Unraveling Information Sharing in Consumer Credit Markets

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Thanks to NBER and Chicago Booth's Fama-Miller, Kilts, & Stigler Centers for supporting this research.

Breakdown in information sharing

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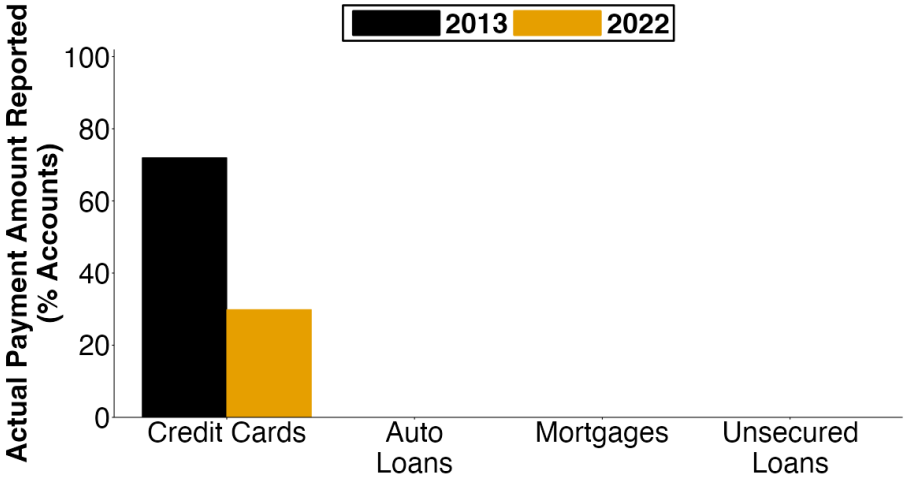
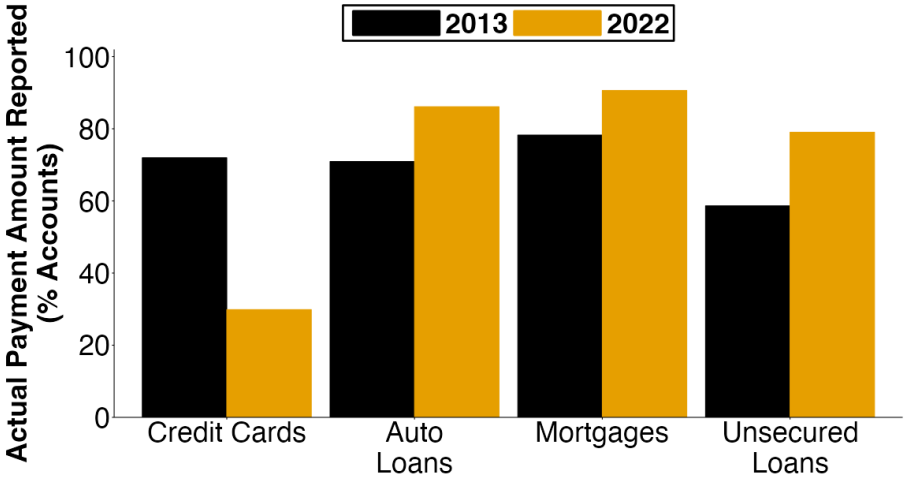


Breakdown in information sharing in credit cards but not in other credit products



Study breakdown of information sharing in US consumer credit markets

Learn about the limits of voluntary information sharing in developed markets.

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What information is missing in YOUR credit report, why missing, its implications?

Four Parts to Paper

1. **Unraveling Information Sharing**
2. **Consumer Credit Profitability**
3. **Credit Card Lender Selection**
4. **Competitive Effects**

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- All four parts use US consumer credit reporting data (TransUnion at Booth Kilts)

Part 1. Unraveling Information Sharing

- Describe unraveling
- Institutional details of innovation ('Trended Data')
  - *"The most important tool developed...since the credit score."*
  - Innovation harnesses actual payment for revealing profitable consumers to target marketing
  - Unraveling an unintended response to innovation
- Difference-in-differences: innovation $\rightarrow$ information sharing
  - Credit cards as treatment group
  - Installment loans (auto loans, unsecured loans) as control group
  - $\downarrow$ 50 percentage point information sharing credit cards vs. installment loans
- Unraveling of market for sharing information

Part 2. Consumer Credit Profitability

- Framework for consumer credit profitability
- Measurement error by not observing actual payment data
  - 50% noise credit card spending
  - 5% noise revolving debt
- Predict profitability in credit cards, auto loans,& unsecured loans
  - New methodology to estimate financing charges
    using institutional feature of credit card minimum payments
  - Innovation $\uparrow$ predict profits
  - Innovation $\uparrow$ interchange revenue (and also financing charges)

- Only worst residual types remain sharing information (Akerlof-esque)
- Higher profitability and more dependence on interchange explains differential decisions
- Dominant strategy rather than co-ordination failure

Part 4. Competitive Effects

- Difference-in-differences: innovation $\rightarrow$ poaching
  - Heterogeneous exposure by % card balances
    with lenders sharing actual payment information.
  - More exposed $\rightarrow$ more information revealed $\rightarrow \uparrow$ credit cards.
- Difference-in-differences: effects of mandating information sharing
  - Federal Trade Commission (FTC) mandating credit card limit reporting
  - Heterogeneous exposure by institutional feature of utilization.
  - Control of unaffected cards with same lenders.
  - $\uparrow$ 43 point credit score
    - $\uparrow$ credit access
  - $\uparrow$ competition:
    - Before information revelation, incumbent inside lender originates more
    - After information revelation, outside lenders expand credit

Contributions to Literature

- **Household Finance:** Importance of (i) credit card spending (ii) predicting lifetime profits. (e.g., Ausubel, 91; Agarwal, Comsisengphet, Mahoney, & Stroebel 15; Stango & Zinman, 16; Mukharlyamov & Sarin, 19; Nelson, 23; Agarwal, Presbitero, Silva, & Wiz, 23; Wang, 23)
- **Financial Intermediation:** Sensitivity of credit market to poaching. (e.g., Diamond, 84; Ramakrishan & Thakor, 84; Pagano & Japelli, 93; Bouckaert & Degryse, 06; Huang, He, Zhou, 23; Blattner, Hartwig & Nelson, 23; Jansen, Nagel, Yannelis, Zhang, 23)
- **Information Economics:** Document information sharing breakdown in developed market. (e.g., Akerlof, 70; Rothschild & Stiglitz, 76; Roth & Xing, 94)
- **Methodological:** New methodology for estimating profitability including credit card financing charges. (e.g., Ganong & Noel, 20; Gross, Notowidigdo, Wang, 20; Shahidinejad, 23;Yannelis & Zhang, 23)

Roadmap

1. **Unraveling Information Sharing**
2. **Consumer Credit Profitability**
3. **Credit Card Lender Selection**
4. **Competitive Effects**

Why did actual payment information reporting to US credit bureaus unravel?

