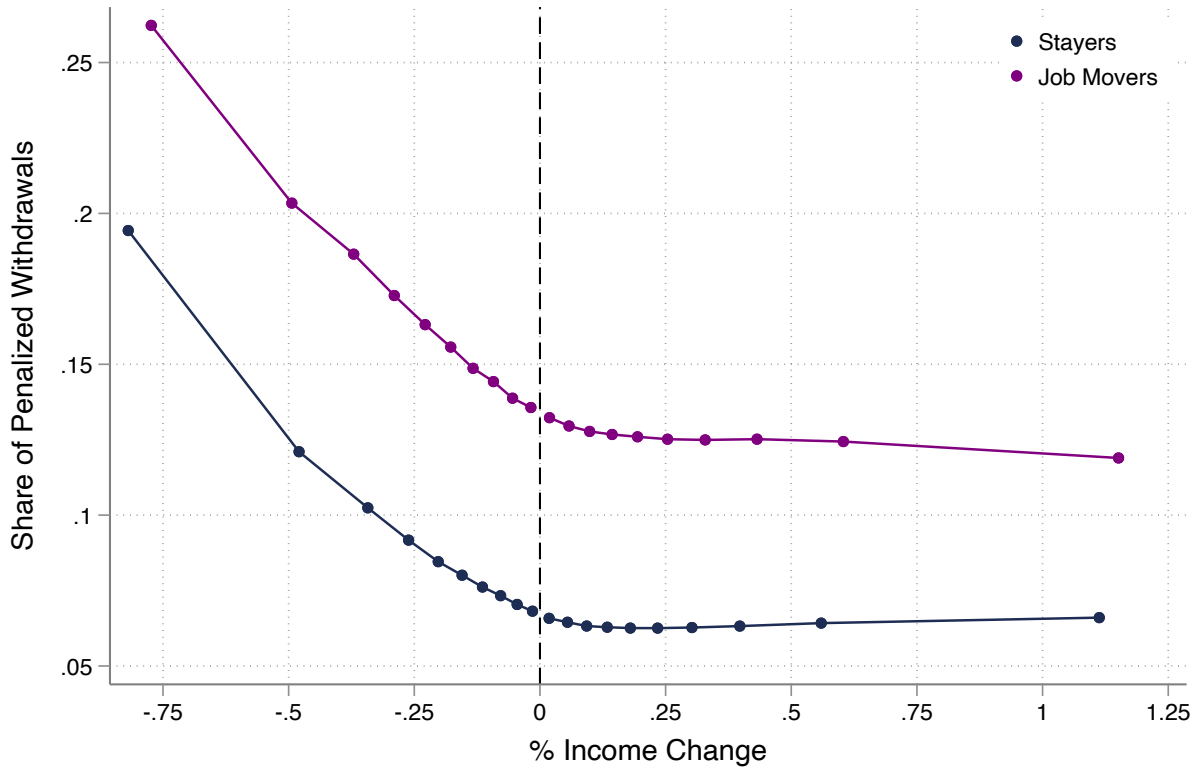


- Event: hh income decreases by more than 20% (rel to previous year)

$\Rightarrow$ Large increases in withdrawals $\rightarrow$ income shocks not fully insured

Income Changes and Penalized Withdrawals

Amounts



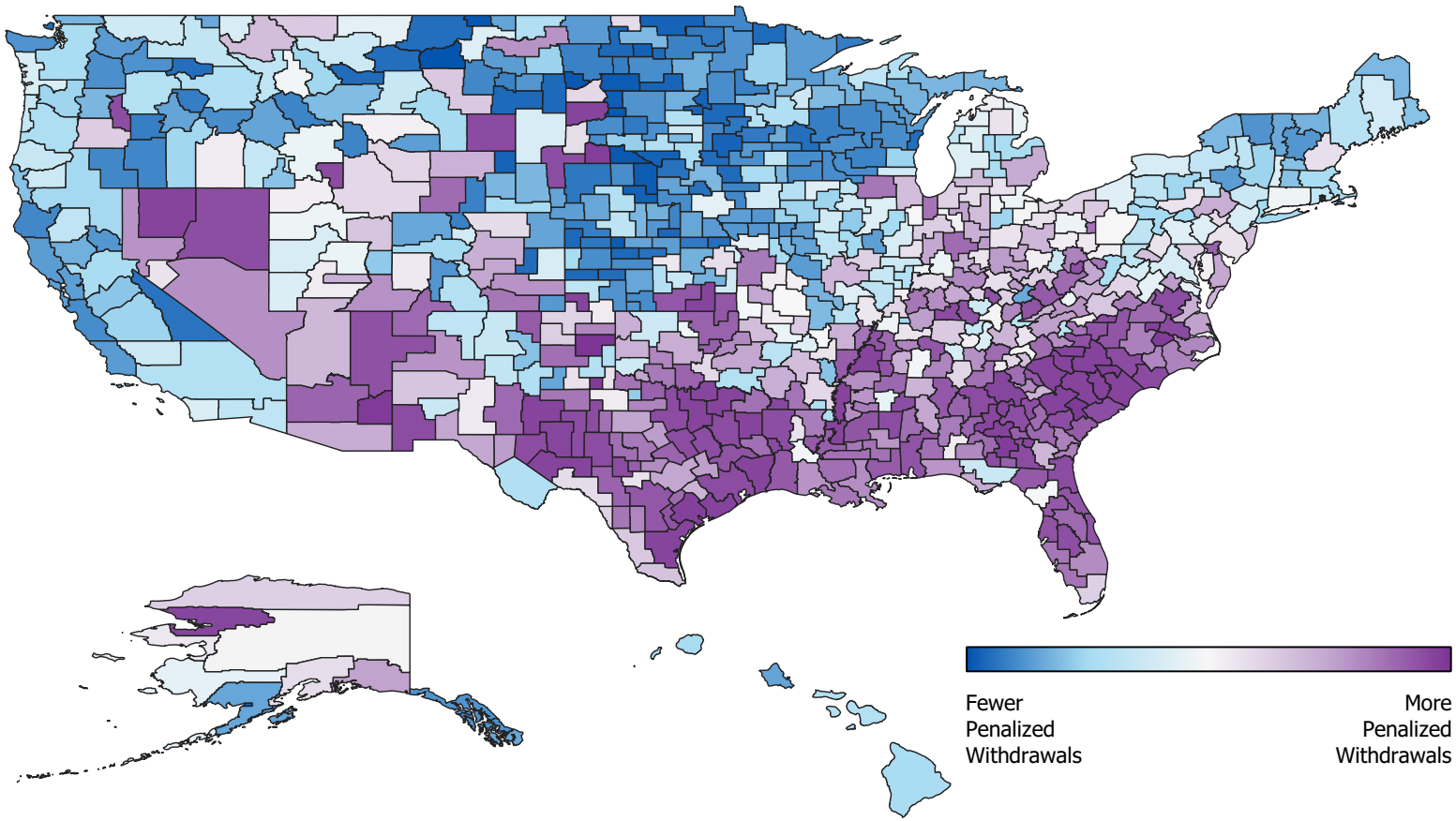
- Strong gradient with respect to income losses → self-insurance
- Stark asymmetry is consistent with self-insurance and rules out alternative explanations (e.g. strategic withdrawals for tax purposes)

2: Local Supply (Γ_z) and hhs Access to Credit (α_i)

Determinants of Supply

Starting point: Large Regional Heterogeneity

(mean: 7.05%. std: 1.30%)



$\Rightarrow$ Next, leverage the spatial variation to study the (supply side) determinants of valuation of liquidity – i.e. Γ_z and α_i

Statistical Model of Household Withdrawals

- Following the conceptual framework, we posit the model

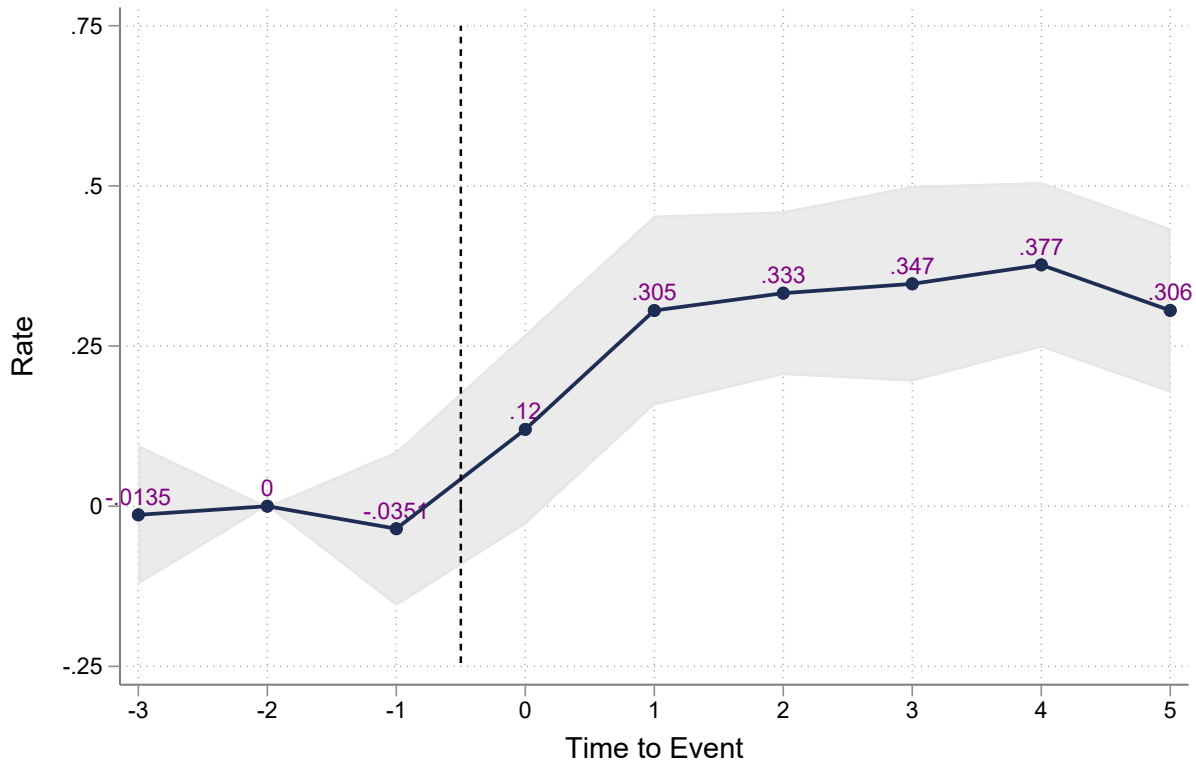
$$y_{izt} = \alpha_i + \Gamma_{z(i,t)} + x_{it}\lambda + \varepsilon_{it}.$$

