Regulating Consumer Financial Products: Evidence from Credit Cards*

Sumit Agarwal† Souphala Chomsisengphet‡ Neale Mahoney§ Johannes Stroebel¶

October 3, 2013

Abstract

We analyze the effectiveness of consumer financial regulation by considering the 2009 Credit Card Accountability Responsibility and Disclosure (CARD) Act in the United States. Using a unique panel data set covering over 150 million credit card accounts, we find that regulatory limits on credit card fees reduced overall borrowing costs to consumers by an annualized 2.8% of average daily balances, with a decline of more than 10% for consumers with the lowest FICO scores. Consistent with a model of low fee salience and limited market competition, we find no evidence of an offsetting increase in interest charges or a reduction in access to credit. Taken together, we estimate that the CARD Act fee reductions have saved U.S. consumers $20.8 billion per year. We also analyze the CARD Act requirement to disclose the interest savings from paying off balances in 36 months rather than only making minimum payments. We find that this "nudge" increased the number of account holders making the 36-month payment value by 0.5 percentage points, with a similarly sized decrease in the number of account holders paying less than this amount.

*For latest version, go to http://ssrn.com/abstract=2330942. We are grateful to Liran Einav, Alexander Frankel, Matthew Gentzkow, Andres Liberman, Emir Kamenica, Theresa Kuchler, Monika Piazzesi, Jesse Shapiro, Chad Syverson, Richard Thaler, Alessandra Voena, Glen Weyl and seminar participants at the University of Chicago, the Empirical Macro Workshop in New Orleans, the Consumer Financial Protection Bureau and the Office of the Comptroller of the Currency for helpful comments, and to Regina Villasmil for truly outstanding and dedicated research assistance. The views expressed are those of the authors alone and do not necessarily reflect those of the Office of the Comptroller of the Currency.

†National University of Singapore. Email: ushakri@yahoo.com

‡Office of the Comptroller of the Currency. Email: souphala.chomsisengphet@occ.treas.gov

§Chicago Booth and NBER. Email: neale.mahoney@gmail.com

¶New York University, Stern School of Business. Email: johannes.stroebel@nyu.edu

1 Introduction

The recent financial crisis triggered a surge of interest in regulating consumer financial products (e.g., Campbell et al., 2011; Posner and Weyl, 2013). In the United States, the Dodd-Frank "Wall Street Reform and Consumer Protection Act" of 2010 established a Consumer Financial Production Bureau to monitor and regulate mortgages, students loans, credit cards, and other similar products. In July 2013, the European Commission followed suit and proposed new consumer financial protection legislation to simplify disclosures and tighten guidance requirements related to financial products.

Proponents of this type of regulation argue that consumer financial markets have become increasingly unfair. Firms take advantage of consumers' behavioral biases—such as myopia, present bias and inattention—to earn large profits, especially from unsophisticated and poor consumers.[1] These proponents suggest that regulation and additional information provision can protect less sophisticated consumers and reduce borrowing costs for consumers in aggregate.

Critics have expressed skepticism about the effectiveness of consumer financial regulations. While limits on hidden fees, for example, can shift surplus from more to less sophisticated consumers (Gabaix and Laibson, 2006), there is less evidence that regulators can bring about an across-the-board reduction in consumer costs. Regulators, these critics attest, are naively playing a game of regulatory Whac-A-Mole—efforts to limit certain fees will simply lead firms to offset reduced revenue with higher prices on other product dimensions and to restrict the supply of credit (American Bankers Association, 2013).[2] Even proponents of regulating late fees, such as Mullainathan, Barr and Shafir (2009), worry that "the reduced revenue stream to lenders from these fees would mean that other rates and fees would be adjusted to compensate."

The success of regulation meant to influence the behavior of consumers, such as "nudging" them to make larger payments, is also subject to debate. While countries such as the United Kingdom have set up "Nudge Units" to "encourage people to make better choices for themselves," there has been skepticism as to whether nudges in isolation can make a "real difference to society's biggest

[1] Senator Chris Dodd, lead sponsor of the CARD Act in the U.S. Senate, has noted that "My colleague from New York, Senator Schumer, has called this 'trip-wire pricing,' saying the whole business model of the credit card industry is not designed to extend credit but to induce mistakes and trap consumers into debt. I think he is absolutely right, unfortunately. This is an industry that has been thriving on misleading its consumers and its customers." (U.S. Senate, 2009*a*)

[2] Whac-A-Mole is a classic arcade game in which the objective of hitting a mechanical mole with a mallet causes another mechanical mole to instantly appear. This concept is similar to the "waterbed effect," which is used to describe the offset of prices in two-sided markets.

problems." (House of Lords, 2011)[3]

This paper aims to advance this debate in the context of the Credit Card Accountability Responsibility and Disclosure (CARD) Act of 2009, which was drafted to "implement needed reforms and help protect consumers by prohibiting various unfair, misleading and deceptive practices in the [U.S.] credit card market" (U.S. Senate, 2009*b*). We focus on analyzing the effectiveness of two key aspects of the CARD Act: (i) regulatory limits on the ability of banks to charge certain types of credit card fees, which became effective in February and August of 2010, and (ii) attempts to affect consumers' repayment behavior by installing requirements that credit card bills provide clear information on the costs of only making the minimum payment, which became effective in February 2010.

We conduct a quantitative analysis of the effects of the CARD Act's provisions using a unique dataset on a near universe of credit card accounts held by the eight largest U.S. banks. These data, assembled by the Office of the Comptroller of the Currency (OCC), provides us with account-level information on contract terms, utilization and payments at the monthly level from January 2008 to December 2012. We observe fees at a disaggregated level, allowing us to isolate effects on categories such as over-limit and late fees. Our data cover 150 million accounts and a significant share of total industry assets during our period of study.

We show that in the pre-CARD Act period (April 2008 to January 2010), for each dollar borrowed in average daily balances (ADB), the average consumer paid an annualized 21.9% in interest payments and fees, cost the bank 15.6% in charge-offs, and generated a net profit of 1.6%.[4] Given the leverage of the U.S. commercial banking sector, this implies a return on equity for the credit card portfolio of at least 10%, about five times the U.S. commercial banking sector's average return on equity over the same period. Consumers with low FICO scores (<620) paid about 43.9% per dollar borrowed in interest and fees and generated a net profit of 7.9%.[5] Consistent with the view promoted by supporters of enhanced regulation, banks seem to be earning significant profits, even during the

[3]The report finds that nudges, "used in isolation, will often not be effective in changing the behaviour of the population. Instead, a whole range of measures—including some regulatory measures—will be needed to change behaviour in a way that will make a real difference to society's biggest problems." It concludes that "a lot more could, and should, be done to improve the evaluation of interventions. This is not only good practice but would help to build a body of research that could inform effective policies targeting population-level behaviour change."

[4]The balance of the bank's revenue is derived from interchange income, which is roughly proportional to the transaction volume on the credit cards, and contributed 3.2% income per unit of borrowing. The other costs for the banks were the cost of funds (2.3% of ADB), rewards and fraud expenses (2.2% of ADB) and operational costs (3.4% of ADB).

[5]We use the term "borrow" to refer to average daily balances (ADB). As we discuss in Section 2, ADB do not include purchase volume that is paid off before the end of the consumer's grace period.

depth of the financial crisis, and earn the most from the consumers with the lowest FICO scores.[6]

We then analyze the effectiveness of the CARD Act's provisions to limit the various fees charged by credit card issuers. We start by making a conceptual point that for limits on fees to be offset by price increases on other dimensions, it is sufficient for either (i) markets to be perfectly competitive or (ii) fees to be perfectly salient. If markets are perfectly competitive, then aggregate prices inclusive of all fees will be forced down to marginal costs. Any regulation that reduces a certain fee will be offset with a similarly sized increase in another pricing dimension. If all fees and prices are perfectly salient, then demand is only responsive to the aggregate price. Demand will be unresponsive to an equally sized reduction in one fee and increase in another. If, however, markets are not perfectly competitive and the fee is at least partially non-salient, then regulators can be successful in lowering aggregate consumer costs.

We find that regulations to limit fees were highly effective. Over-limit fees dropped from an annualized 1% of average daily balances to zero in February 2010. Late fees dropped by 0.5 percentage points in February 2010 and another 0.5 percentage points in August 2010, for a combined decline of 1 percentage point on a base of 2%. Combined across the various implementation phases, the CARD Act seems to have reduced overall fee costs by an annualized 2.8% of borrowing volume. Given an outstanding credit card volume of $744 billion in the first quarter of 2010 (Federal Reserve Bank of New York, 2013), this translates into annual cost savings for U.S. credit card users of $20.8 billion per year. The decline in fees was the largest for borrowers with low FICO scores. For borrowers with FICO scores below 620, overall fee revenue dropped by over half, from 23% to about 9% of ADB.

We find little offsetting response in terms of pricing. We do not observe a sharp uptick in interest charges during the CARD Act implementation period or a gradual increase in interest charges over a longer time horizon. We also examine new accounts, which may be less constrained in their ability to adjust contract terms. We find no evidence of an uptick or gradual increase in this sample. In addition, there appears to be no reduction in the overall availability of credit—the number of new accounts opened and the credit limits on new and existing accounts seem unaffected or are even increasing during the CARD Act's implementation period. These results suggest that the CARD Act brought about an across-the-board reduction in borrowing costs.

[6]It is conceivable the these consumers are also gaining the most consumer surplus from credit access through credit cards. A responsible policymaker would consider both consumer and producer surplus when evaluating the merits of this segment of the market.

Some commentators have argued that the reason interest rates did not increase was because they would have naturally declined absent the CARD Act (e.g., American Bankers Association, 2013). We examine this argument by exploiting differential exposure to CARD Act fee restrictions stemming from pre-CARD Act heterogeneity in fees. Using a difference-in-differences design, we find that low-FICO score accounts that saw more than a 10% drop in fee revenue did not experience a resulting increase in interest charges relative to high-FICO score accounts that saw virtually no decline in fee revenue. Within FICO groups, some banks generated substantially more pre-CARD Act fee revenue than others, partly due to differences in business strategy. Exploiting variation across banks within a FICO group, we find that account holders at banks that experienced larger declines in fee revenue did not see interest rate increases relative to account holders at banks with smaller fee declines. This evidence shows that accounts that were relatively unaffected by the CARD Act did not see a decline in interest charges.

Taken together, we interpret the results as demonstrating that regulation of "hidden fees" can bring about a substantial reduction in borrowing costs without necessarily leading to an offsetting increase in interest charges or a reduction in access to credit. While the results do not speak to the persistence of these savings, even over a modest time horizon the estimated savings of $20.8 billion per year are quantitatively significant.

The CARD Act also included provisions to affect the repayment behavior of credit card borrowers. In particular, it required credit card statements to prominently display the cost to repay the balance when only making minimum payments, and to compare this amount to the cost if the card holder repaid the current balance within 36 months. The aim was to "nudge" consumers towards paying off a larger fraction of their balance and reduce their overall interest payments (Thaler and Sunstein, 2008). While the impact of these types of disclosure regulations has been studied in small, experimental settings (Navarro-Martinez et al., 2011), the CARD Act provides a rare opportunity to analyze the impact of framing in financial decision making in a nationally representative and economically important context.

We find that these disclosure requirements had a small but significant effect on borrowers' repayment behavior. The number of account holders paying at a rate that would repay the balance within 36 months increased by 0.5 percentage points, with a similarly sized decrease in the number of account holders below this rate of repayment. For borrowers that shifted their behavior, we estimate

that the nudge reduced interest payments by an annualized $24. Because relatively few account holders responded to the nudge, we calculate an annualized aggregate reduction in interest payments for U.S. credit card borrowers of less than 0.01% of ADB, approximately $71 million. This evidence suggests that the nudge was worthwhile if costless to implement, but might have been relatively less beneficial than other policy options.

Our paper builds on work on the credit card market by Ausubel (1991) and Calem and Mester (1995), who have documented and examined the stickiness of credit card interest rates at high levels. We also contribute to the more general household finance literature analyzing credit card usage and pricing (Gross and Souleles, 2002*a*,*b*; Stango and Zinman, 2013), subprime lending (Adams, Einav and Levin, 2009; Mian and Sufi, 2009; Keys et al., 2010; Einav, Jenkins and Levin, 2012; Han, Keys and Li, 2013; Mian, Rao and Sufi, 2013), and the debate about regulating consumer financial products (Campbell, 2006; Gabaix and Laibson, 2006; Bar-Gill and Warren, 2008; Mullainathan, Barr and Shafir, 2009; Cooley et al., 2009; Heidhues and Kőszegi, 2010; Campbell et al., 2011; Soll, Keeney and Larrick, 2013).

Our paper also contributes to the behavioral consumer finance literature such as Agarwal et al. (2006), Meier and Sprenger (2010), and Kuchler (2013). This work documents the significant role behavioral biases play in explaining credit card usage behavior. We also add to a body of research that analyzes consumer "mistakes" in financial decision making (Calvet, Campbell and Sodini, 2007, 2009; Bertrand and Morse, 2011; Stango and Zinman, 2011) and the effectiveness of nudges and default options in influencing consumer financial decision-making (Madrian and Shea, 2001; Thaler and Benartzi, 2004; Choi, Laibson and Madrian, 2005; Carroll et al., 2009; Mitchell et al., 2009).[7]

To our knowledge, Debbaut, Ghent and Kudlyak (2013) is the only other paper empirically analyzing the impact of the CARD Act. They focus on the restriction of lending to borrowers under the age of 21, and find that young borrowers are, in fact, less likely to default.

The rest of the paper proceeds as follows. Section 2 provides background on the U.S. credit card industry, describes the data, and establishes some basic facts about profitability in the pre-CARD Act period sample. Section 3 describes the key provisions of the CARD Act. In Section 4, we investigate the effect of the fee restrictions, first presenting the model and then examining the evidence on the

[7]Our research is also more broadly related to research on price salience for economic decision-making and welfare (Chetty, Looney and Kroft, 2009; Finkelstein, 2009; Bernheim and Rangel, 2012; Bordalo, Gennaioli and Shleifer, 2012). The modeling approach for our analysis of the determinants of fee pass-through draws heavily upon Weyl and Fabinger (2013).

reduction in fees and offsetting price response. Section 5 examines the effectiveness of the nudge. Section 6 concludes.

2 Background and Descriptive Analysis

2.1 Credit Cards

Consumers use credit cards to make purchases and to borrow. When a consumer carries a balance from the previous period, interest charges for the current cycle are given by

$$\text{Interest Charge} = \text{ADB} \times \frac{\text{APR}}{365} \times \text{Days in Billing Cycle}$$

where the right-hand side is the product of the average daily balance (ADB), defined as the arithmetic mean over the billing cycle of end-of-day balances; the daily interest rate, defined as the annual percentage rate (APR) divided by 365; and the number of days in the billing cycle.[8,9]

Consumers who do not carry a balance into the current period have the possibility of repaying current period purchase volume without incurring interest charges. If a consumer pays off her purchase volume completely, interest charges typically fall within a grace period and are not assessed by the bank. If consumers do not pay their balances in full, consumers are charged interest starting from the date of purchase.

