Do Banks Pass Through Credit Expansions to Consumers Who Want to Borrow?

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Motivation

- During Great Recession, key policy objective was to provided banks with lower-cost capital and liquidity
- One motivation was to stimulate aggregate demand

$$\downarrow \text{Cost of lending} \Rightarrow \uparrow \text{Credit availability} \Rightarrow \uparrow \text{Borrowing, spending, investment}$$

- Growing view that these policies were less successful than anticipated at stimulating economic activity (e.g., Sufi, Crockett Lecture 2015)

$\Rightarrow$ Present explanation grounded in micro-economics of consumer credit markets

This Paper

- Impact on borrowing

$$-\frac{dq}{dc} = \underbrace{-\frac{dCL}{dc}}_{\text{MPL}} \times \underbrace{\frac{dq}{dCL}}_{\text{MPB}}$$

- Low FICO consumers have highest MPB (e.g, Gross and Souleles, 2002)

  $\Rightarrow$ Credit expansions to low FICO consumers will have largest aggregate effects

- Asymmetric info important in low FICO segment (Adams Einav Levin, 2009)

  $\Rightarrow$ Reduces pass-through bc higher credit limits lead to higher rates of default

- Concern: Bank's MPL lowest for consumers with highest MPB

  $\Rightarrow$ Estimate heterogeneous MPBs and MPLs in U.S. credit card market

Outline

- **Data**
- Research Design
- Marginal Propensity to Borrow
- Marginal Propensity to Lend

Data

- OCC Credit Card Metrics
  - All credit cards issued by 8 largest U.S. banks
  - 400 million credit card accounts
  - Monthly data from January 2008 to December 2014
- Key variables
  - Spending and borrowing information $\Rightarrow$ MPB
  - Interest payments, fees and chargeoffs $\Rightarrow$ MPL
  - Merged in credit bureau information
- Sample restrictions
  - Focus on cards originated within our sample (since January 2008)

Outline

- Data
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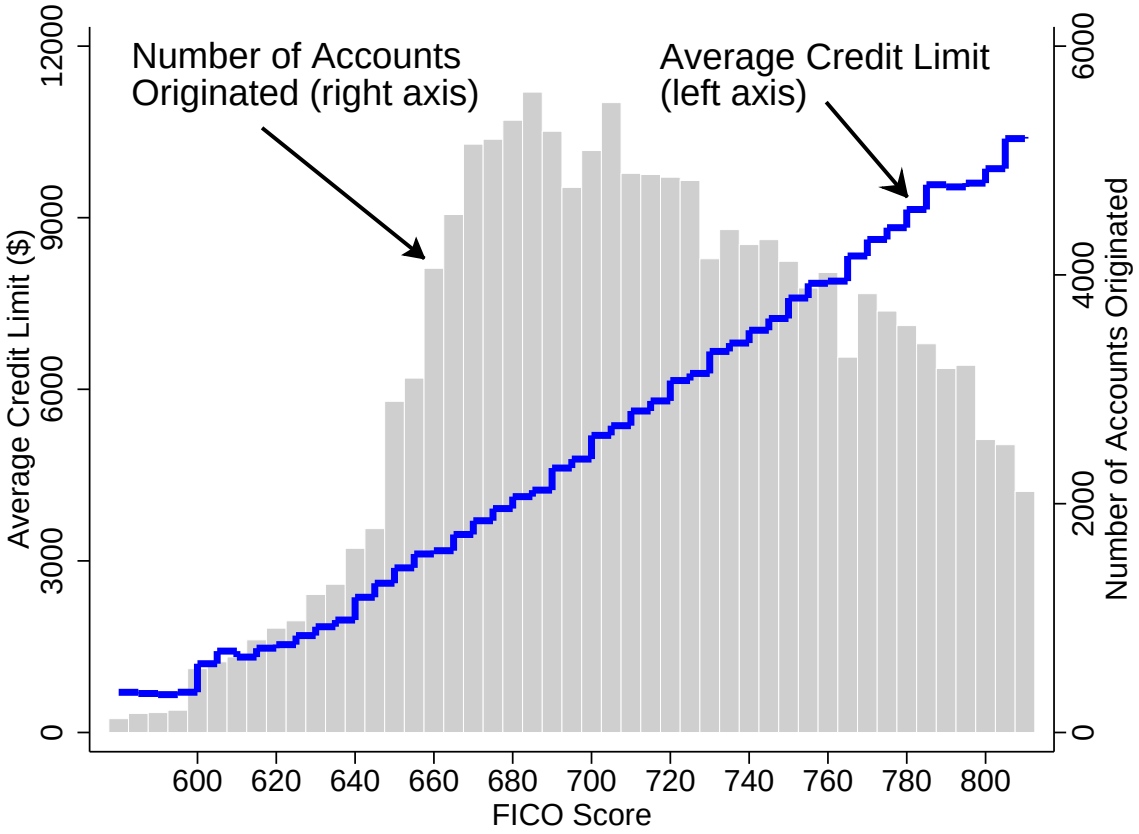
- Marginal Propensity to Borrow
- Marginal Propensity to Lend

Credit Limit Quasi-Experiments

- Credit card lenders assign credit limit based on FICO score
- Might also consider other factors, such as internally generated behavior scores



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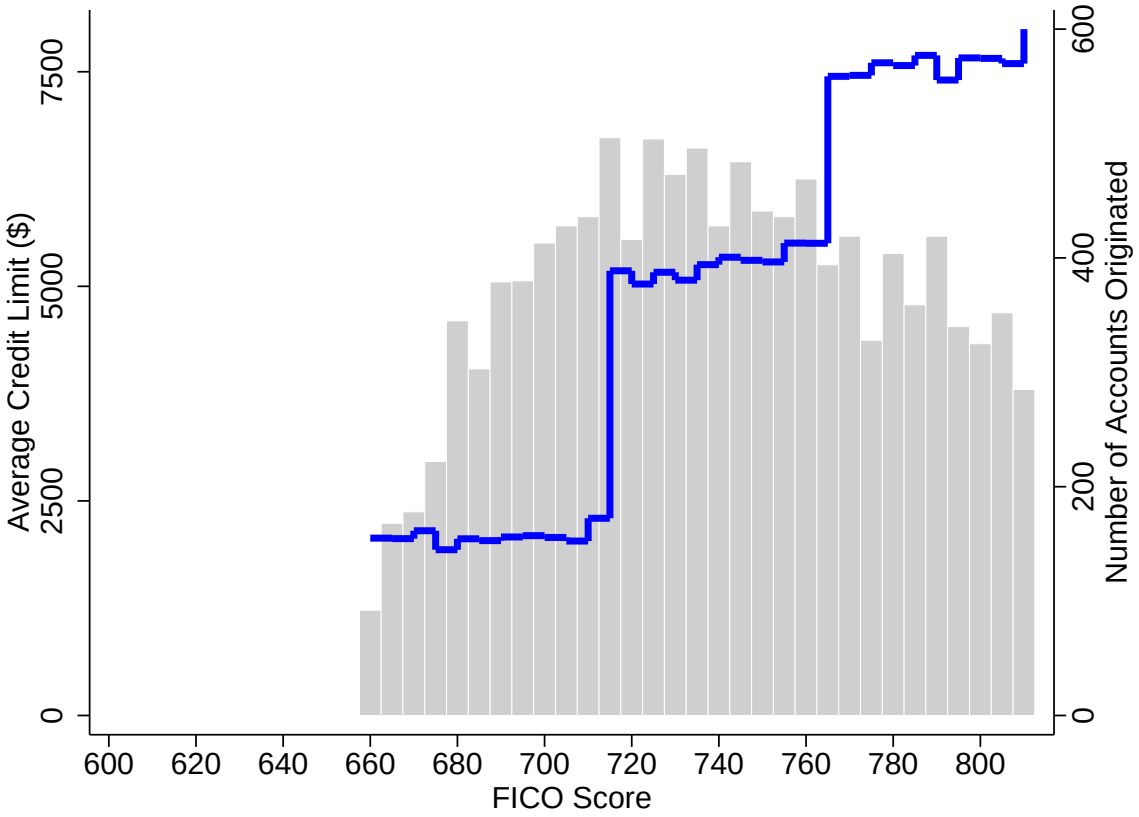
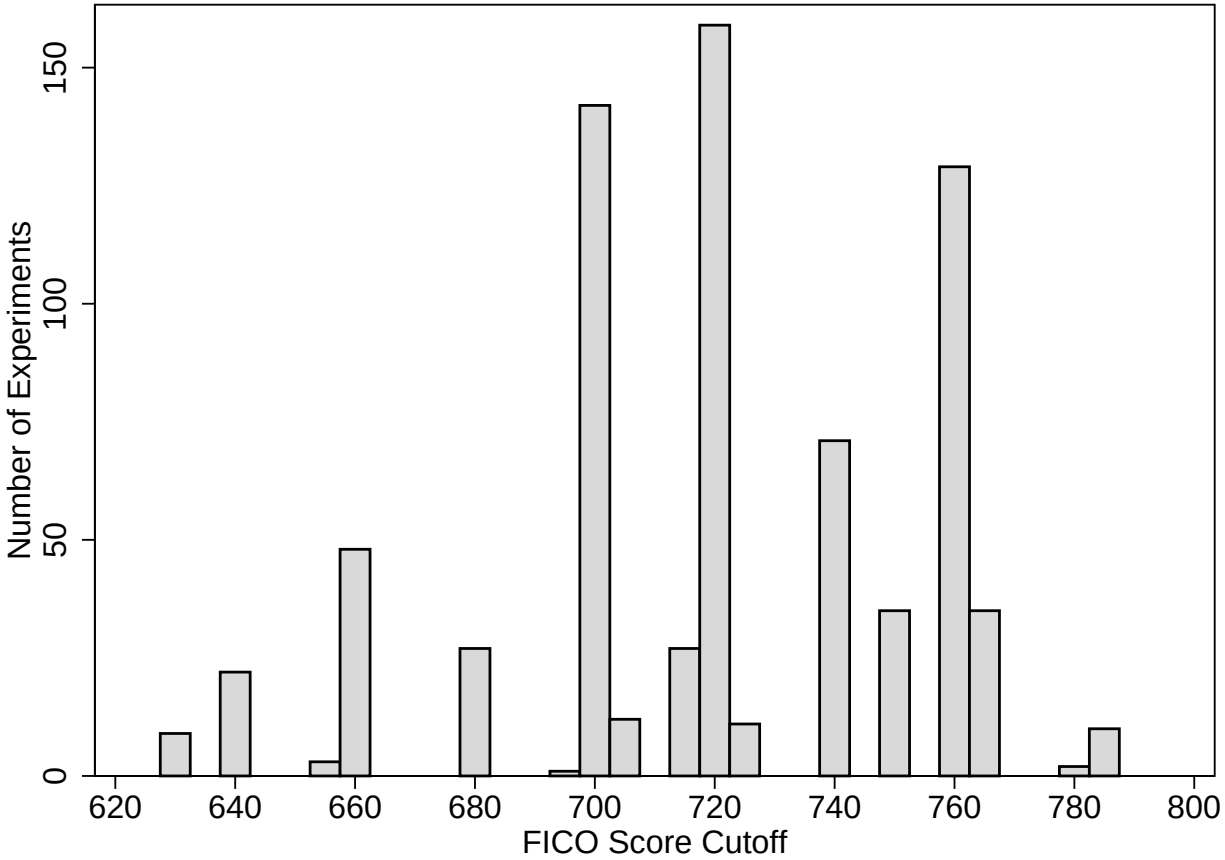


Credit Limit Quasi-Experiments

- Identify 743 quasi-experiments between Jan 2008 and Jun 2013
- 8.5M accounts originated within 50 FICO points of exps ($<$ 5% of new cards)



RD Estimator

- Fuzzy RD estimator for a given experiment

$$\tau_j = \frac{\lim_{\text{FICO}\downarrow\overline{\text{FICO}}} E[Y|FICO] - \lim_{\text{FICO}\uparrow\overline{\text{FICO}}} E[Y|\text{FICO}]}{\lim_{\text{FICO}\downarrow\overline{\text{FICO}}} E[CL|\text{FICO}] - \lim_{\text{FICO}\uparrow\overline{\text{FICO}}} E[CL|\text{FICO}]}$$