y_{izt} is the outcome for household i is commuting zone (CZ) z at time t
α_i is a household fixed effect
$\Gamma_{z(i,t)}$ are location fixed effects

x_{it} is a vector of time-varying controls (age, year effects, economic indicators)

- We next use this same model for two related analyses
  1. Movers design $\rightarrow$ quantify role of location + persistence
  2. Average α_i by CZ and Γ_z to study correlates of liquidity needs

Movers Design: Balanced Sample



$\Rightarrow$ location characteristics pass-through to individual withdrawals

Place Effects Explain $\frac{1}{3}$ of Variation

Interpretation and Threats to Identification

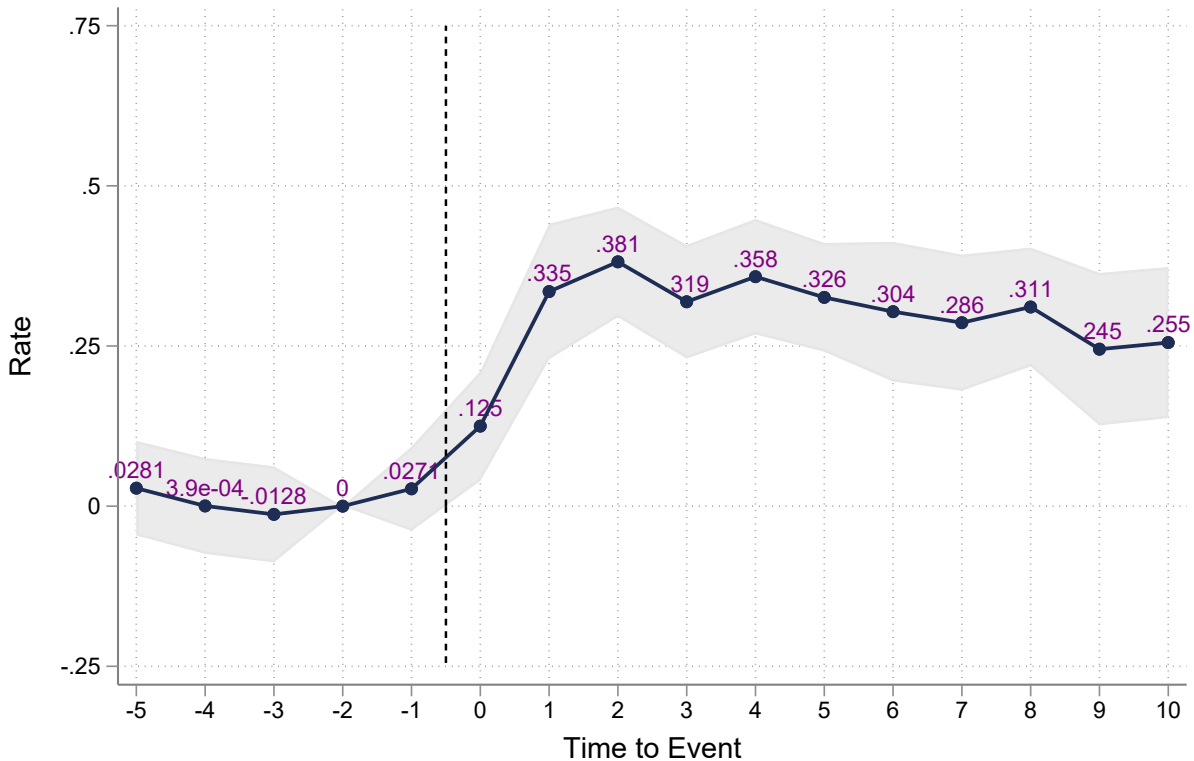
- Our interpretation: when individuals move to locations with worst local supply of credit, they have to rely more on penalized withdrawals for liquidity
  - from last slide: effect is large $\rightarrow$ explains $\frac{1}{3}$ of the total spatial variation

- Threats:
  1. cannot account for shocks that align with the timing of moves
  2. alternative mechanism A: learning about withdrawal from co-workers
  3. alternative mechanism B: tax optimization
  4. limited mobility bias may lead to overestimation of the effects