The APR and the credit limit are two of a credit card's most important contract characteristics. Many credit cards have initial interest rates of zero that jump to pre-specified amounts after a pre-set number of months. Credit limits place an upper bound on consumer purchases and borrowing. Consumers who exceed their credit limit are assessed an over-limit fee or can have transactions declined. Credit card contracts have other types of fees that we discuss below. Credit cards often provide consumers with cash back or reward points that scale with purchase volume. These points can be used with airlines, gas stations, or other affiliated stores.

[8]The APR measure does not account for compounding. For instance, a consumer with an APR of 15% that carries an ADB of $1,000 for 12 consecutive 30-day months would have their balance grow to $1,158 = 1,000 \times (0.15/365 \times 30 + 1)^{12})$ instead of $1,150 = 1,000 \times (0.15 + 1)$.

[9]In the past, some credit card issuers used a method known as "double cycle billing" to calculate interest payments. This method calculated average daily balances over two cycles, rather than just considering the current cycle. Double cycle billing sometimes added significant interest charges to customers whose average balance varied greatly from month to month. This method was banned by the CARD Act.

2.2 Data

Our main source of data is the Credit Card Metrics (CCM) dataset assembled by the U.S. Office of the Comptroller of the Currency (OCC). The OCC charters, supervises and regulates nationally chartered banks and federal savings associations.[10] In 2008, the OCC initiated a request to the nine largest banks that issue credit cards to submit data on general purpose, private label and small business cards. The purpose of the data collection was to have more timely and complete information for ongoing supervision, which includes quarterly risk assessments, supervisory strategy and continuous monitoring. The OCC worked diligently with industry to develop standard data definitions for the types of accounts assessed.

The CCM dataset has two components. The main dataset is account-level information on credit card utilization (e.g. purchase volume, ADB), contract characteristics (e.g. interest rates, credit limits), charges (e.g. interest, assessed fees) and performance (e.g. charge-offs, days overdue) for the near universe of credit card accounts at these banks. The second dataset is portfolio-level information for each bank on items such as operational costs and fraud expenses for the entire general purpose credit card portfolio managed by the bank. Both datasets are submitted monthly. Reporting started in January 2008 and continues through the present, although there is incomplete reporting in the first few months of 2008. Due to mergers and other reporting issues, we observe entry and exit of banks during the time period examined.

To obtain a balanced panel of banks, while maintaining a sufficiently wide window around the CARD Act implementation dates, we drop a small bank that enters and exits the sample and restrict our time period from Q2 2008 to Q4 2011. We also restrict attention to "general purpose" credit card accounts. Our sample does not include business credit cards and private label cards (which can only be used at the issuing retailer's stores). The sample does include affinity and co-branded cards.[11]

Table 1 presents an overview of our sample by reporting quarter. The sample contains data from eight banks and approximately 150 million accounts, covering roughly 40% of all outstanding U.S.

[10] As of 2012, the OCC supervised and regulated 1,955 institutions (46 large banks, 47 midsize banks, 47 federal branches and 1,815 community banks). Total assets of the OCC-regulated banking institutions represent about $10 trillion or 69 percent of all U.S. commercial banking assets.

[11] Additional sample restrictions exclude: cards from portfolios purchased from third parties; a very small number of joint credit card accounts backed by more than one individual; and an equally small number of secured credit cards (since we want to focus on the overwhelming role of credit cards as a means of unsecured borrowing). We also restrict our sample to accounts that report the FICO score at origination. Since we are interested in heterogeneity across borrower types, many results will be segmented by FICO score at origination. Restricting all samples to have a non-missing value for this ensures consistency.

credit card accounts over this period. The average account carries an average daily balance of $1,251 and has an annualized purchase volume of $1,810. Multiplying by the number of accounts implies that these data account for about $210 billion in average daily balances, or 30% of total outstanding U.S. credit card debt over this period (Federal Reserve Bank of New York, 2013). The sample also covers an annualized $250 billion in purchase volume (relative to total U.S. consumption expenditure of approximately $10 trillion).

Panel A of Table 2 shows annualized summary statistics for key account-level variables. The average account holder pays about $159 in interest charges per year, and incurs $53.60 in fees. Fees for late payment ($22.99 per year), fees for exceeding a credit limit ($7.48 per year), and annual fees for the card itself ($5.87) are the three largest constituents of total fee costs. Banks charge off an average $159 per account per year, of which $131 is a charge-off of loaned principal and $28.14 is a charge off of unpaid interest charges and fees.[12] Lenders only manage to recover $5.91 per account per year or 3.7% of total charge-offs. We use the term "net charge-offs" to indicate total charge-offs minus recoveries.

In addition to the income and cost figures observed at the account level, there are other important drivers of credit lending profitability that we only observe at the portfolio level. Panel B of Table 2 shows account-level averages for these variables, which we construct using the portfolio data and data from other sources. (See Appendix A for details on these calculations.) Interchange fees are charged to merchants for processing credit card transitions and scale with purchase volume. We assess account-level interchange income as a constant 2.0% of purchase volume, or $36.21 per account annually.[13] In the portfolio data, we also observe rewards expenses, fraud expenses and operational costs aggregated to the bank-month level. Reward and fraud expenses correspond to about 1.4% of purchase volume on average, or approximately $25.35 per account per year. We calculate operational costs as a percent of ADB by month in the portfolio data and estimate account-level operational costs assuming they scale proportionally with ADB. Operational costs are $46.14 per account per year. Finally, banks report the total interest expense for funding their credit card liabilities at the portfolio

[12] "Charge-offs" refer to an expense incurred on the lender's income statement when a debt is considered sufficiently long past due that it is deemed uncollectible. For an open-ended account such as a credit card, regulatory rules usually require a lender to charge off balances after 180 days of delinquency.

[13] Figure A3 shows that this ratio of 2% is very similar to what we find when considering the ratio of interchange income to imputed purchase value, where we impute the portfolio-level purchase volume by scaling portfolio-level measures of ADB with the ratio of purchase volume to ADB derived from the account-level data. Appendix A describes this procedure in detail.

level by month. This expense scales with average daily balances, and varies significantly over time (see the top panel of Figure A2). Over the sample period it cost banks $20.85 to fund the average account's credit card receivables for one year.

2.3 Utilization and Profitability

Proponents of increased regulation of the credit card industry often claim that lenders earn significant profits, with especially large profits earned from fees charged to the most vulnerable consumers. We assess this claim by analyzing data on average credit card issuer income and costs across the FICO score distribution for the pre-CARD Act period sample (April 2008 to January 2010). Table 3 shows key summary statistics on account-level credit card utilization and profitability grouped by FICO score at account origination.[14] About 17.3% of accounts have FICO scores below 620, which the industry classifies as subprime. The median FICO score is approximately 720. Consumers with FICO scores of 760 or higher constitute the top 26.8% of the distribution.

Panel A describes credit card utilization and capacity. Average daily balances are hump-shaped in FICO score, rising from $804 for borrowers with FICO scores below 620 to $2,029 for borrowers in the 660-719 range, then falling to $1,110 or less for account holders with scores above 760, who usually pay off their balances by the end of the billing cycle. Credit limits increase from $2,025 for account holders with FICO scores below 620 to $12,400 for borrows in the 760-799 range, then tail off moderately. Purchase volume rises over much of the FICO score distribution, increasing from an annualized $730 for account holders with a FICO score below 620 to $2,892 for account holders in the 760-799 range. Overall, the share of people using credit cards to borrow rather than to facilitate transactions declines as FICO scores rise.

We next examine components of profitability by FICO score. To compare across different components of profits, we report all variables as an annualized percent of ADB. For example, given monthly data on total fees and ADB, we calculate

$$\text{Total fees as an annualized percent of ADB} = \left(\frac{\text{Total fees}}{\text{ADB}} + 1\right)^{12} - 1. \tag{1}$$

[14] We use FICO scores at account origination to avoid the reverse casualty that could arise if an account is assigned a low FICO score precisely because it missed a payment and now has to pay a late fee. Using FICO scores at origination introduces some measurement error if the object of interest is profitability by contemporaneous FICO score.

For an account holder with a constant interest rate, interest charges as an annualized percent of ADB is simply the interest rate. Our measure can be interpreted as an interest rate equivalent for different components of income and costs.

We define profits for a credit card account as the difference between total income and total costs. Total income for an account is the sum of interest payments, fee payments and interchange fees. The most basic measure of total costs includes realized net charge-offs, the cost of funds, rewards and fraud expenses and operational costs. We call this measure realized costs.

Panel B of Table 3 examines the components of profits as a percent of ADB. Borrowers with a FICO below 620 pay an annualized 20.6% of ADB in interest charges and 23.3% of ADB in total fees. Interest charges decline modestly in FICO score, falling to 15.2% of ADB for FICO scores between 660-719 and less than 9.3% of ADB for account holders with FICO scores above 760. Total fee payments decline precipitously, dropping to 4.1% for account holders with FICO scores in the 660-719 range and to less than 2.5% for higher FICO scores. Interchange income is not quantitatively important, except for the highest FICO score borrowers, who generate interchange income of more than 9.5% of ADB.[15]

The main component of realized costs is net charge-offs. During our time period, account holders with FICO scores below 620 incurred annualized net charge-offs of 30.8% of ADB. This number declines to 15.8% for account holders with FICO scores between 660-719, and 6.3% or less for consumers with FICO scores of 760 and above. Similar to interchange income, rewards and fraud costs as a fraction of ADB are more significant for higher FICO account holders, who generate more purchase volume per unit of borrowing.

The income and costs data combine to produce a U-shaped distribution of realized profits by FICO score. Account holders with FICO scores below 620 generated realized profits of 7.9% of ADB. Realized profits bottom out at -1.6% of ADB for accounts with FICO scores in the 660-719 range. They rise to above 1.5% for account with the highest FICO scores. Overall profitability averages 1.6% of ADB.

Figures 3 and 4 provide graphical evidence on the relationship between FICO scores, grouped in buckets of 5, and key income and cost components. Figure 3 shows that fee income drops much

[15]This is not surprising given the ratio of purchase volume to average daily balances for different FICO score groups. The highest FICO score account holders primarily use credit cards to facilitate transactions, not to borrow. Hence, interchange income relative to overall receivables managed by the bank increases significantly as FICO rises.

more sharply in FICO score than income from finance charges. Figure 3 also shows that interchange income is only quantitatively important for consumers with FICO scores above 760. Figure 4 shows that the largest realized profits are generated by the subprime segment of the market, although there are relatively fewer account holders in this FICO score range.

The realized profits calculations imply that banks seem to earn significant profits from credit cards relative to measures of average industry profitability. The top panel of Figure A4 shows total U.S. commercial banking sector ROA over the 2000 to 2013 period, with ROA $= \frac{\text{Earnings}}{\text{Assets}}$. Average ROA is 0.2% during the pre-CARD Act period, and 1% over the entire timeframe. We estimate that credit cards generated a net profit of 1.6% and an ROA of 1.1% after adjusting for taxes.[16,17] This implies an ROA about five times the industry average during the pre-CARD Act period. The bottom panel of Figure A4 shows the leverage of the U.S. commercial banking sector. Given an ROA of over 1% and average leverage of about 10, this suggests a return on equity (ROE) for credit card lending of about 10%.

In Panel B we measured ex-post profitability using our definition of realized costs. However, when a bank makes a lending decision—and when policymakers consider regulation—the metric that should be kept in mind is not realized but expected profitability. This is particularly relevant for the measure of charge-offs. While the other main components of profitability, such as fees and interest charges, are not correlated with the business cycle, the time series data on net charge-offs is strongly related to the macro-economy.[18,19] Given that our data coincide with a period of deep economic distress, using realized charge-offs as a measure of expected charge-offs is likely to lead to an understatement of the expected profitability of the industry.

Figure A1 shows charge-offs as an annualized percent of ADB between 1985 and 2013, using

[16] We use the average tax rate for U.S. commercial banks of 32% from Lee and Rose (2010).

[17] Our measure of net profits subtracts out financing costs and other expenses. The other adjustment one might want to make is to include some of the purchase volume that gets repaid at the end of the period. This value would not show up in ADBs, but would still be part of the bank's assets during the month. Table 3 shows that this adjustment would not make a large quantitative difference. An upper bound on the assets we would miss is the total purchase volume divided by 2 (i.e. assuming that it gets built up evenly throughout the month). Since the number presented in Table 3 is annualized, including purchase volume in the total assets would add about $75 or about 6% to total assets. This is an upper bound on the total amount, since the fraction of purchase volume that is not repaid at the end of the month might already be included in average daily balances.

[18] The other variable that exhibits cyclical variation is the Cost of Funds. For example, the 11th District Cost of Funds Index, discussed in Appendix A, shows that the average cost of funds since Q1 1985 was 4.6% rather than the 2.3% that we observe over our sample period.

[19] Recall that our measure of fees is relative to the level of borrowing (fees as an annualized percentage of ADB). Thus the finding that fee revenue is non-cyclical does not imply that absolute fee revenue does not vary but simply that any shifts in fee revenue over the business cycle are proportional to changes in the level of borrowing.

data compiled by the Federal Reserve Bank. The definition of charge-offs is different from the one we use in our data but we think the relative magnitudes are informative.[20] Charge-offs during the pre-CARD Act sample period are slightly higher than charge-offs during the full sample period and a full 68% ($= 7.9\%/4.7\% - 1$) higher than the long-run historical average.

Panel C of Table 3 shows a measure of expected profits in which we replace realized net charge-offs in our pre-CARD Act sample with average net charge-offs over the full Q2 2008 to Q4 2011 sample period. Not surprisingly, using a longer sample increases total profits from 1.6% to 2.0% of ADB. The largest increase is for accounts with a FICO score below 620, for which our measure of expected profits rises from 7.9% to 8.7% of ADB. This is consistent with low FICO score borrowers being even more profitable on average than they are in our pre-CARD Act sample. Panel D shows an additional measure of expected profits in which we further adjust net charge-offs to reflect their long-run historical average. Scaling net charge-offs by 4.7/7.9 increases expected profit to 7.9% of ADB and has proportional effects across the FICO score distribution. This suggests a long-run average ROE in excess of 50% for credit card lending.

Thus credit cards are a particularly profitable segment of the banking industry, with credit card issuers earning a significant return on equity at the height of the financial crisis. Indeed, at the same time that bank divisions making subprime home or auto loans were losing unprecedented amounts of money, credit card issuers were earning their largest profits from the subprime segment of the market.

3 The 2009 CARD Act

The Credit Card Accountability Responsibility and Disclosure Act of 2009 or CARD Act was introduced in the 111th United States Congress (H.R. 627).[21] On April 30, 2009, it passed the House with a

[20] Three important differences are: (i) The Federal Reserve data series uses a different sample of banks; (ii) Since the denominator for the Federal Reserve series is total assets at a particular point in time, it likely includes the float – purchase volume that is repaid at the end of the billing cycle and does thus not show up in our measure of ADB; (iii) The Federal Reserve series only includes "purified chargeoffs" in the numerator. Purification is the practice of reversing uncollectible accrued fees and finance charges against earnings rather than accounting for them as charge-offs against the allowance for loan and lease losses. Purification generates lower charge-off ratios, in particular when the accrued fees and finance charges are included in the denominator.