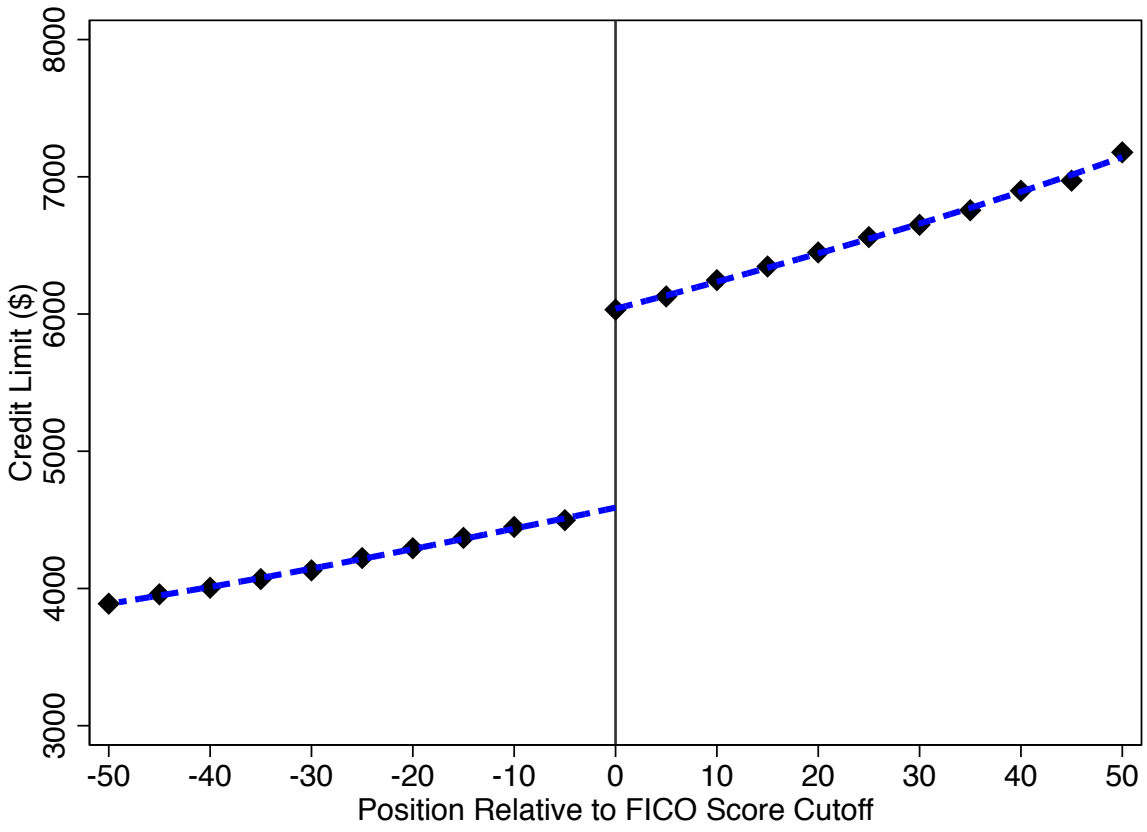
$$= \frac{\text{"Jump in outcome"}}{\text{"Jump in CL"}}$$

- Causal interpretation requires two assumptions:

  A1: Other contract / borrower characteristics trend smoothly through cutoff

  A2: No strategic movement around cutoff

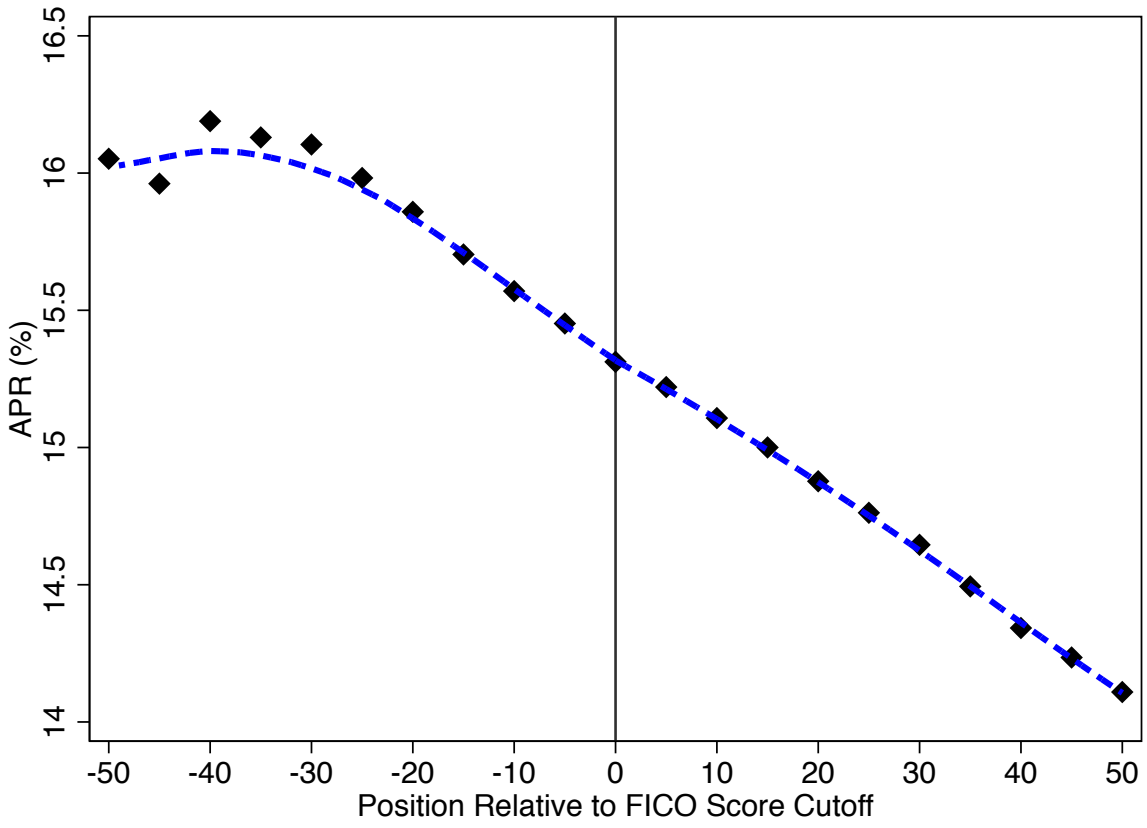
First Stage on Credit Limits



- Pooled across all quasi-experiments, centered around cutoff
- $1,472 higher average credit limit around our cutoffs

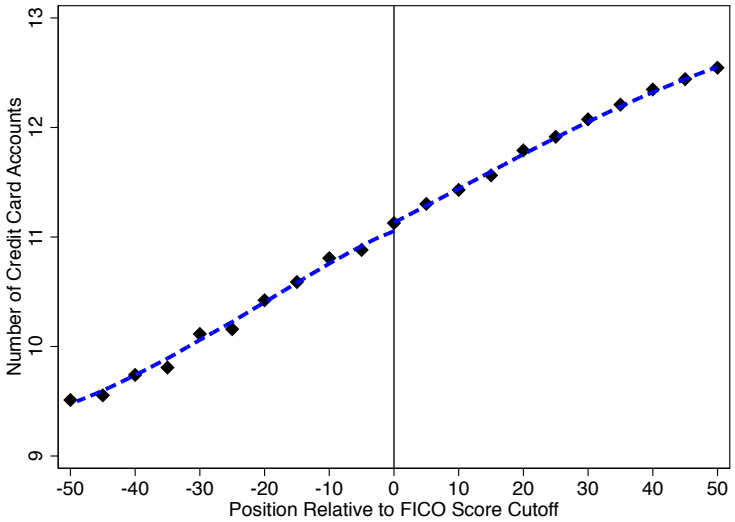
Distribution Persistence

A1: Interest Rate (APR) Trends Smoothly

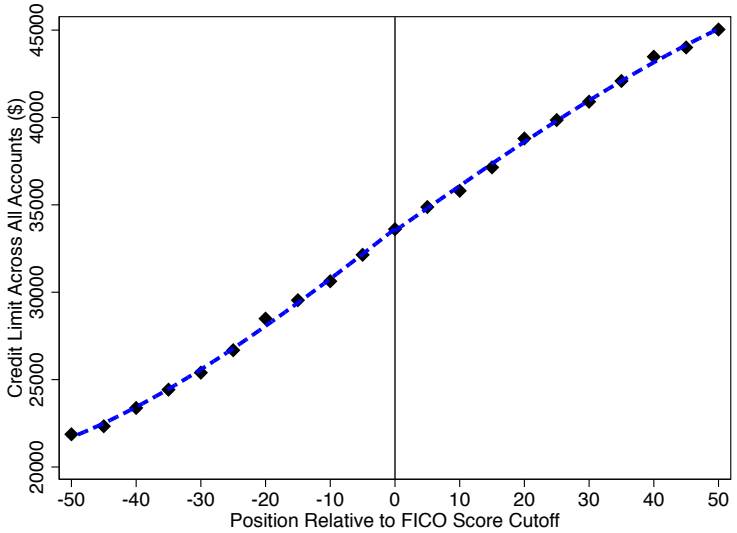


- No discontinuous change in interest rates around credit limit cutoffs.

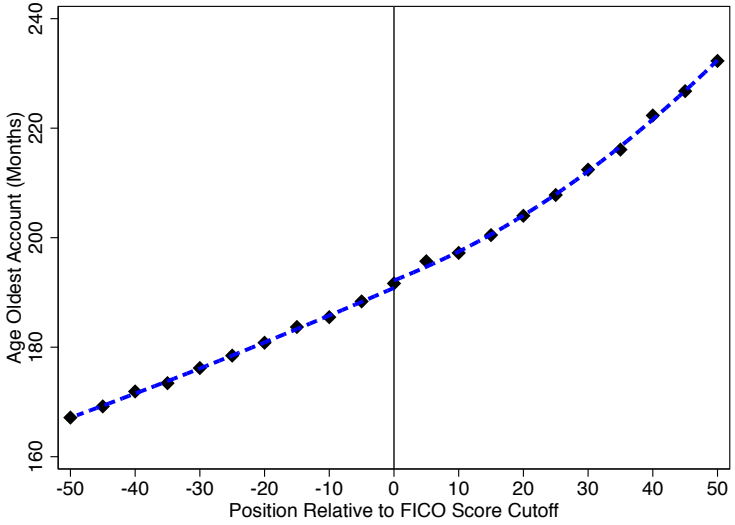
A1: Borrower Characteristics Trend Smoothly



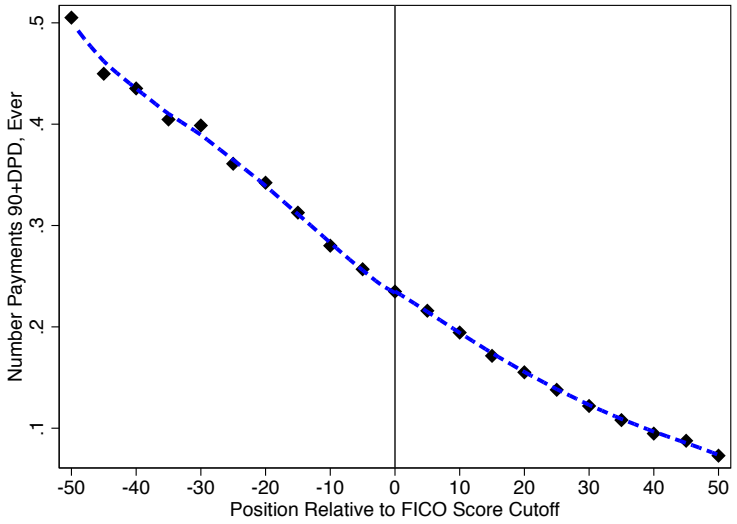
(a) Number of Credit Card Accounts



(b) Total Credit Limit ($)

