

# Unraveling Consumer Credit Markets

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## Contributions:

- Study an unraveling in information sharing due to innovation.
- Unravel how profitability depends on multiple sources of information asymmetry.
- Adverse selection of information sharing.
- New empirical insights on credit markets  
(distribution & predictability of consumer behaviors driving realized profitability).

## Why should you care?

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- How about one from?  
American Express, Bank of America, Chase, Capital One, Citi, Discover
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  - Public Economics & Market Design: Regulation
  - Finance: Economics of Credit Cards & Credit Information

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  - Finance: Economics of Credit Cards & Credit Information
  - Sorry no labor...

# Roadmap

- Credit Card Behaviors (Accounting)
- Unraveling Innovation (Innovation)
- Adverse Selection in Reporting (Information)
- Predicting Credit Card Behaviors (Marketing)
- Installment Loans

## Credit Card Behaviors

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## Credit Cards Revenues Explained

$t = 0$ : \$0 statement balance

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- \$1,000 new spending ( $\rightarrow$  generates \$5 net interchange revenue)
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- \$2,777 statement balance & \$55 minimum payment due

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$$\text{spending}_t = \text{balance}_t - \text{balance}_{t-1} + \text{repayment}_t - \text{fincharge}_t$$

$$\text{debt}_t = \text{balance}_{t-1} - \text{repayment}_t$$

# Credit Card Profitability Uncertain: Multiple Dimensions of Information Asymmetry & Revenue Streams

$$\text{spending}_t = \text{balance}_t - \text{balance}_{t-1} + \text{repayment}_t - \text{fincharge}_t$$

$$\text{debt}_t = \text{balance}_{t-1} - \text{repayment}_t$$

Credit cards have multiple revenue streams.

Profitability ultimately depends on ex-post consumer behaviors:

- Revolving debt amount & duration → interest income
- Delinquency → charge-offs
- Late fees (Agarwal et al., 15 QJE; Nelson, 22 WP)
- Spending → interchange income.

If  $\text{repayment}_t$  unobserved, do not know  $\text{spending}_t$  or  $\text{debt}_t$

Will model profitability ft. new methodology estimating  $\text{fincharge}_t$

# Predicting Credit Card Profitability is Hard!



how predictable is credit card profitability



Credit card profitability is a complex and multi-dimensional concept that depends on a variety of factors, including customer behavior, credit risk, interest rates, fees, and operating costs, among others. Therefore, it can be challenging to predict credit card profitability with high accuracy.



Empirically, if *repayment<sub>t</sub>* unobserved, introduces noise...especially for spending



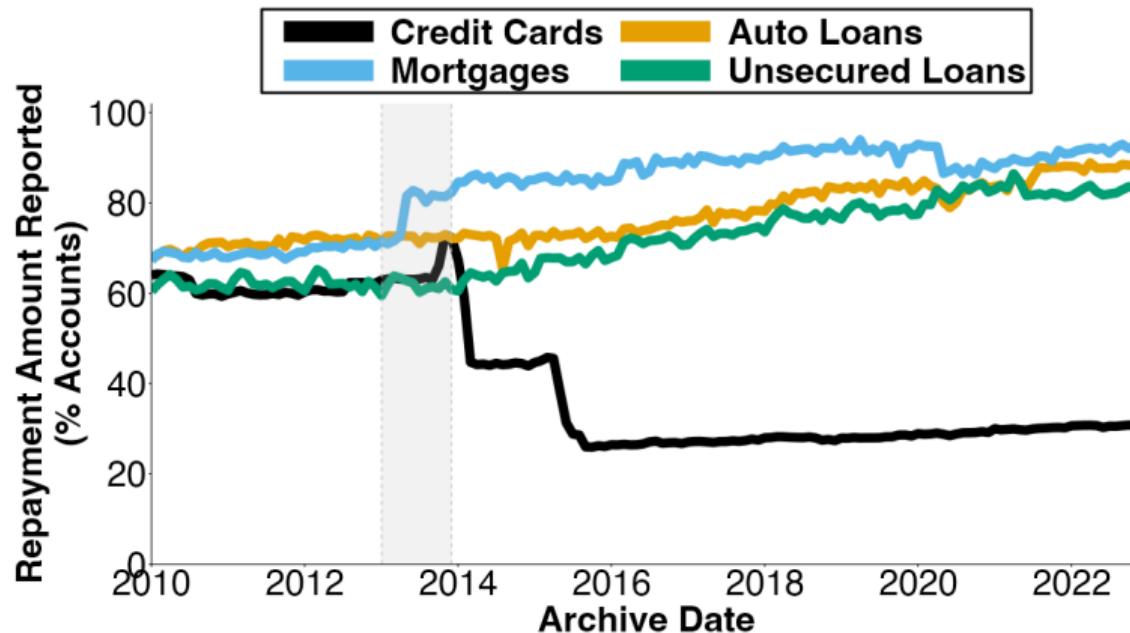
Simple OLS Regression:

$$Y_{i,t} = \alpha + \beta_1 balance_{i,t} + \beta_2 balance_{i,t-1} + \beta_3 \Delta balance_{i,t} + \beta_4 1\{balance_{i,t} > 0\} + \beta_5 \Delta 1\{balance_{i,t-1} > 0\} + \varepsilon_{i,t}$$

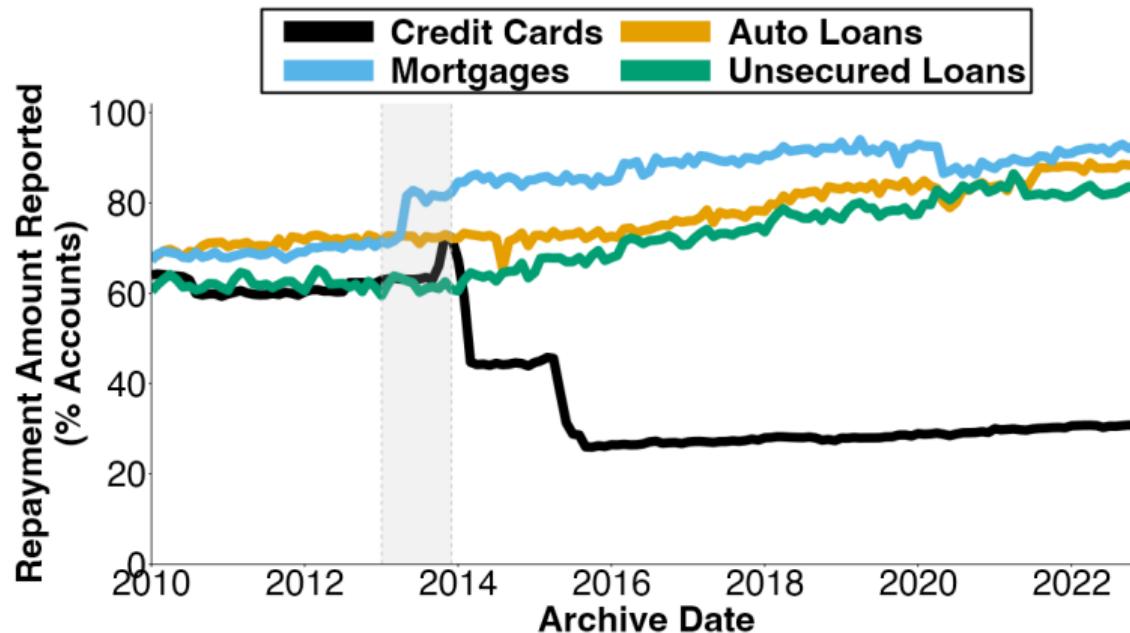
## Unraveling Information Sharing

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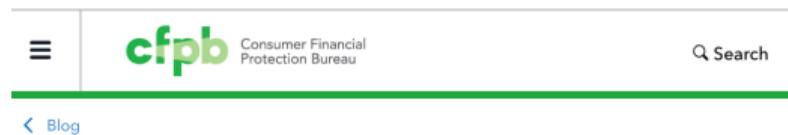
# Unraveling in Credit Card Reporting of repayments amounts to US Credit Bureau



## Unraveling in Credit Card Reporting of repayments amounts to US Credit Bureau



No unraveling in UK or Canadian credit information markets.



## CFPB tells credit card CEOs: Practice of suppressing payment data has potential for consumer harm

By John McNamara - MAY 25, 2022

- **Non-Reporters:** American Express, JPMorgan Chase, Citibank, Bank of America, Capital One, Discover.
- **Of these:**
  - 2 never report
  - 1 stopped in 2014
  - 3 later stopped (1x 2014, 2x 2015)

# Innovation

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## 'Core / Non-Payment Data'

- statement balance
- minimum payment due
- delinquency status
- credit limit
- opening date

**Actual repayments** unraveled.

Installment loans (e.g. auto loans, mortgages, unsecured loans) also show:

- origination amount
- scheduled term

Can recover installment loan interest rates (Shahidinejad, 22 WP; Yannelis & Zhang, 22 WP)

## Credit Bureaus Created Innovation in 2013: “Trended Data”

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July 2, 2020

# What is Trended Data and Why Should I Care?

[News](#)

## Trended Data reveals consumer heterogeneity - *especially* for credit cards

Traditional credit reports create point-in-time variables  
(e.g. current balance, any delinquency in last 7 years).

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– especially combining payments data with balances.

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Trended Data creates variables using credit reports over time (trends!)  
– especially combining payments data with balances.