[21] Congress had previously drafted consumer financial regulation that included many of the same provisions as the CARD Act. The most recent attempt, also sponsored by Carolyn Maloney, was known as the "Credit Cardholders' Bill of Rights Act of 2008," and was introduced in the 110th Congress as H.R. 5244. While the bill had passed 312 to 112 in the House, it was never given a vote in the Senate.

significant majority (357-70). The Senate passed an amended version of the bill on May 19, 2009, also with an overwhelming majority (90-5). President Obama signed the bill into law on May 22, 2009. The Credit CARD Act primarily amended the Truth in Lending Act (TILA) and instituted a number of new substantive consumer protection and disclosure requirements scheduled to take effect in three phases between August 20, 2009 and August 22, 2010.

3.1 Phase 1 - August 20, 2009

On August 20, 2009, the first wave of CARD Act provisions came into effect. The most important change required banks to provide a 45-day advance notice to consumers of rate increases or any other significant changes to terms and conditions. Lenders were also required to (i) inform consumers in the same notice of their right to cancel the credit card account before the increase or change goes into effect and (ii) mail or deliver periodic statements for credit cards at least 21 days before payment is due.

3.2 Phase 2 - February 22, 2010

The bulk of CARD Act provisions came into effect on February 22, 2010. A key requirement was that no fees could be imposed for making a transaction that would put the account over its credit limit unless the cardholder explicitly "opts in" for the credit card company to process rather than decline over-limit transactions. Furthermore, an over-limit fee may be imposed only once during the billing cycle when the limit is exceeded, not once for each transaction that exceeds the credit limit. The new provisions also prohibited creditors from charging a fee for making a payment, except for payments involving an expedited service by a creditor representative. Other restrictions regulated the issuance of credit cards to borrowers aged 21 and below.

The CARD Act also introduced regulation detailing repayment disclosures required in monthly credit card statements. In particular, it required statements to show important repayment information including:

1. The number of months (rounded to the nearest month) that it would take to pay the outstanding balance, if the consumer only pays the required minimum monthly payments and no further advances are made;

2. The total cost to the consumer, including interest and principal payments, of paying that balance, if the consumer only pays the required minimum monthly payments and no further advances are made; and

3. The monthly payment amount that would eliminate the outstanding balance in 36 months, if no further advances are made, and the total cost to the consumer, including interest and principal payments, of paying that balance in full.

Figure 1 provides an example of the way this information is displayed on credit card statements.[22]

The CARD Act also included a restriction on interest rate increases for new transactions within the first year of opening the card. It also limited the application of increased rates to existing balances, except if the prior rate was temporary (e.g., an introductory rate) lasting at least six months or if the minimum payment has not been received for 60 days. For cards with multiple interest rates (e.g., a balance-transfer and a new-purchase rate), issuers were required to apply payments to the highest-rate balances first.

Finally, the CARD Act regulated payment due dates and times. Credit card issuers are no longer allowed to set early morning or other arbitrary deadlines for payments. Any payments received before 5 p.m. on the payment due date have to be accepted. If payments are due on a day during which lenders do not receive payments by mail (including weekends and holidays), a payment received on the next business day cannot be treated as late.

3.3 Phase 3 - August 22, 2010

The third phase of the CARD Act further regulated the fees banks can charge by requiring them to be "reasonable and proportional." Under the new rules a credit card company generally cannot charge a late fee of more than $25 unless one of the last six payments was late (in which case the fee may be $35). Second, the late fee cannot be larger than the minimum payment. Similarly, over-limit fees were capped at the actual over-limit amount. An additional provision prevented issuers from charging more than one penalty fee based on a single violation of account terms per period (such as a late payment). The CARD Act also prohibited the charging of inactivity fees for not using the credit

[22]This new information might be less salient for individuals who do most of their banking online. Rather than alerting consumers to the minimum payment warnings when they log on, many banks limited the changes to monthly statements. That means cardholders have to view a PDF copy of their full statements to see the minimum payment warnings.

card for a period of time. Finally, it required lenders to re-evaluate any new rate increases every six months.

4 Fee Restrictions

In this section, we quantitatively assess the impact of the CARD Act on the overall pricing behavior of credit card lenders. We start by presenting a model of offsetting prices. The model shows that the extent to which fee limits are offset is determined by (i) the degree of competition in the market and (ii) the salience of the regulated fee. It provides a framework for assessing the empirical results that follow.

4.1 Model Setup

Consider a setting in which n identical firms compete to offer a credit card with a salient price p_1 (e.g., interest rate) and a potentially non-salient price p_2 (e.g., over-limit fee).[23] Since firms are identical, they charge the same prices in equilibrium. Aggregate demand is given by the function $q(p_1 + \psi p_2)$ where $\psi \in [0,1]$ parameterizes the degree of salience of p_2. A value of $\psi = 1$ indicates perfect salience; a value of $\psi = 0$ indicates that consumers are completely oblivious to the price. Following Heidhues, Kőszegi and Murooka (2012), we assume that there is a maximum $\bar{p}_2$ that is determined by regulation or some other factor.[24]

Firms have identical costs structures, which include both the cost of financing consumer lending and the cost of default. Assume for now that lending to consumers has constant marginal costs c. In Appendix Section B we show that the results are similar when we allow for marginal costs to vary, as they would in an environment with adverse or advantageous selection.

It is optimal for firms to set the potentially non-salient price p_2 to the maximum allowable amount $\bar{p}_2$. To see this, suppose a firm sets a $p_2 < \bar{p}_2$. The firm can increase profits by decreasing the salient price by ψdp_2 and increasing the non-salient price by dp_2. This pricing change has no effect on demand because $q\left(p_1\psi - dp_2 + \psi(p_2 + dp_2)\right) = q(p_1 + \psi p_2)$ but raises total profits by $(1-\psi)\, dp_2\, q(p_1 + \psi p_2) > 0$. This means that $p_2 < \bar{p}_2$ cannot be an equilibrium.[25]

[23] See Stango and Zinman (2011) and Bar-Gill and Bubb (2012) for discussions of the salience of credit card fees.

[24] Alternatively, one could specify demand as a function of $q(p_1 + \psi(p_2))$ where $\psi(\cdot)$ is increasing and convex and has the property $\psi'(\bar{p}_2) = 1$. This would result in the firm setting $p_2 = \bar{p}_2$ in equilibrium.

[25] If p_2 is perfectly salient ($\psi = 1$), the equilibrium is described by a single price $p^* \equiv p_1 + p_2$ and firms are indifferent

Following Weyl and Fabinger (2013), we characterize the first order condition for the salient price p_1 as

$$p_1 + p_2 - c = \theta\, \mu(p_1 + \psi p_2) \tag{2}$$

in which the markup of price over marginal cost is set equal to the product of a market competitiveness parameter $\theta \in [0, 1]$, which indexes the degree of competition in the market (see Bresnahan, 1989) and an absolute markup function $\mu(p_1 + \psi p_2)$, which is equal to p times the inverse elasticity of aggregate demand: $\mu(p_1 + \psi p_2) \equiv -\frac{q}{q'} = \frac{p}{\varepsilon_{p_1}}$, where ε_{p_1} is the aggregate elasticity of demand.[26]

The specification is flexible and nests a number of standard cases. Monopoly is given by $\theta = 1$, which simplifies the equation to the standard Lerner Index for optimal pricing $p_1 + p_2 - c = \frac{1}{\varepsilon_{p_1}}$. This means that another way to think about $\mu(p_1 + \psi p_2)$ is that it is the absolute markup that would be charged by a monopolist. Perfect competition is given by $\theta = 0$ and simplifies the first order condition to the standard "price equals marginal cost" condition $p_1 + p_2 = c$. Differentiated product Nash-in-prices competition is given by $\theta = 1 - A$, where $A = -\frac{\sum_{j \neq i} \partial q_j / \partial p_i}{\partial q_i / \partial p_j}$ is the aggregate diversion ratio, which is defined as the sum of consumers lost by firms $j \neq i$ divided by the consumers gained by firm i for a change in firm i's price p_1. Cournot competition is given by $\theta = 1/n$, where n is the number of firms. See Bresnahan (1989) and Weyl and Fabinger (2013) for extended discussions of the micro-foundations of this specification.

4.2 Pricing Offsets

Next consider a regulation that decreases the maximum allowable price $\bar{p}_2$. We want to know how much of the decline in p_2 is offset by an increase in p_1. For small changes in p_2, this offset is given by $\omega \equiv -\frac{dp_1}{dp_2}$. We will say there is a full offset if $\omega = 1$ and no offset if $\omega = 0$. In principle, the offset can be greater than full, with $\omega > 1$.

Assume that θ and ψ are invariant to the price. Totally differentiating the first order conditions (Equation 2) with respect to p_2 and rearranging yields

$$\omega = \frac{1 - \psi\, \theta\, \mu'}{1 - \theta\, \mu'} \tag{3}$$

between all combinations of p_1 and p_2 that sum to this p^*, including the combination with $p_2 = \bar{p}_2$.

[26] The second order condition for p_1 is $\theta\, \mu' < 1$. We assume that at the optimal price this condition is satisfied.

where we have suppressed the arguments of μ for notational simplicity. To gain intuition for the offset formula, consider two special cases.

Special Case 1. *(Perfect Competition) If there is perfect competition ($\theta = 0$), then a limit on p_2 will be fully offset by an increase in p_1 ($\omega = 1$).*

Since competition drives price to marginal cost, any decrease in p_2 must be fully offset by an increase in p_1 to maintain zero markup in equilibrium.

Special Case 2. *(Perfect Salience) If p_2 is perfectly salient ($\psi = 1$), then a limit on p_2 will be fully offset by an increase in p_1 ($\omega = 1$).*

If p_2 is perfectly salient, consumers view both prices as equivalent and firms can maintain their desired level of demand by increasing p_1 one-for-one with the decline in p_2.

In Appendix Section B, we show that the offset is relatively larger when there is adverse selection (i.e., marginal costs increasing in price) and relatively smaller when there is advantageous selection (i.e., marginal costs decreasing in price).[27] The reason the offset is larger with adverse selection is that a higher p_1 brings in higher marginal cost consumers, requiring a further increase in the price.

Intuitively, the offset can be less than one-for-one when there is both imperfect competition ($\theta > 0$) and imperfect salience ($\psi < 1$). Figure 2 plots the offset by the degree of competition and salience when demand is given by constant pass-through demand function with $\mu' = -5$. Lines show offset isoquants. A monopolist ($\theta = 1$) facing consumers that are completely non-salient ($\psi = 0$) will offset one-sixth of the required decrease in the non-salient price ($\omega = 0.17$). The plot shows that the size of the offset is increasing as the market becomes more competitive ($\theta \to 0$) and p_2 becomes more salient ($\psi \to 1$). Taking derivatives of Equation 3 with respect to θ and ψ yields the following proposition:

Proposition 1. *(Offset) The offset is converging toward full ($\omega \to 1$) as (i) the market becomes more competitive ($\theta \to 0$) and (ii) p_2 becomes more salient ($\psi \to 1$).*

The offset is converging from below for many standard parameterizations of demand, but can also converge from above for some parameterizations. Technically, the offset converges from below when $\mu' < 0$ or equivalently if log demand is concave, since $(\log q)'' = \mu'/\mu^2 < 0 \iff \mu' < 0$. See

[27] The offset is similarly larger when marginal cost is increasing in price due to an effect in which higher prices increase debt levels and lead to higher probabilities of default.

Fabinger and Weyl (2013) for more on the slope of the μ parameter.[28]

Finally, it is useful to establish a link between the offset of a reduction in the non-salient price and the pass-through of an increase in marginal costs. Let $\rho \equiv \frac{dp_1}{dc}$ denote the pass-through of a increase in marginal costs. Differentiating the first order conditions with respect to c yields:

$$\rho = \frac{1}{1 - \theta\, \mu'} \tag{4}$$

We can then write the offset as a function of the pass-through rate:

$$\omega = \rho + \psi\,[1 - \rho] \tag{5}$$

This relationship is useful for two reasons. First, it allows us to identify of the salience parameter ψ. In any setting where there is variation in the non-salient price p_2 and in marginal costs c, we can use the differential response of p_1 to these shocks to estimate ω and ρ, and thereby identify ψ. Second, the equation places restrictions on the relationship between ω and ρ, which can be used as an ancillary test of the model:

Corollary 1. *(Offset vs. Pass-Through) The offset (ω) of a decrease in the non-salient price is closer to full than the pass-through (ρ) of an increase in marginal costs (i.e., $|1 - \omega| \leq |1 - \rho|$).*

This implies, for instance, that the offset must be weakly greater than the pass-through when the offset is less than one. To see this, notice that if consumers are completely oblivious to the potentially non-salient price ($\psi = 0$), the firm's first order condition is given by $p_1 + p_2 - c = \theta\, \mu(p_1)$ and a decrease in the non-salient price p_2 enters the firm's problem in the exact same manner as an increase in marginal costs c. Thus, the offset is equal to the pass-through when $\psi = 0$ and weakly greater when $\psi > 0$ due to the fact that the offset is increasing in ψ. See Appendix Section B for more details on this calculation.

[28] Fabinger and Weyl (2013) prove that $\mu' < 0$ if demand is linear or if it is based on an underlying willingness-to-pay distribution that is normal, logistic, Type I Extreme Value (logit), Laplace, Type III Extreme Value, or Weibull or Gamma with shape parameter $\alpha > 1$. They show that $\mu' > 0$ if demand is based on a willingness-to-pay distribution that is Pareto (constant elasticity), Type II Extreme Value, or Weibull or Gamma with shape parameter $\alpha < 1$. They show that μ switches from $\mu' < 0$ to $\mu' > 0$ for a log-normal distribution of willingness-to-pay.

4.3 Results

We next examine the extent to which the CARD Act lowered the cost of credit card borrowing. We start by examining the fees that were targeted by the legislation. We then examine whether lenders offset reduced fee revenue by increasing interest rates and the resulting effect on profits. Finally, we examine whether the CARD Act brought about changes in the supply of credit.

4.3.1 Estimating Equation

Our primary approach to examining the effects of the CARD Act's fee regulation is to plot mean outcomes over time. These plots visually convey information on the magnitude of the effects and the underlying variability in the data. They allow us to visually determine if there are pre-exisiting trends that could give rise to our findings.

We also estimate event-study regressions to more rigorously control for time trends and other potentially confounding factors. Let y_{it} denote an outcome for consumer i in month t (such as annualized late fees as a percentage of ADB). The underlying regression specification is

$$y_{it} = \delta_1 1_{(t>\text{February 2010})} + \delta_2 1_{(t>\text{August 2010})} + f(t, X_i) + \epsilon_{it} \tag{6}$$

where $1(\cdot)$ are indicator functions for the two key CARD Act implementation dates, $f(t, X_i)$ is a polynomial in months interacted with other factors X_i, and ϵ_{it} is the error term.[29] To facilitate the analysis, we aggregate the account-level data to the bank-month level and run regressions on this aggregated data.[30]

When we include polynomial controls, we interpret the coefficients δ_1 and δ_2 as measuring the short-run causal effect of the reform on the outcome variable. The identifying assumption is that unobservable factors that might also affect our outcome trend smoothly through the time periods when the reform was implemented. When we exclude the polynomial controls, the coefficients can capture anticipation or delayed effects, but may also pick up spurious trends. For most of our analysis, the

[29] For example $1_{(t>\text{February 2010})}$ takes on value of 1 if the month is greater than February 2010. Because reforms are implemented mid-month, we replace the indicators for February 2010 and August 2010 with the fraction of days in these months for which the reform has been implemented.