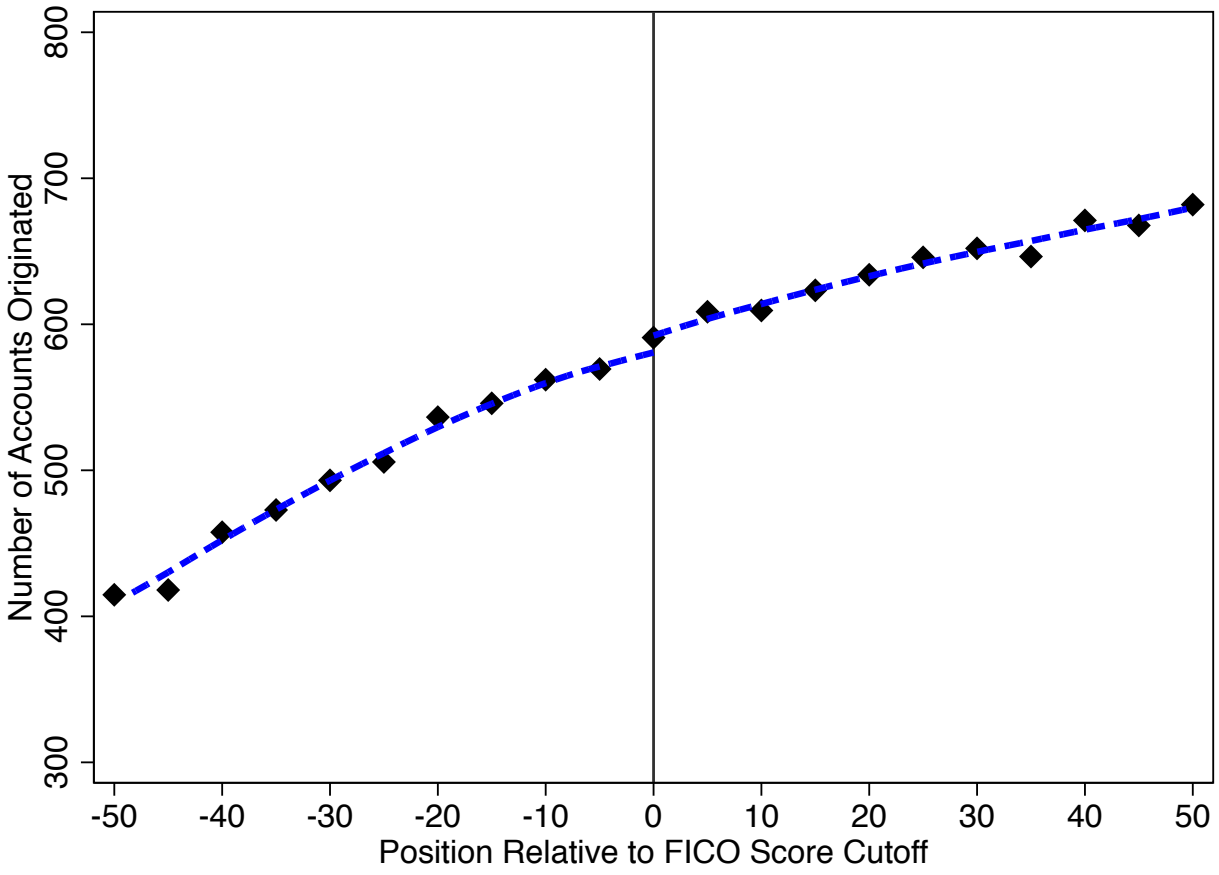


(c) Age of Oldest Account (Years)



(d) # of Payments 90+ DPD (Ever)

A2: No Strategic Movement Around Cutoff



- Hard to precisely manipulate FICO score
- Credit supply function not known
- Credit limit unknown when consumer applies for card (no demand response)

Aggregating Across Experiments

- Estimate τ_j separately for each quasi-experiment j
  - Separate second-order local polynomial with Imbens-Kalyanaraman (2011) optimal bandwidth Details
- Recover average effect by FICO group with regression

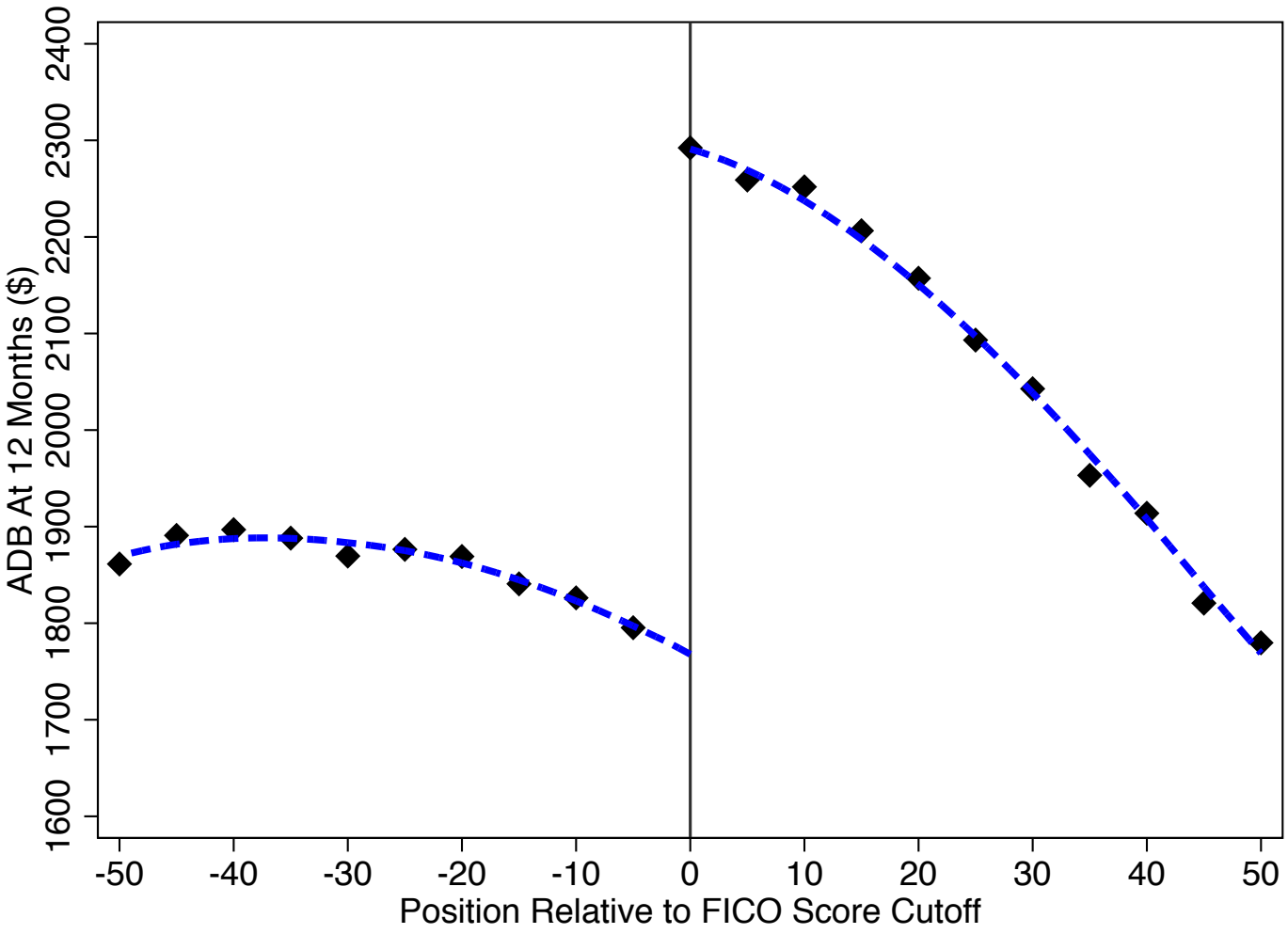
$$\tau_j = \sum_{k \in K} \beta_k FICO_k + X_j' \delta_X + \epsilon_j$$

  - $FICO_k$ are FICO group quartiles
  - X_j are fully interacted bank $\times$ origination quarter fixed effects
- Standard errors constructing by bootstrapping over experiments

Outline

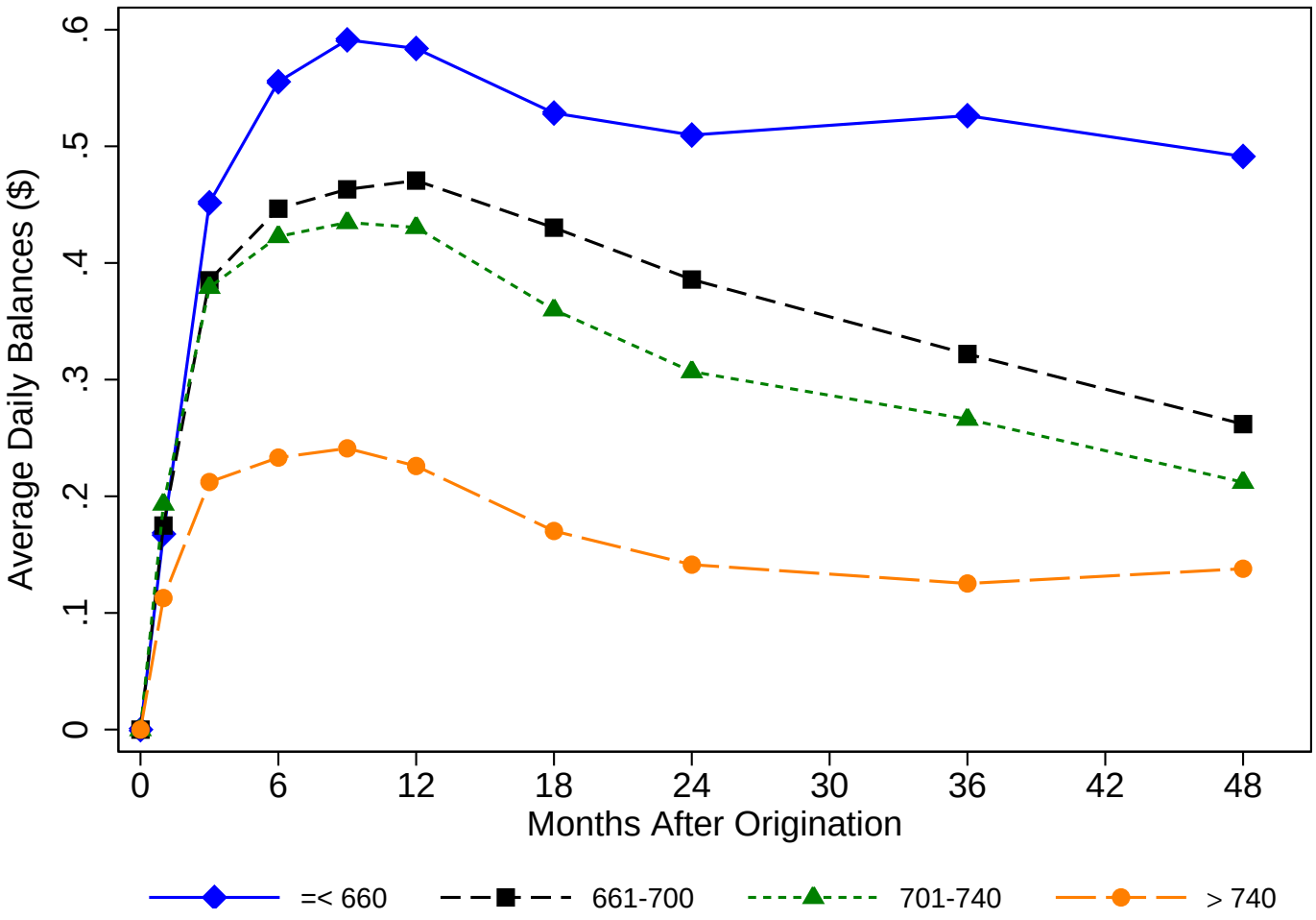
- Data
- Research Design
- **Marginal Propensity to Borrow**
- Marginal Propensity to Lend