- Next: several pieces of evidence corroborate our interpretation

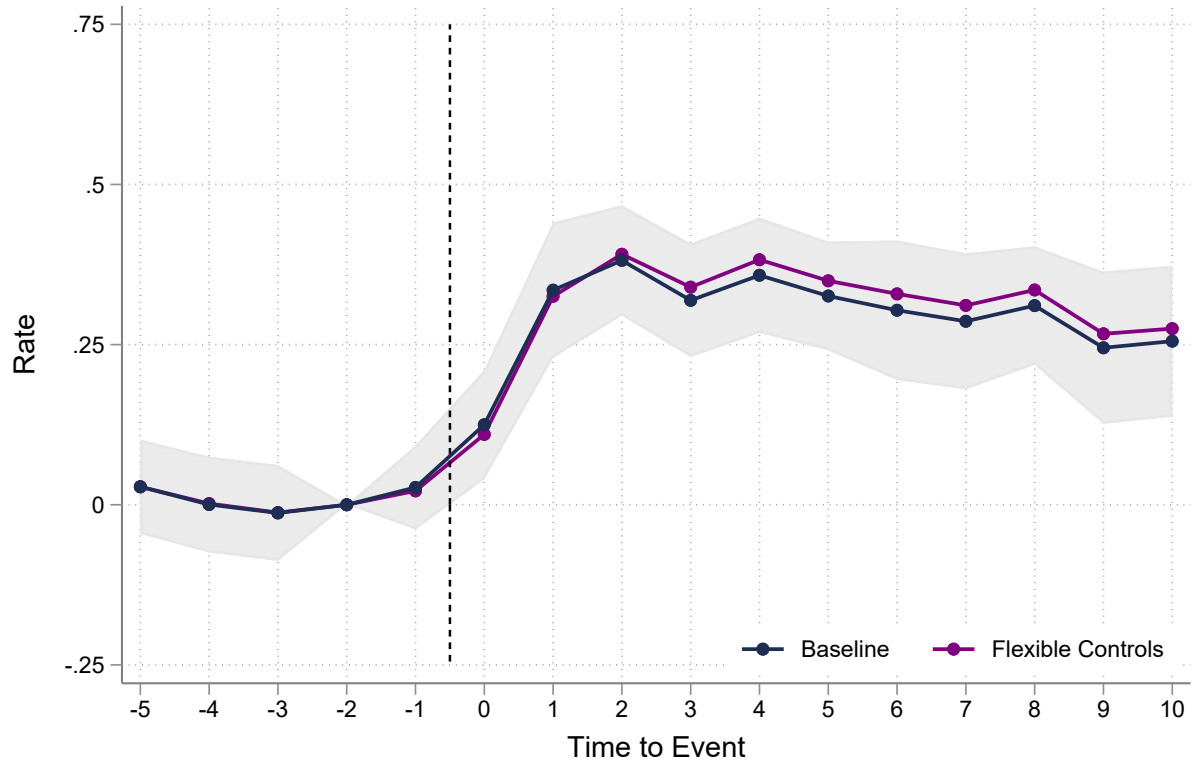
Movers Design: Long-Run Dynamics

Attrition Move Event



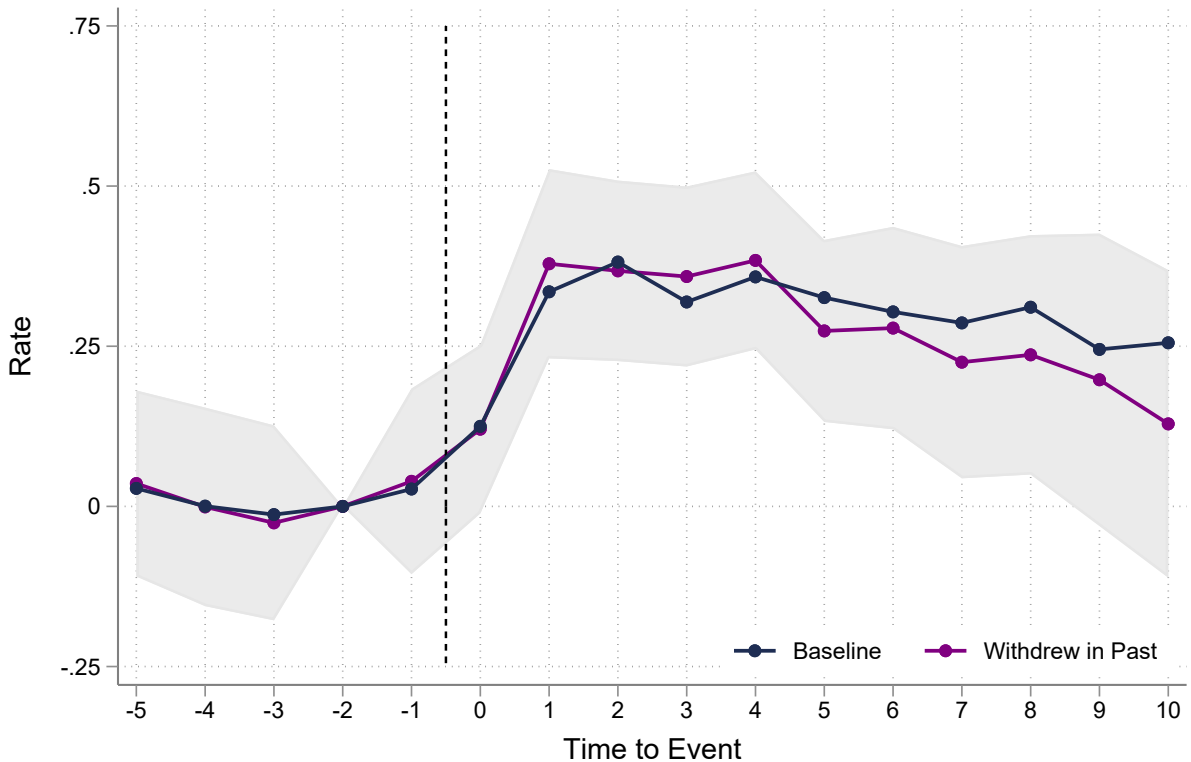
- The effect strongly persists for up to ten years → hard to reconcile with the main effect being driven by shocks aligned with time of the move

Movers Design: Including Rich Set of Controls



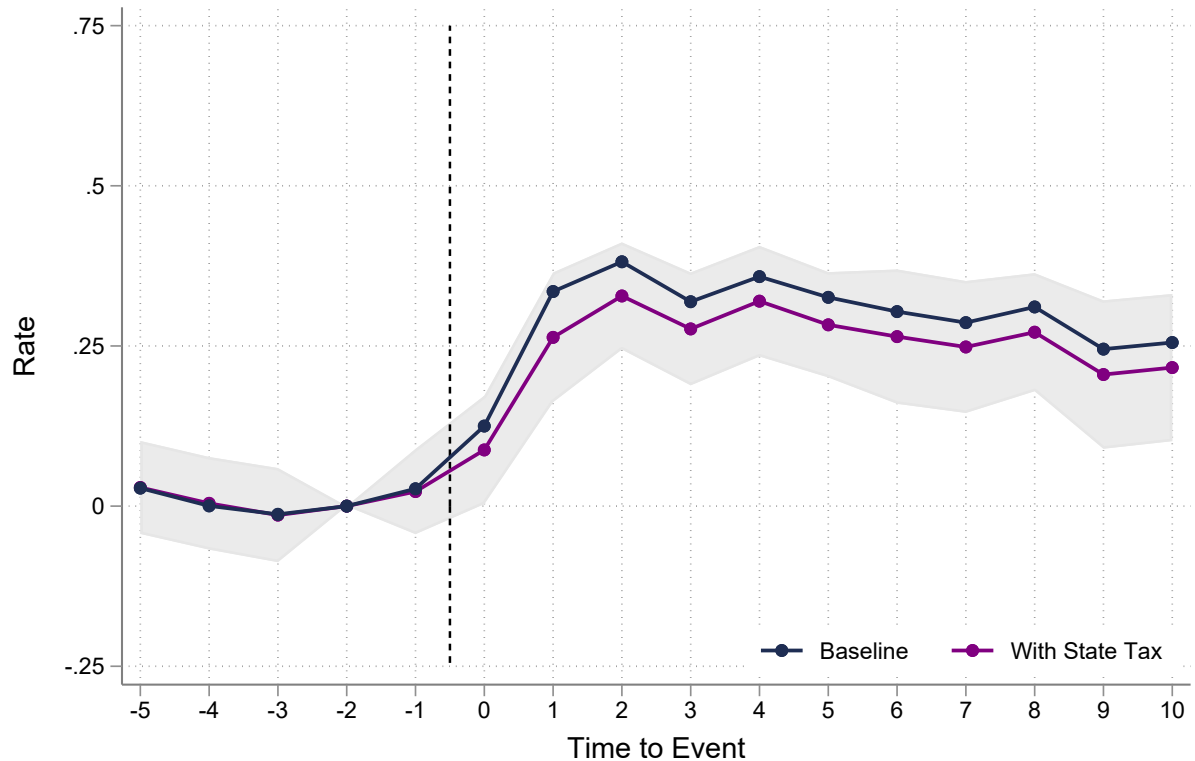
- Controlling directly for hh level shocks does not affect the results
  - include rich controls on income with leads and lags interacted with the move

Movers Design: Only hhs with Previous Withdrawals



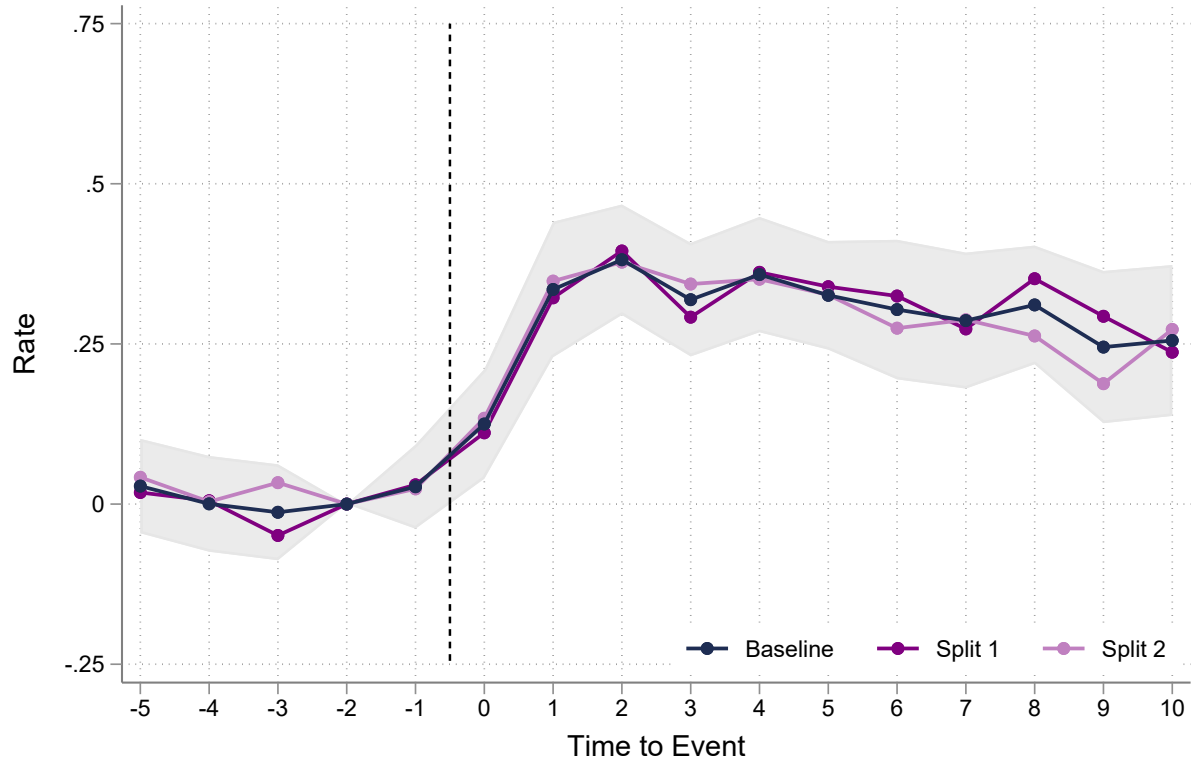
- Focus on hhs that have made a penalized withdrawal before → results unaffected show that alt. mechanism A (learning) is not at place