- Reveals **credit cards** behaviors  
driving profitability beyond delinquency.

- Revolving debt.
- New spending.
- Interest rates.

## Premium Algorithms

Understand key consumer behavior patterns such as revolving credit, balance build, loyalty and product preference to enhance strategies



Reveals *not just* credit risk but *who* profitable consumers are.

## Trended Data w Bureaus Created Innovation in 2013: “Trended Data”

- New Information Revealed from Data
- Cost Reduction: Technically firms could construct from raw data themselves. In practice they did not. Why?

- Technological constraints:

“It took us time just to build the infrastructure to house the data.”

(Equifax Earnings Call 2013)

- Cost constraints:

Data sold on per archive basis (& typically at consumer-level). Previously needed 24 trade archives, now 1 consumer-archive.

## Trade-offs of sharing data non-reciprocally

### Benefits of Sharing

1. Technology
2. Reduce Information Asymmetries

### Costs of Sharing

1. Short-Run Poaching
2. Long-Run Increased Competition

#### Pre-Trended Data:

Incumbent with market power non-reciprocally shares partial data to foreclose on aggressive poaching by entrant if adverse selection (Brouckaert & Degryse, 06 EJ)

#### Post-Trended Data:

Consumer switching costs ↓, incumbent ↓ information sharing.

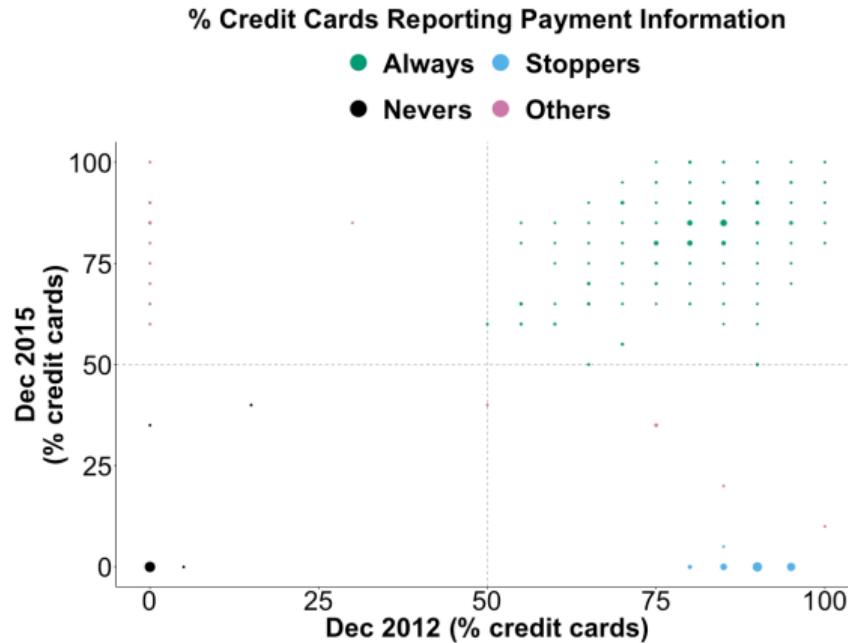
N.b. work-in-progress adapting to market structure.

Moral hazard versions (Padilla & Pagano, 97 RFS; Gehrig & Stenbacka, 06 EER)

## Adverse Selection in Reporting

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# Unraveling Driven By Some Credit Card Lenders **Stopping** Reporting



**Always:** Share payments data in 2012 & by 2015.

**Stoppers:** Share payments data in 2012 but not by 2015.

**Nevers:** Never share payments data in 2012 & by 2015.

**Others:** Everyone else.

Firm A: "Doesn't believe benefits outweigh proprietary interests."

Firm B: "Other major issuers were no longer providing this information... left at competitive disadvantage".

## Selection in Reporting Repayments Data

Always < Stoppers < Nevers

	Always	Stoppers	Nevers
Credit Score (S.D.)	720.53 (87.54)	719.62 (89.96)	743.32 (77.03)
Tenure (S.D.)	69.85 (81.21)	96.49 (83.40)	145.96 (120.84)
Credit Limit (S.D.)	8615.89 (7659.00)	9508.78 (9528.84)	10397.93 (9520.58)
Statement Balance (S.D.)	2204.53 (3811.80)	2426.43 (4279.58)	2580.47 (4852.06)
Utilization (S.D.)	0.36 (0.39)	0.39 (0.41)	0.30 (0.35)
Δ Statement Balance (S.D.)	266.29 958.96	294.64 1171.50	364.36 1524.48

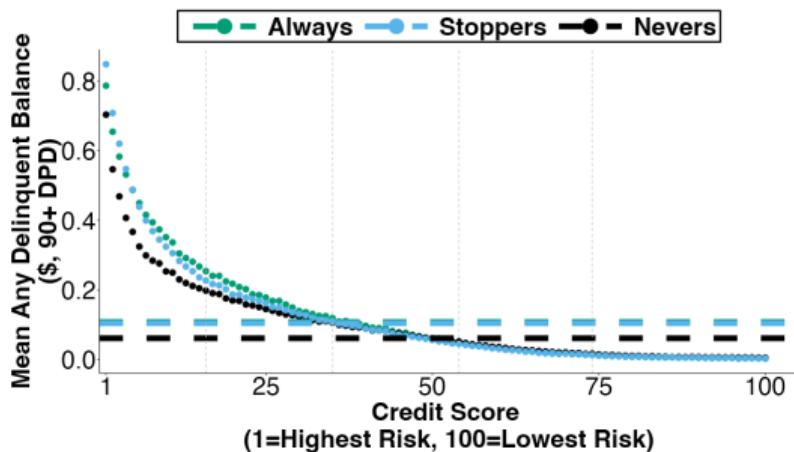
## Adverse Selection in Reporting Repayments Data *Residual* of Credit Risk: **Always < Stoppers < Nevers**

	Always	Stoppers	Nevers
Residual Tenure	-35.87	-9.34	32.90
(S.D.)	(78.27)	(79.72)	(116.83)
Residual Credit Limit	-710.27	185.62	134.99
(S.D.)	(6720.39)	(8536.33)	(9317.46)
Residual Statement Balance	-313.73	-74.73	278.08
(S.D.)	(3651.87)	(4145.36)	(4633.57)
Residual Utilization	-0.01	0.01	-0.01
(S.D.)	(0.26)	(0.28)	(0.27)
Residual $\Delta$ Statement Balance	-44.63	-13.68	43.81
(S.D.)	956.12	1167.17	1521.42

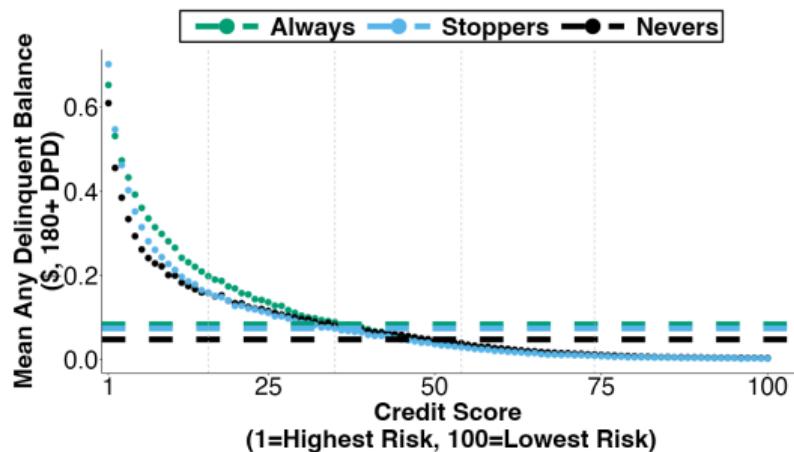
# Credit risk *not* main reason for differential reporting

Lenders Have Similar Delinquency Rates Conditional on Credit Score.