MPB on "Treated" Card, After 12 months



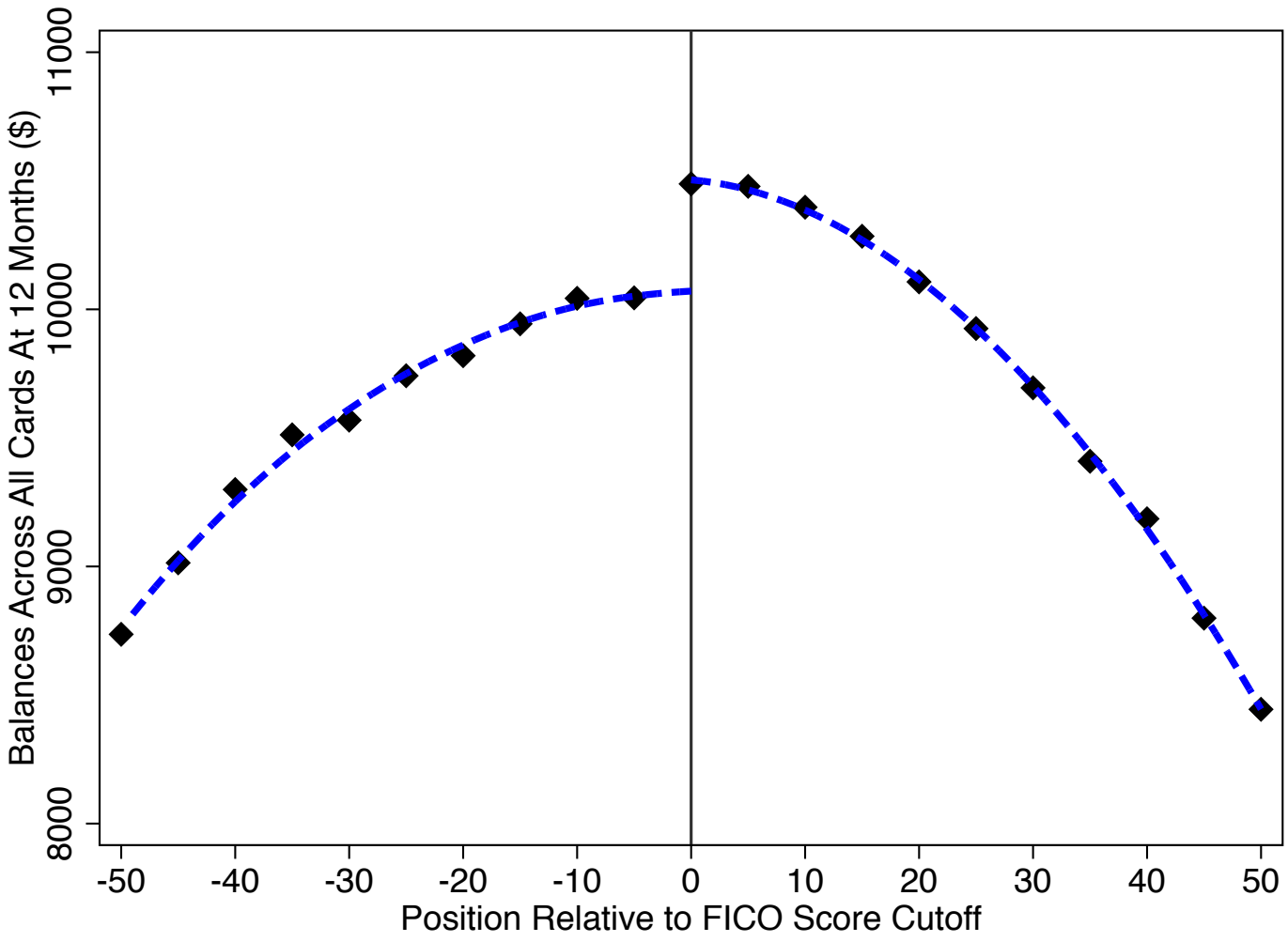
- Pooled across all quasi-experiments, centered on cutoff

MPB on Treated Card, Heterogeneity



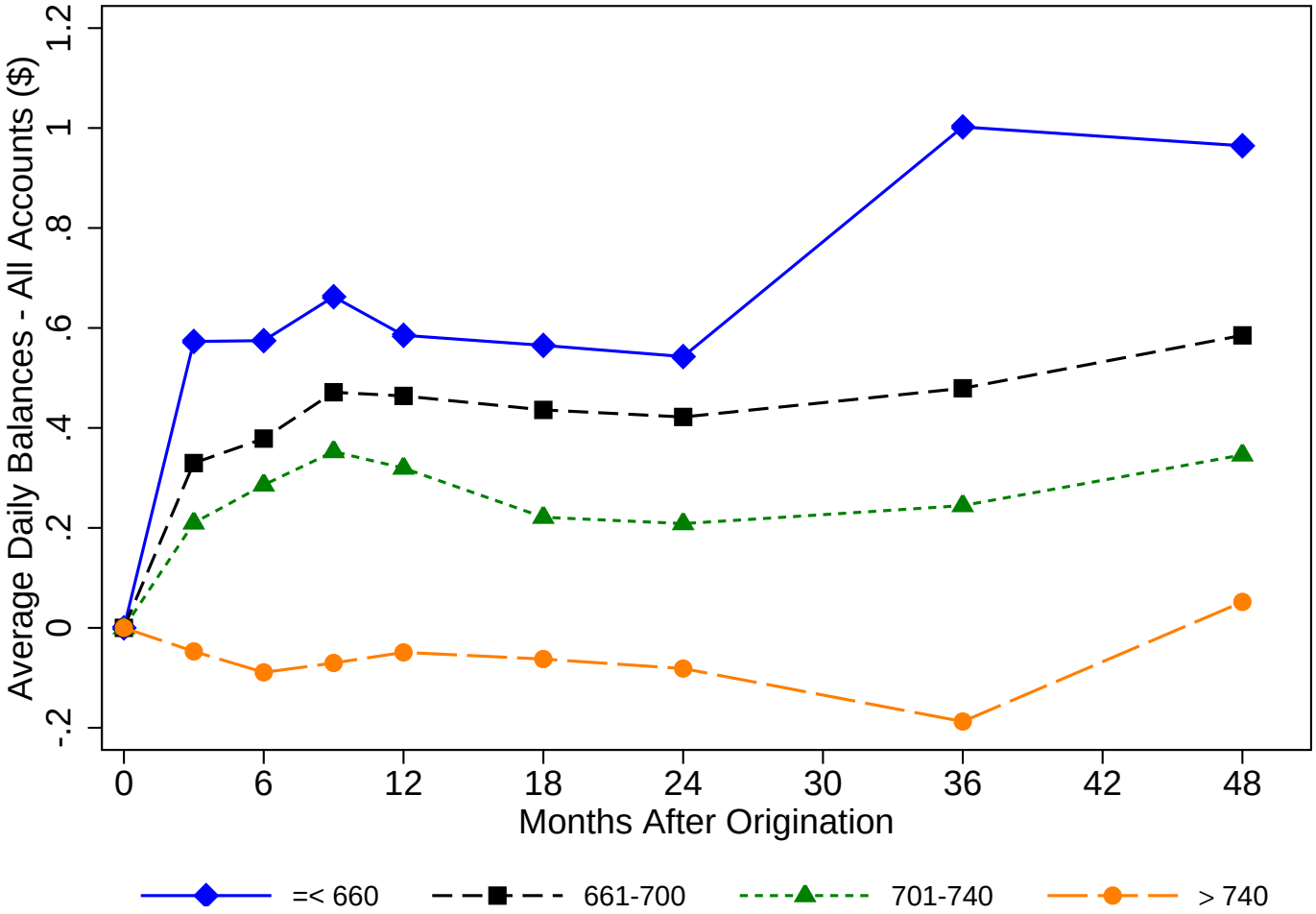
- Quick response, gradual decline
- Substantial heterogeneity by FICO score
- Even high FICO borrowers respond

MPB Across All Cards, After 12 months



- Borrowing across all cards measured in merged credit bureau data
- Y-axis scale much larger because consumers have multiple cards

MPB Across All Cards, Heterogeneity



- Lower-FICO borrowers: 1-for-1 increase in total borrowing
- FICO $>$ 740: No response in total borrowing $\Rightarrow$ balance shifting

MPB Takeaway

Substantial heterogeneity in borrowing / spending behavior

- FICO $\leq$ 660
  - MPB of at least 50% on treated card
  - Not offset by decline on other cards
  - Corresponds to increase in spending on treated card Figure
- FICO $>$ 740
  - MPB of $\approx$ 15% on treated card
  - Completely due to balance shifting
  - Zero MPB despite significant borrowing on average

$\Rightarrow$ Stimulating borrowing requires credit expansion to low-FICO households

- Not population parameters, but relevant group for stimulating consumption

Outline

- Data and Research design
- Marginal Propensity to Borrow
- **Marginal Propensity to Lend**
  - **Model**
  - Estimates

Marginal Propensity to Lend

- **MPL:** Effect on credit limits of (permanent) 1 pp reduction in cost of funds
- **Why not use an event-study approach?**:
  - Large decline in Fed Funds rate during financial crisis
  - Financial crisis had independent effect on banks' expectations and credit limits

  $\Rightarrow$ Potential for substantially biased estimates
- **Our approach**: Simple model of optimal credit limits that allows us to characterize MPL with a few parameters we can estimate directly
  - Requires bank lending responds optimally to changes in cost of funds
  - Requires us to be able to measure banks' incentives to lend

Margin of Adjustment

- Rely on literature that shows CL, not interest rates, margin of adjustment
  - Pass-through evidence (e.g., Ausubel 1991; Agarwal, Chomsisengphet, Mahoney, and Stroebel, 2015)
  - Reasons: Low price-elasticity, tacit collusion, adverse selection
  - We take this feature of the credit card market as given, and focus on credit limits as dimension of adjustment
  - Mechanism might carry over to other margins of adjustment

Model Setup

Simple model of optimal CL for group of observably identical borrowers

- $q(CL)$ is quantity of borrowing
- r is exogenously determined interest rate
- $F(CL) \equiv F(q(CL), CL)$ is fee revenue
- $C(CL) \equiv C(q(CL), CL)$ is net chargeoffs
- c is cost of funds

Bank Objective

- Bank objective function for observationally identical borrowers

$$\max_{CL} q(CL)(r-c) + F(CL) - C(CL)$$

- First order conditions

$$\underbrace{q'(CL)r + F'(CL)}_{=MR(CL)} = \underbrace{q'(CL)c + C'(CL)}_{=MC(CL)} \iff MP(CL) = 0$$

MPL

- Define MPL as $-\frac{dCL}{dc}$

- Applying implicit function theorem to FOC yields

$$MPL = -\frac{MPB}{MR'(CL) - MC'(CL)} = -\frac{MPB}{MP'(CL)}$$

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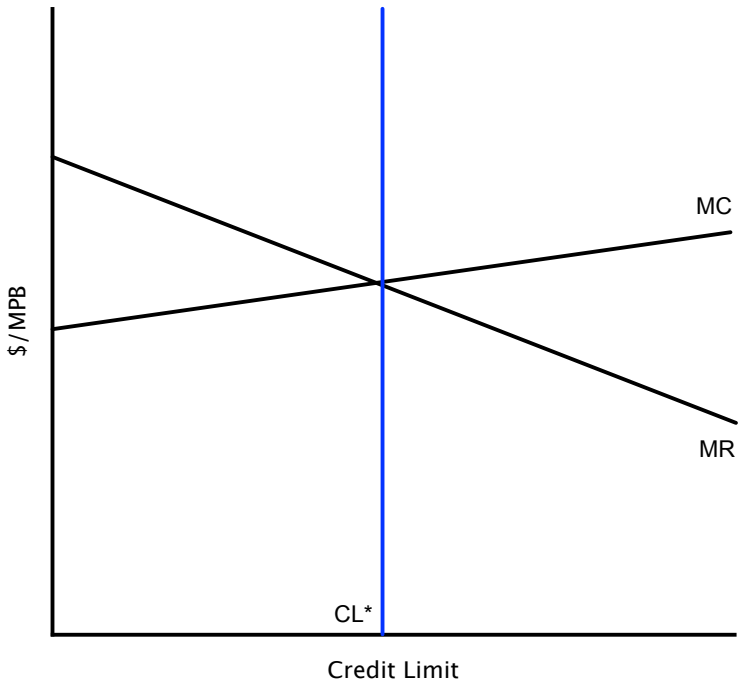