Movers Design: Potential Role of Tax Motives



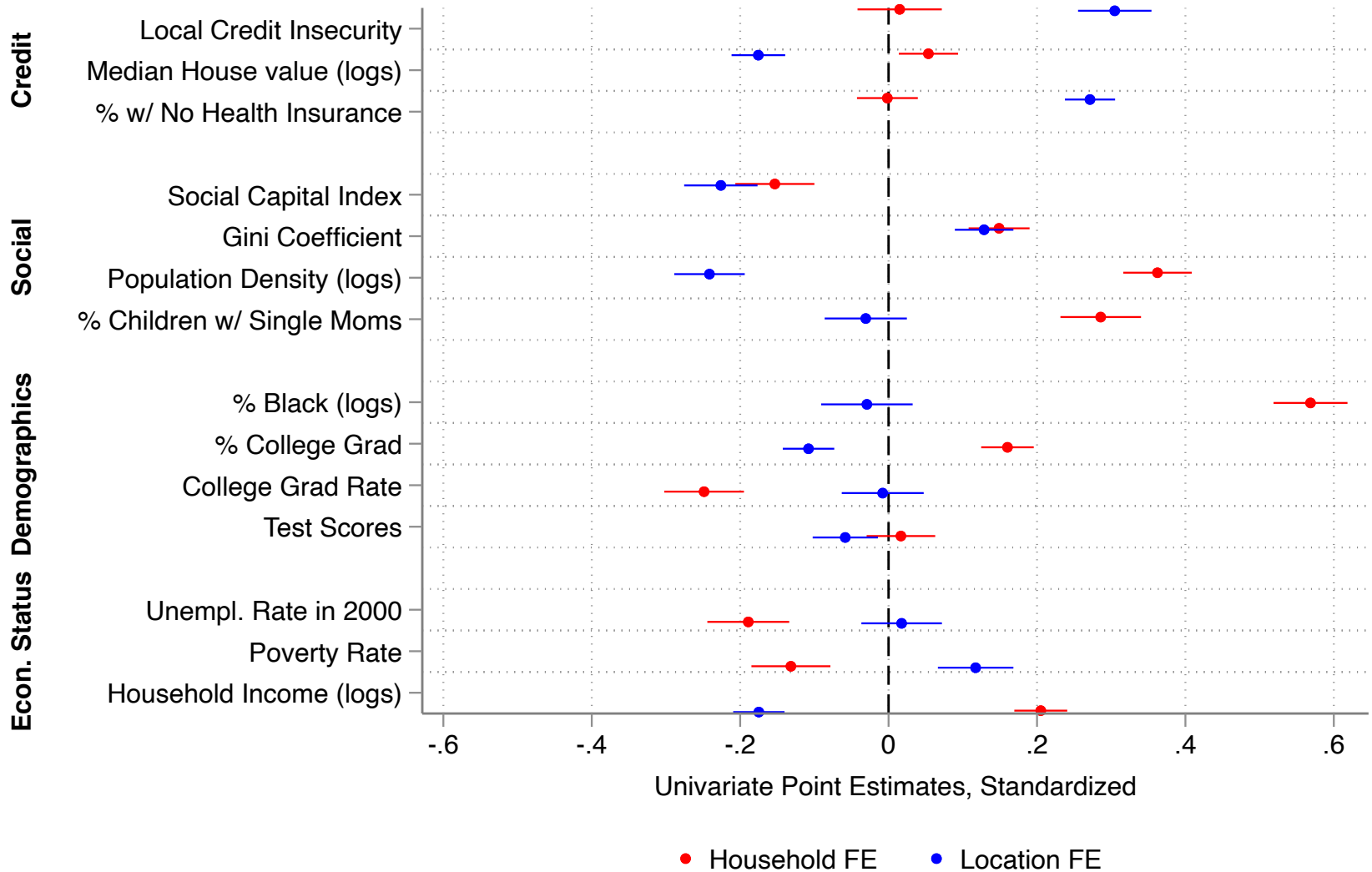
- Location effect reduces only slightly if we control for local tax rates interacted with the time of the move
  - attenuation shows that alt. mechanism B might play a minor role

Movers Design: Sample Split (Limited Mobility Bias)

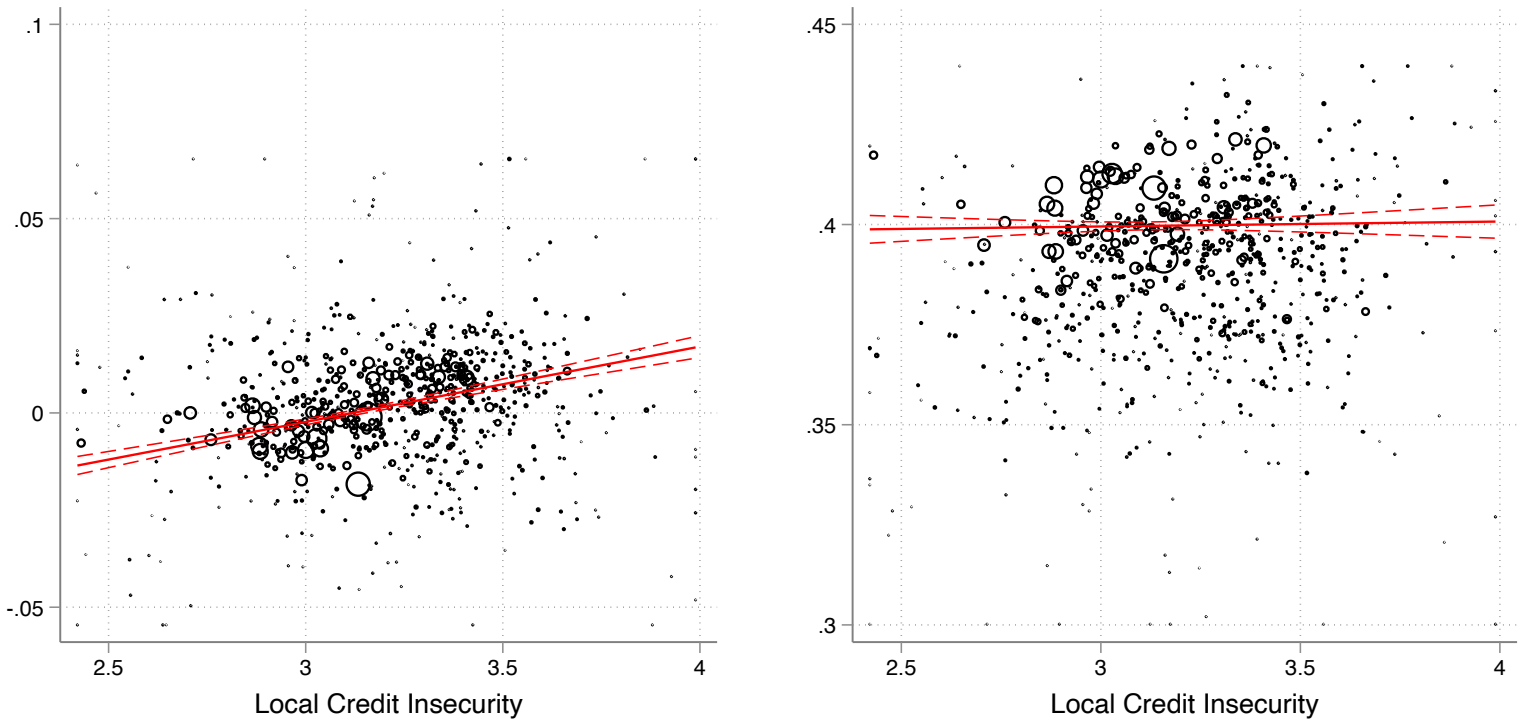


- Concern: limited mobility bias may affect AKM models
- Solution: split sample and estimate movers design on each sample separately → our benchmark results are not subject to limited mobility bias (consistent with frequent moves in our data)

Correlates of Location and Household Effects



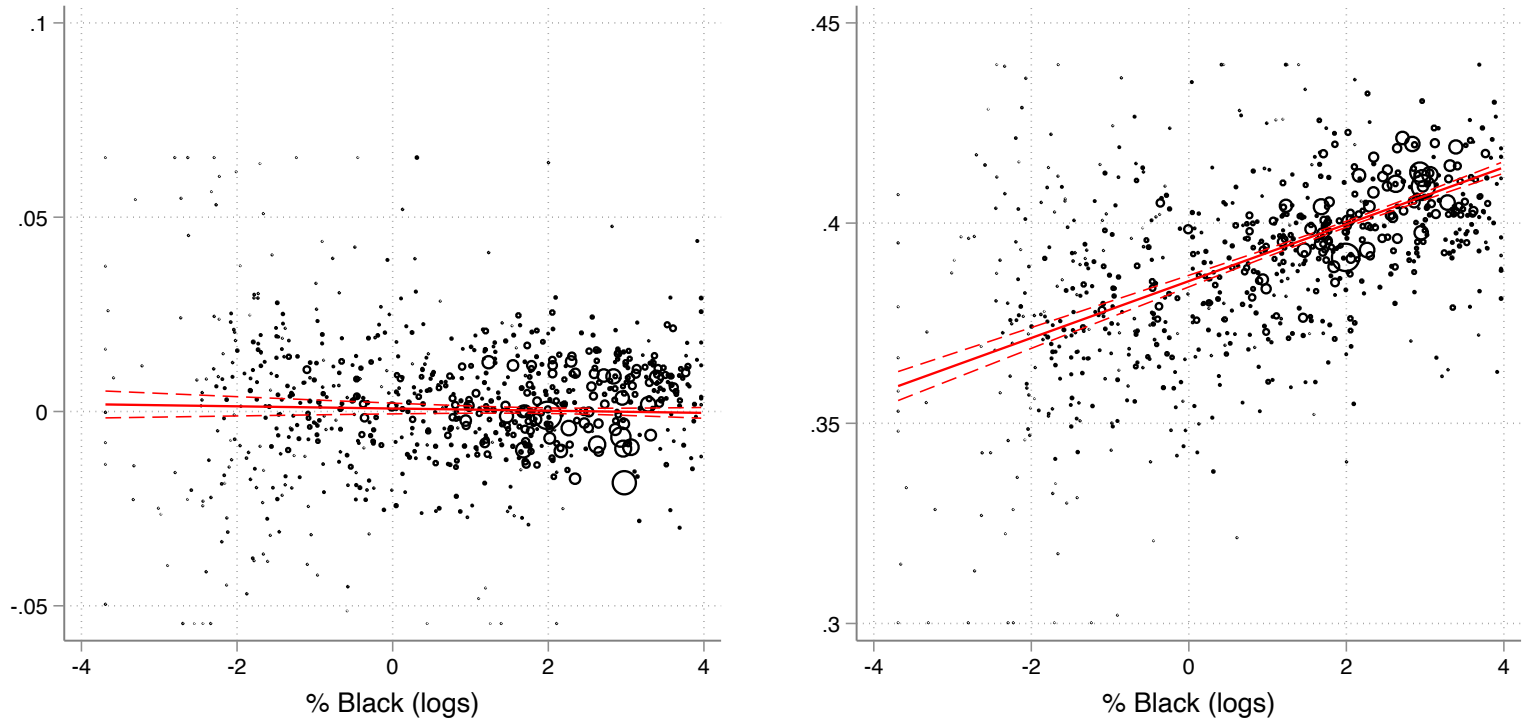
Credit Insecurity is Strongest Correlate of Location FE