[30] We construct heteroskedasticity and autocorrelation consistent standard errors as proposed by Newey and West (1987). We set the number of auto-regressive lags to be 3 using the rule of thumb proposed by Stock and Watson (2003). Extending the number of lags to 6 has no impact on the statistical significance of our findings.

estimates with and without the polynomial controls are very similar.

4.3.2 Fees

The CARD Act had two primary elements that were targeted at reducing credit card fees. These regulations, described in more detail in Section 3, aimed at significantly reducing the incidence of over-limit fees and the magnitude of late fees.

Figure 5 examines the effect of these regulations by plotting payments of the different types of fees over time. The vertical axis in this figure shows average fee revenue as an annualized percent of average daily balances (ADB), calculated in the same manner as the values in Panel B of Table 3. The horizontal axis shows months, with the vertical bars in February 2010 and August 2010 indicating the dates when the relevant CARD Act provisions were implemented. The figure shows a sharp decline in over-limit and late fees. Over-limit fees drop from about 1 percent to zero in February 2010. Late fees drop by about 0.5 percentage point in February 2010 and another 0.5 percentage point in August, for a combined decline of 1 percentage point on a base of 2 percent.[31]

Table 4 shows estimates of these declines in fees from event-study regressions with indicator variables for February 2010 and August 2010. Panel A includes bank fixed effects as control variables; Panel B adds a fifth-order polynomial to control for smooth trends over time; Panel C interacts the fifth-order polynomial with the bank fixed effects, allowing for differential smooth time trends across banks. The regression estimates confirm the conclusions from Figure 5. Combined across the February and August implementation phases, the CARD Act reduced fees by 2.1 to 2.9 percentage points, with most of the effect coming from declines in late and over-limit fees. Additional small

[31] Total fee income also declined by a sizable amount in January 2009, led by a decline in late and over-limit fees. Since this decline was well before the passage of the CARD Act, a deeper analysis is beyond the scope of this paper. However, industry experts suggest that this decline might be driven by banks' voluntary early compliance with UDAP. The Federal Trade Commission Act (15 USC 45) had previously established the statutory basis for this provision, prohibiting "unfair or deceptive acts or practices in or affecting commerce," with rulemaking and enforcement authority for financial products given to various regulatory agencies (the FDIC, the Federal Reserve Board, the Office of the Comptroller of the Currency, the Office of Thrift Supervision and the National Credit Union Administration). On December 18, 2008, the Federal Reserve Board approved final rules that provide clarification to the body of law surrounding unfair or deceptive acts or practices (also see 74 Fed. Reg. 5498 [Jan. 29, 2009]). They describe specific acts or practices relating to credit card accounts that are identified as "unfair." For example, these rules require banks to provide period statements to borrowers at least 21 days prior to the due date. Even though the effective date for the new regulation was July 1, 2010, the agencies "encouraged early implementation of the required changes (Hastings, 2009)," and market observers noted that "many credit card issues may have already taken actions to implement such changes in their credit card operations [by June 2009]." The Dodd-Frank Wall Street Reform and Consumer Protection Act expanded on this regulation, essentially maintaining the FTC Act's definitions of "unfair" and "deceptive," while also adding a third element, "abusive" (making the acronym UDAAP). Dodd-Frank tasked the Consumer Financial Protection Bureau with enforcing UDAAP for institutions with over $10 billion in assets.

but statistically significant declines are detected for not sufficient funds (NSF) fees—which, following the "one penalty per transgression" provision implemented in August 2010, could no longer be charged in addition to other penalties—and other fees, which include fees for making a payment, which were significantly curtailed in the February 2010 implementation phase. Given an outstanding credit card volume of $744 billion in the first quarter of 2010 (Federal Reserve Bank of New York, 2013), we estimate that the CARD Act's fee regulation reduced annual credit card borrowing costs for U.S. consumers by $20.8 billion per year.

Table 4 shows some evidence of a small increase in annual fees. The increase did not occur around the CARD Act implementation dates, but smoothly over the observed time horizon, as indicated by the fact that the inclusion of the time polynomial in the regression flips the sign on the event dummies. It is possible that banks increased annual fees in anticipation of or as a delayed response to revenue lost due to CARD Act provisions. However, even when the entire increase of 0.2 percentage point over the period is attributed to the CARD Act, charging annual fees allowed banks to offset less than 10% of the overall decline in fee revenue.

The regulation of fees has the largest effect on the borrowing costs of consumers with the lowest FICO scores. Figure 6 plots total fees as a percentage of average daily balance for different FICO score groups. Table 5 shows the corresponding regression estimates. For the lowest FICO score group (<620), total fees drop by about 14 percentage points on a pre-CARD Act base of about 23.3 percent (see Table 3) . The drop-off is 6 percentage points on a pre-CARD Act base of 10.9% for consumers with FICO scores in the 620-659 range and 2 percentage points on a base of 4.1% for consumers in the 660-720 range. For consumers with FICO scores of 720 or above (approximately the median in the data), base fee payments are no more than 3 percent of average daily balances and the effect of the CARD Act is correspondingly smaller, although still statistically different from zero.[32]

[32]With transaction level data, it might be possible to examine fee salience directly. For example, the CARD Act eliminated early morning deadlines for monthly payments. If these early morning deadlines were non-salient, we would expect to see very little change in the distribution of time-of-the-day when payments were submitted. The CARD Act also placed restrictions on over-limit fees. If these fees were non-salient, we would expect little change in attempted transactions that would put an account over its credit limit (although we might expect a reduction in processed transactions since the reduction in fee revenue reduces bank incentives permit this over-the-limit spending).

4.3.3 Interest Charges

We next examine the extent to which lenders offset the observed reduction in fee revenue with increased revenue from interest charges. Figure 7 shows interest charges as an annualized percent of ADB for different FICO score groups. Interest charges are virtually flat over the entire period for every FICO group. There is no increase around either of the implementation dates. And there is no evidence of anticipatory increases in the time period between when the bill was introduced in January 2009 and when it was implemented. The plot also shows that interest charges were unresponsive to a sharp two percentage point drop in the cost of funding credit card liabilities beginning in late 2008, a key determinant of the marginal cost of lending (see top panel of Figure A2). This is consistent with the findings of Ausubel (1991), who documents the extreme stickiness of credit card interest rates during the 1980s, when, despite significant movements in the cost of funds, credit card interest rates were virtually constant. Appendix Figure A5 shows the average interest rates (APRs) by FICO group. Like interest charges, interest rates are quite stable over time. If anything, interest rates actually decline during CARD Act implementation.

Table 6 column 2 shows regression estimates of the effect of the CARD Act on interest charges. The point estimates show a 1 percentage point *decline* in interest charges around the CARD Act implementation dates. This effect, which is not always statistically significant, comes off a base of about 14 percent. The effects are of similar magnitude when we include a polynomial control, which isolates sharp changes around the implementation dates or when we exclude these variables, which allows for more gradual or anticipatory responses. Table 7 columns 1 to 3 show regression estimates for different FICO score ranges. Recall that consumers with the lowest FICO scores (<620) experienced a fee decline of 14 percentage points. Panel A shows that for those consumers in particular, the evidence points to a decline in interest charges, and certainly not an increase of anything close to the magnitude required to offset the drop in fee revenue.[33]

[33]One might also be concerned that banks passed on some of the decline in fee revenue to merchants through assessing higher interchange fees (the "waterbed effect") or to consumers through fewer rewards. This was not the case. The bottom panel of Figure A3 shows that interchange income as a share of purchase volume was a constant 2% throughout the entire sample period. The bottom panel of Figure A2 shows that the ratio of fees to interchange income (and thus to purchase volume) was similarly constant over the sample.

4.3.4 Alternative Explanations

While perhaps surprising, we do not view the non-response of interest charges as unlikely or implausible. Indeed, it is fully consistent with the theoretical model and prior evidence on limited competition and low salience of fees in the credit card market. Below we examine other potential explanations for the non-response we have documented.

One potential explanation for the non-response of interest charges is the CARD Act provision that (i) required lenders to notify consumers 45 days in advance of rate changes and (ii) limited the ability to change interest rates on existing accounts, in particular in the first year after origination. While lenders could have announced rate changes 45 days in advance of CARD Act implementation dates, regulatory uncertainty may have reduced their willingness to institute such preemptive interest rate increases.

To address this concern, we examine the sample of newly originated credit card accounts, for which this restriction on interest rate changes does not apply. Figure 8 shows interest charges for new accounts as an annualized percent of ADB by FICO score.[34] The figure shows no evidence of a discontinuous or persistent increase in interest charges around the implementation of the CARD Act.[35] Appendix Figure A6 shows interest *rates* for new accounts by FICO score. Panel A shows no evidence of a jump in interest rates at either CARD Act implementation date. The plot shows evidence of a temporary spike in mid-2009 (which was also visible in Figure 8). Panel B shows that this increase is explained by a temporary uptick in the share of accounts with a non-zero initial interest rate.

Another potential reason why we might not have observed an offsetting rise in interest rates is if interest rates would have been lower if the CARD Act had not occurred. For example, the American Bankers Association (2013) argues that there should have been a counterfactual decrease in interest rates, and therefore the flat interest rates we observe should be interpreted as an increase relative to this downward counterfactual path.

One way to assess the validity of this argument is to examine the relative trends of interest charges for account holders with different FICO scores. As shown in Figure 6 and Table 5, account-

[34] New accounts are defined as accounts in their first full month of activity.

[35] The reason interest charges as a fraction of ADBs is smaller for this sample of newly originated accounts is that a significant fraction of accounts offer a zero introductory APR, and hence do not charge interest in months shortly after origination. This series is also noisier, partly because it is constructed off a smaller number of accounts.

holders with FICO scores of at least 720 saw less than a 1 percentage point reduction in fees, relative to 14 percentage point drop for account holders with FICO scores below 620. If this alternative explanation is correct, we would expect these high FICO score accounts to experience the counterfactual decline in interest charges. Evidence from Figure 7 indicates that there is no such decline in interest charges for high FICO score accounts, either in isolation or relative to low FICO score accounts.[36]

A second way to address this concern is to exploit additional variation across banks in the magnitude of the fee reductions. Prior to CARD Act implementation, banks in our data exhibit substantial differences in the amount of revenue they generated from fees, even among consumers with the same FICO scores. If there is a strong relationship between fees and interest charges, then we would expect to see those banks with the largest decline in fee revenue to raise their interest charges more relative to banks that experienced a smaller drop in fees.

Figure 9 examines this source of difference-in-differences variation by plotting the decline in fee revenue as a percent of ADB (horizontal axis) against the increase in interest charges (vertical axis) for the two months before and after the February 2010 implementation phase of the CARD Act (top panel) and the two months before and after the August 2010 implementation phase (bottom panel). Points in these plots show the average change in interest charges and fees within a bank-by-FICO group cell (<620, 620-660, 660-720, 720 - 760, 760-800, 800+). Figure 10 shows the same patterns for a twelve months horizon around the implementation dates. If a decline in fee revenue was fully offset by a increase in interest charges, we would expect the points to lie on the displayed 45 degree line. The plots show no sign of an upward sloping relationship.[37]

To address concerns that the CARD Act might have restricted the banks' ability to adjust interest rates on existing accounts, Figure 11 shows the change in the APR quoted on newly originated accounts by bank and FICO group, together with the decline in overall free revenue. The results are very similar to those presented for all accounts. Taken together, this evidence shows that accounts that were relatively unaffected by the CARD Act did not see the claimed decline in interest charges,

[36] While high FICO score account holders are not a perfect control group, and may not respond at the same magnitude to underlying trends, we find the complete absence of a differential response to be hard to reconcile with the argument that interest rates would have counterfactually declined in the absence of the CARD Act. In addition, while Gabaix and Laibson (2006) show that banks might sometimes be subsidizing across consumers that differ on unobservable characteristics, FICO scores are observable to all market participants, and therefore they should not be a dimension along which banks cross-subsidize.

[37] The FICO groups in these plots are coarse and may mask some cross-bank heterogeneity in default risk. Figure A7 and Figure A8 show the analogous plots, this time with more finely split up FICO score groups. The results are very similar.

challenging the validity of this argument.[38]

An ancillary prediction of the model is that the offset of a decrease in fee revenue should be closer to full than the pass-through of increase in marginal costs. Thus, evidence on the relationship between interest charges and costs provides an additional test of our theory, with a finding of non-zero pass-through raising serious questions about the evidence on the lack of a fee offset. Figure 12 examines the pass-through of costs by plotting the change in the cost of funds as a percent of ADB (horizontal axis) against the change in financed charges (vertical axis) for the two periods in our data with the largest swings in the cost of funds. Points in the plots show the averages at the bank level. The left plot shows the change between the three months before and after November 1, 2008; the right plot shows the change between the three months before and after February 1, 2009. The figures show substantial variation across banks of up to 1 percentage point in the change in the cost of funds as a percentage of ADB. There is no evidence of a positive relationship between these changes in costs and changes in interest charges.

In addition to providing further support for the validity of our findings, the evidence on pass-through can be used to identify the salience parameter ψ in the model. Recall that the relationship between the offset (ω) and pass-through (ρ) parameters is given by the equation $\omega = \rho + \psi\,[1 - \rho]$. Our finding of approximately zero offset ($\omega \approx 0$) and approximately zero pass-through ($\rho \approx 0$) implies that fees were completely non-salient to consumers in their choice over credit card contracts ($\psi \approx 0$). This is consistent with the results of Stango and Zinman (2011).[39,40]

4.3.5 Income and Profits

Total income for credit card lenders is defined as the sum of fees, interest charges and interchange income. Figure 13 plots total income as an annualized percent of ADB. Total income declines by about 3 percentage points in February 2010 and another 2 percentage points in August for a combined drop

[38] Another objection to the no-offset finding is the claim that banks will eventually offset the reduced revenue but that inertia has prevented them from raising prices immediately. We think this is unlikely. If banks fully offset the reduction in fee revenue with higher interest charges, and there was no corresponding drop in demand, then this offsetting response would increase revenue for the accounts in our data by $5.2 billion (=2.8% $\times$ 150 million accounts $\times$ $1,251 ADB per account) per year. It is hard to imagine any form of inertia that could led banks to forgo this much revenue.

[39] Our setting is actually the special case where only ω is required to identify ψ. This is because $\omega = 0$ implies both $\rho = 0$ and $\psi = 0$. In all other circumstances when $\omega > 0$, estimates of both ω and ρ are required to identify ψ.