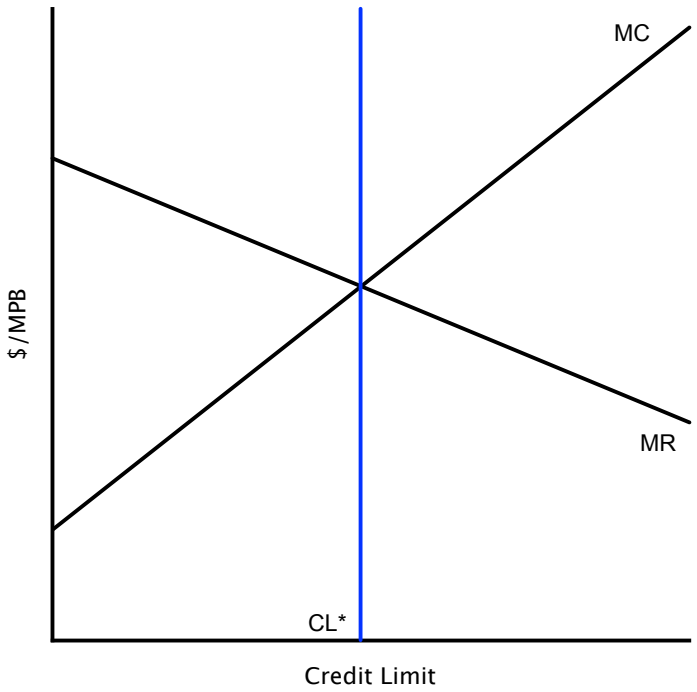

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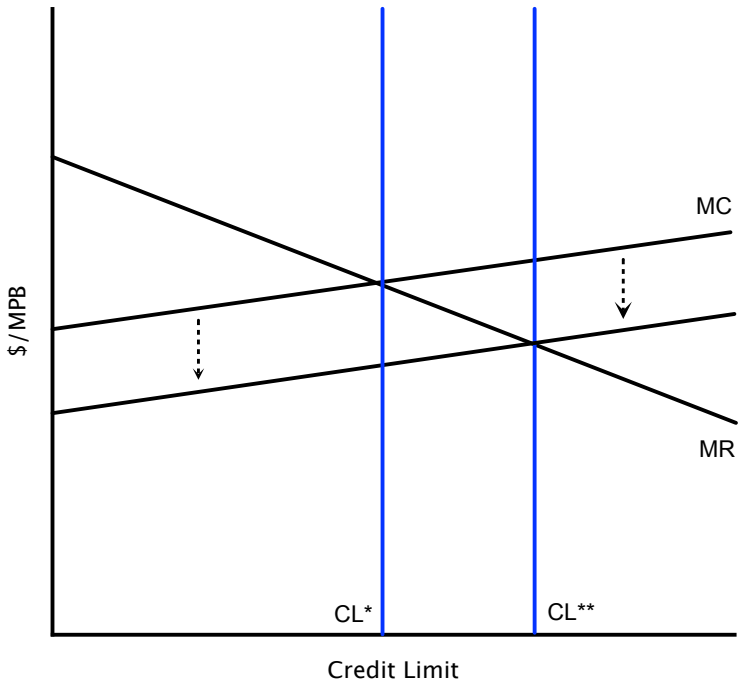
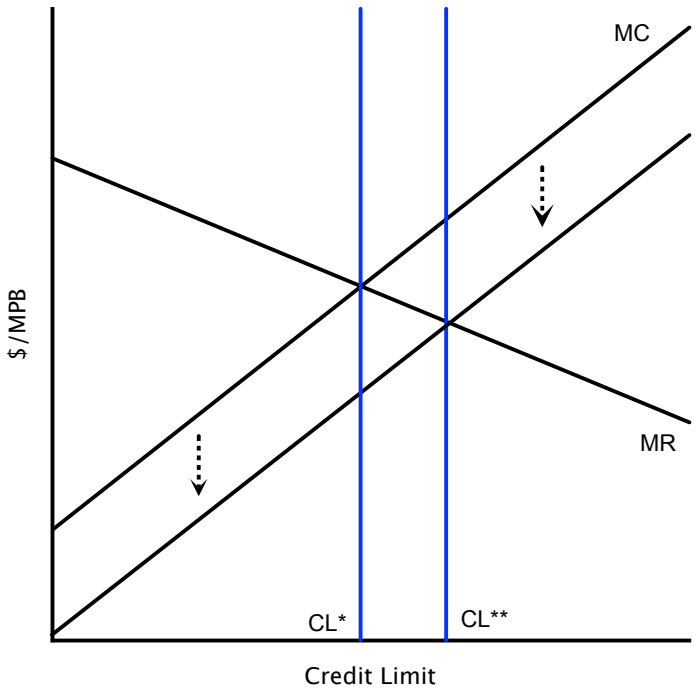




Interpretation of $MC'(CL)$

1. Adverse selection (changing marginal borrower)
   - Larger increases in borrowing by households with higher default probability
   - Slope of $MC'(CL)$ parameterizes degree of selection across different models of selection in the literature (Mahoney and Weyl, 2014)
2. Direct effect of higher credit limits (keeping marginal borrower constant)
   - Moral hazard: Over-borrow today because can strategic default tomorrow
   - Myopia: Over-borrow today bc don't fully internalize paying back tomorrow
   - Other models of household behavior

$\Rightarrow$ Slope of MC parameterizes the importance of these factors for pass-through

- Sufficient statistic (Chetty, 2009)

Outline

- Data and Research design
- Marginal Propensity to Borrow
- **Marginal Propensity to Lend**
  - Model
  - **Estimates**

Estimating $MC'(CL)$

- Estimate $MC'(CL)$ using the same RDs with costs as outcome variable
  - Standard approach used in empirical insurance literature
- Each experiment delivers two moments:
  1. Marginal costs at prevailing credit limit
  2. Average costs per dollar of credit limit

$\Rightarrow$ Two moments allow us to identify two-parameter curve for marginal costs

Estimating $MC'(CL)$

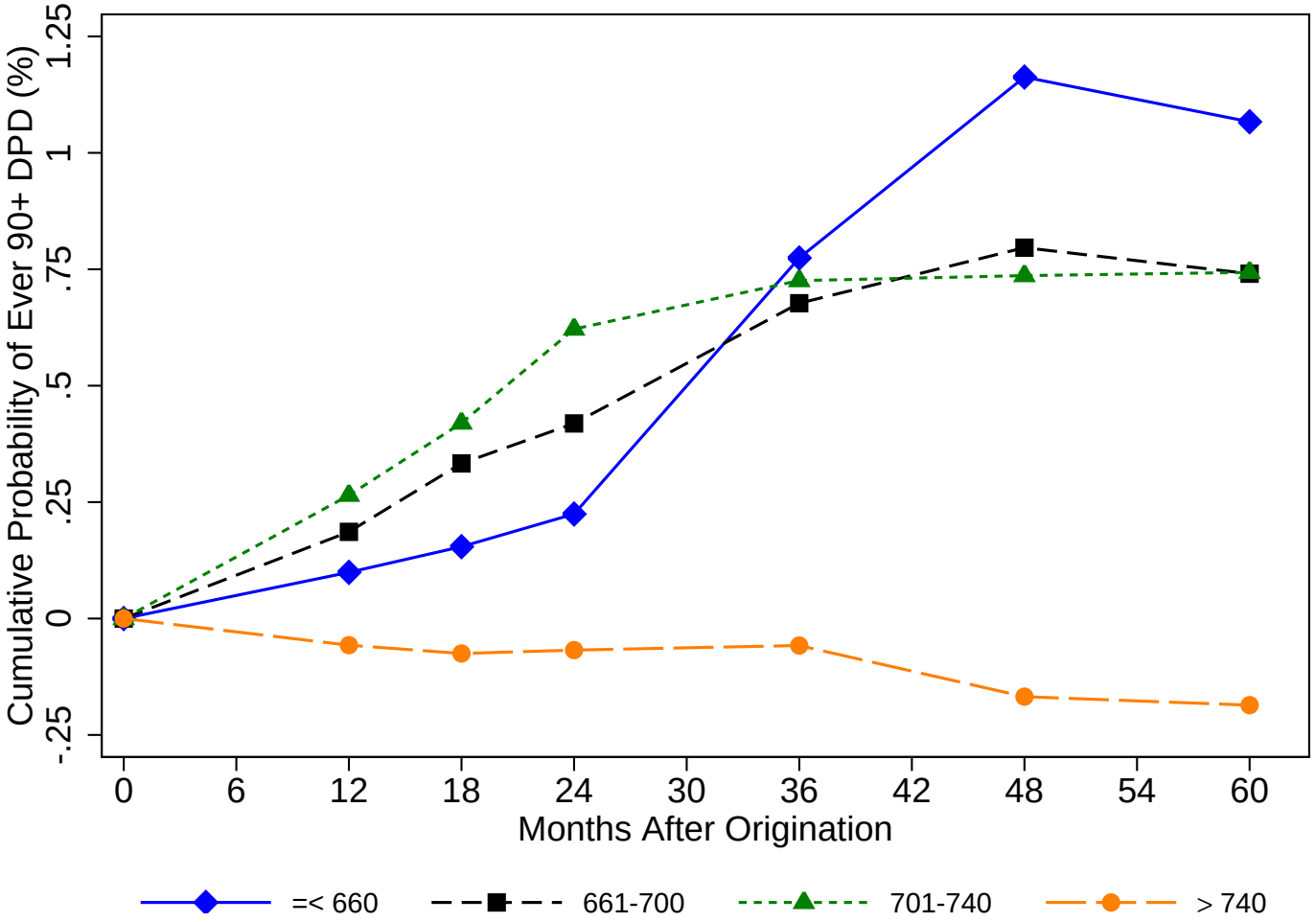
- Baseline specification: Linear marginal costs[1]
- $MC(CL) = \alpha + \beta CL$
- $AC(CL) = \frac{1}{CL} \int_0^{CL} MC(CL)\, dCL = \alpha + \frac{1}{2}\beta CL$
- Slope is therefore

$$\beta = \frac{2(MC(CL) - AC(CL))}{CL}$$

  - Steep slope: $MC(CL) >> AC(CL)$
  - No slope: $MC(CL) = AC(CL)$

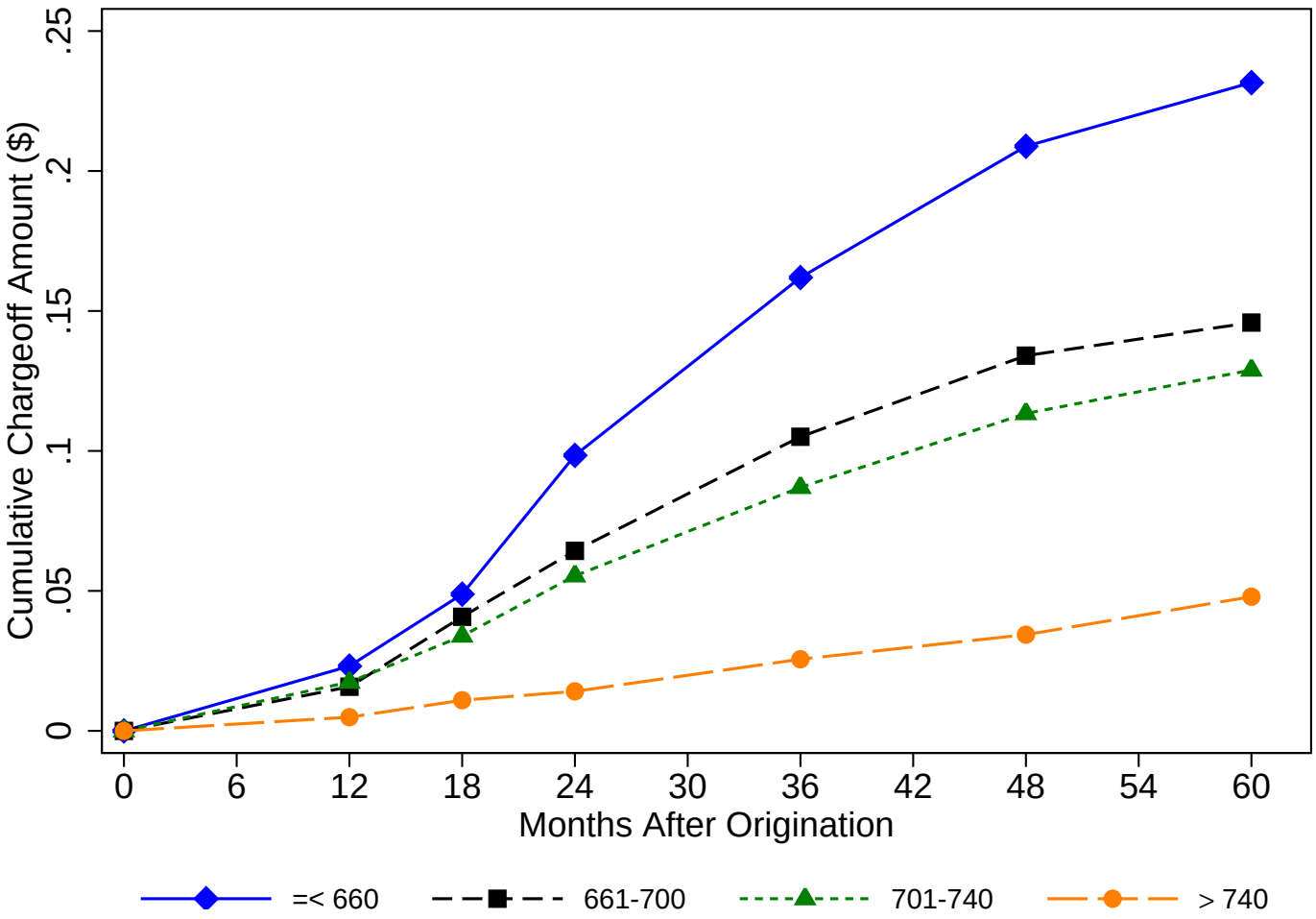
[1] Robustness to alternative functional forms coming soon!