Key Findings:

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3. **Mandating information sharing can $\uparrow$ competition and $\uparrow$ credit access**

1.Unraveling Information Sharing

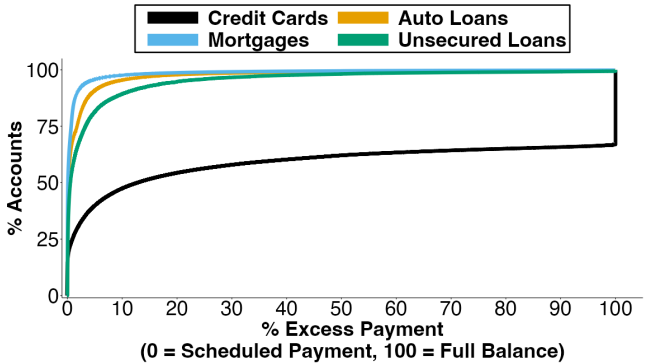
Data: University of Chicago Booth's TransUnion Consumer Credit Panel (BTCCP)

- BTCCP is TransUnion anonymized sample of US credit reporting data.
- Sample of 1 in 10 consumers with US credit reports.
- Monthly, individual credit tradelines + consumer-level data (e.g. credit scores).
- Anonymized consumer, trade, and furnisher identifiers.
- Apply standard data cleaning steps
  (Gibbs, Guttman-Kenney, Lee, Nelson, van der Klauuw, Wang, *AEA 2023 Panel / for JEL*)
- Lender heterogeneity studying 84 credit card furnishers (92-93%), of which 6 (66-67%).

No individual firms are identified in BTCCP data.

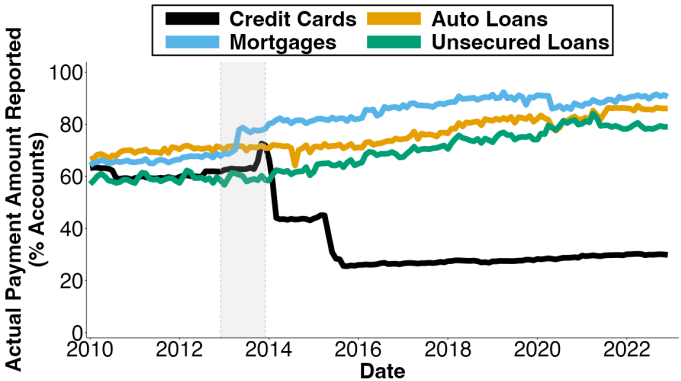
What Are Actual Payment (Amounts) Data?

Actual Payment Amounts	Scheduled Payment Amounts
How much paid	Minimum payment due



$$\% \text{ Excess Payment} = \frac{\text{Actual Payment Amounts - Scheduled Payment Amounts}}{\text{Balance}}$$

Breakdown in sharing credit card actual payment with US credit bureau



Also occurs in other US credit bureaus (Equifax & Experian).

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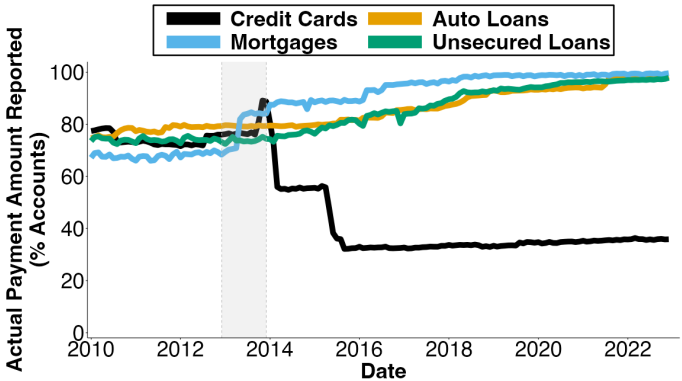
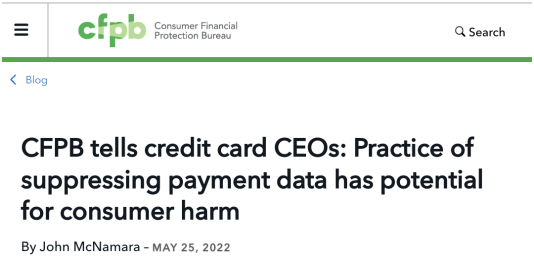


"None plan to furnish actual payment information voluntarily" (CFPB).

Policy relevant



CFPB documents:

- **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)

Some numbers

- Only 24% of credit cardholders have no missing data.
- 165 m consumers missing information.
- None of six largest credit card lenders report (2/3 market share)

Why is YOUR credit card lender not reporting information in YOUR credit report?

When your auto loan, mortgage, unsecured loan are!

Innovation

Institutional details on credit reporting data

Sharing information with US credit reporting agency is:

- Voluntary
- Non-Reciprocal

If share information, law (FACT Act, FCRA) requires:

- **Loan Terms:** origination amount, # payments, scheduled payment, open and close dates.
- **Loan Performance:** balance, delinquency status, and credit limit (post-2010).

Actual payment data not required by law.

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US credit reporting data used by lenders for:

- Credit risk (underwriting, portfolio management).
- Marketing (pre-selected credit offers)

Credit Bureaus Innovation Launched from 2013: "Trended Data"

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Trended Data creates a bundle of variables using credit reports over time (trends!)
– especially combining actual payment with balances.

"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.

Reveals heterogeneous credit cards behaviors driving profitability.
Use for targeted marketing & credit risk.

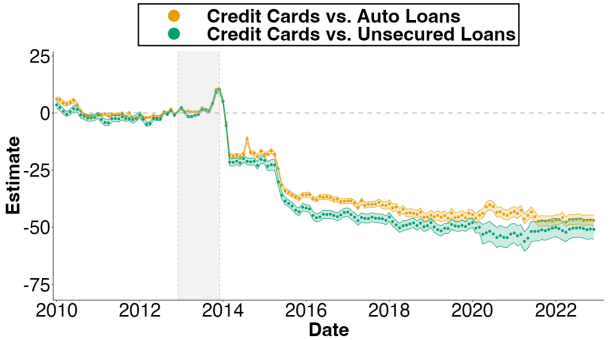
"Trended Data" is technological advance ↑ information from data

- **New information revealed** from data
- **Cost reduction:** Technically lenders 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 2013)
  - **Legal constraints:**
  compliance concerns prevented lenders constructing trended data.
  - **Cost constraints:**
  constructing trended data would mean purchasing 24 archives.