90+ Days Delinquent

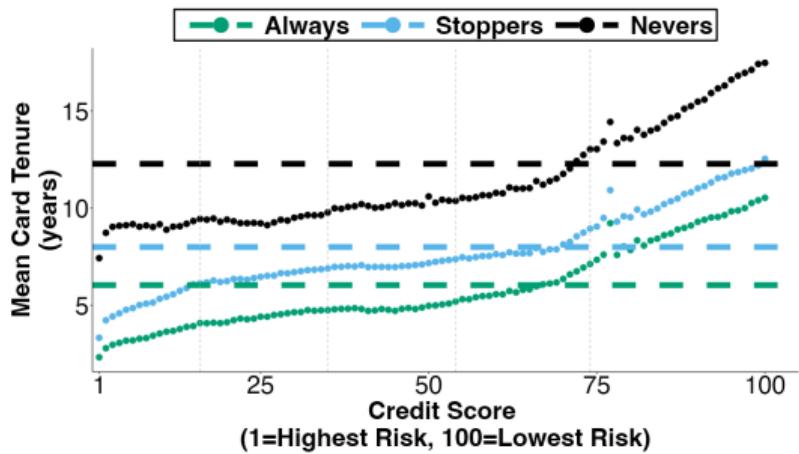


180+ Days Delinquent

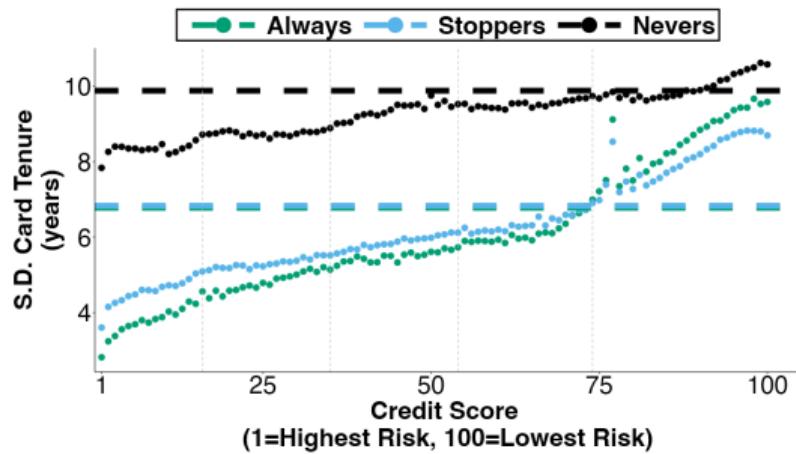


# Lenders Have Different Card Tenure for Given Risk: Impact Lifetime Profitability

Mean



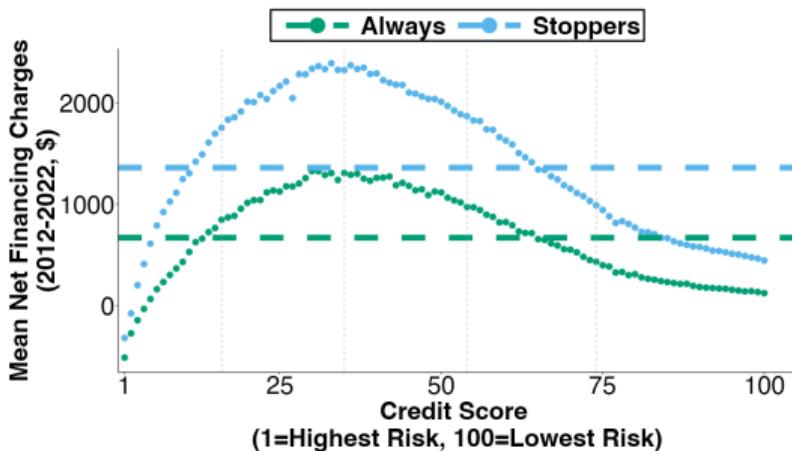
S.D.



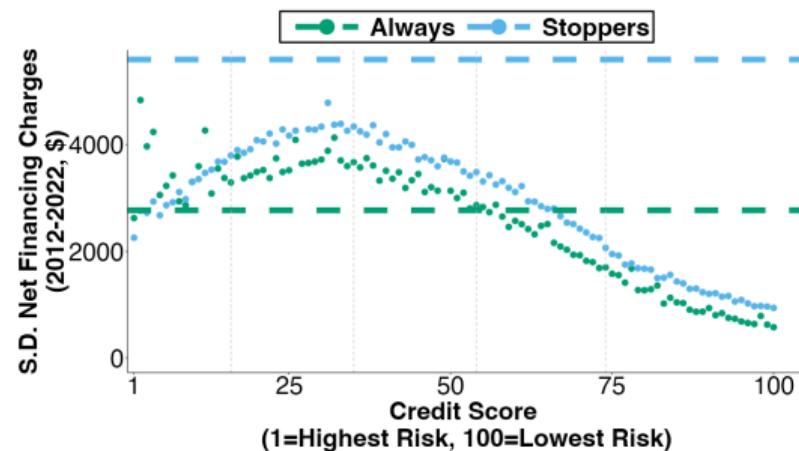
- Agarwal et al., (15 QJE, 22 WP) studies point-in-time profits.
- Nelson (17 WP) structurally estimates lifetime net financing charges.

# Always & Stoppers : Financing Charges - Charge-Offs (2012 to 2022)

Mean



S.D.



New methodology for deriving financing charges (annual means matches Agarwal et al., 15 QJE, 22 WP).

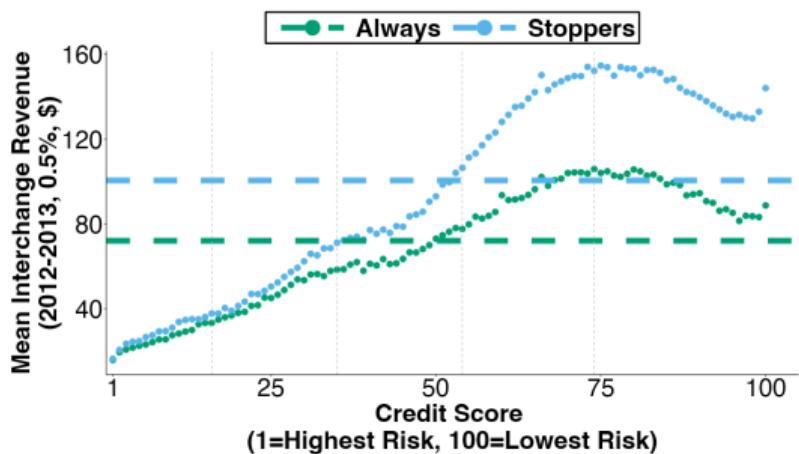
Minimum payment ( $M_t$ ) are calculated deterministically by formula such as:

$$M_t = \max\{\$D, I\% \text{ balance}_t + \text{interest}_t + \text{fees}_t\}$$

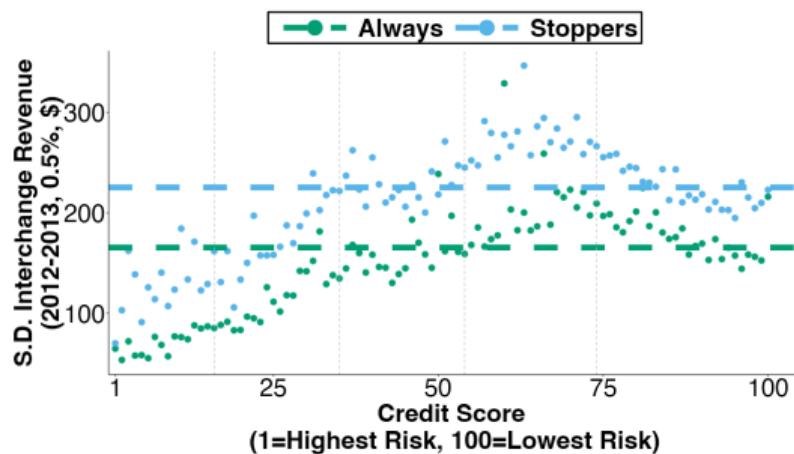
*Observed minimum payment - predicted minimum payment = financing charges.*

# Always & Stoppers: 0.5% Spending Interchange Net of Rewards (2012 to 2013)

Mean



S.D.



## Predicting Profitability

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## *How Predictable* are Consumer Behavior & Profitability?

Firm's problem is predicting profitable types to target marketing to.

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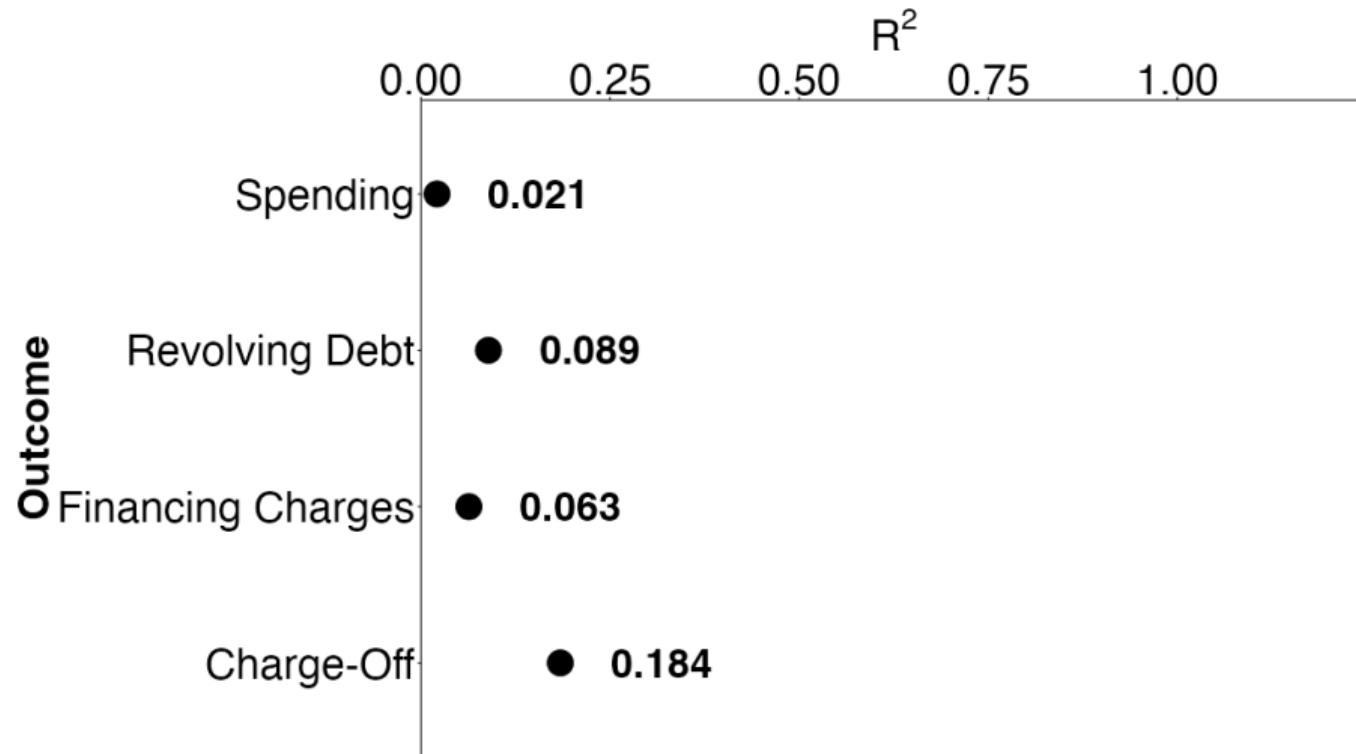
Models:

1. Credit Score (100 groups)
2. Credit Score + Non-Payment (e.g. credit limit, statement balances, utilization, delinquency)
3. Credit Score + Non-Payment + Payment (e.g. spending, revolving debt)

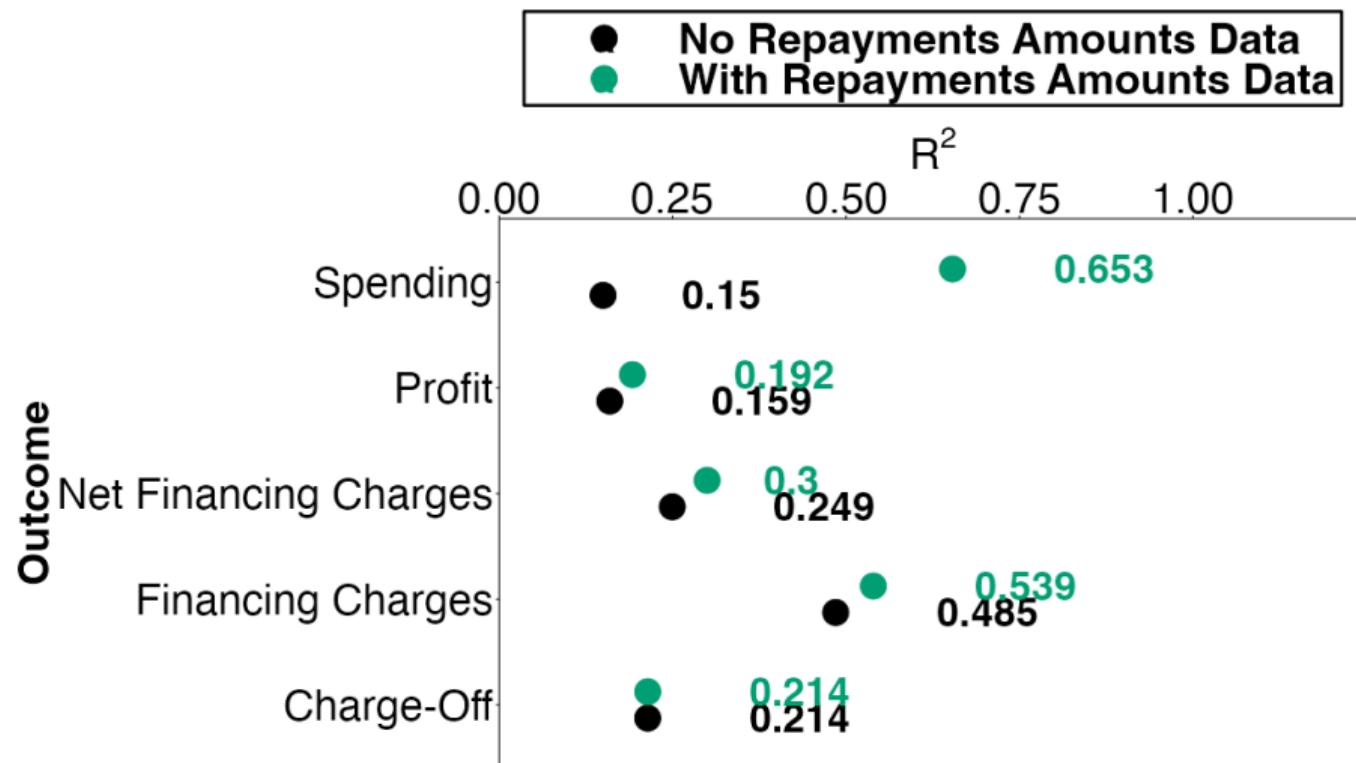
Use data to December 2012 to predict outcomes.

Show out-of-sample  $R^2$ .

## Credit Scores Alone Poor Predictor of Spending & Revolving Debt



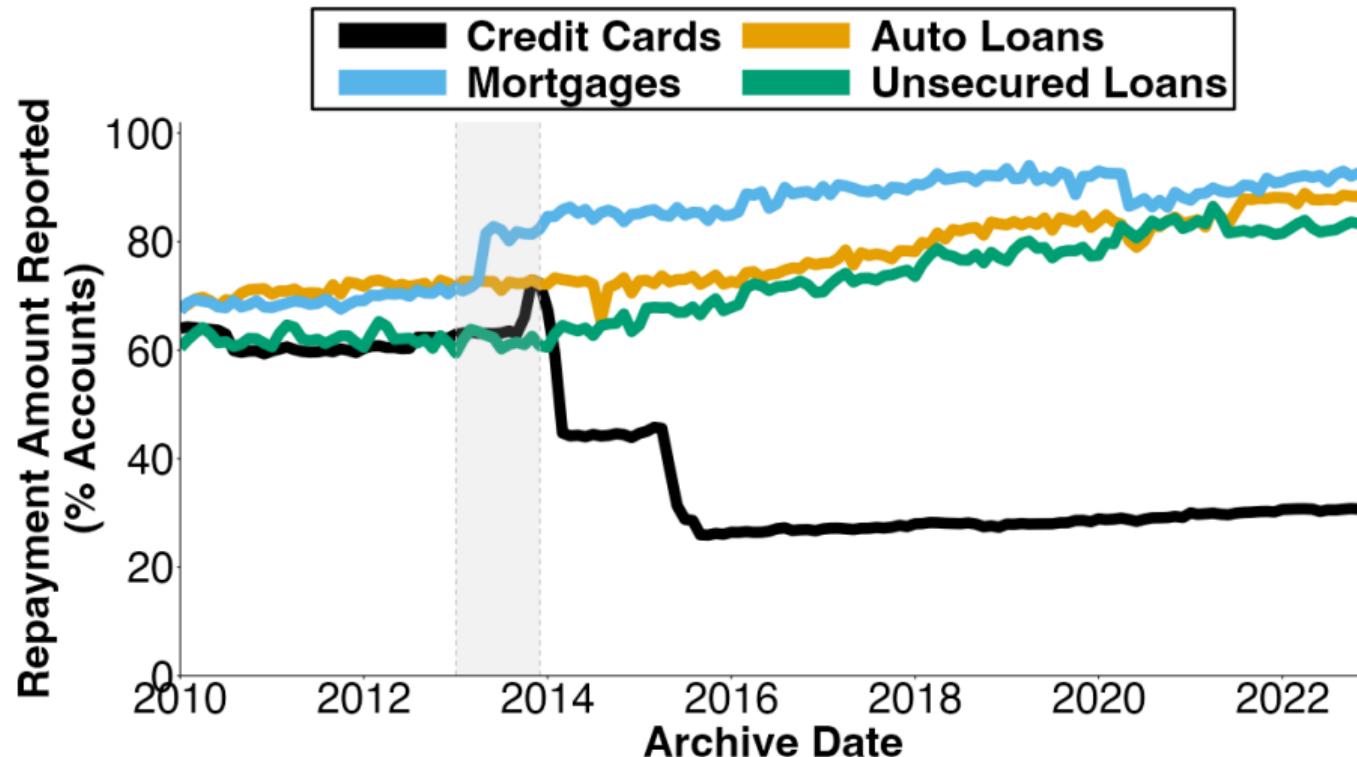
# Repayments Data Predicts Profitability: Especially Spending Driving Interchange Revenue



## Why Other Credit Products Didn't Unravel?

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Reminder: Auto Loans, Mortgages, Unsecured Loans, did Not Unravel