Marginal Probability of Default



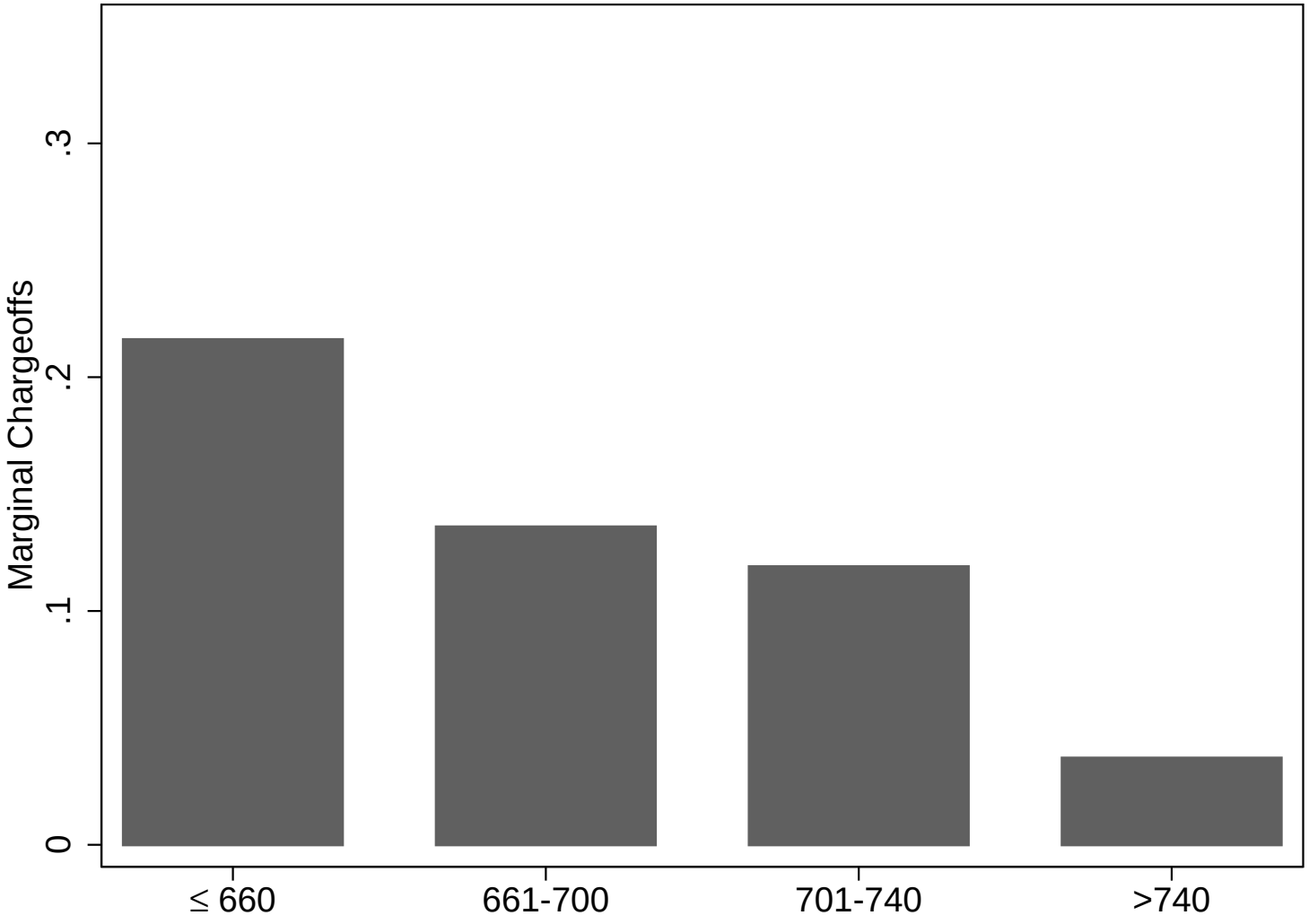
- Effect of \$1K increase in credit limits on probability of default
- Positive effect on default indicative of $MC'(CL) > 0$

Marginal Chargeoffs

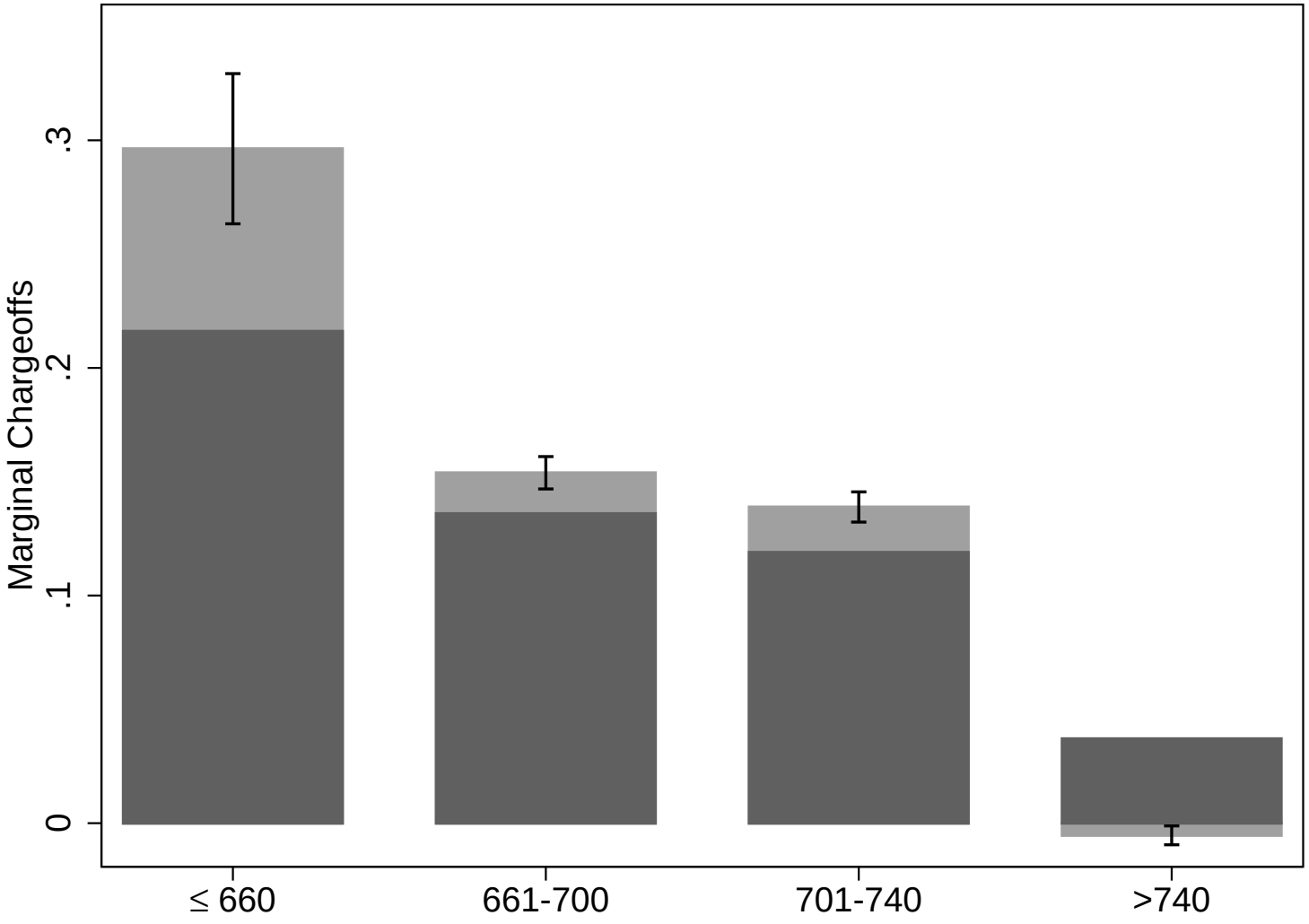


- Effect of $1 increase in credit limits on chargeoffs at prevailing equilibrium credit limit level