Difference-in-Differences Effect of Trended Data on Reporting

Credit cards more exposed as use for pre-selected marketing

↓ 47.1 to 51.0 p.p. in reporting credit cards vs. auto loans / unsecured loans



$$Y_{s,t} = \sum_{\tau \neq \text{Dec 2012}} \delta_\tau \Big(D_\tau \times CRED_s \Big) + \gamma_s + \gamma_t + \varepsilon_{s,t}$$

Unraveling of actual payment data is US-specific

Actual payment data remain reported in UK and Canada post introducing Trended Data.

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Why?

- **UK** Principles of Reciprocity by industry body Steering Committee on Reciprocity:
  (i) bans use of credit files for pre-selected marketing to individuals
  (ii) reciprocality in sharing data

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Why?

- **UK** Principles of Reciprocity by industry body Steering Committee on Reciprocity:
  (i) bans use of credit files for pre-selected marketing to individuals
  (ii) reciprocality in sharing data
- **Canada** has limited use of credit files for marketing e.g. can use for geographic variables but not for individual targeting.

Much less trade-off of sharing actual payment data in UK or Canada: less risk of poaching.

2.Consumer Credit Profitability

Credit card profitability depends on ex-post consumer behaviors: multiple dimensions of information asymmetry & revenue streams

$t = 1$:

- \$1,000 new spending ($\rightarrow$ generates \$5 interchange revenue net of rewards)
- \$1,000 statement balance & \$10 minimum payment due

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$t = 2$:

- \$250 actual payment amount

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t = 2:

- \$250 actual payment amount
- \$1,000 - \$250 = \$750 revolving debt ($\rightarrow$ generates interest revenue but risk of charge-off)
- \$12 interest + \$30 fee = \$42 financing charges

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- $1,000 - $250 = $750 revolving debt ($\rightarrow$ generates interest revenue but risk of charge-off)
- $12 interest + $30 fee = $42 financing charges
- $2,000 new spending ($\rightarrow$ generates $10 net interchange revenue)
- $2,792 statement balance & $70 minimum payment due

Credit card profitability depends on ex-post consumer behaviors: multiple dimensions of information asymmetry & revenue streams

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$$spending_t = statement\ balance_t - statement\ balance_{t-1} + actual\ payment_t - financing\ charge_t$$

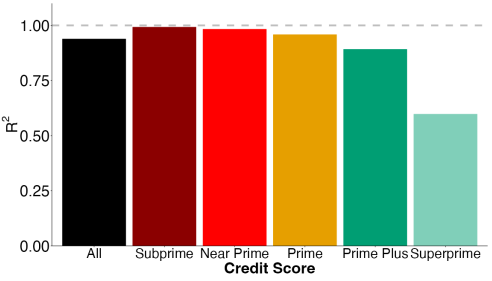
$$revolving\ debt_t = statement\ balance_{t-1} - actual\ payment_t$$

If $payment_t$ unobserved, ↑ noise to measurement of spending & revolving debt

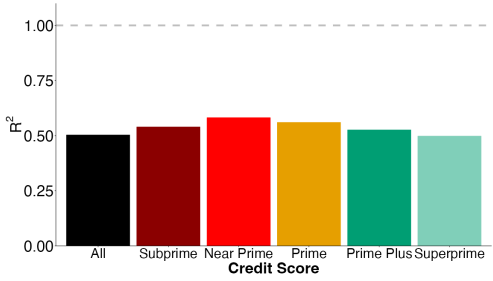
OLS regressions using Dec 2013 data on statement balances.

Out-of-sample R^2 shown.

Revolving Debt



Spending



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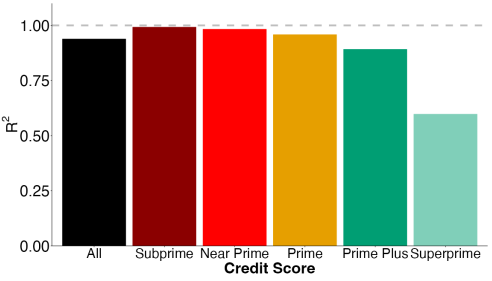

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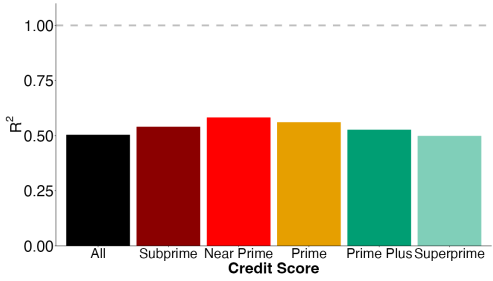

Noise impedes targeting of pre-selected credit card offers.

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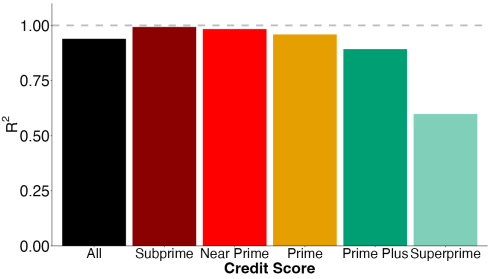

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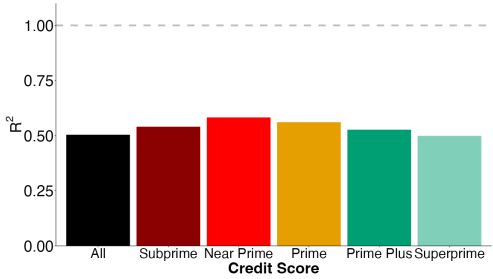

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Bad news for academics & policymakers measuring revolving debt or consumption.

Consumer Credit Profitability Relies on Predicting Consumer Behaviors

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

How Predictable are Consumer Behavior & Profitability?