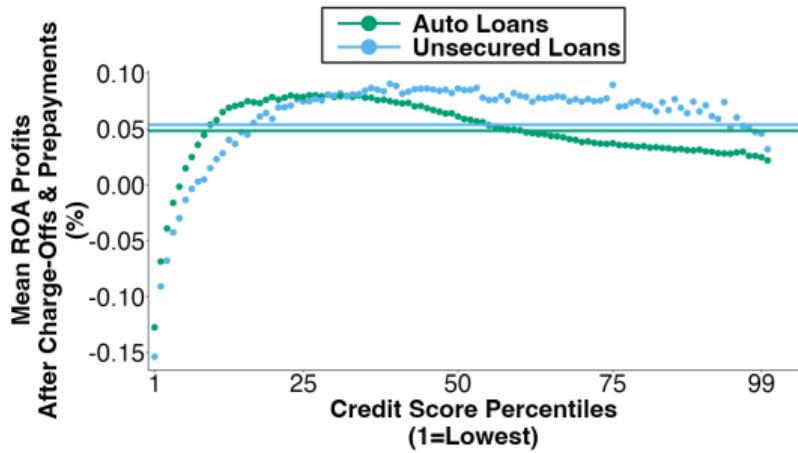


## Ex-Post Profitability in Auto Loans and Unsecured Personal Loans Depends on (i) Charge-Offs (ii) Prepayments

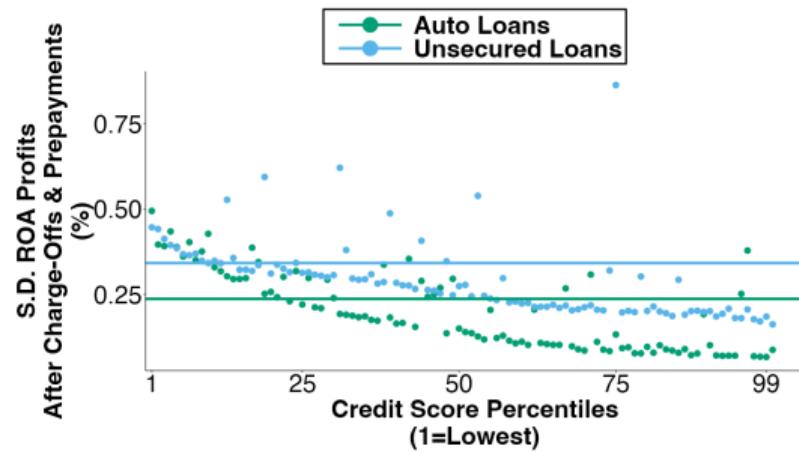
	Auto Loans	Unsecured Loans	Credit Cards
Collateral	Secured		Unsecured
Life		Fixed-Term	Open-Ended
Revenue Streams		Financing Charges (Interest, Fees)	Financing Charges (Interest, Fees), Interchange
Risks		Delinquency, Prepayment	Delinquency, Revolving Amount & Duration Spending

# Installment Loan Ex-Post Profits

Mean



S.D.



$$ROA = \frac{\Pi}{A} = \frac{(P \times \frac{T}{N}) - C}{A}$$

where  $ROA$  is Return on Assets,  $A$  is loan principal,  $\Pi$  is ex-post realized profits,  
 $P$  is scheduled monthly payments,  $C$  is charge-offs,  
 $T$  is actual loan months (restrict to  $T \leq N$ ),  $N$  is scheduled loan months.

## Auto Loans & Unsecured Very Different Markets, But Results Consistent

'Repayment amount' does little to improve prediction of post-origination behaviors (charge-offs, prepayment) and so does not help targeting of profitable consumers.

Model	$R^2$ Predicting Profits (\$) After Charge-Offs & Prepayments	
	Auto Loans	Unsecured Loans
1. Credit Score	0.019	0.014
2. Credit Score + Core Variables	0.376	0.952
3. Credit Score + Core Variables + Actual Payment	0.382	0.954

## Conclusions

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## Interim Conclusions

- Unraveling driven by innovation (Trended Data) enhancing profitability prediction.
- Unraveling due to multiple sources of information asymmetry (spending & revolving debt) beyond credit risk.
- Credit card market – and especially subset of lenders – most affected: large dispersion in profitability & predictability.
- Large unraveling in credit cards and not installment-based credit products (e.g. autos, mortgages) where less information asymmetry beyond credit risk & innovation less disruptive.
- Lenders most affected stopped reporting data input (payments data) innovation relied on to foreclose on competitors.
- Requiring firms to report data improves market efficiency (based on credit limit reporting).

Thank you!



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## Appendix

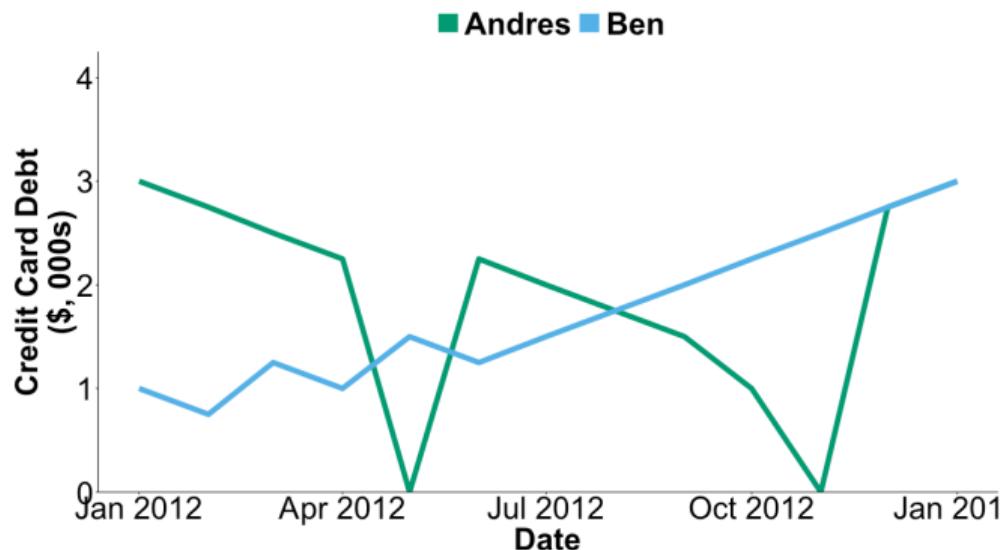
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## What is “Trended Data”?

Trended Data uses up to 30 months of data:

- Trends in balances, credit utilization, payments.

Example: Jan 2013 (**Avocado**) Andrés & (**Blue**) Ben same credit card debt but...  
Trended Data reveals **Andrés** repays their debt unlike **Ben**.



## How Is Trended Data Marketed & Used?

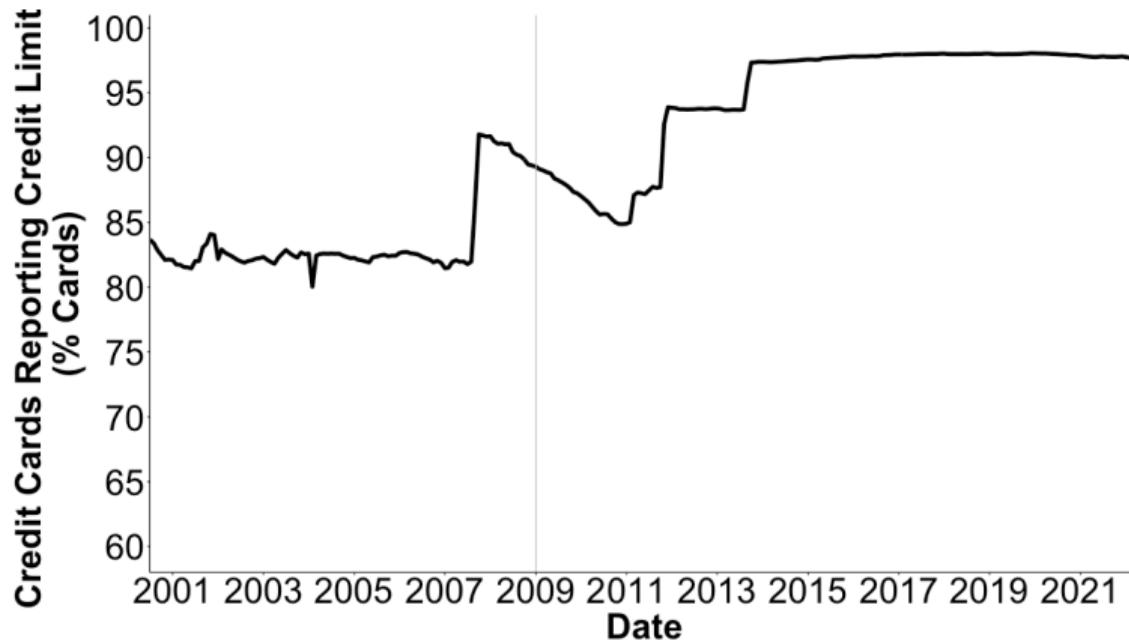
- Market response to CARD Act that limited fees (Agarwal et al., 15) & interest (Nelson, 22). Interchange fees increasingly important revenue stream.
- Mainly appears useful for **targeted marketing**:  
*“Helps Clients...calculate profit by providing an estimate of consumer spend...prioritize marketing investments and target higher spending consumers...optimize enhanced value propositions to the right spending segments.”* - Experian.  
*“A national bank wanted to build more market share and also proactively target consumers who are more likely to be high spenders in the next 12 months. They needed a solution to more accurately predict propensity to spend while creating profitable returns on marketing investments.”* - Equifax.
- Some **credit risk** benefit:  
*“Including trended data materially improved modeling of loan performance.”*  
- Fannie Mae (consistent with Equifax, Experian, TransUnion, FICO & VantageScore).

## Appendix: Market Design

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# Exogenous Increases in Credit Card Credit Limit Reporting (2007, 2011, 2013)

- Driven by FTC



Learn what happens when firms are forced to share.