(a) Location: Credit Insecurity (b) Household: Credit Insecurity

- CZs with weak local credit have higher valuation of liquidity
- Magnitude can be compared to unemployment event: from low to high credit insecurity $\rightarrow$ valuation of liquidity increases by $\frac{1}{3}$ as much

% *Black* is Strongest Correlate of Household FE



(a) Location: % Black (b) Household: % Black

- Households in CZs with a high % black have higher valuation of liquidity → might be excluded from alternative means of credit
- Large effect: gap in valuation of liquidity of HHs in low and high % black areas is $\frac{1}{2}$ as large as the gap of employed and unemployed HHs

3: Valuation of Liquidity During the Great Recession

Dynamics in Local Supply

Liquidity During the Great Recession

- Apply our tool to a study of the Great Recession

- Use Yagan '19 measure of local labor market shock, and run

$$y_{izt} = \sum_{r \neq 2006, r=2000}^{r=2017} \beta_r \times I_r + \sum_{r \neq 2006, r=2000}^{r=2017} \theta_r \times I_r \times Treat_z + \Gamma_z + \alpha_i + x_{it}\lambda + \varepsilon_{it}$$

y_{izt} is the outcome for household i is commuting zone (CZ) z at time t

α_i is a household fixed effect

Γ_z are location effects

x_{it} is a vector of time-varying controls (age, year effects, economic indicators)

$Treat_z$ is treatment intensity for location z in terms of unemployment shock

Most Affected Areas Saw Large Increase in Valuation



- Large effect which peaked in the height of the Great Recession

Market Spillover

- The flow effect is over 4 times as large as the effect of unemployment event (0.39 vs 0.095)
- Breakdown of cumulative impact into direct and indirect effects by flexibily accounting for household economic circumstances:

Model	**Increase in Penalized Withdrawals (pp)**
Baseline	1.46
	(0.22)
Spillover	0.98
	(0.20)

- Indirect effect represents $\frac{2}{3}$ of the overall effect

Conclusions

- We introduce and empirically validate penalized withdrawals as a tool that carries information on households' valuation of liquidity

  - features: i. comparable magnitudes; ii. meaningful (welfare relevant) units

- We use it to characterize the anatomy of valuation of liquidity
  1. Households valuation of liquidity spikes at adverse income events
  2. Valuation of liquidity is strongly affected by local supply
  3. Local supply can change over time as a function of aggregate shocks
  4. Some communites seems to display higher liquidity valuation suggesting that they may be excluded from alternative credit channels

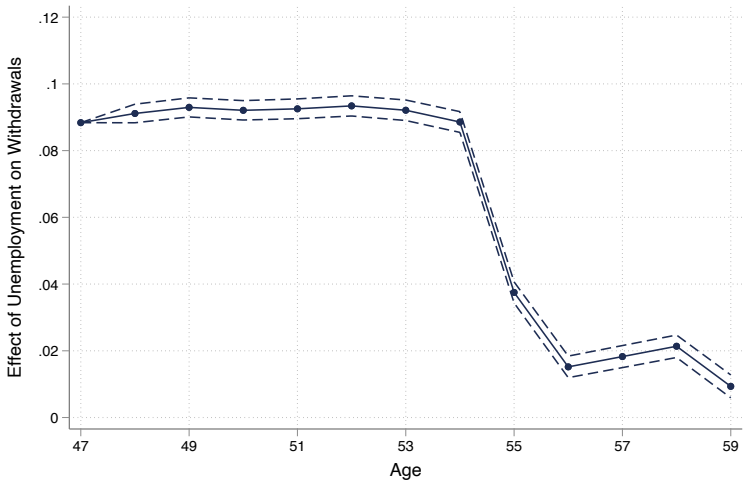
- Takeaways for policy

1. use penalized withdrawals as a tool to monitor local liquidity needs
2. welfare gains from geographic targeting of policy/insurance

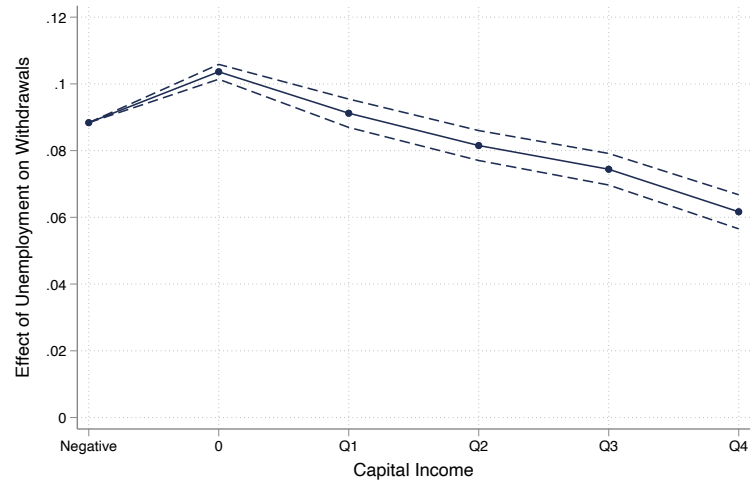
Appendix

Heterogeneity in the Elasticity to *Unemployment*

Back



(c) Elasticity by Age

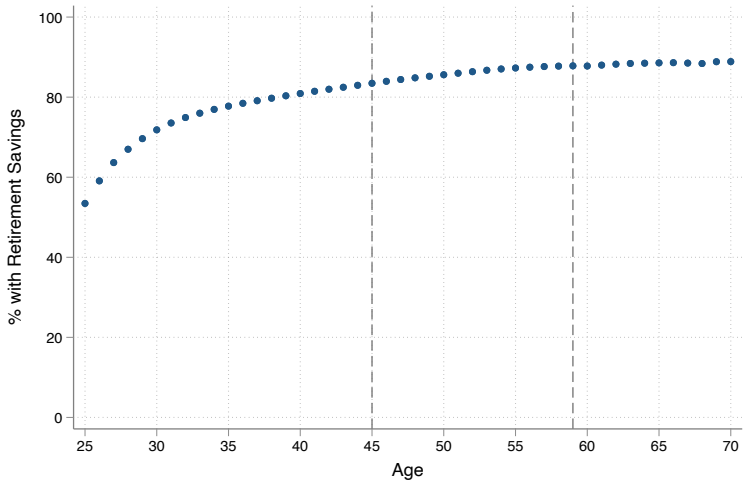


(d) Elasticity by Capital Income

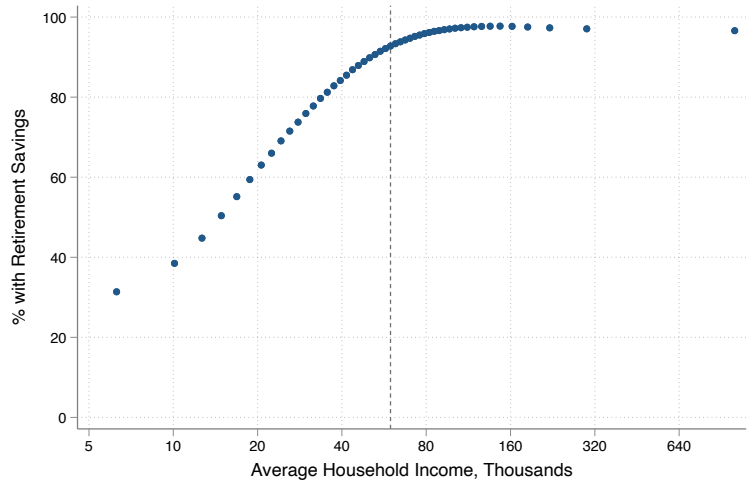
- Age: Evidence not consistent with older individuals being more resilient to shocks due to a buffer stock of savings
- Capital: i) households w\ alternative financial means less likely to rely on withdrawals; ii) a negative capital income may signal access to capital market