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

$$\Pi_{PRE}^{CRED} = E_{t=0}[\Pi_{POST}^{CRED}|X_0] = E_{t=0}\Big[\sum_{t=1}^{T} \delta^t \Big(i_t + r_t + f_t - c_t\Big)|X_0\Big] - a$$

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Estimate profitabiilty and its components in data:

- **Auto Loans and Unsecured Loans:** Scheduled financing charges adjusted for ex-post prepayments and charge-offs

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Estimate profitabiilty and its components in data:

- **Auto Loans and Unsecured Loans:** Scheduled financing charges adjusted for ex-post prepayments and charge-offs
- **Credit Cards:** Estimate financing charges from minimum payments, assume interchange net of rewards is 0.5% of spending.

Lender's problem is predicting profitable types to target marketing

1. **No actual payment data.** Use interactions of credit score, credit limit, statement balances, utilization, delinquency etc

$$Y_{i,2022} = X'_{i,2012}\beta + \varepsilon_{i,2022} \tag{1}$$

2. **With Actual Payment Data**: Model 1 + interactions of actual payment data with Model 1 variables.

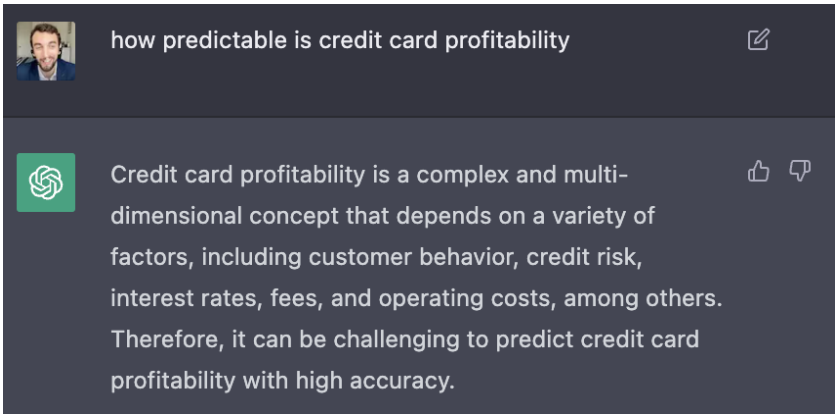
$$Y_{i,2022} = X'_{i,2012}\beta + Z'_{i,2012}\lambda + \varepsilon_{i,2022} \tag{2}$$

Use data to December 2012 to predict 2013+ outcomes.

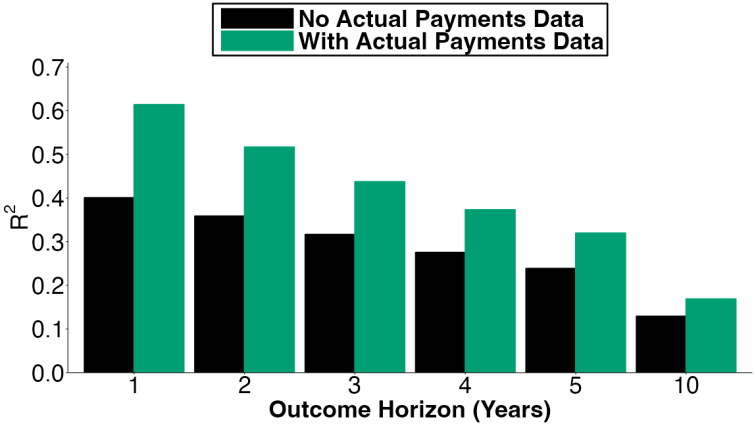
Evaluation metrics:

- Out-of-sample R^2
- Portfolio value of top 100,000 cards ranked by out-of-sample predictions.

Predicting Credit Card Profitability is Hard!



Actual Payment Data Predicts Interchange



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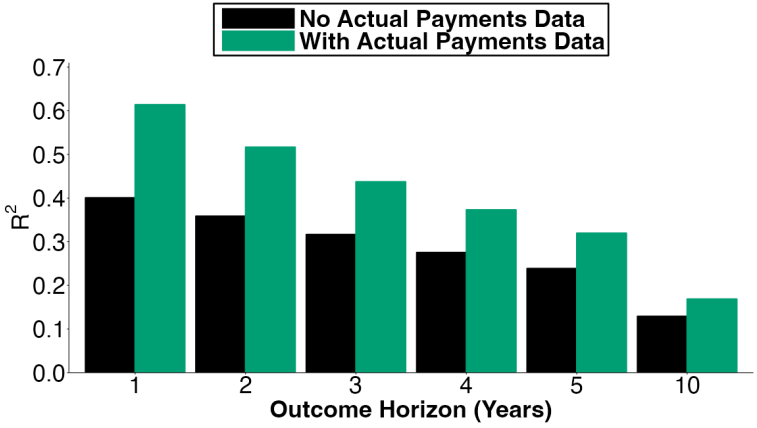


1 year

R^2: 0.4006 $\rightarrow$ 0.6139

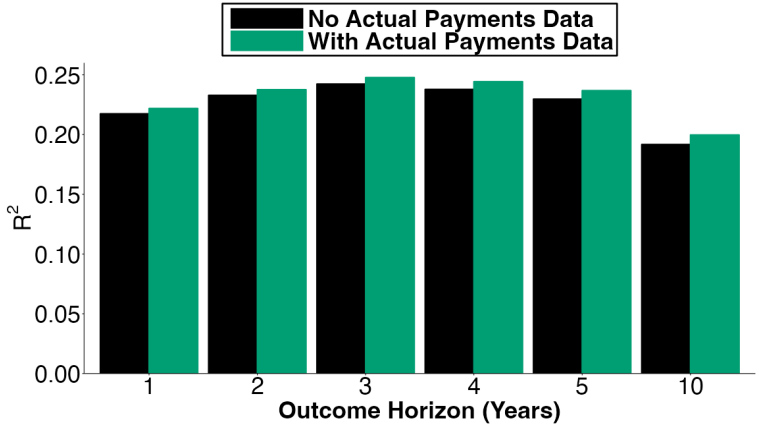
Portfolio value: +24%

10 year

R^2: 0.1291 $\rightarrow$ 0.1687

Portfolio value: +13%

Actual Payment Data Predicts Profitability: Small Uplift for Financing Changes Net Charge-Offs