# Effects Of Unraveling On Market

- Trended Data Appears Efficient Innovation  
(e.g. Fannie Mae (2016), VantageScore 4.0 (2017), & FICO 10 (2020))
- Non-Reporting & Unraveling Inefficient  
(Adverse Selection of Servicers)

## Market design solutions?

### A. Ban Use Of Credit Files For Marketing

- No unraveling in reporting in UK or Canada where this system occurs.
- Unclear welfare impact (less marketing vs. improved credit risk)

### B. Reciprocity: Only able to use payments data if share payments data (UK system).

### C. Regulatory Requirement

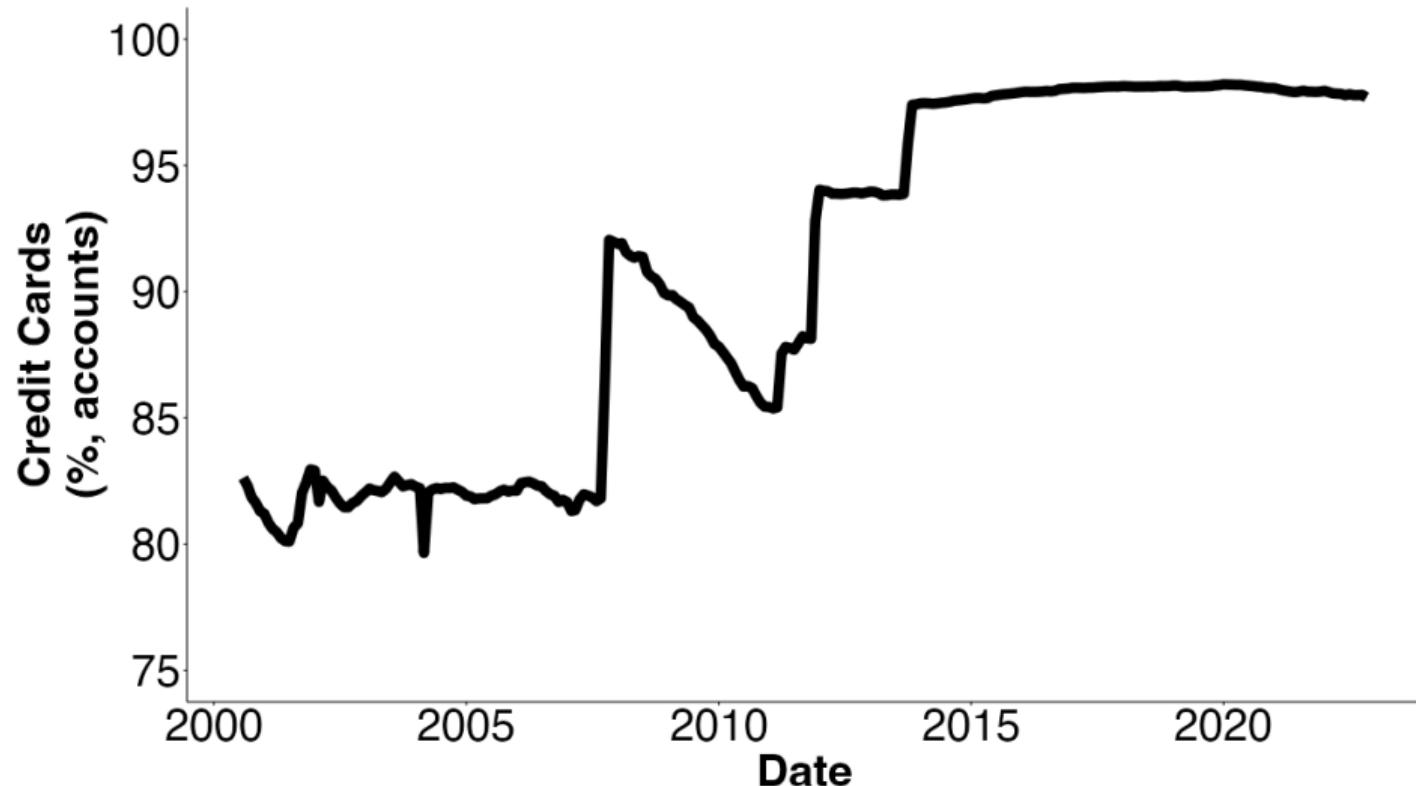
- Regulatory: CFPB / Fed / Treasury “require” reporting as done with credit limits.  
(via ‘soft’ supervisory power or ‘hard’ law)

# Understanding Credit Reporting

What would be the effects of a counterfactual regulation requiring credit card lenders to report data?

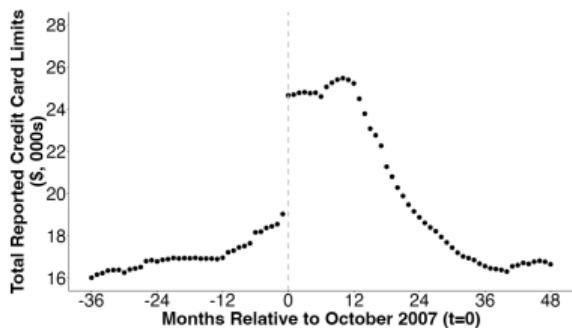
1. Market effects of reporting (efficiency, strategic reactions, competition).
2. Effects on consumer outcomes (credit score, credit access).
3. A new source of exogenous variation other researchers can use more broadly.
4. Clean empirical application of seminal theoretical finance literatures on (i) relationship lending (inside vs. outside) and (ii) credit reporting.

## Credit Card Credit Limit Reporting

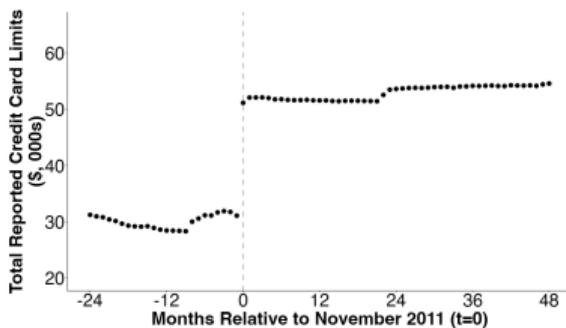


### 3 Events of Lenders Starting Reporting of Credit Card Credit Limits

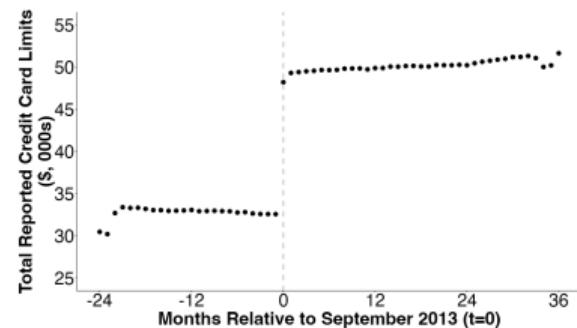
2007  
14.00 mn



2011  
12.85 mn consumers



2013  
5.70 mn



FTC action (announced 2009, in rules 2011) required firms to report credit limits  
(if firms decide to voluntarily report data to bureaus).

Fair and Accurate Credit Transactions Act (FACTA 2003, Revised 2011).

## What Does Credit Limit Reveal?

**Utilization Behavior:** Key input to credit scores.

- If credit limit not reported, highest historical balance is utilization denominator.

Lenders can use to inform consumer's **expected profitability** for poaching. Learn about:

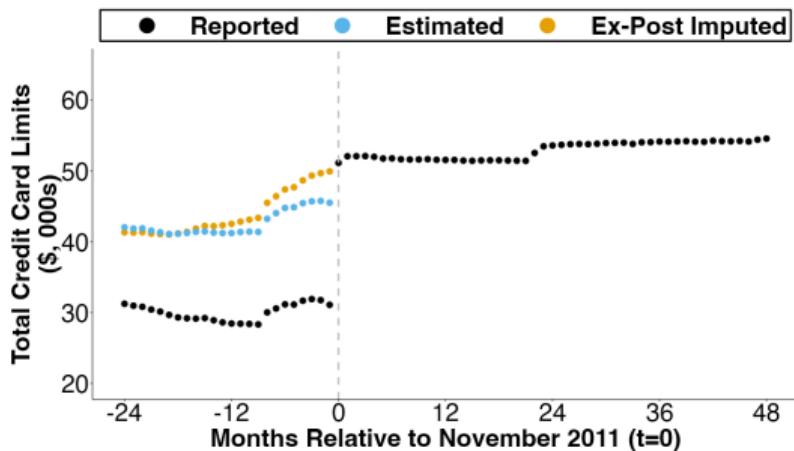
1. Consumers' behavioral type.
2. Credit limit their competitors (who have private information) are willing to extend.

N.b. as shown previously, credit utilization reveals very little about spending and not much about revolving behavior.