Facts 1: Prevalence of Accounts

Back



(e) By Age of Primary-Filer

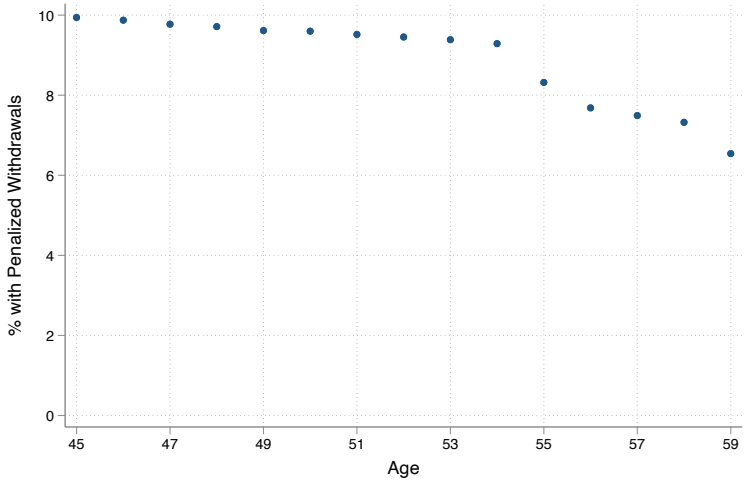


(f) By Household Overall Income

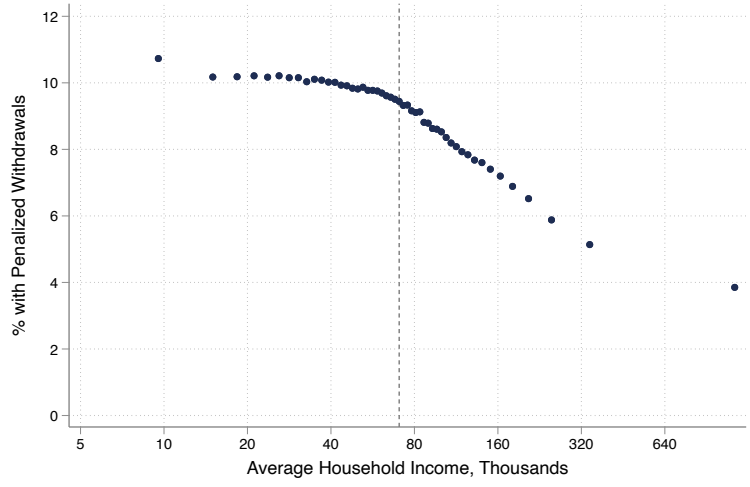
$\Rightarrow$ Most households have access to retirements accounts

Facts 2: Prevalence of Withdrawals

Back



(g) By Age of Primary-Filer

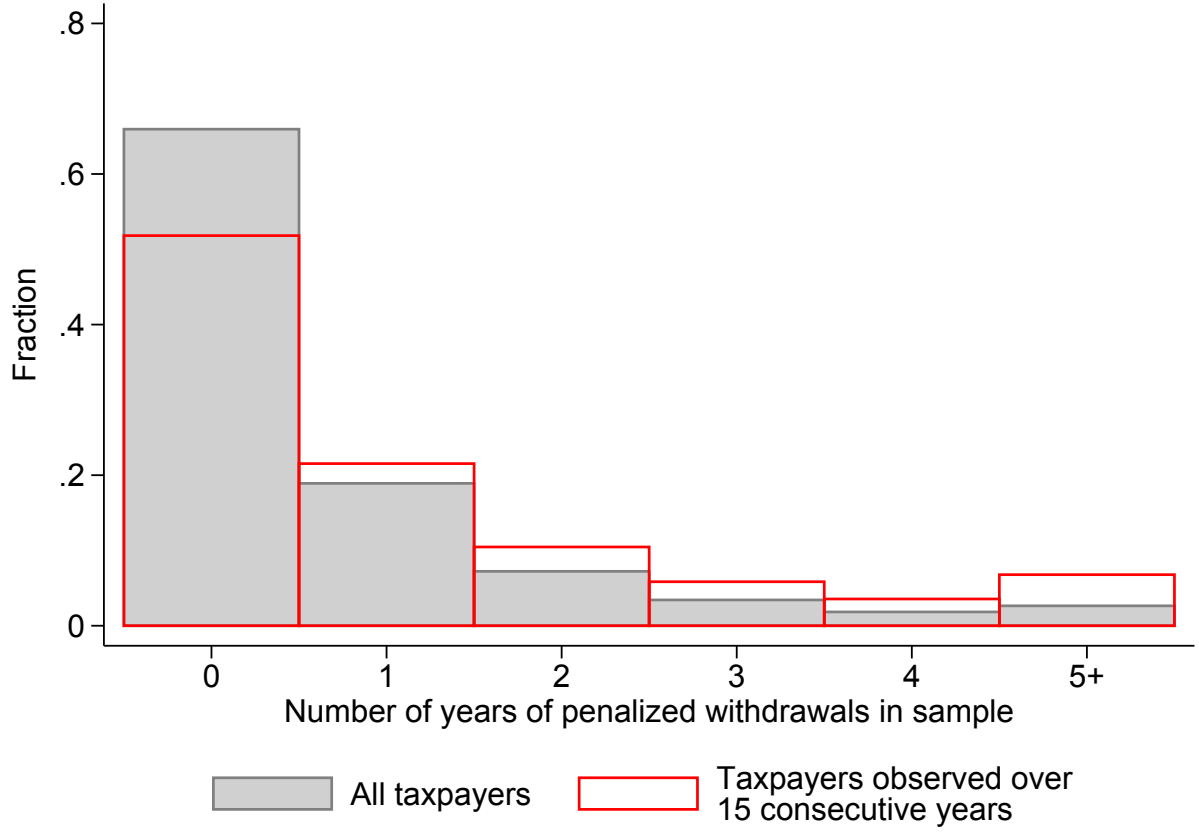


(h) By Household Overall Income

$\Rightarrow$ Throughout age and income distributions, households make penalized withdrawals

Facts 2: Frequency of Withdrawals

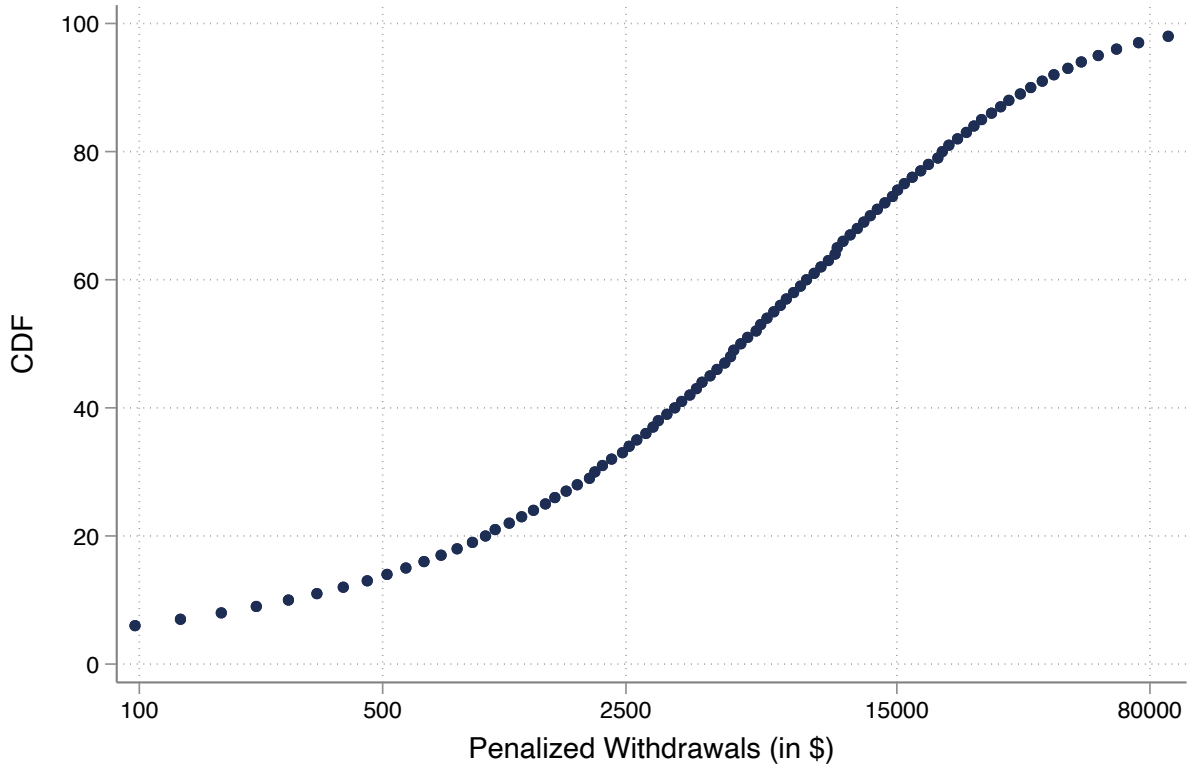
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$\Rightarrow$ Typical household only withdraws infrequently and almost half of the households observed in all years make at least one withdrawal