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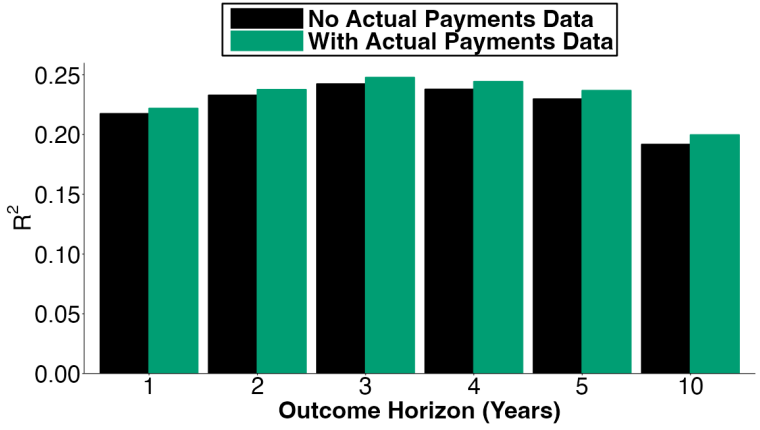
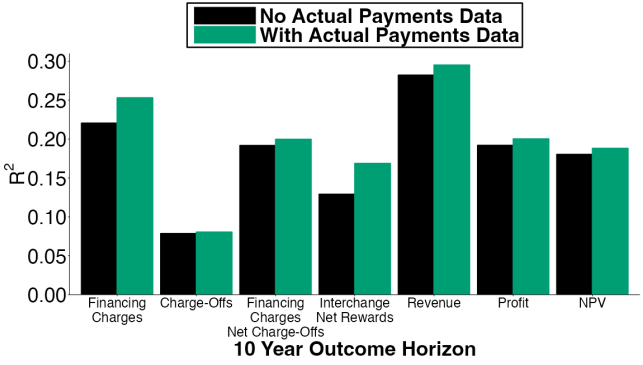


R^2: +4.2%

Portfolio value: +2.8%

Actual Payment Data Predicts Profitability (R^2: +4.2%, Portfolio: +2.8%): Especially Spending Driving Interchange Revenue



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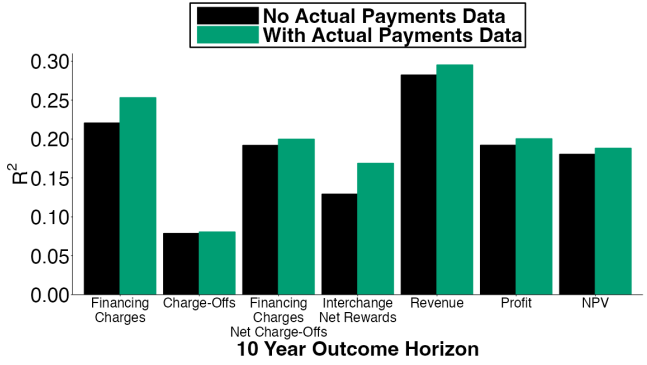

Model	Credit Cards Cards	Auto Loans	Unsecured Loans
1. No Actual Payment Data	0.1919	0.1925	0.3508
2. With Actual Payment Data	0.2003	0.1928	0.3511

3.Credit Card Lender Selection

Unraveling Driven By Some Credit Card Lenders Stopping Reporting

Aggregate 84 furnishers in BTCCP based on 2012 vs. 2015 reporting:

Group	% 2012 Cards	% 2012 Balances
Always: Share AP data in 2012 & 2015.	18%	17%
Stoppers: Share AP data in 2012 but not 2015	47%	47%
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Others: Everyone else.	3%	1%

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Lenders' Responses to CFPB:

Stoppers:

- Firm 4: "Doesn't believe benefits outweigh proprietary interests."
- Firm 6: "Other major issuers were no longer providing...left at competitive disadvantage".

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Nevers:

- Firm 1: "Not required to do so. Not consistently furnished nor adequately studied."
- Firm 5: "Not required, furnishing is voluntary. Doesn't believe cost...is worth it."

Noise heterogeneously affects credit card lenders' business models

Firms vary in reliance on interchange revenue:

	American Express	Capital One
Interchange Revenues (% Revenues)	55%	27%
Net Interchange Revenues (% Net Revenues)	68%	18%
Marketing Costs	\$5.5 bn	\$4.0 bn

Sources: American Express & Capital One Annual Accounts

Marketing large expense for all firms.

Selection in Reporting Actual Payment Data

	Always	Stoppers	Nevers
Credit Score	720.73	719.70	744.23
(S.D.)	(87.10)	(89.61)	(76.16)
Tenure	68.52	95.18	141.21
(S.D.)	(76.65)	(79.13)	(109.75)
Credit Limit	8,575.06	9,461.19	10,409.80
(S.D.)	(7,631.69)	(9,500.02)	(9,542.53)
Statement Balance	2,191.83	2,417.90	2,571.61
(S.D.)	(3,795.31)	(4,263.29)	(4,873.83)
Utilization	0.36	0.39	0.29
(S.D.)	(0.39)	(0.40)	(0.35)
Proxy Spending	2,454.94	2,754.02	3,385.40
(S.D.)	(4,072.05)	(5,100.28)	(7,465.29)

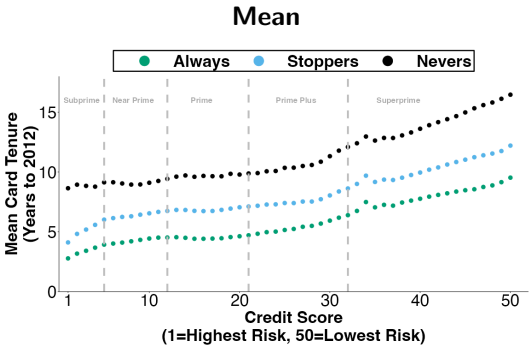
Adverse Selection in Reporting Actual Payment Data Residual of Credit Risk: Always < Stoppers < Nevers

	Always	Stoppers	Nevers
Residual Tenure	-34.78	-8.19	30.68
(S.D.)	(73.80)	(75.50)	(105.98)
Residual Credit Limit	-713.94	177.91	147.72
(S.D.)	(6,693.71)	(8,497.69)	(9,337.62)
Residual Statement Balance	-319.20	-75.50	282.11
(S.D.)	(3,635.34)	(4,129.43)	(4,655.80)
Residual Proxy Spending	-425.54	-110.51	389.84
(S.D.)	(4,049.22)	(5,043.53)	(7,446.02)

Residual of 100 credit score quantiles.

Credit risk *not* main reason for differential reporting

Lenders Have Different Card Tenure for Given Risk: Informational Rents!