[40] This does not mean that fees have no impact on credit card usage conditional on obtaining a given credit card. It implies that when consumers are choosing a credit card, they do not seem to be elastic in their substitution between fees and interest rates.

of 5 percentage points on a pre-CARD Act base of 25 percent (see Table 3). Regression estimates from Table 6 confirm this finding. Table 7 shows a decline of about 17 percentage points for consumers with a FICO score of less than 620, and a decline of 8 percentage points for consumers with a FICO score in the 620-659 range.

To calculate the effect of the CARD Act on overall profits, we also need to analyze whether any costs changed discontinuously around the CARD Act implementation dates. Figure 14 shows the development of charge-offs as a share of ADBs over the sample period. It is declining continuously beginning in 2010. This development is most easily explained by the general recovery of the economy, and is unrelated to the CARD Act. No discontinuous changes in charge-offs around the CARD Act implementation dates can be detected. Figure 15 shows the development of other costs over time. This series captures the sum or rewards expenses, cost of funds and operational expenses. It does not display any persistent changes around the CARD Act implementation dates.

Table 8 shows the effect of the event-study regressions analyzing the effect on cost terms and net income by FICO score. The first column captures the decline in charge-offs during the later parts of our sample. Columns 2 and 3 show that even the inclusion of the time polynomial does not capture the entire time movement of charge-offs. Overall, around the CARD Act implementation dates, net income declined by about 18 percentage points of ADB for the lowest FICO groups, and 9 percentage points for the 620-659 FICO group. For the other FICO groups, the smaller decline in fee revenue was offset by a decline in charge-offs, such that overall observed net income declined by about 3 percentage points or less.

4.3.6 Credit Supply

The decline in profitability, especially for consumers with the lowest FICO scores, raises the question of whether lenders responded to the CARD Act by restricting credit supply. Lenders will restrict supply if the decline in fee revenue, coupled with the inability to raise other prices, reduces net profits below zero. However, if pre-CARD Act profits were large enough that lenders could absorb the decline in fee revenue and still make a profit, then they do not necessarily have to reduce the supply of credit.

We assess the effect on the supply of credit by examining whether the CARD Act impacted the the number accounts or average credit limit for these accounts. These outcomes do not perfectly isolate

the supply of credit but are likely to pick up changes in credit availability. We start by examining effects on new accounts.[41] Figure 16 plots the number of new accounts originated by FICO score. The plot shows that the number of new accounts declined significantly during the earlier parts of the sample period, a time of substantial deleveraging of U.S. households. Since Q4 2009, and during all implementation phases of the CARD Act, we observe a steady increase in the number of accounts. Moreover, low FICO score groups, for which lenders experienced the steepest decline in total net income, show the fastest increase in the number of accounts over this period.[42]

We also analyze the channels through which banks originated these new accounts. Banks can originate new accounts pro-actively through mailings of pre-approved offers and "invitations to apply" or through unsolicited applications at a branch or online. Although changes in the number of accounts originated through these channels does not isolate the effects supply or demand, we interpret the bank-initiated pre-approved and invitation-to-apply loan channels as relatively more indicative of supply, and the consumer-initiated branch and online applications as relative more indicative of demand. Figure 17 shows a shift during the CARD Act period towards bank-initiated loan channels, providing more evidence that banks are not cutting back on the supply of credit.

Figure 18 plots credit limits by FICO score for new accounts; Figure 19 shows these data for all of the accounts in our sample. Credit limits are flat during the CARD Act implementation phases and generally flat for new accounts. There is a consistent decline in average credit limits for high-FICO score accounts over the sample period. The results indicate that the CARD did not decrease the supply of credit.

5 Payoff Nudge

In addition to regulating the fees charged by banks, the CARD Act also introduced rules requiring certain repayment disclosures in monthly credit card statements. Debt repayment decisions involve the choice between (i) repaying less today and having more resources for current consumption or (ii) repaying more today and reducing future interest payments. To properly evaluate this trade-off, the relative cost of these choices must be fully salient (Mullainathan, Barr and Shafir, 2009). The

[41] For new accounts, lenders have more margins of adjustment than for existing accounts, for which their ability to adjust account terms and conditions might be limited.

[42] We think that the small downtick in February 2009 may be a result of the lower need for liquidity among low FICO consumers during the time when tax refunds are being redistributed.

aim of the CARD Act's disclosure requirements was to provide information on the consequences of making only the minimum payment, as well as information on the reduction in interest payments that could be achieved by making payments that would eliminate the balance within 36 months. Indeed, some have argued that information such as the 36-month payment amount might be understood by consumers as a payment recommendation or nudge, anchoring repayment at this level (Navarro-Martinez et al., 2011).[43] However, it is not obvious that this nudge would actually lead to a shift in behavior, both because it is unclear if the nudge would be sufficiently powerful and because current repayment levels might be optimal.[44]

5.1 Pre-CARD Act Payoff Behavior

We begin by documenting the credit card payoff behavior in the pre-CARD Act period. Let T be the number of months it would take to pay off a given cycle-ending balance if the account holder makes constant payments and avoids new purchases.[45]

$$T = 1 - \frac{\ln\left(1 - \frac{\text{APR}}{12}\frac{\text{Cycle Ending Balance} - \text{Payment}}{\text{Payment}}\right)}{\ln(1 + \frac{\text{APR}}{12})} \tag{7}$$

Full repayment is indicated by $T = 1$. At the average pre-CARD Act interest rate of 16.5%, $T = 5$ implies a payment of 20.5% of the cycle-ending balance; $T = 10$ implies a payment of 10.6% of the balance; and $T = 83$ implies a payment of 2% of the balance, which is a typically minimum payment in our data. The CARD Act requires a disclosure of the payment that would result in $T = 36$. At the average interest rate, this implies a payment of 3.5% of the cycle ending balance.

Figure 20 shows a histogram of T in the year preceding the implementation of the CARD Act disclosure requirement.[46] We top-code T at 99 months and let $T = 100$ denote account holders that

[43] Using experimental evidence from the United Kingdom, Stewart (2009) shows that presenting a minimum payment requirement on credit card statements has the effect of anchoring repayment behavior at that level, and reduces overall willingness to repay.

[44] This point was made by Warren (2011), who argued that "changes that make the credit card market more transparent can echo throughout our economy. [...] Some consumers may respond by deciding to purchase less, to use a different card, or to pay with cash or another financial instrument. Others may pay down more of their credit card debt. Of course, some may go the other way: With confidence that they can assess the real cost of their credit cards going forward, some consumers may choose to borrow on their card more frequently. In any case, clear information about prices and risks would make it easier for consumers to sort through their options."

[45] This equation obtains from re-arranging the standard monthly payment formula for a series of payments starting in the *current* month: Payment $= \left(\frac{\text{APR}/12}{1-(1+\text{APR}/12)^{-(T-1)}}\right)$ (Cycle Ending Balance $-$ Payment).

[46] As we discuss below, there is seasonality in repayment behavior, so analyzing the 12 months prior to the CARD Act is more representative than analyzing the entire pre-CARD Act period.

make no payment. We exclude accounts that do not have a positive cycle-ending balance. About 28.9% of people pay their cycle-ending balance in full, and do not carry balances from month to month. Most other people pay off only a relatively small fraction of their balance, and carry significant interest-accumulating debt. We calculate that 14.1% of borrowers only make the minimum payment and 13.8% of people make no payment whatsoever.

Low FICO score account holders are substantially more likely to make low payment amounts. The top panel of Figure 21 shows the share of account holders making full payments by FICO score. About 10% of borrowers with a FICO scores below 620 fully repay their balance. This share rises monotonically in FICO score, with about 25% of borrowers with a FICO score of 720 and about 75% of borrowers with a FICO score above 800 making the full payment. The bottom panel of Figure 21 shows the share of account holders making only minimum payments or less by FICO score. About 60% of borrowers with FICO score below 620 pay the minimum or less. The number of account holders making the minimum payment or less declines monotonically, with about 25% of borrowers with a FICO score of 720 and 10% of borrowers with a FICO above 800 making payments of the minimum or less.

5.2 Effect of Payoff Nudge

We next examine the effect of the payoff disclosures on repayment behavior. Figure 22 shows the distribution of months-to-payoff T in the three months before and after the CARD Act. The vertical axis variable is top-coded at 1% to focus on the distribution around the 36-month payoff amount. Following the implementation of the CARD Act, there was a small but significant increase in the share of consumers that choose payment amounts that would repay their balance at the target 36-month value.[47] For repayment amounts of $T > 36$, the post-CARD Act distribution appears to be shifted below the pre-CARD distribution. This suggests that the nudge shifted account holders to the target payment ($T = 36$) from making lower payments ($T > 36$) and thereby increased overall credit card payments.

[47] We would expect increases in a small range around 36-months for a number of reasons. The most important is that we use the current interest rate for our calculation of T, while banks are required to account for contractually determined changes in interest rates over the 36-month period. In particular, if the interest rate in effect on the date on which the disclosure is made is a temporary rate (such as an introductory rate) that will change under a contractual provision applying an index or formula for subsequent interest rate adjustment, the creditor is required to apply the interest rate in effect on the date on which the disclosure is made for as long as that interest rate will apply under that contractual provision, and then apply an interest rate based on the index or formula in effect on the applicable billing date.

We also estimate event-study regressions to more rigorously control for time trends, seasonality, and other potentially confounding factors. The dependent variable is the share of account holders making payments that would allow them to repay their balance within a given number of months. For example, following the evidence in Figure 22, we indicate the fraction of account holders making the target payment with the dependent variable $\Pr(31 \leq T \leq 37)$. We estimate regressions of the form

$$\Pr(31 \leq T < 37)_{it} = \delta 1_{(t>\text{February 2010})} + f(t, X_i) + \epsilon_{it} \tag{8}$$

where $1(\cdot)$ is an indicator for the implementation of the disclosure requirement; $f(t, X_i)$ is a set of controls for time, seasonality, and other factors; and ϵ_{it} is the error term.[48]

Table 9 shows the results of these event-study regressions. Panel A shows the effect on the share of account holders repaying their balance in a range around the 36-month value ($31 \leq T \leq 37$). The results show that the nudge increased the share of account holders making the target payment by 0.5 percentage points on a base of 4.1 percent. The estimates are stable across the specifications that control both for time with different polynomials and for seasonality with month-of-the-year fixed effects. These estimates are statistically distinguishable from zero at conventional levels.

Panel B of Table 9 shows the effect on the share of account holders making payments of less than the target amount ($T > 37$). Columns 1 to 5 indicate that the decline in that share was larger than the increase in target payments, suggesting an additional shift of people towards making payments larger than the target amount ($T < 31$). In column 6, when we include a fifth-order time polynomial and month-of-the-year fixed effects (admittedly a very saturated specification) the coefficient declines to about half of the increase in the target payment. This suggests that the increase in payments at the 36-month level is largely driven by a decrease in the number of account holders paying less than the 36-month value. However, these results do not conclusively provide evidence for a larger shift in payments.

Figure 23 shows the increase in the share of people making the 36-month target payment by FICO score between the three months before and after the CARD Act implementation date. The majority of

[48] As before, we replace the indicators for February 2010 with the fraction of days in these months for which the reform has been implemented. We also construct Newey and West (1987) heteroskedasticity and autocorrelation consistent standard errors allowing for 3 lags using the rule of thumb proposed by Stock and Watson (2003).

account holders that shift their behavior have FICO scores in the middle of the distribution. Account holders with low FICO scores, who made the smallest pre-CARD Act payments, are a small fraction of account holders that change their behavior. Account-holders with high FICO scores, who typically repay their entire balance, are also largely unaffected by the nudge.

For account holders that shift their behavior, we estimate that the nudge has a modest effect on annualized interest payments. Assume that the nudge does not impact the cycle-ending balance of account holders. The one-month change in interest payments for account holders that shift their behavior is given by the product of the change in the percent of balance paid, the cycle ending balance, and the monthly interest rate:

$$\Delta \text{ Interest Payments} = \Delta \text{ \% of Balance Paid} \times \text{Cycle Ending Balance} \times \frac{\text{APR}}{12} \tag{9}$$

To provide an upper bound, suppose that the nudge shifted account holders from making no payment to paying at the 36-month value. Account holders making no payment had a pre-CARD Act average cycle-ending balance of $2,957 and an average APR of 21.7%. Plugging this average APR into Equation 7 implies a change in the percent of balance paid from 0% to 3.7%.[49] Taking the product of these numbers and multiplying by 12 to annualize yields an estimated $24.00 reduction in annualized interest payments for account holders that shift their repayment behavior in response to the nudge.

While this reduction in interest payments is non-negligible for the account holders that shift their behavior, the fact that few account-holders do so leads to small aggregate effects. The estimate of $24.00 annualized savings for 0.5% accounts that switch translates to aggregate savings of 0.0096% (= $\frac{0.5\% \times \$24.00}{\$1,251}$) of aggregate average ADB. If we extrapolate these results to the entire $744 billion national credit card market, the nudge generated annual savings of $71 million (= $744 billion $\times$ 0.0096%).

6 Conclusion

The recent financial crisis has focused considerable attention on regulating consumer financial products, with the newly-created CFPB and other federal agencies given an explicit mission to "promote fairness and transparency for mortgages, credit cards, and other consumer financial products and

[49] Assuming that these account holders were making positive pre-CARD Act payments would directly reduced this value.

services." We agree with Campbell et al. (2011) that an important priority for economic research is to "evaluate both potential and existing regulations to determine whether interventions actually deliver the desired improvements in the metrics for success."

This paper aims to take a step in this direction, by providing a quantitative analysis of the impact of the CARD Act, argued by some to be the most significant piece of credit card legislation in a generation (Levitin, 2010). We find that the CARD Act was successful at reducing borrowing costs, in particular for borrowers with the lowest FICO scores. We find no evidence for offsetting increases in other costs or a decline in access to credit. In addition, we find that the disclosure requirements of the CARD Act had a small by significant impact on borrower's repayment behavior.