# Credit Card Credit Limits

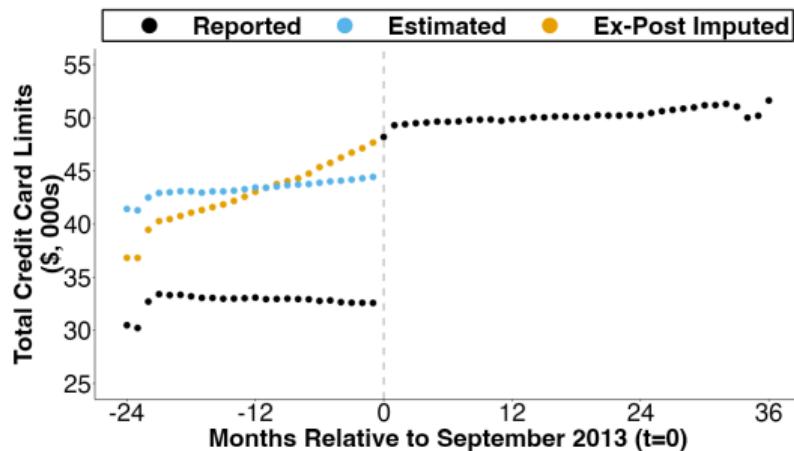
2011

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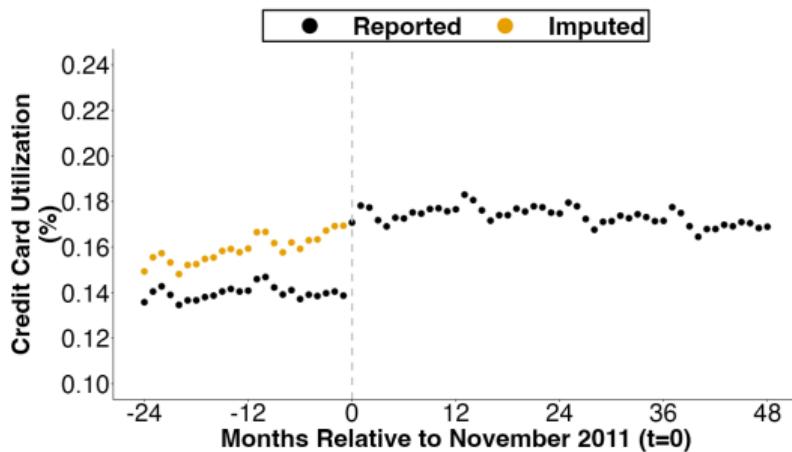


- **Reported:** Credit limit amount reported.
- **Observed:** Highest statement balance amount previously reported on tradeline.
- **Imputed:** Take reported credit limit at t=0 and impute for pre-periods where tradeline open.

# Credit Card Utilization

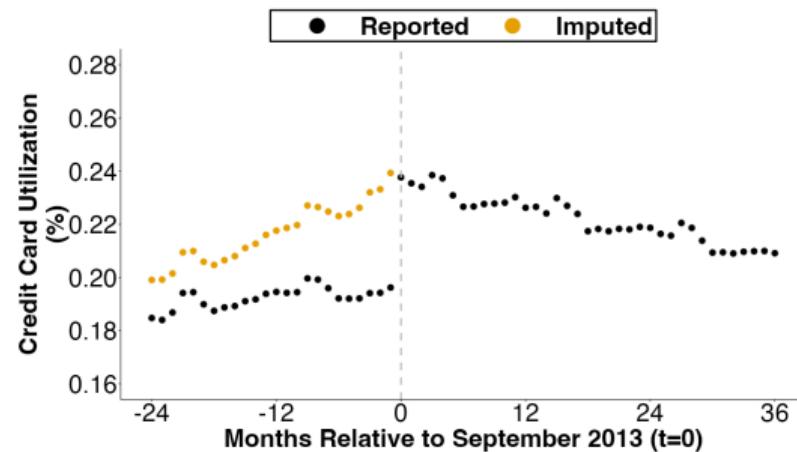
2011

12.85 mn consumers



2013

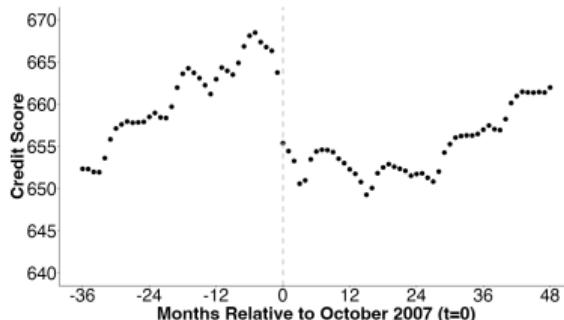
5.70 mn



## Credit Score

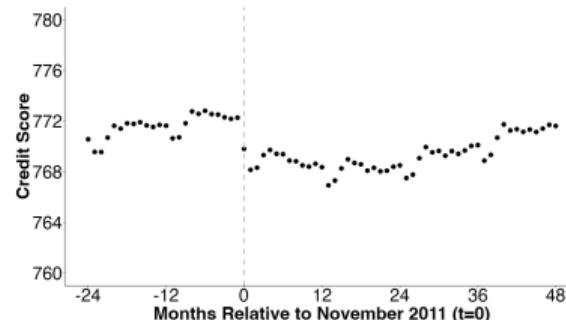
2007

14.00 mn consumers



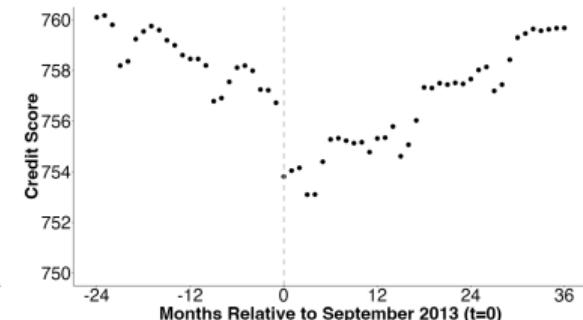
2011

12.85 mn consumers



2013

5.70 mn

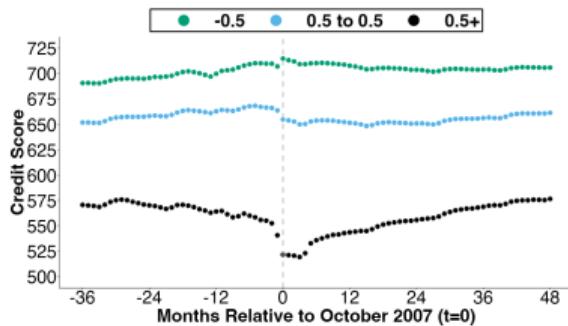


- Lower score as more utilized than observed using highest historical statement balance.
- Must mean highest historical statement balance > current credit limit.
- i.e. Limits on these cards declined (on average). Makes sense given crisis timing.

# Credit Score

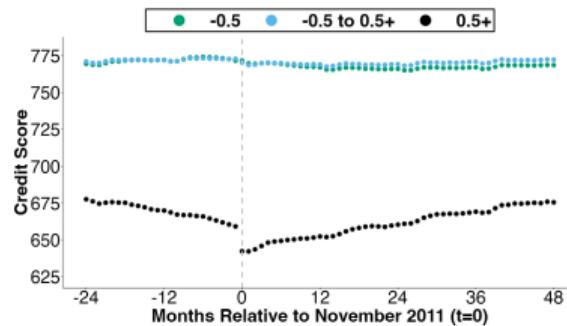
2007

14.00 mn consumers



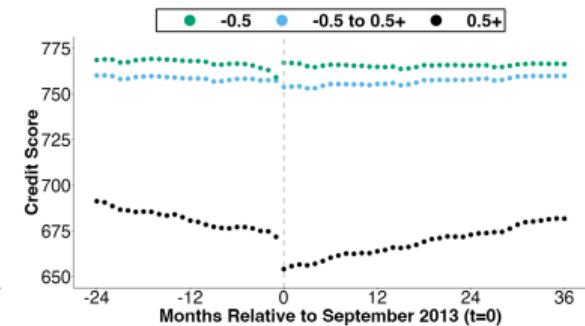
2011

12.85 mn consumers



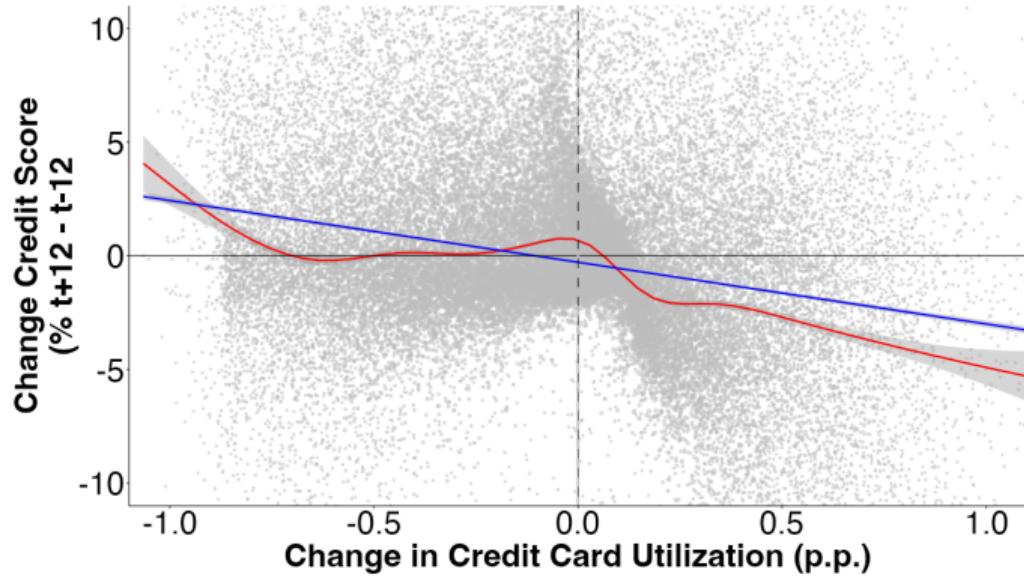
2013

5.70 mn consumers



HTE by change in utilization:  $\frac{Balance_{t-1}}{CreditLimit_t} - \frac{Balance_{t-1}}{HighBalance_{t-1}}$

## $\Delta$ Utilization x Credit Score



HTE by change in utilization:  $\frac{Balance_{t-1}}{CreditLimit_t} - \frac{Balance_{t-1}}{HighBalance_{t-1}}$

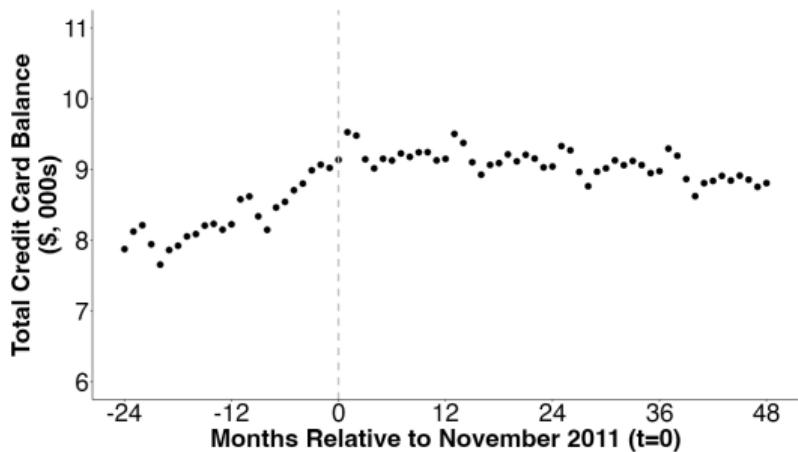
i.e. how much *new* information

- will do other HTE cuts (e.g. \$ limits, portfolio utilization, credit score).