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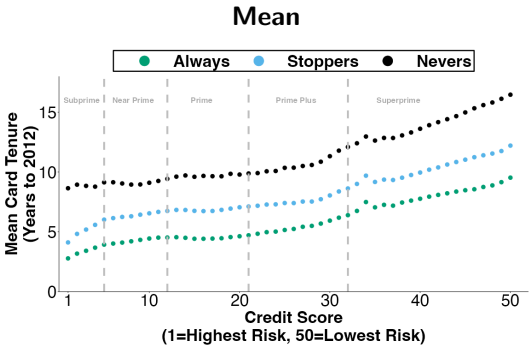

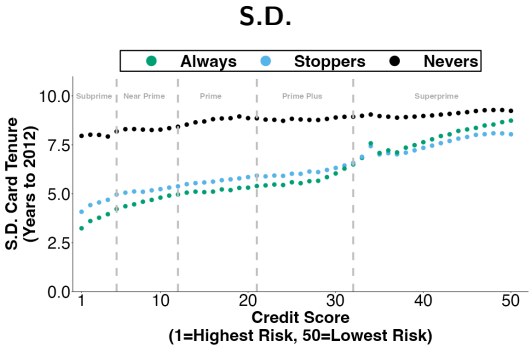

N.b. Fixed thresholds for credit score quantiles across all groups and charts.

Develop New Methodology for Measuring Financing Charges

Minimum payment (M_t) determined by: $M_t = \max\{\$\mu,\ \theta\%\ b_t + r_t + f_t\}$

- Infer μ and $\theta\%$ for each furnisher using observed minimum payment and statement balance
- *Observed* minimum payment - *predicted* minimum payment = financing charges.

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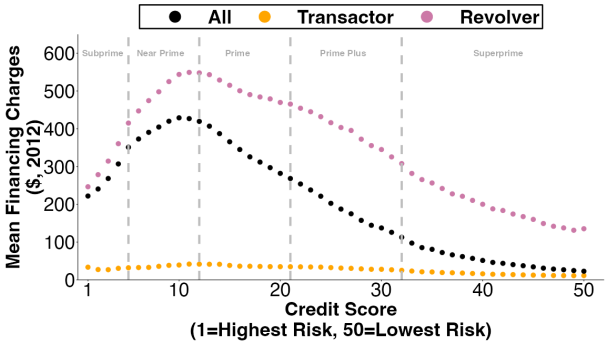
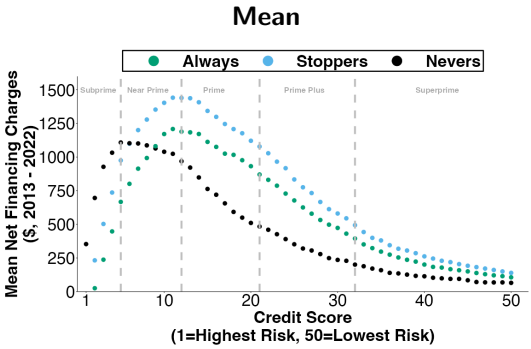


Always & Stoppers : Financing Charges - Charge-Offs (2013 to 2022)



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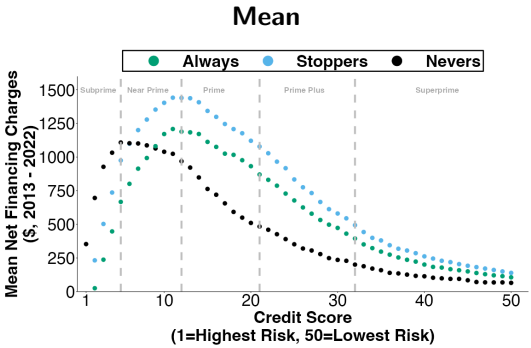
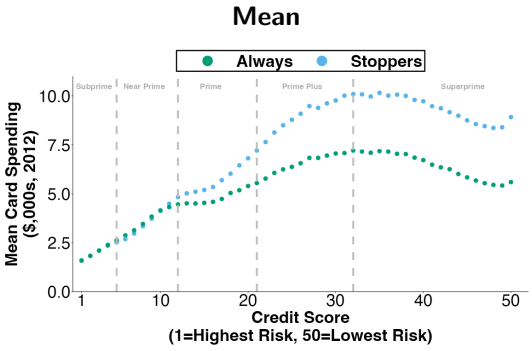


Revolving larger balances, similar revolving rate:

- Mean (S.D.) Revolving Debt: **Stoppers** \$1,705 (\$3,597) vs . **Always** \$1,548 (\$3,201)
- Means Any (Majority) Transacting: **Stoppers** 71.0% (51.3%) vs . **Always** 77.4% (51.2%)

Always & Stoppers: Spending (2012 to 2013)



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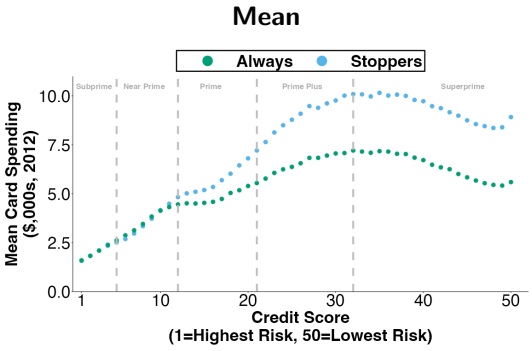

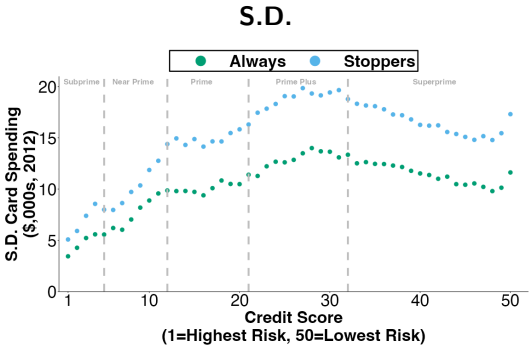

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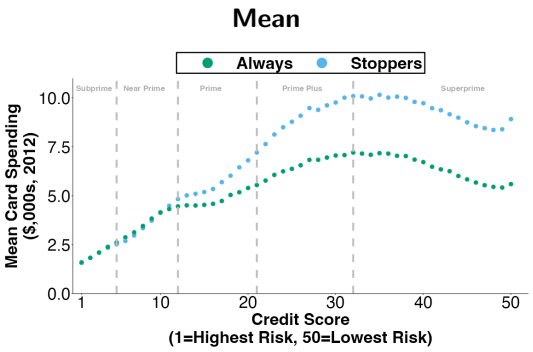
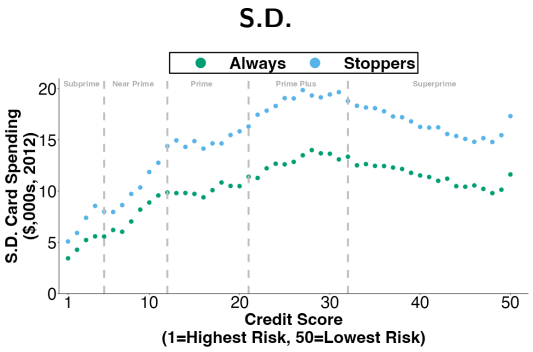