Facts 3: Withdrawal Amounts

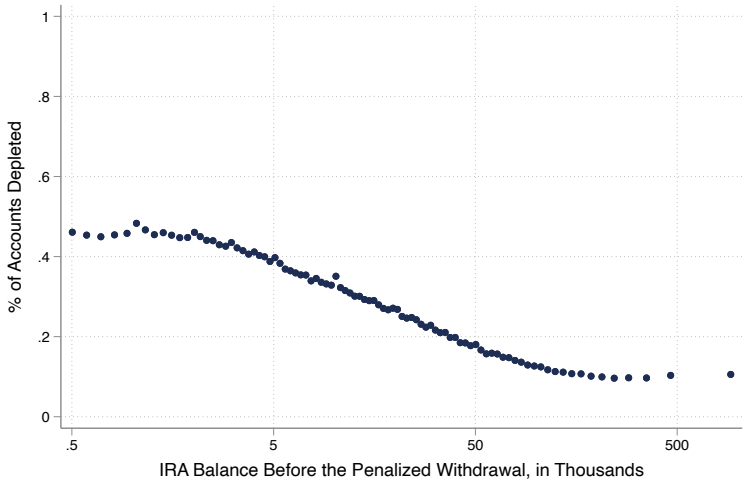
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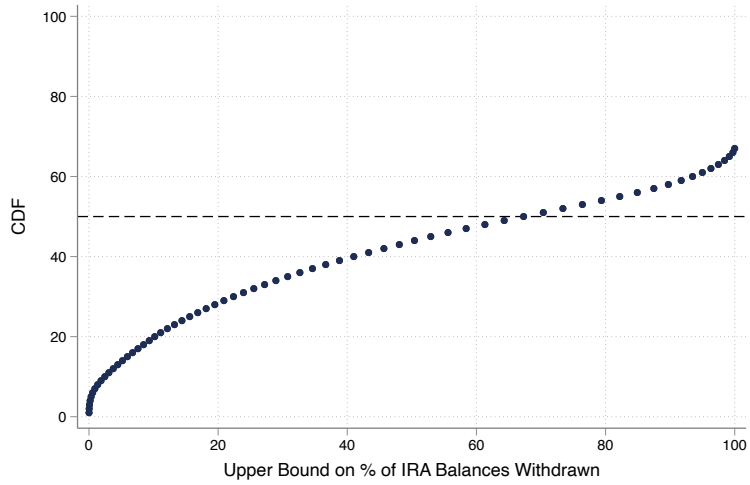
$\Rightarrow$ The median size of a withdrawal is $\sim$ 5000$

Facts 3: Share of Accounts Depleted

Back



(i) Share of IRA Accounts Fully Depleted after a Withdrawal



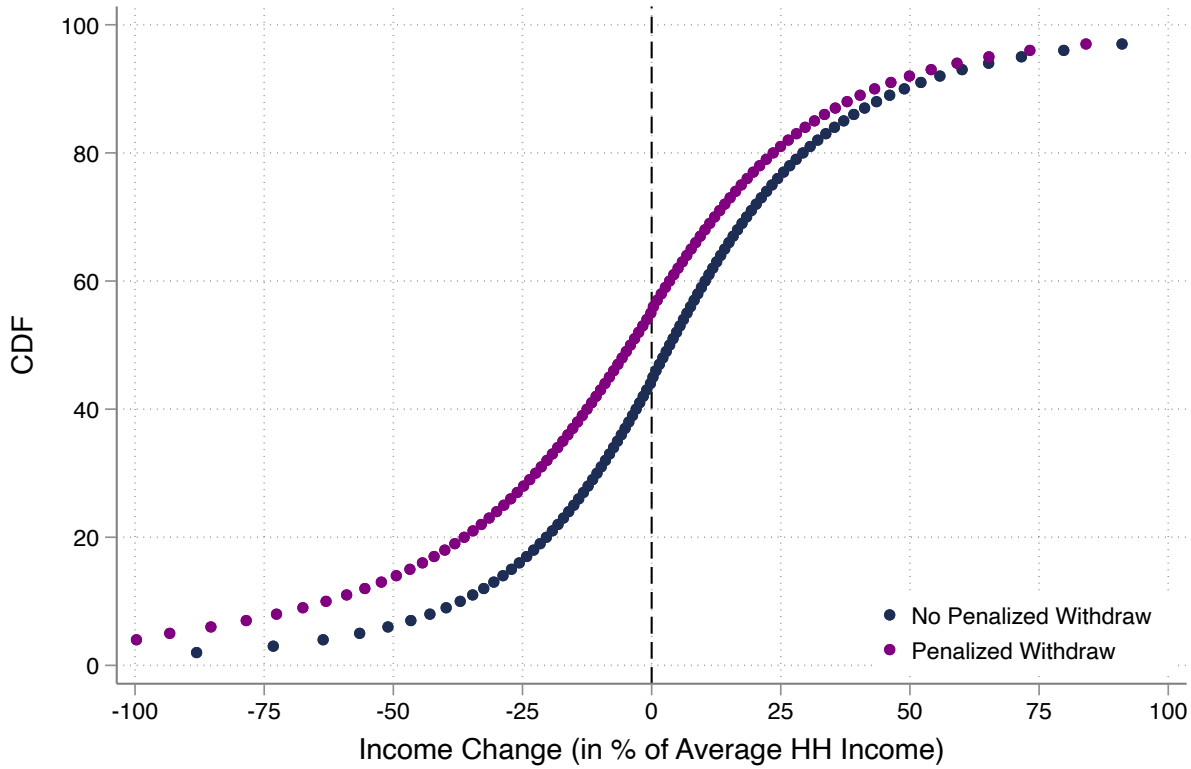
(j) Upper Bound on Share of Balances in IRA Accounts Withdrawn

- Data challenge: observe balances only for IRA accounts, do not observe from which account penalized withdrawal is distributed
  → can compute only an upper bound on depletion due to withdrawals

$\Rightarrow$ at least $\frac{2}{3}$ of households partially withdraw their balances (internal solution)

Facts 4: Distribution of Income Losses

Back



$\Rightarrow$ Households that make a penalized withdrawal are more likely to have suffered large income losses

Takeaways

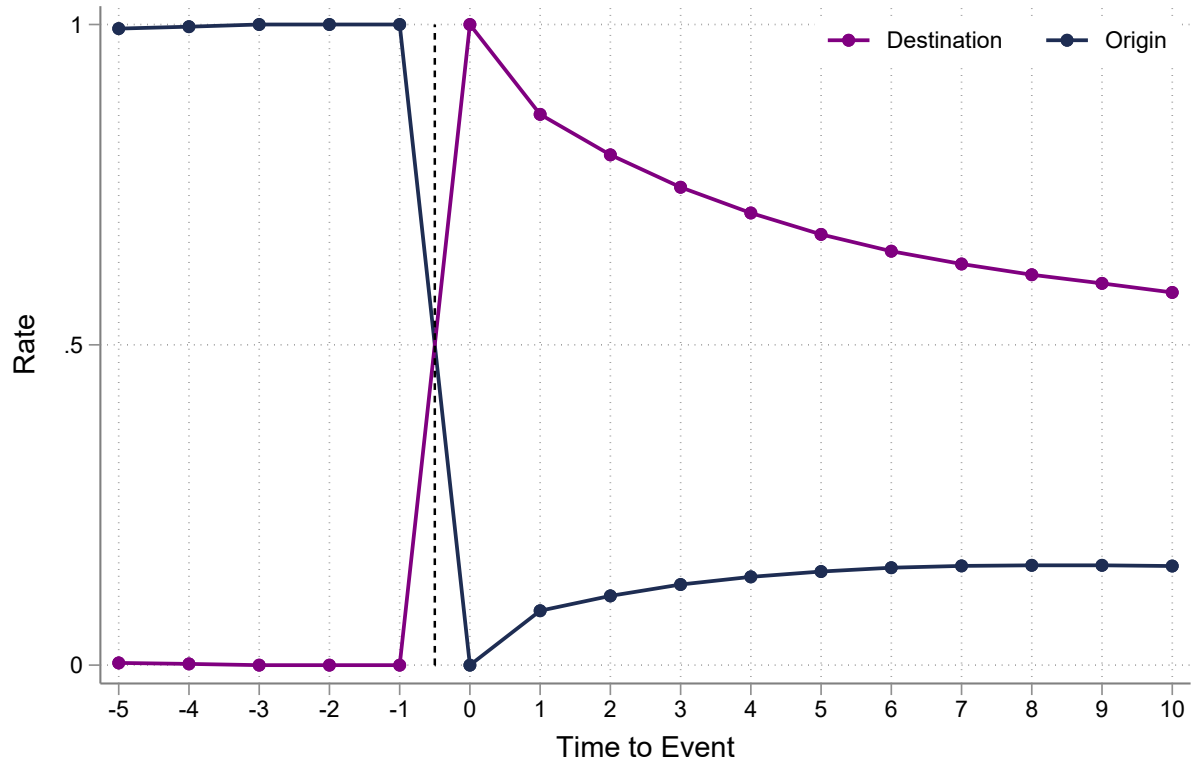
Back

- Evidence supports that households optimize on the margin and use penalized withdrawals to mitigate short run liquidity needs

- Evidence is less consistent with behavioral tendencies
  1. myopia: overall frequency of withdrawals is not driven by a small share of myopic types that make repeated withdrawals
  2. mental accounting/narrow bracketing: most households do not fully close their accounts, but rather only withdraw a fraction of the money as if they are fullfilling a liquidity need