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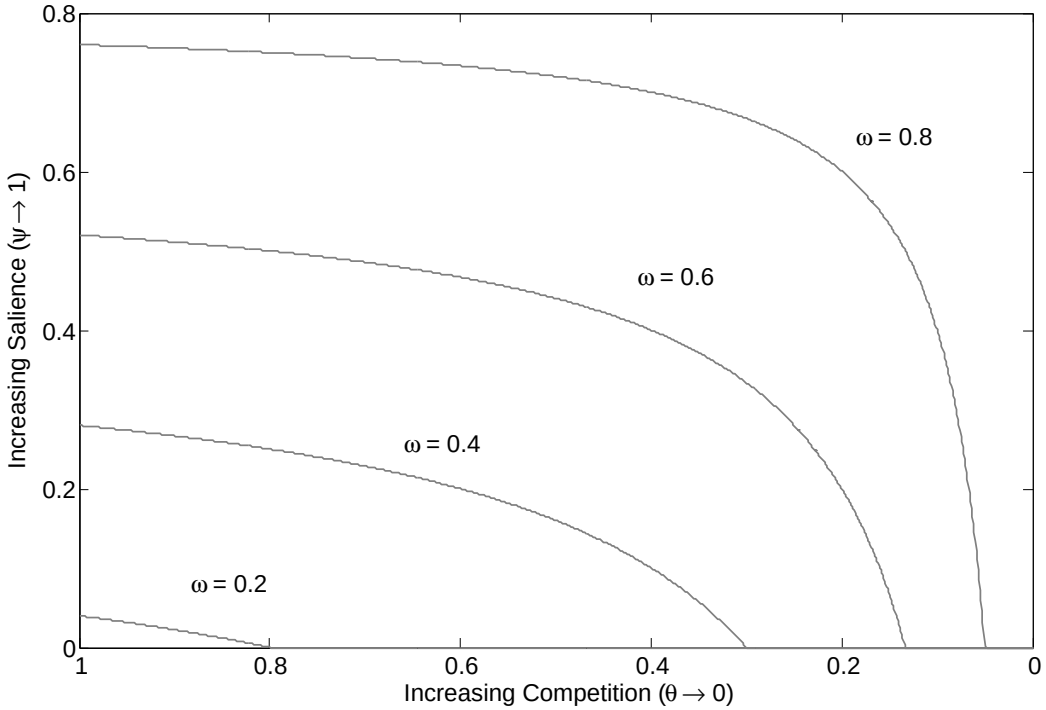
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Figure 1: Payoff Disclosure

If you make no additional charges using this card and each month you pay …	You will pay off the balance shown in this statement in about …	And you will end up paying an estimated total of …
Only the minimum payment	10 years	$3,284
$62	3 years	$2,232 (Savings of $1,052)

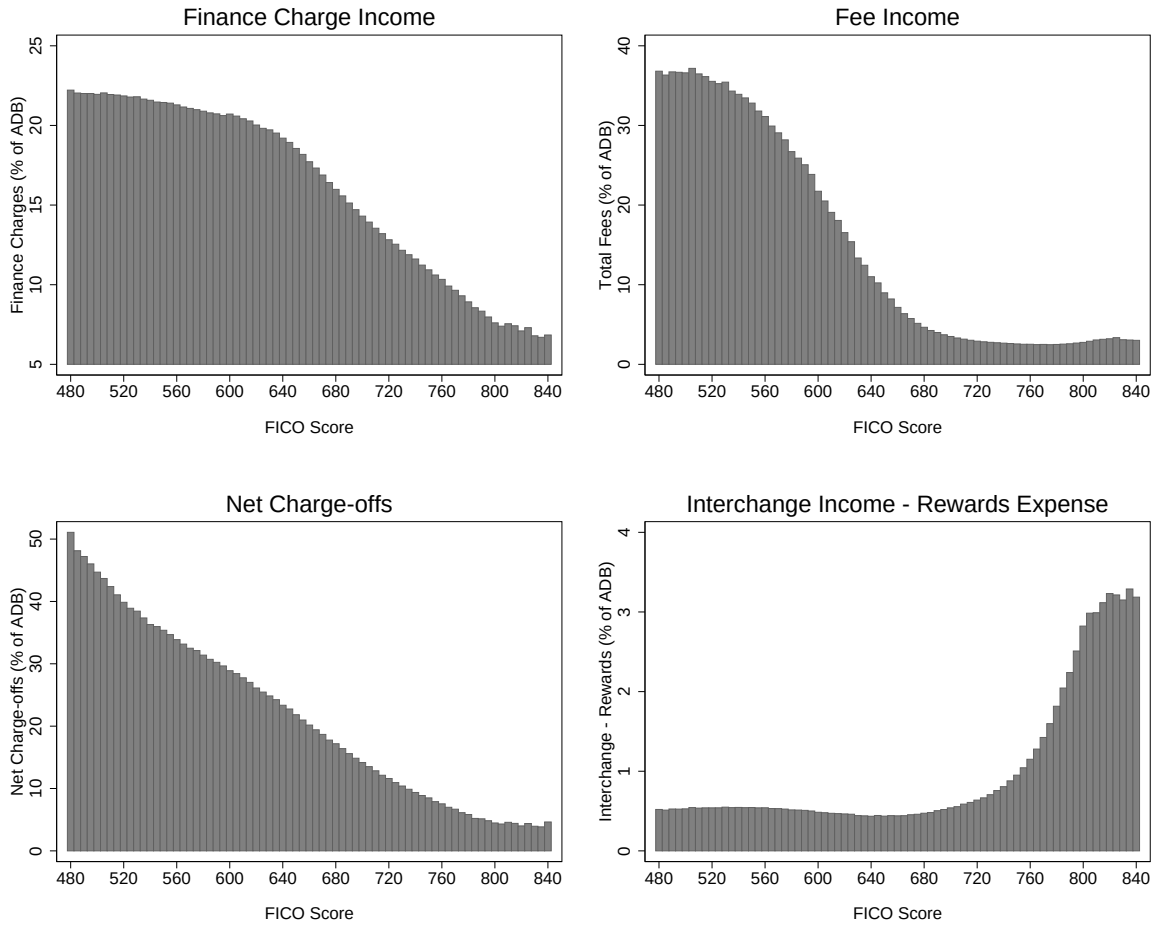
Note: Figure provides an example of the disclosure statement on monthly credit card reports required by the CARD Act.

Figure 2: Offset Isoquants



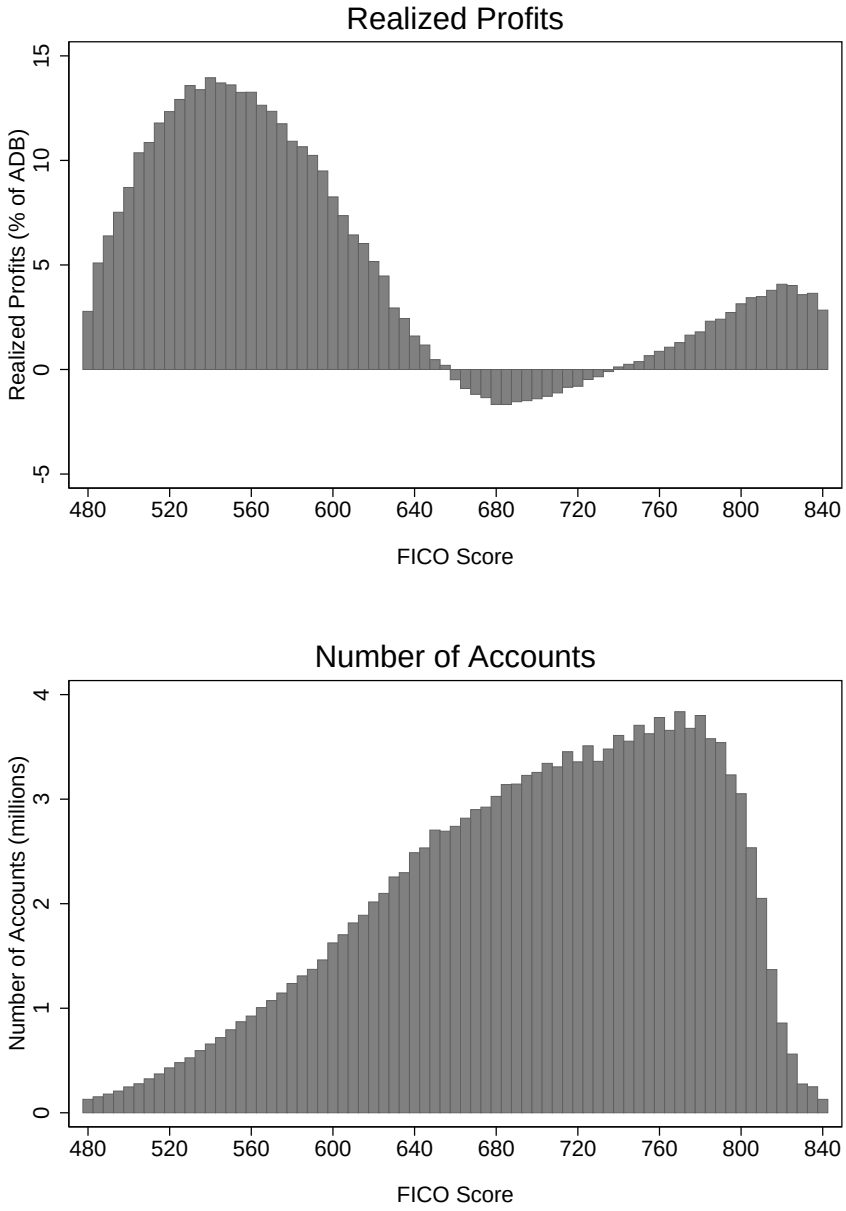
Note: Figure shows offset isoquants by competition parameter θ and salience parameter ψ.

Figure 3: Profit Components by FICO Score



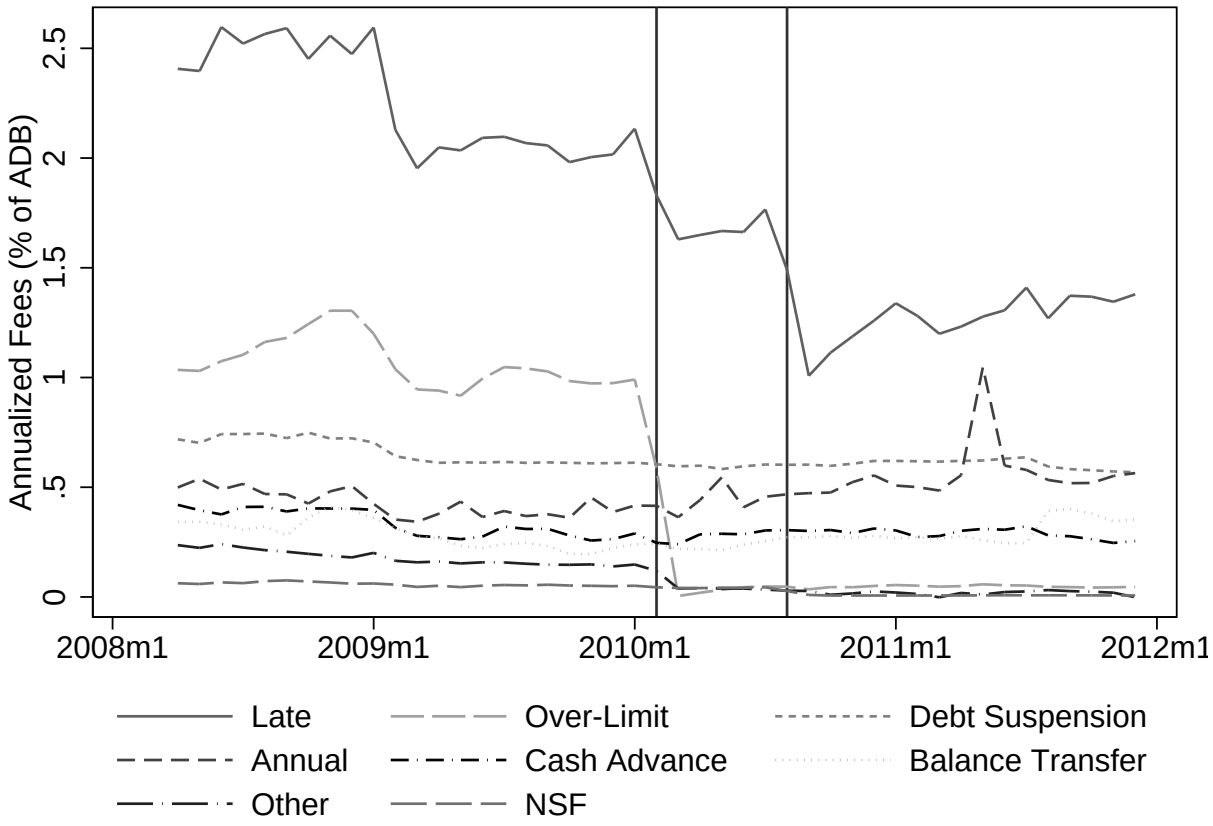
Note: Figure shows key components of realized profits as an annualized percentage of ADB by FICO score at origination binned in groups of 5. The sample is restricted to the pre-CARD Act period, defined as April 2008 to January 2010.

Figure 4: Realized Profits and Number of Accounts by FICO Score



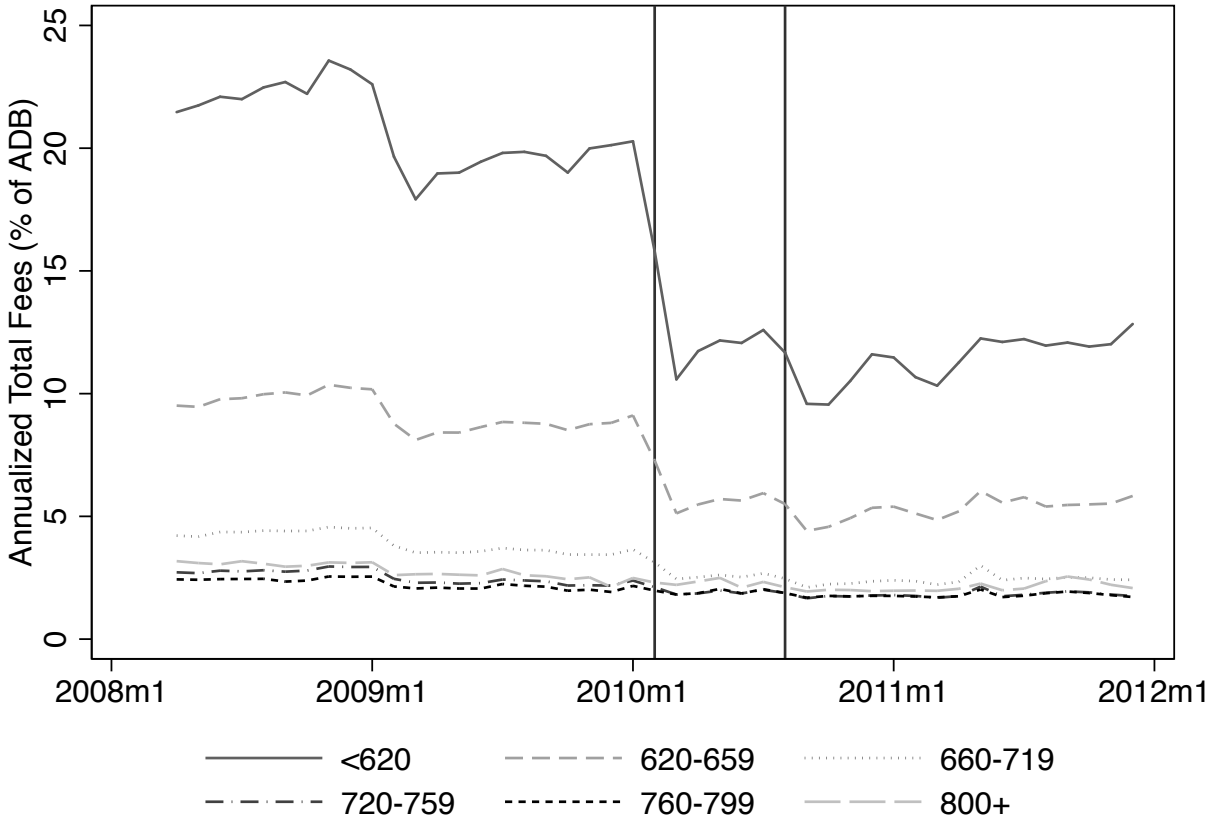
Note: Figure shows realized profits as an annualized percentage of ADB (top panel) and number of accounts (bottom panel) by FICO score at origination binned in groups of 5. The sample is restricted to the pre-CARD Act period, defined as April 2008 to January 2010. Realized profits are the difference between revenues (interest charges, fees and interchange income) and costs (charge-offs, cost of funds, operational expense, and fraud and rewards expense). Number of accounts are per reporting month.