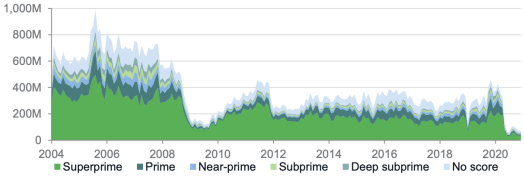


- 2012 Mean (S.D.) Spending: **Stoppers** \$7,143 (\$15,504) vs . **Always** \$5,380 (\$10,729)
- Comparing to Fed aggregate credit card spending data indicates **Nevers** > **Stoppers**.
- Variation within-consumer's card wallet.
  - High returns from being 'top-of-wallet'.

Are transactors profitable?

- Hard to reconcile with large, costly marketing to superprime transactors.

Credit Card Offers Mainly Superprime



Source: CFPB, 2021

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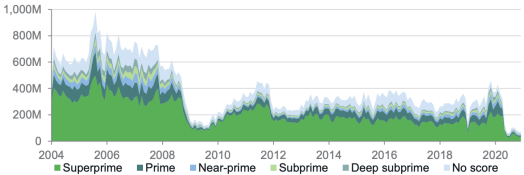

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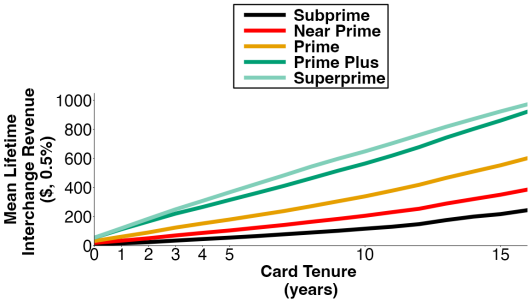
Lifetime Interchange Revenue By Card Tenure & Credit Score



Average transactor may have 'low' p.a. net revenues...but longer tenure means $NPV > 0$.

For Always, interchange increases mean lifetime profits of 2012 transactors: \$230 to \$450.

Recap of key findings so far

- Credit card profitability depends on ex-post consumer behaviors with multiple dimensions of information asymmetry & revenue streams.
- Observing actual payment data crucial to measuring consumer behaviors.
- Unraveling of reporting actual payment data by credit card lenders (2013 - 2015).
- Timing due to credit bureau innovation revealing private consumer behaviors:
  - spending (driving interchange revenue)
  - revolving (driving interest revenue).
- Adverse selection in reporting.
  - Longer tenure.
  - Higher mean and variance.

4. Competitive Effects

Difference-in-Differences: Effects of Innovation on Credit Card Poaching

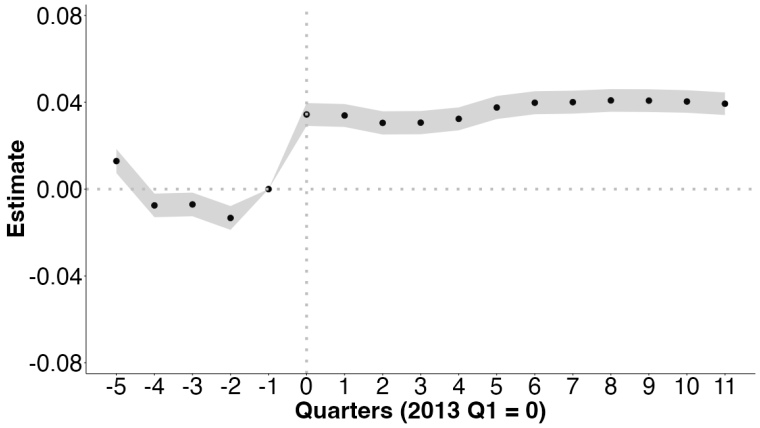
Exposure Measure: % consumer's card balances in Dec 2012 where actual payment **shared**:

$$EXPT_i \equiv \frac{\sum_c 1\{F_c \in \textbf{Sharers}\} \times b_{i,c}}{\sum_c b_{i,c}}$$

Balanced panel of consumers 2011 to 2015.

Innovation Caused ↑ Poaching

Outcome: Any New Credit Card Opened



$$Y_{i,t} = \sum_{\tau \neq -1} \delta_\tau \Big(D_\tau \times EXPT_i \Big) + \gamma_i + \gamma_t + \varepsilon_{i,t}$$

Mandating Information Sharing

Effects of Mandating Information Sharing

Policy

- 1990s most credit limits not reported
  $\rightarrow$ Regulatory pressure and threats by agencies to restrict access
- 2000s most **but not all** lenders reporting credit limits (Hunt, 05)
  $\rightarrow$ Federal Trade Commission (FTC) rules requiring reporting credit limits from July 2010.
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How credit limits matter

- 20% to 30% of your credit score is credit utilization: $\frac{\text{balance}}{\text{credit limit}}$
- If no credit limit reported: use highest historical account balance.
  → Typically overstates utilization.
  → Consumers appear riskier to outside lenders.

Difference-in-Differences for Causal Effects of Mandating Information Sharing

Study furnishers revealing credit limits 20.9 million accounts in November 2011

Exposure measure: Difference in utilization rate from credit limit revelation.

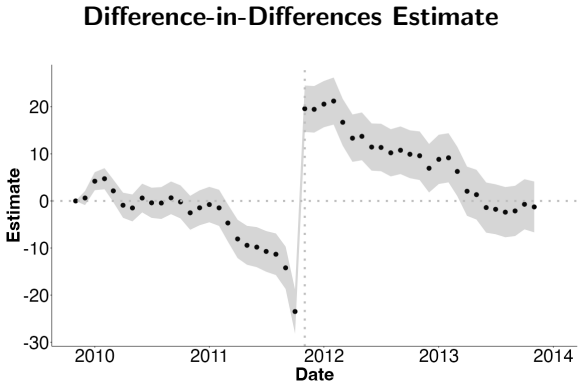
$$EXPL_i = \left(\frac{\sum_c b_{i,c,t-1}}{\sum_c l_{i,c,t}} - \frac{\sum_c b_{i,c,t-1}}{\sum_c \mathbf{1}\{l_{i,c,t-1} = null\} h_{i,c,t-1} + \sum_c l_{i,c,t}} \right) \times -1$$

Difference-in-Differences: Control group is consumers holding cards with same furnisher but where limits reported pre November 2011.

$$Y_{i,t} = \sum_{\tau \neq \text{Nov 2009}} \delta_\tau \Big(D_\tau \times EXPL_i \Big) + \gamma_i + \gamma_t + \varepsilon_{i,t}$$

49 month balanced panel of consumers who held card with furnisher (at least) 2009 - 2011.