Movers Design: Attrition

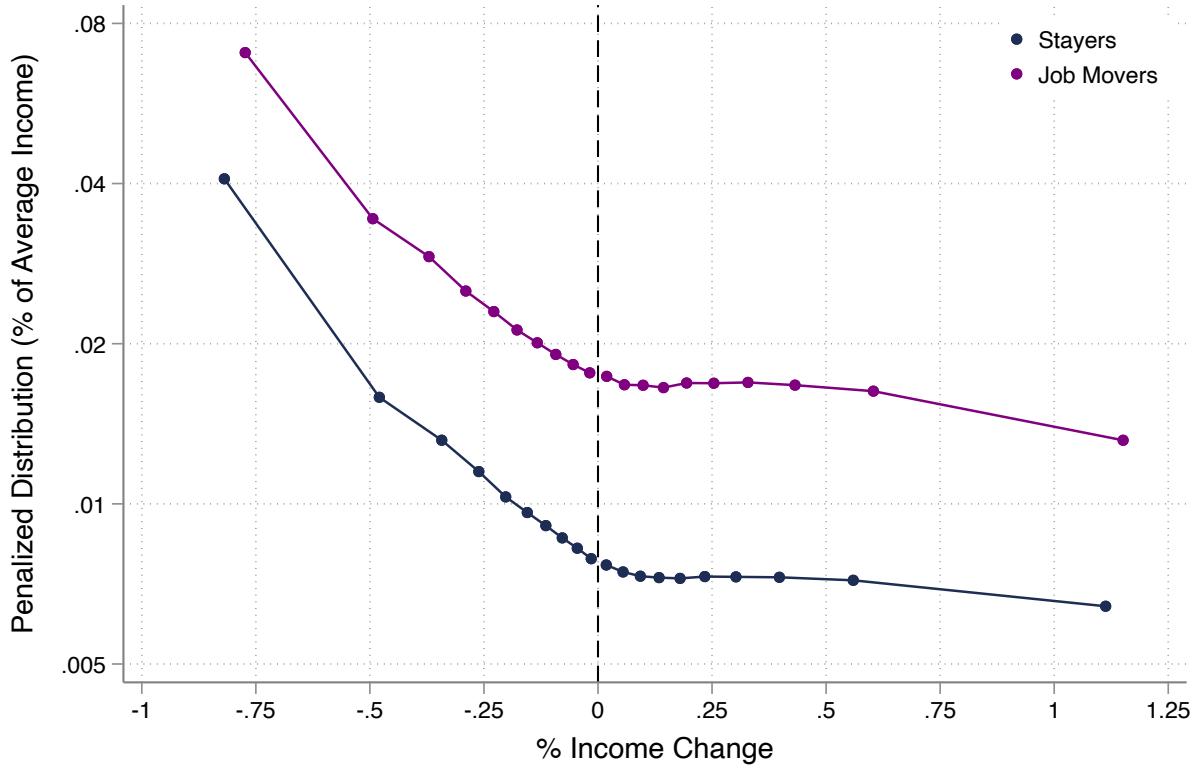
Back



- Attrition + Return moves → attenuate persistence of effects

Income Changes and Penalized Withdrawals

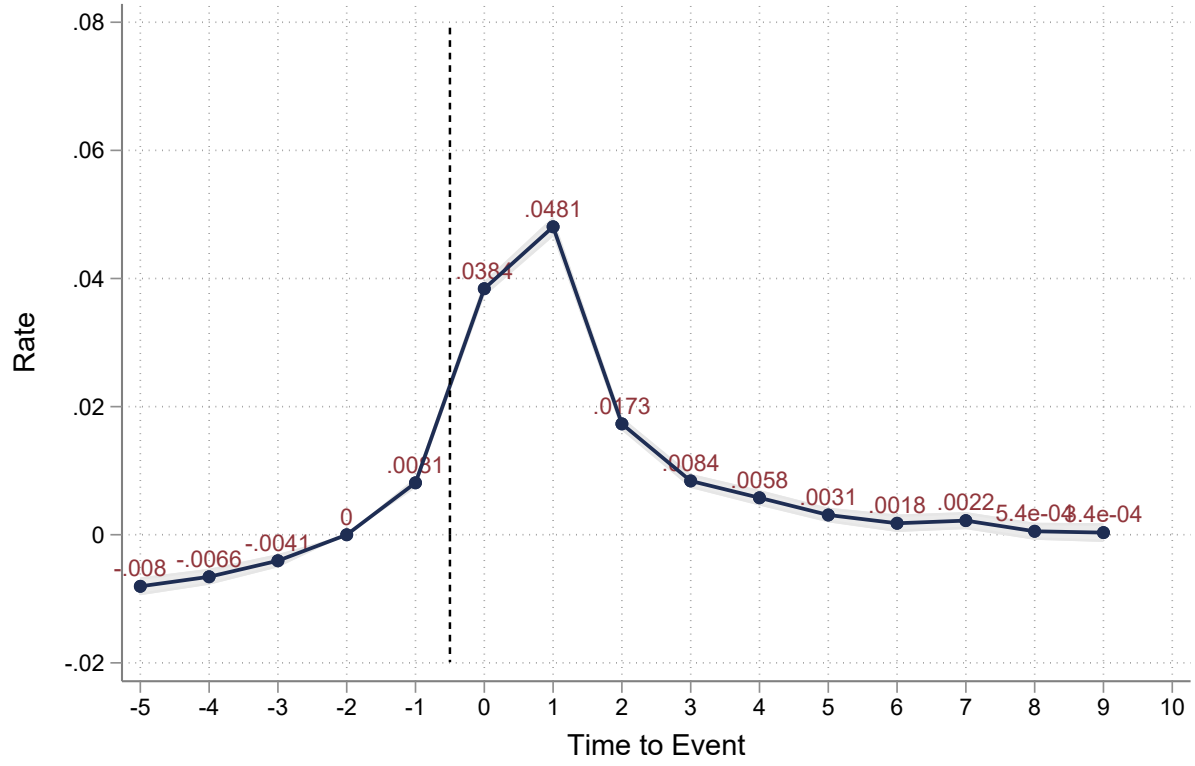
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- Strong gradient with respect to income losses → self-insurance
- Stark asymmetry is consistent with self-insurance and rules out alternative explanations (e.g. strategic withdrawals for tax purposes)

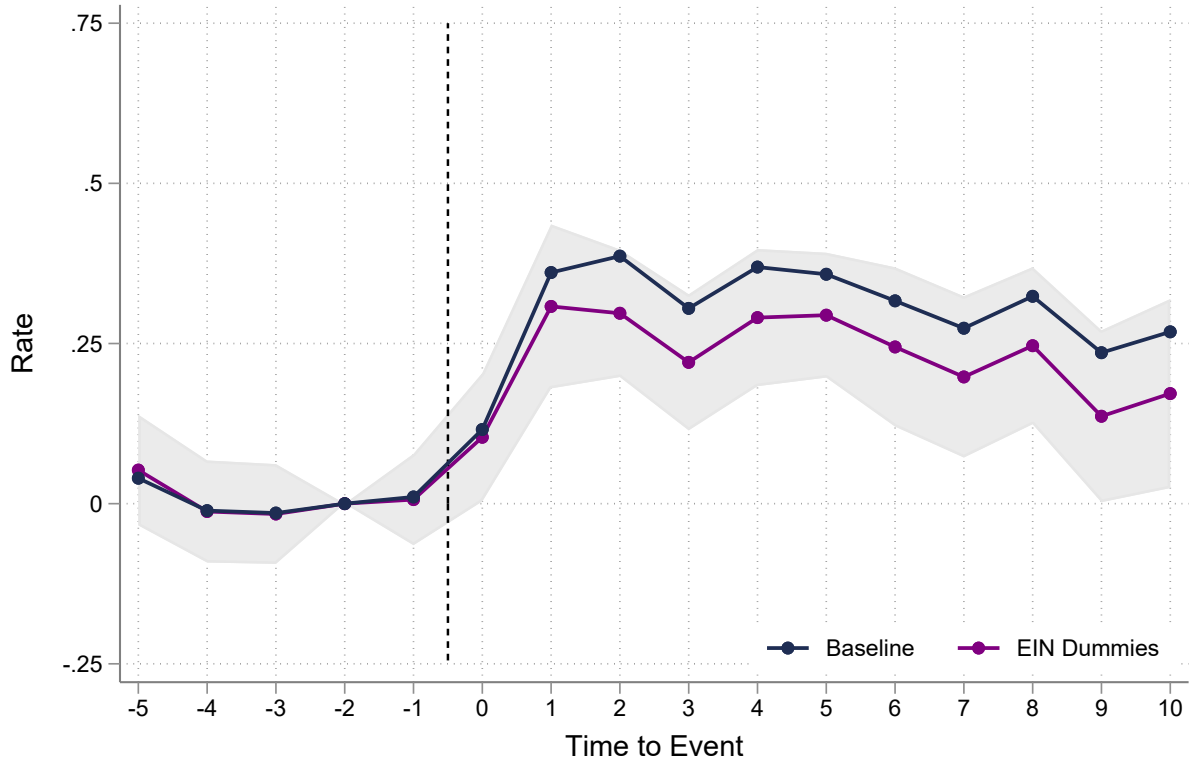
Move Event

Back



- Movers have a **transitory** increase in penalized withdrawals
  - moving "shock" leads to a transitory effect, while the location effect is very persistent → further evidence corroborating our interpretation

Movers Design: Role of Selection to Employers



- Location effect reduces slightly if we control for establishment dummies suggesting a mild within location selection towards establishments with higher intensity