Figure 5: Fees by Month



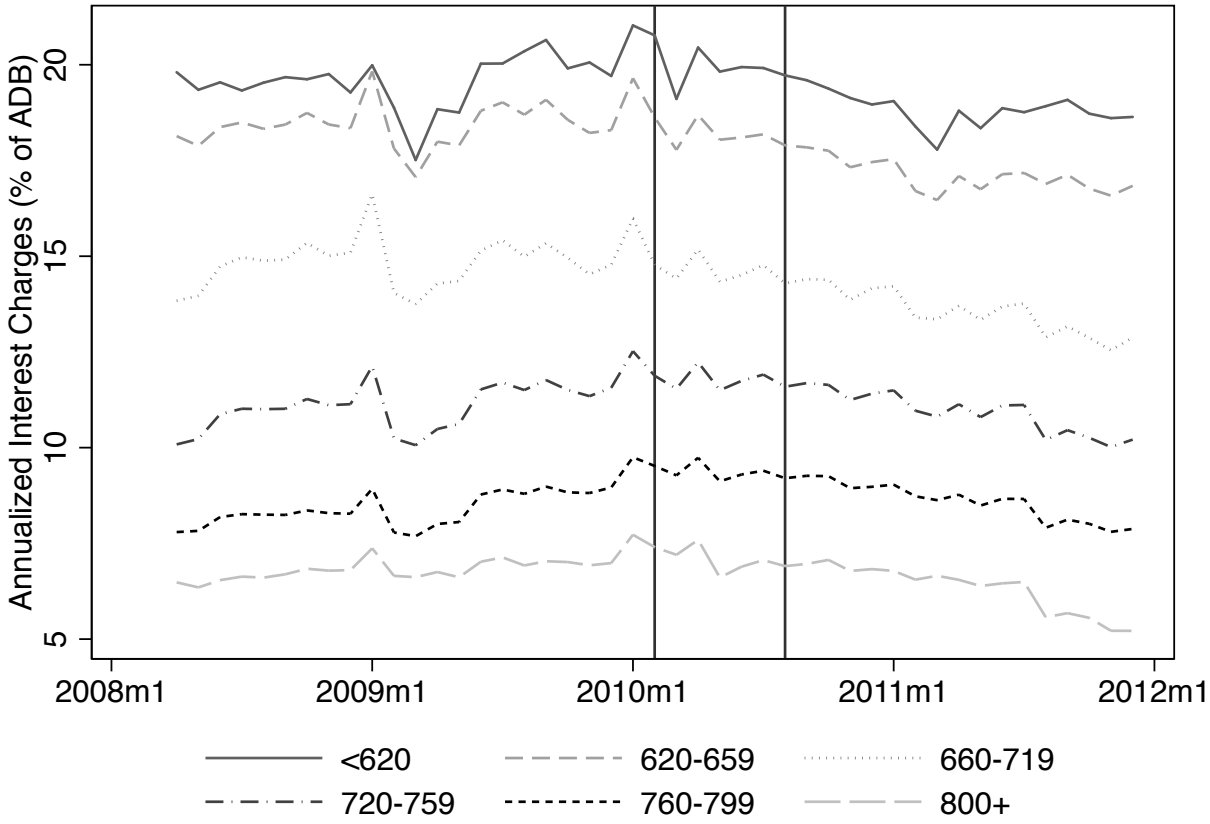
Note: Figure shows monthly averages of annualized fees as a percentage of ADB over all reporting accounts, weighted by ADB. Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates for the CARD Act. Labels are ordered by the absolute magnitude of the fees in April 2008.

Figure 6: Total Fees by FICO Score



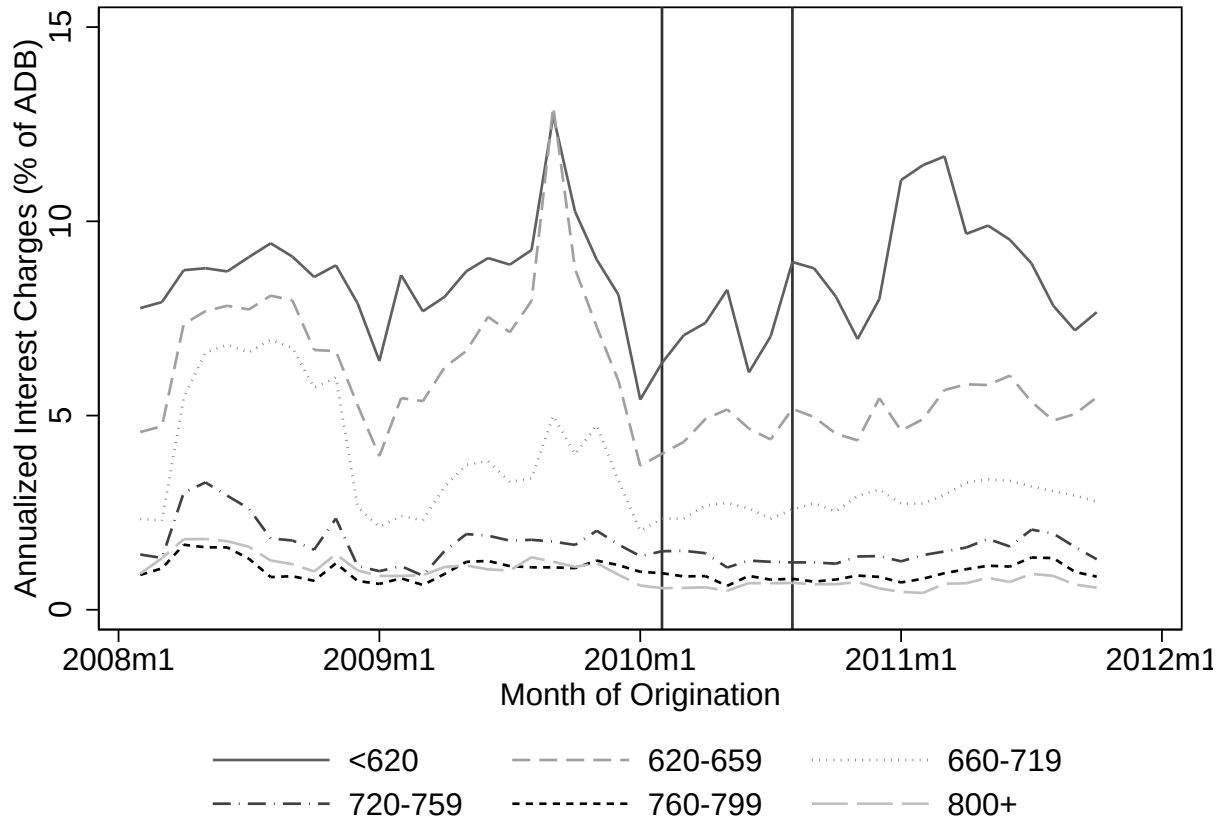
Note: Figure shows monthly averages of annualized total fees as a percentage of ADB over all reporting accounts, weighted by ADB. The data is split by FICO score at origination. Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates of the CARD Act.

Figure 7: Interest Charges by FICO Score, All Accounts



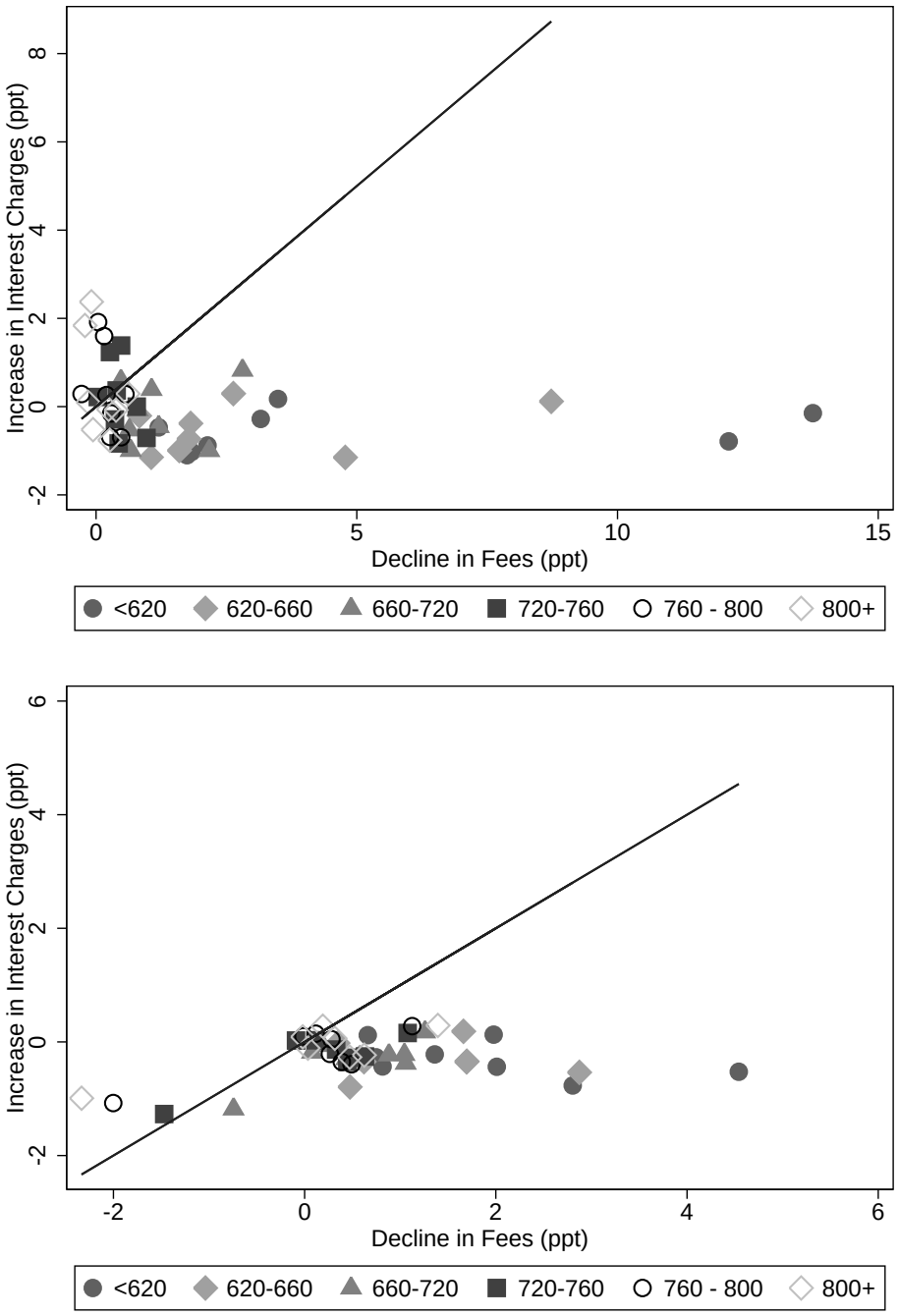
Note: Figure shows monthly average of annualized interest charges as percentage of ADB over all reporting accounts, weighted by ADB. The data is split by FICO score at origination. Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates of the CARD Act.

Figure 8: Interest Charges by FICO Score, New Accounts



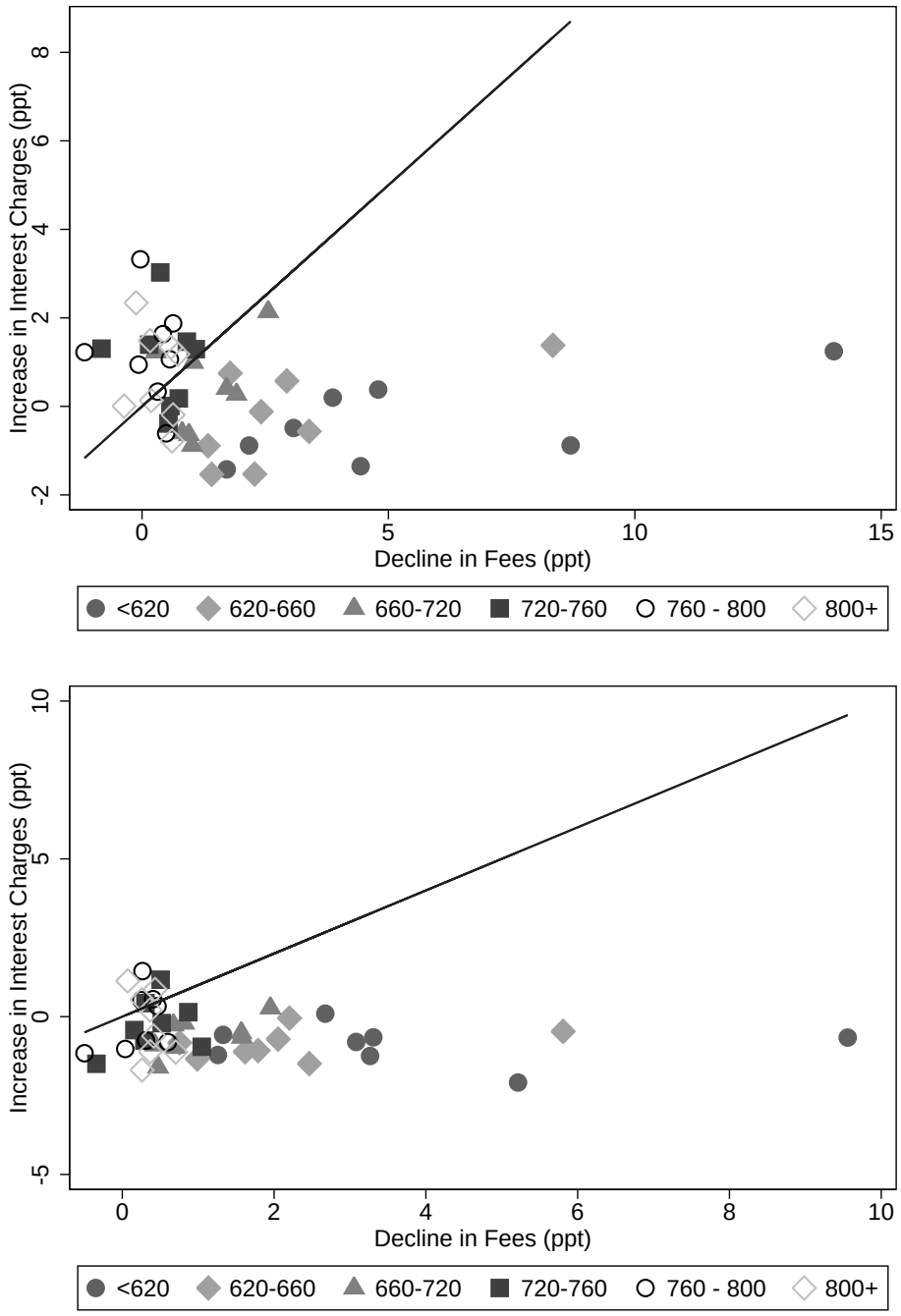
Note: Figure shows monthly averages of annualized finance charges as a percentage of ADB for new accounts, weighted by ADB. New accounts are defined as accounts in their first full month of account activity. The data is split by FICO score at origination. Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates of the CARD Act.