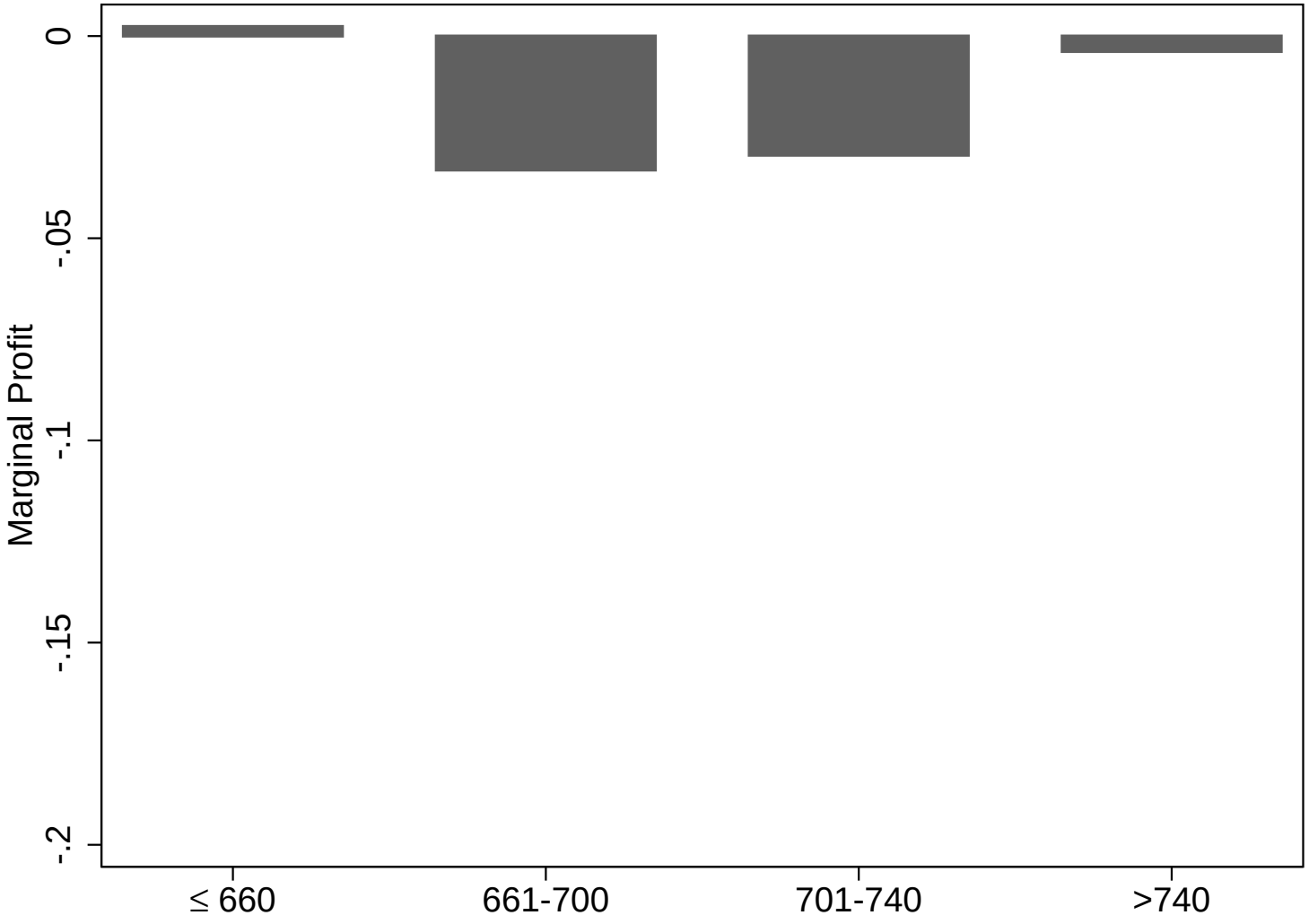
Marginal Chargeoffs at 48 Months



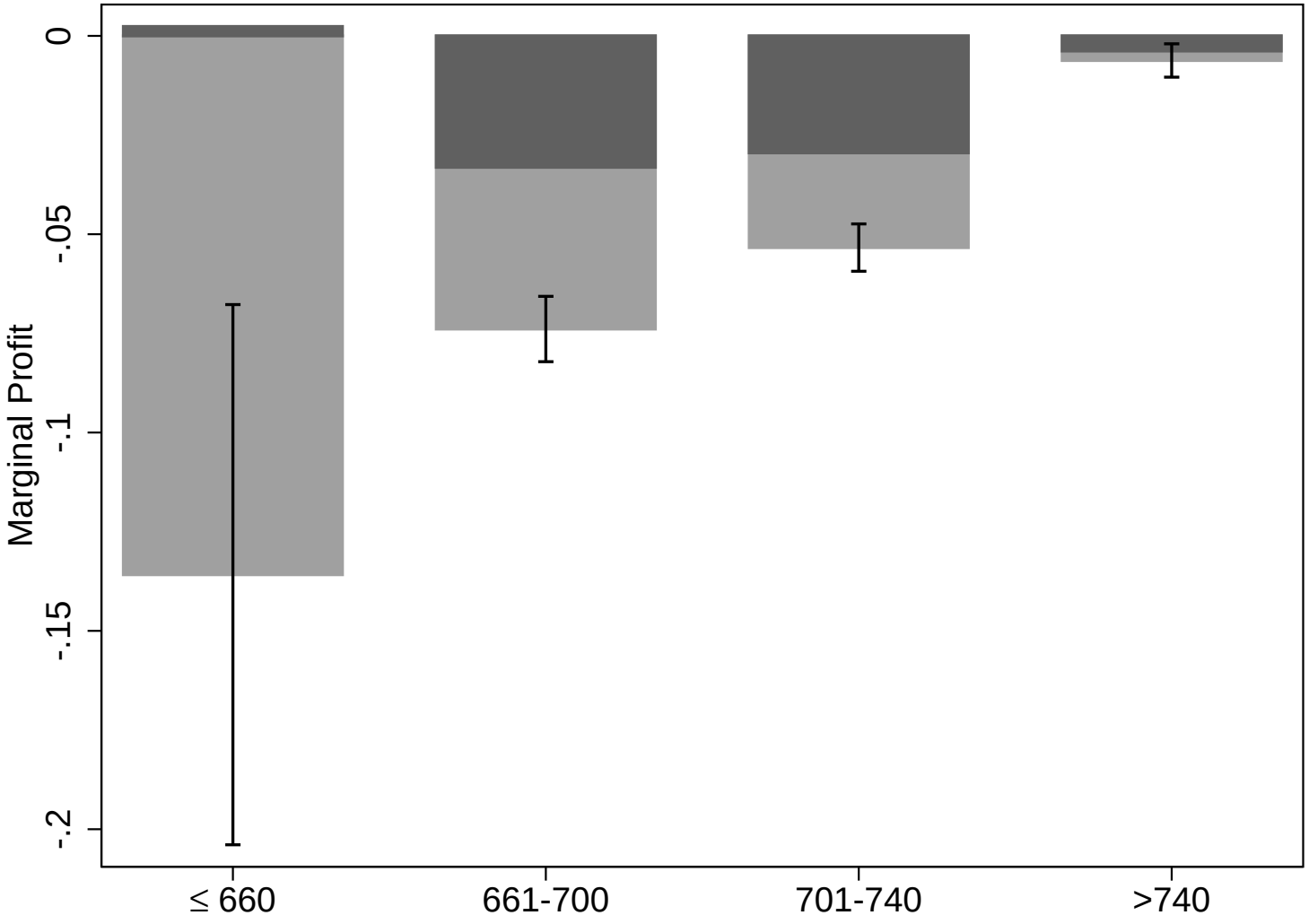
Effect of $1K Increase in CL on Marginal Chargeoffs



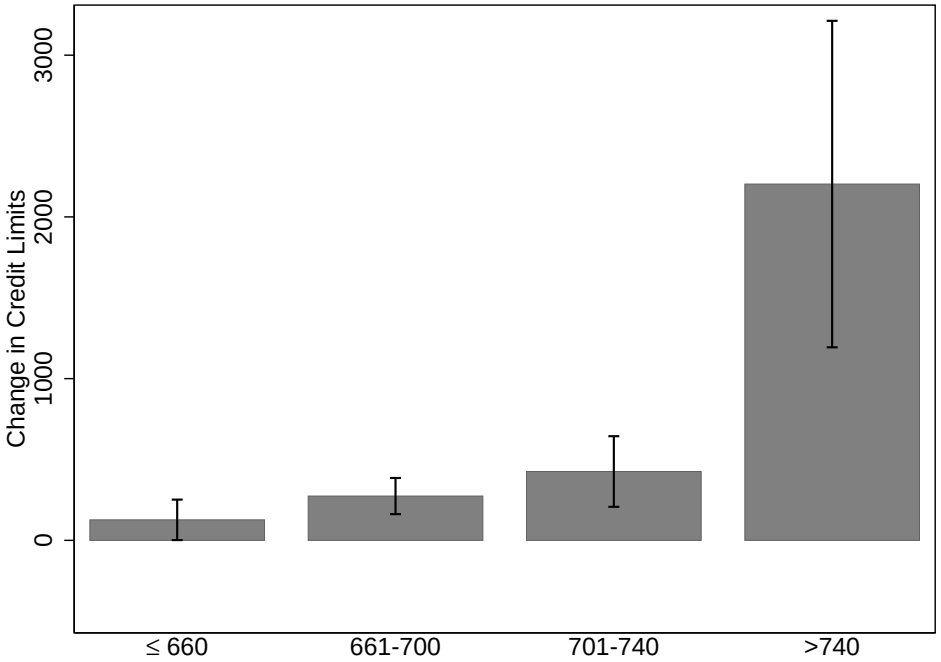
Marginal Profit at 48 Months



Effect of $1K Increase in CL on Marginal Profit



Marginal Propensity to Lend

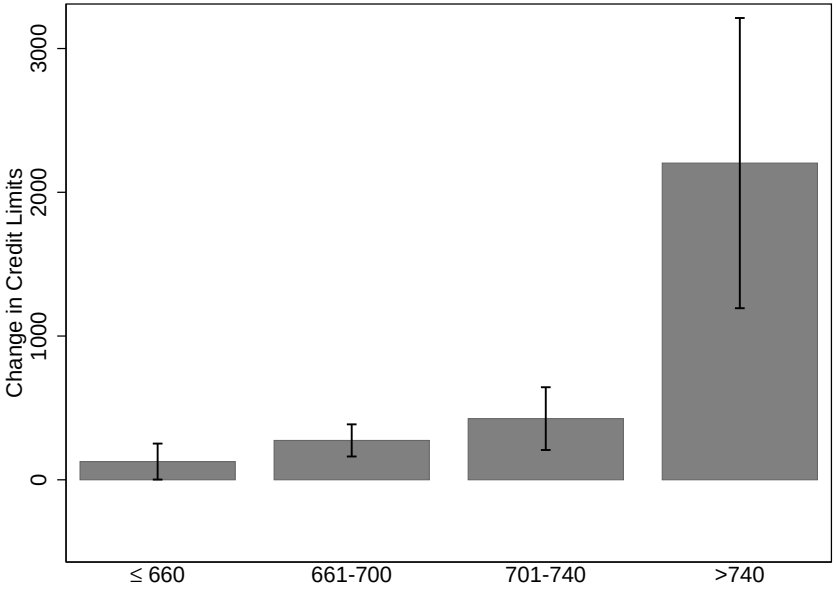


- Response to permanent 1 percentage point reduction in cost of funds:

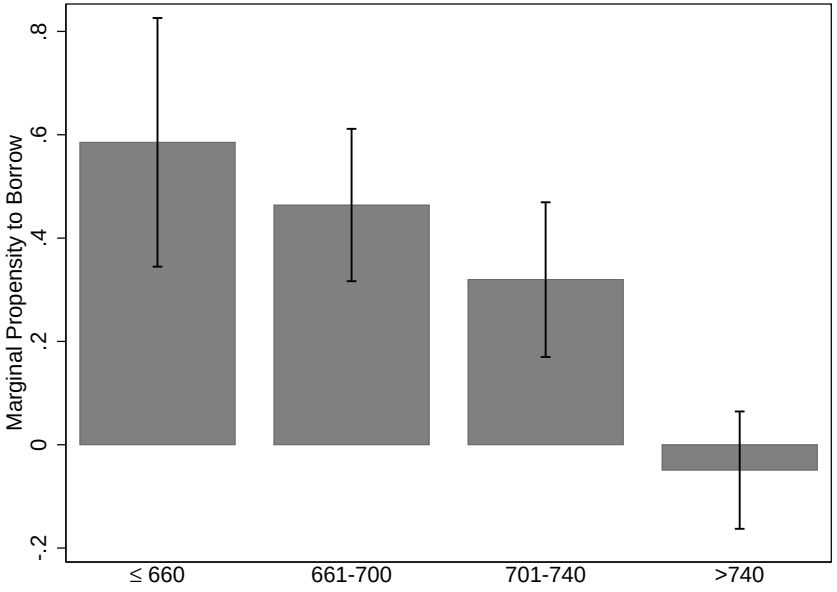
$$MPL = -\frac{dCL}{dc} = -\frac{MPB}{MP'(CL)}$$

  - FICO $\leq$ 660: \$127
  - FICO $>$ 740: \$2,203

MPL × MPB Takeaway



(a) MPL



(b) MPB Across All Accounts, 12 Months

- Suppose calculate effect as avg MPL across FICO × avg MPB across FICO

⇒ Accounting for correlation reduces effect by 76%

Conclusion

- Research question
  - Do banks pass through credit expansions to consumers who want to borrow?
- Research design
  - 743 credit limit regression discontinuities
- Findings
  1. Highest MPB in low FICO score segement
  2. Because of asymmetric information and other factors, MPL is lowest for these households
  3. Negative correlation between MPL $\times$ MPB reduces the impact of bank-mediated stimulus

Conclusion

We see our paper as making 2 contributions:

1. Estimate correlation between MPL $\times$ MPB in important market
   - Credit cards marginal source of credit for majority of households
   - Particular important during Great Recession when homeowners underwater
2. Pass-through likely muted in broad set of markets with asymmetric info
   - Small business loans, mortgages, online lending markets, etc
   - Hope to stimulate research in these areas

Backup Slides

Details on Implementation

For each experiment, run second-order local polynomial regression.