# Credit Card Statement Balance

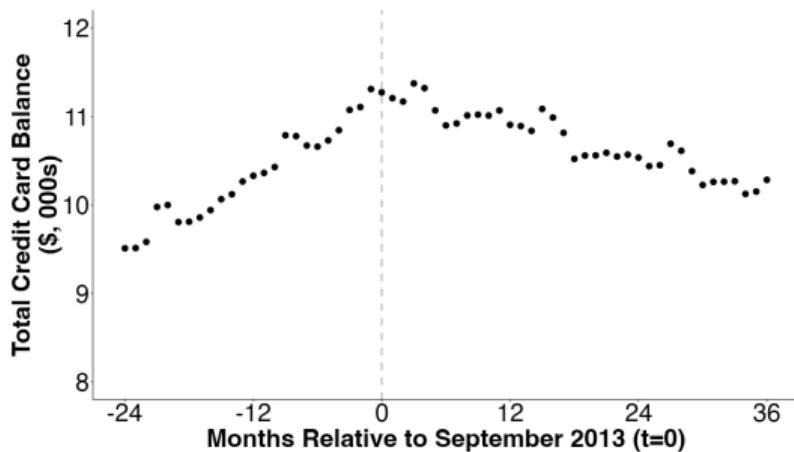
2011

12.85 mn consumers



2013

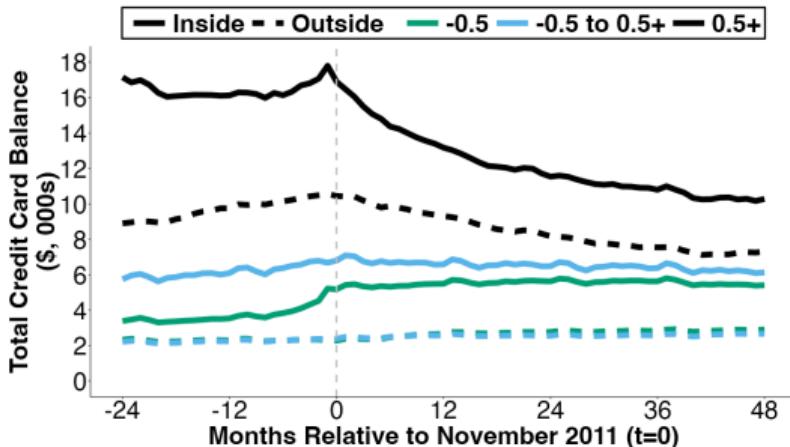
5.70 mn



# Credit Card Statement Balance

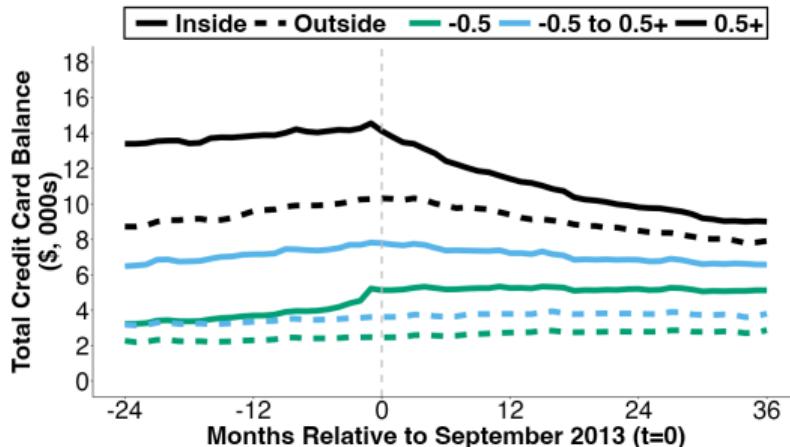
2011

12.85 mn consumers



2013

5.70 mn

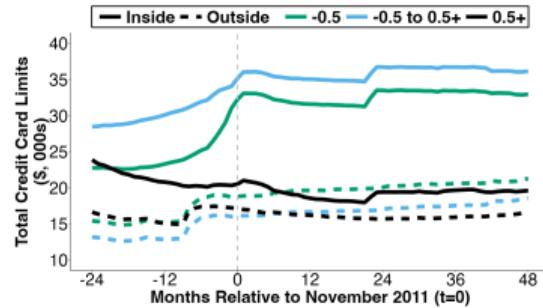


- HTE by change in utilization:  $\frac{Balance_{t-1}}{CreditLimit_t} - \frac{Balance_{t-1}}{HighBalance_{t-1}}$
- **Inside:** Lenders who started reporting credit limits. **Outside:** All other lenders.

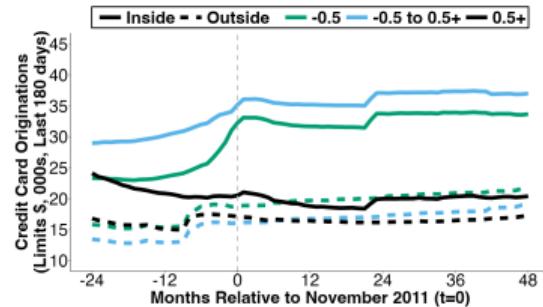
# Credit Card Credit Limits

2011

Credit card limits (portfolio).

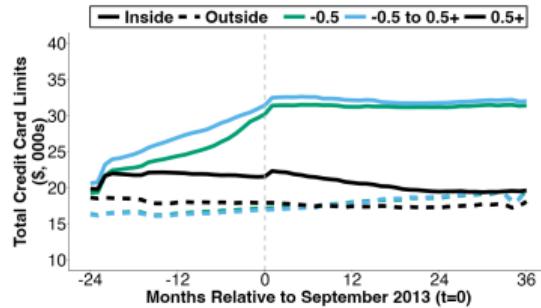


Credit card limits (originations).

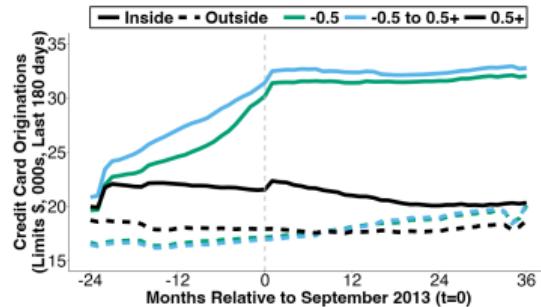


2013

Credit card limits (portfolio).



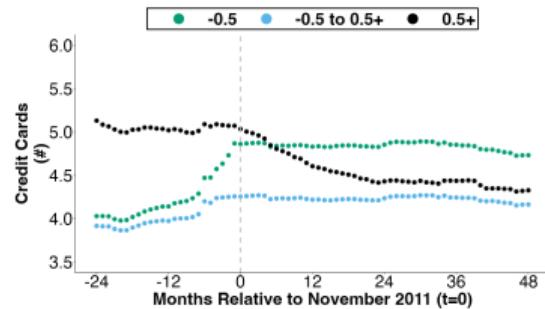
Credit card limits (originations).



# Number Credit Cards

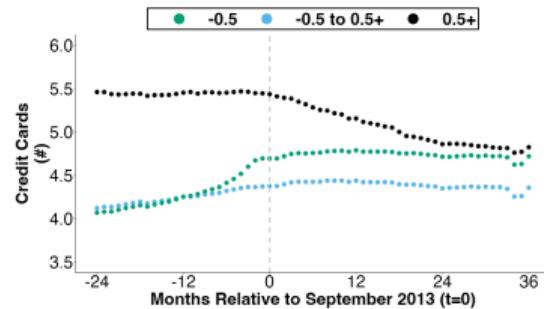
2011

Number credit cards (portfolio).

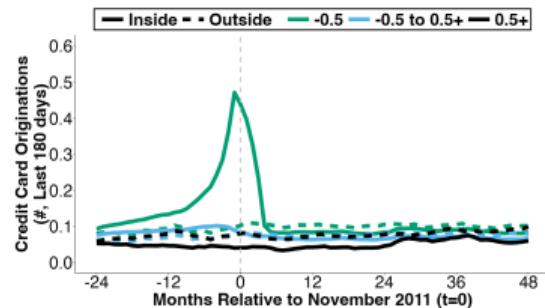


2013

Number credit cards (portfolio).



Number credit cards (originations).



Number credit cards (originations).