Information Revelation ↑ Credit Scores



Consumers appeared *more* risky before revelation but are actually *less* risky!

Information Revelation ↑ Competition & Credit Access

Outcomes by **inside** and **outside** lenders.

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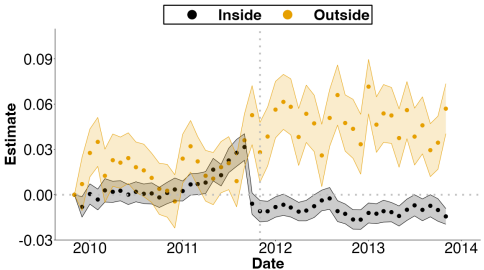

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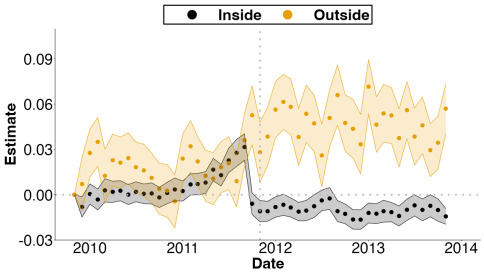

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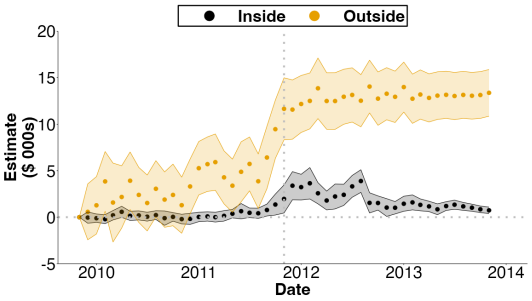
Credit Limits of New Credit Card Opened



- Outsiders more credit post-revelation.

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3. **Mandating information sharing can $\uparrow$ competition and $\uparrow$ credit access**

Thank you!

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Trade-offs of information sharing

Lenders Trade-Offs

Benefits	Costs
Technology	Short-Run Poaching
Reduce Information Asymmetries	Long-Run Increased Competition

Trade-Offs for Credit Reporting Agencies:

- Use technology to produce data products to sell to lenders.
- Incentive compatibility constraint for lenders to share information.

Trade-offs of non-reciprocal information sharing

Benefits of Reporting

1. Technology
2. Reduce Information Asymmetries

Costs of Reporting

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

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Incumbents report data. Why? e.g. firm inertia, fear of regulators, limits scope of entry.

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Post-Trended Data:

Adverse selection $\downarrow$, consumer switching costs $\downarrow \Rightarrow$ information reporting $\downarrow$

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

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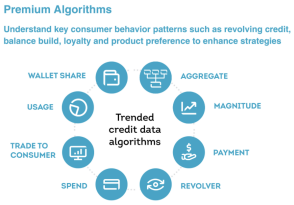
- Reveals **credit cards** behaviors driving profitability beyond delinquency.

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



Reveals not just credit risk but who profitable consumers are.

How is “Trended Data” used by lenders?

- **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.

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Why launched then?

- CARD Act limited credit card fees (Agarwal et al., 15) & interest (Nelson, 22).

- Interchange revenues become increasingly important source of credit card revenue.

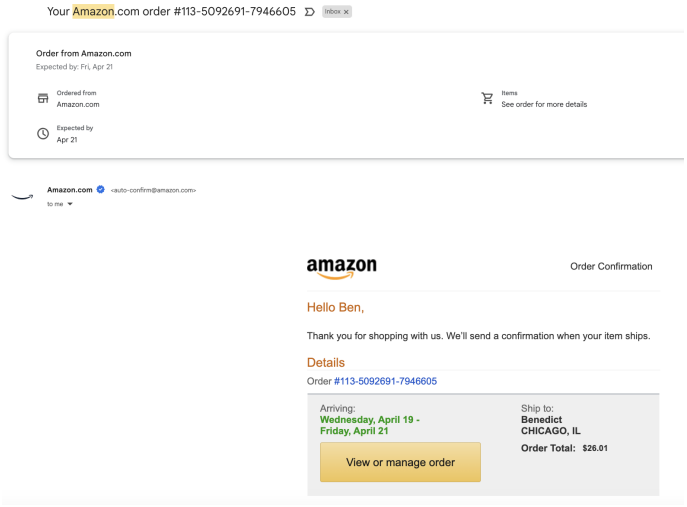
Interchange Stats

1 year: R^2 0.4006 $\rightarrow$ 0.6139
+24% ($171 $\rightarrow$ $213) Always
+25% ($319 $\rightarrow$ $399) Stoppers
3 year: R^2 0.3165 $\rightarrow$ 0.4373

5 year: R^2 0.2386 $\rightarrow$ 0.3197
10 year: R^2 0.1291 $\rightarrow$ 0.1687

3 Motivating Examples of Firms Stopping Sharing Information

1. Amazon Stops Sharing Order Details



3 Motivating Examples of Firms Stopping Sharing Information

1. Amazon Stops Sharing Order Details
2. Apple Stops Sharing Location Data

3 Motivating Examples of Firms Stopping Sharing Information

1. **Amazon Stops Sharing Order Details**
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3. **Twitter Stops Sharing API for Free**

What connects these?

Harnessing Market Power from Information Rents, to Limit Potential of Disruptive Innovation

Selection markets with heterogeneous consumers where ability to target drives profits.

- t = 0: Incumbent firms with market power from informational rents share data.
- t = 1: New technological innovation potentially threatened incumbents.
- t = 2: Incumbents respond by $\downarrow$ information sharing to foreclose on (potential) entrants.

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3 Examples

1. Amazon Stops Sharing Order Details

- Response to scraping technology

2. Apple Stops Sharing Location Data

- Response to tracker technology

3. Twitter Stops Sharing API for Free

- Response to ChatGPT technology