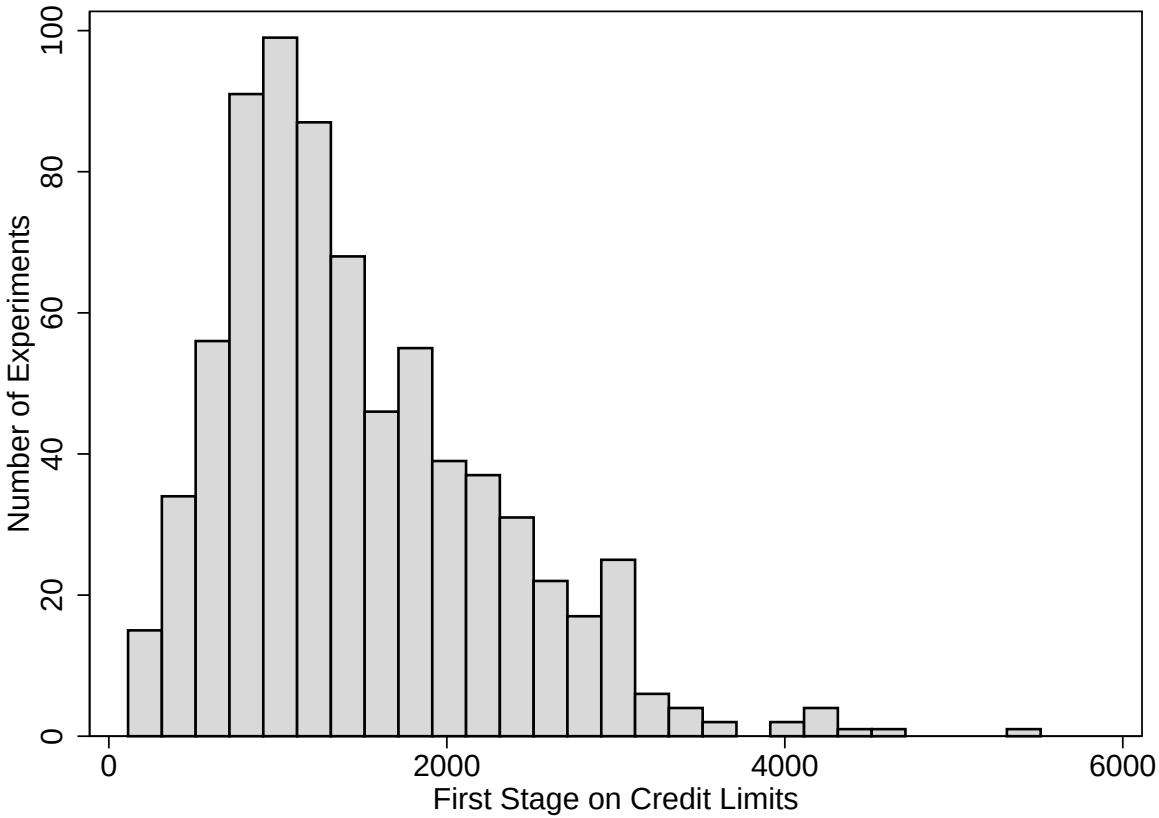
$$\min_{\alpha_{y,D},\beta_{y,D},\gamma_{y,D}} \sum_{i\in\mathbb{I}} \left[y_i - \alpha_{y,D} - \beta_{y,D}(x_i - \overline{x}) - \gamma_{y,D}(x_i - \overline{x})^2\right]^2 K\left(\frac{x_i - \overline{x}}{h}\right)$$

Use triangular kernel: $K\left(\frac{x_i - \overline{x}}{h}\right)$.

$$\tau = \frac{\hat{\alpha}_{\text{Outcome},H} - \hat{\alpha}_{\text{Outcome},L}}{\hat{\alpha}_{\text{Credit Limit},H} - \hat{\alpha}_{\text{Credit Limit},L}}.$$

Back to Research Design

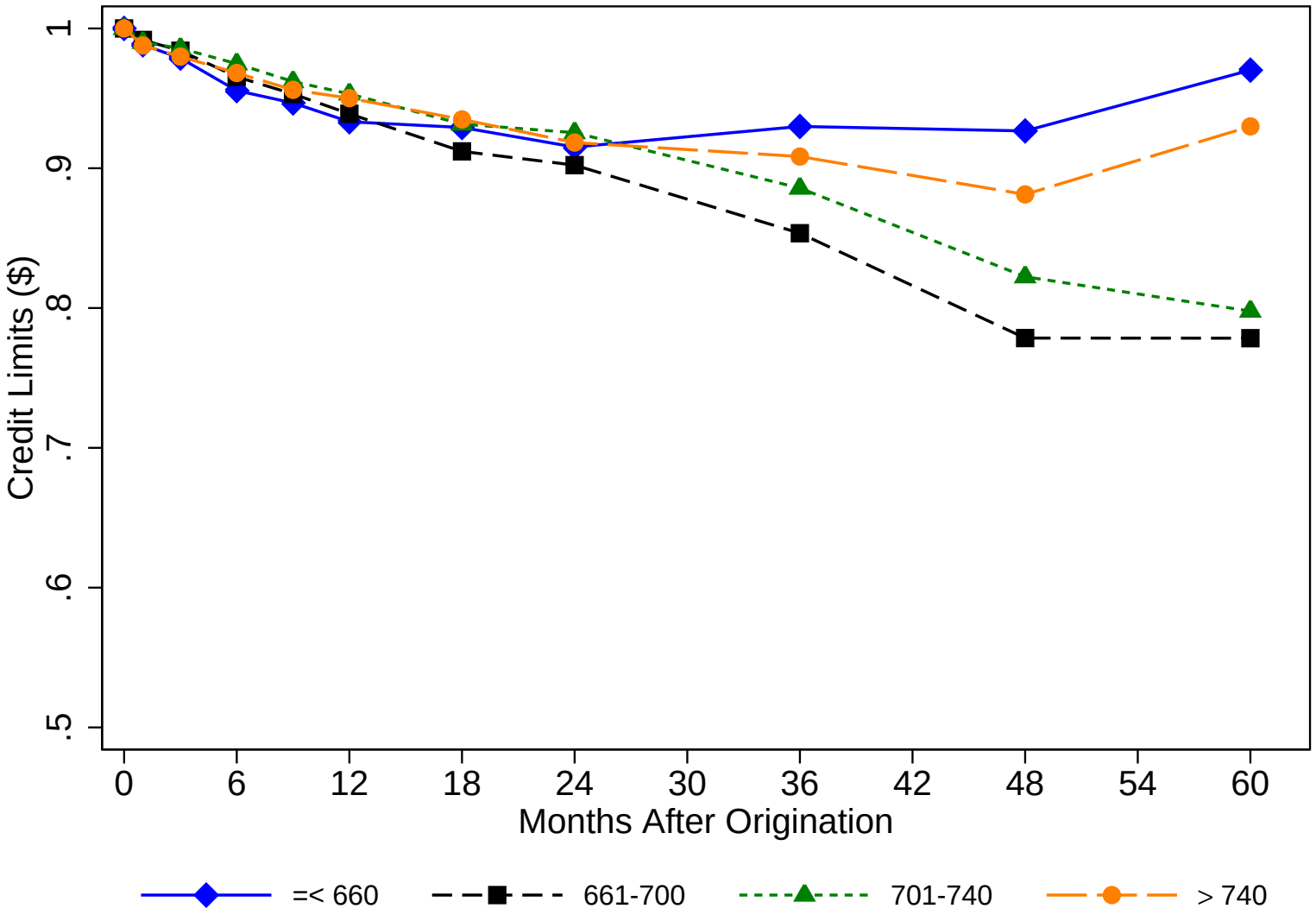
A1: Credit Limits Change at Cutoffs



- Distribution of first-stage across 743 quasi-experiments

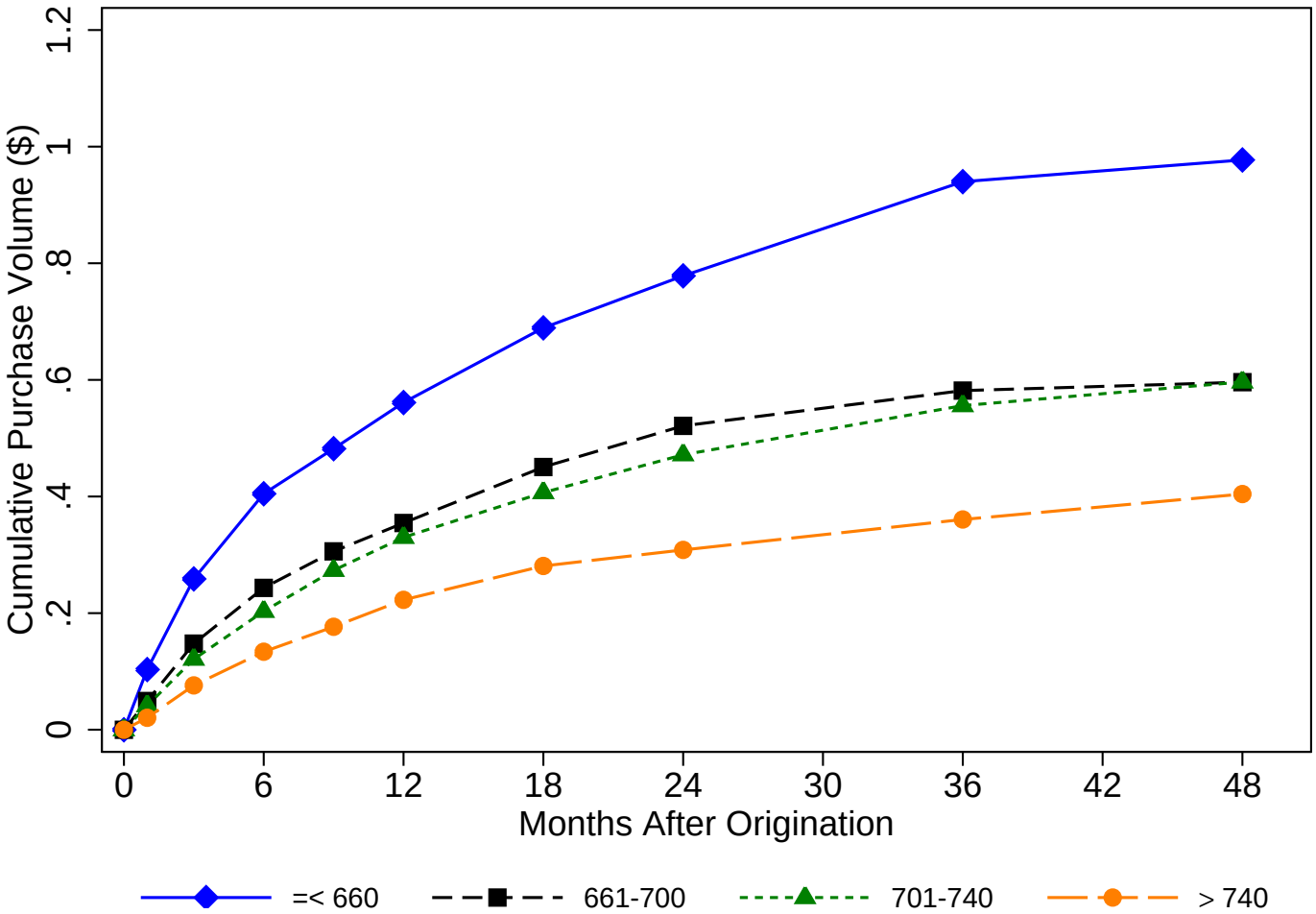
Back to First Stage

Peristence of Credit Limits



Back to First Stage

MPS Heterogeneity (Cumulative Purchase Volume)



- Own-card effect due to additional spending, not slower pay-down of debt.
- BUT: Do not have good measure of total spending ...

Back to MPB

Focus of Program

Bush: "[TARP to] supply urgently needed money so banks and other financial institutions can avoid collapse and resume lending. [This rescue effort] will help American consumers and businesses get credit to meet their daily needs and create jobs."

ECB: *Because the TLTROs will involve targeted lending, they will be tied to lending to euro-area non-financial corporations and households (excluding loans to households for house purchase).*

The ***Bank of England*** *and HM Treasury launched the Funding for Lending Scheme (FLS) in order to encourage lending to households and companies. The FLS offers funding to banks and building societies for an extended period. And it encourages them to supply more credit by making more and cheaper funding available if they lend more. Easier access to bank credit should boost consumption and investment by households and businesses.*

Back to Intro