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 provide 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)

⇒ Present explanation grounded in micro-economics of consumer credit markets
This Paper

- Impact on borrowing

\[ -\frac{dq}{dc} = -\frac{dCL}{dc} \times \frac{dq}{dCL} \]

- 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)
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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

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

= "Jump in outcome"
= "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
• 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 $\tau_j$ separately for each quasi-experiment $j$
  
  - Separate second-order local polynomial with Imbens-Kalyanaraman (2011) optimal bandwidth

- 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 × origination quarter fixed effects

- Standard errors constructing by bootstrapping over experiments
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MPB on “Treated” Card, After 12 months

- Pooled across all quasi-experiments, centered on cutoff
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
• Lower-FICO borrowers: 1-for-1 increase in total borrowing

• FICO > 740: No response in total borrowing ⇒ balance shifting
MPB Takeaway

Substantial heterogeneity in borrowing / spending behavior

- **FICO ≤ 660**
  - MPB of at least 50% on treated card
  - Not offset by decline on other cards
  - Corresponds to increase in spending on treated card

- **FICO > 740**
  - MPB of ≈ 15% on treated card
  - Completely due to balance shifting
  - Zero MPB despite significant borrowing on average

⇒ Stimulating borrowing requires credit expansion to low-FICO households
  - Not population parameters, but relevant group for stimulating consumption
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- 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
  - 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

\[
\begin{align*}
q'(CL)r + F'(CL) &= q'(CL)c + C'(CL) \\
=MR(CL) &= MC(CL)
\end{align*}
\]

\[\iff MP(CL) = 0\]
MPL

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

- Applying implicit function theorem to FOC yields

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

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Applying implicit function theorem to FOC yields

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

⇒ 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: $MC(CL) \gg AC(CL)$

- 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

Marginal Chargeoffs

- 660
- 661-700
- 701-740
- >740
Effect of $1K Increase in CL on Marginal Chargeoffs

Bar chart showing the marginal chargeoffs for different credit score ranges.
Marginal Profit at 48 Months

-2  -1.5  -1  -0.5  0

£ 660 661-700 701-740 >740
Effect of $1K Increase in CL on Marginal Profit

Marginal Profit

-0.2
-0.15
-0.1
-0.05
0

£ 660 661-700 701-740 >740
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 segment
  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 × 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.

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

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

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

Back to Research Design
A1: Credit Limits Change at Cutoffs

• Distribution of first-stage across 743 quasi-experiments
Persistence of Credit Limits

![Graph showing the persistence of credit limits over months after origination for different credit score ranges. The graph plots credit limits against months after origination, with different symbols and line styles representing different credit score ranges: <= 660, 661-700, 701-740, and > 740.](image)

Back to First Stage
• Own-card effect due to additional spending, not slower pay-down of debt.

• BUT: Do not have good measure of total spending ...
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.