Figure 9: Fee Offsets by Bank



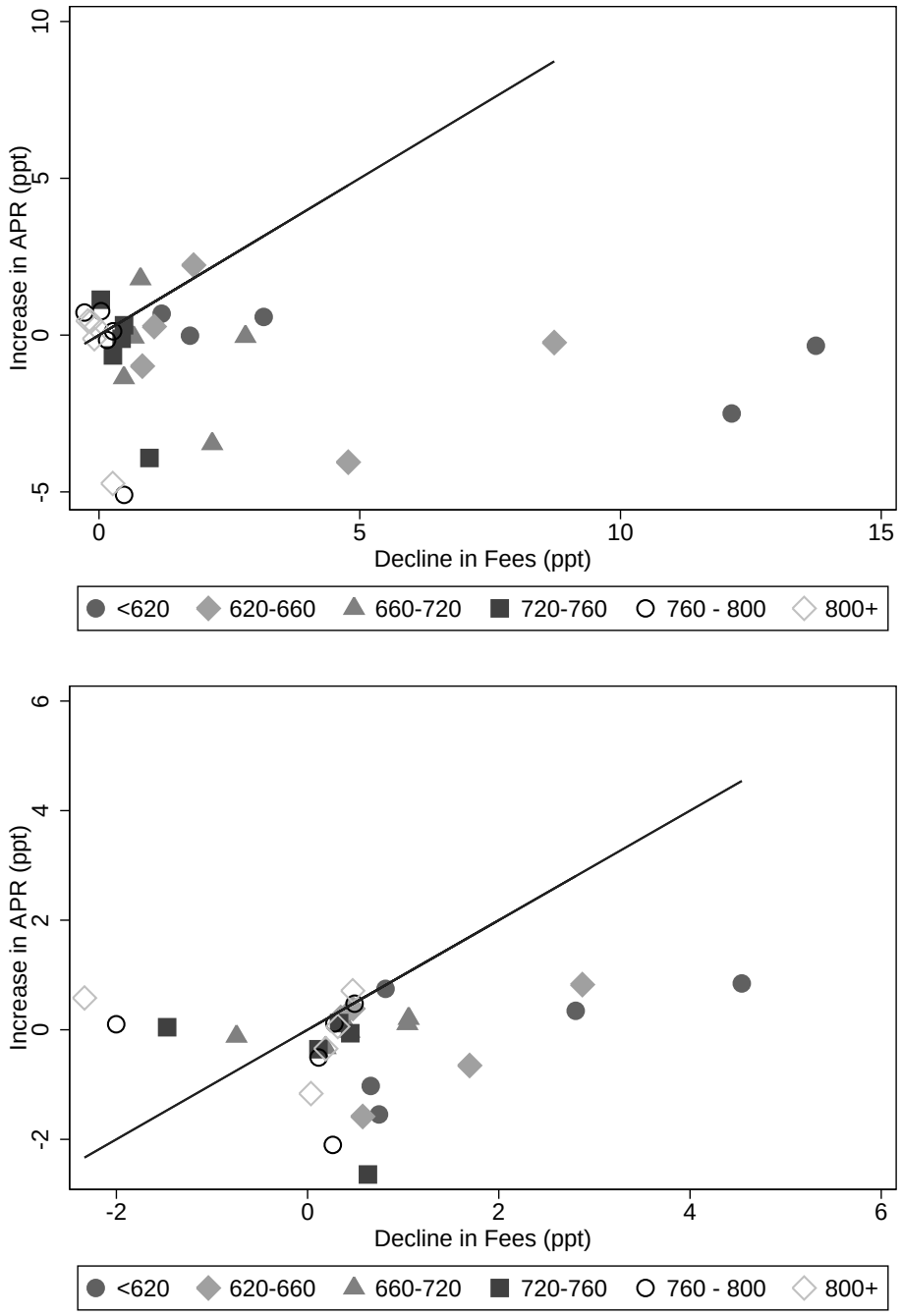
Note: Figure plots the change in interest charges (vertical axis) against the decline in fees (horizontal axis) around the two key implementation dates of the CARD Act: the two months before and after the February 2010 (top panel) and the two months before and after August 2010 (bottom panel). Observations in these plots show the average change in interest charges and fees within a bank by FICO group cell (<620, 620-660, 660-720, 720-760, 760-800, 800+). Symbols denote observations from the same FICO group. FICO scores are those at account origination. Plots include the 45 degree line.

Figure 10: Fee Offset by Bank - One-year horizon



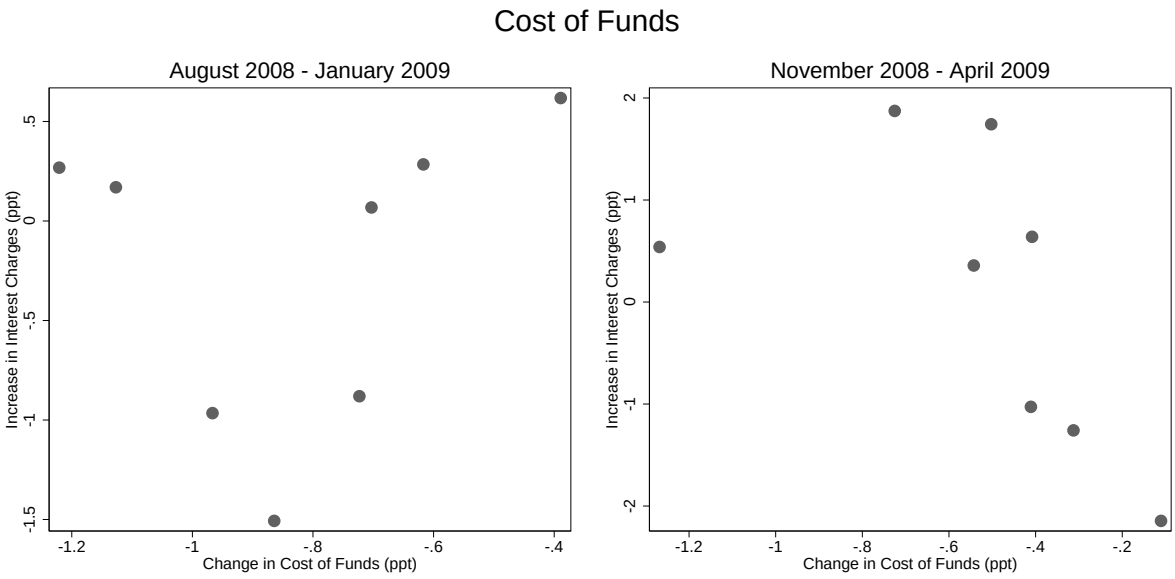
Note: Figure plots the change in interest charges (vertical axis) against the decline in fees (horizontal axis) around the two key implementation dates of the CARD Act: the twelve months before and after the February 2010 (top panel) and the twelve months before and after August 2010 (bottom panel). Observations in these plots show the average change in interest charges and fees within a bank by FICO group cell (<620, 620-660, 660-720, 720-760, 760-800, 800+). Symbols denote observations from the same FICO group. FICO scores are those at account origination. Plots include the 45 degree line.

Figure 11: Fee Offset by Bank - New Accounts



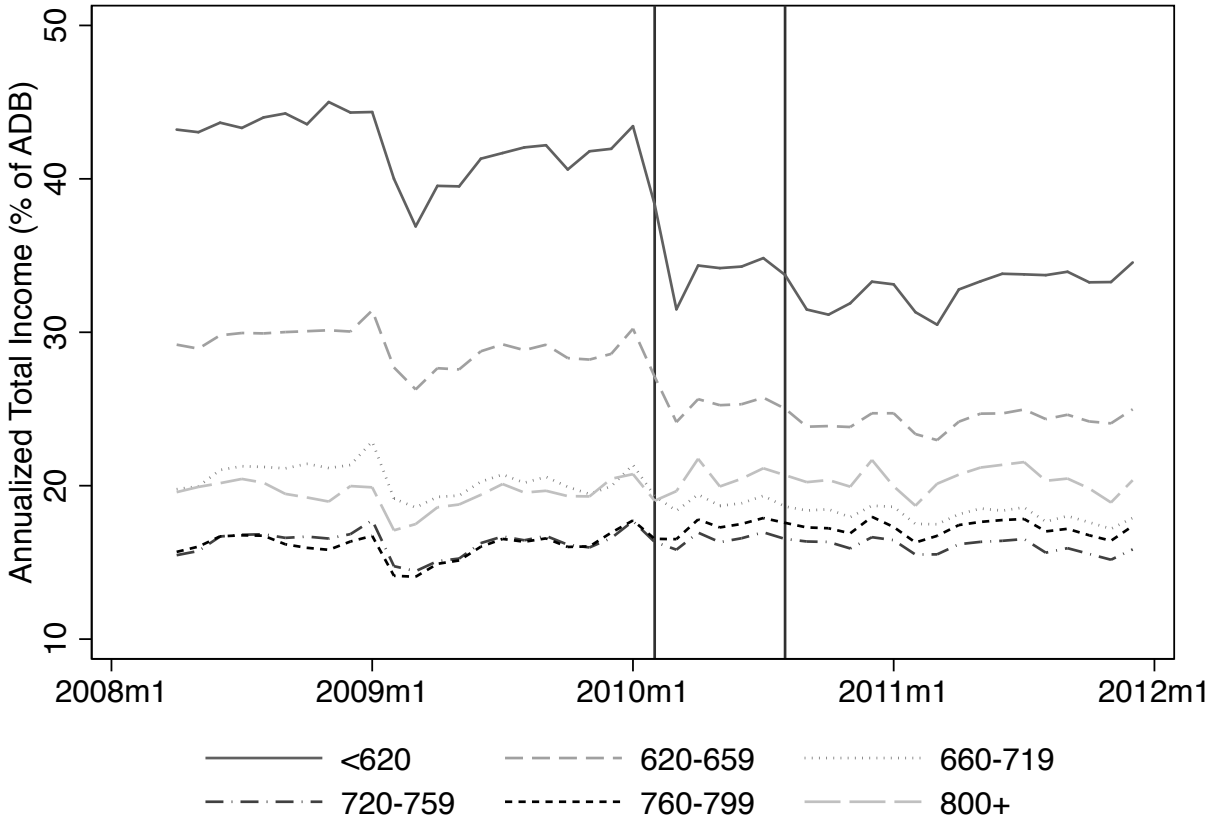
Note: Figure plots the change in APR for newly originated accounts (vertical axis) against the decline in fees for all accounts (horizontal axis) around the two key implementation dates of the CARD Act: the two months before and after the February 2010 (top panel) and the two months before and after August 2010 (bottom panel). Observations in these plots show the average change in interest charges and fees within a bank by FICO group cell (<620, 620-660, 660-720, 720-760, 760-800, 800+). Symbols denote observations from the same FICO group. FICO scores are those at account origination. Plots include the 45 degree line.

Figure 12: Cost of Funds Pass-Through by Bank



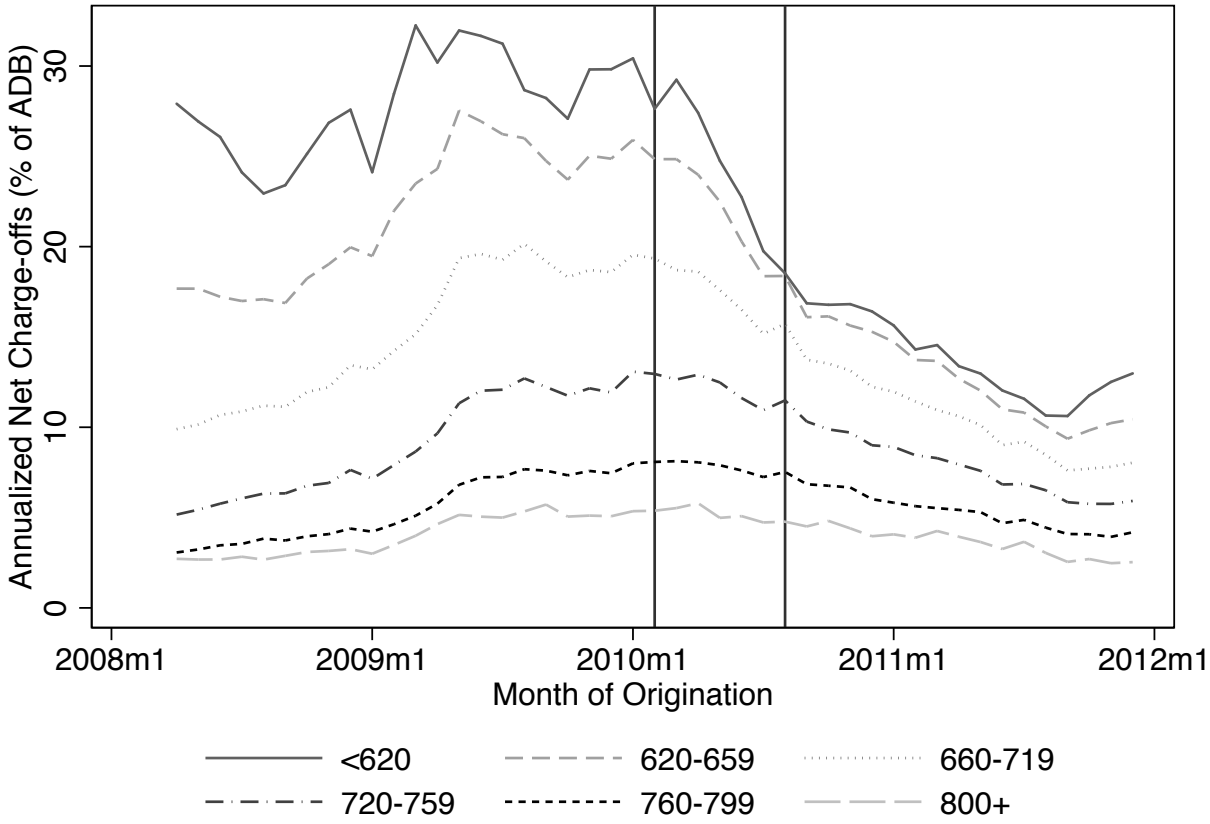
Note: Figure plots the change in interest charges (vertical axis) against the change in the cost of funds (horizontal axis). Each observation represents a bank. In the left panel, the post-period is November 2008 to January 2009, and the pre-period is August 2008 to October 2008. In the right panel, the post-period is February 2009 to April 2009, and the pre-period is November 2008 to January 2009.

Figure 13: Total Income by FICO Score



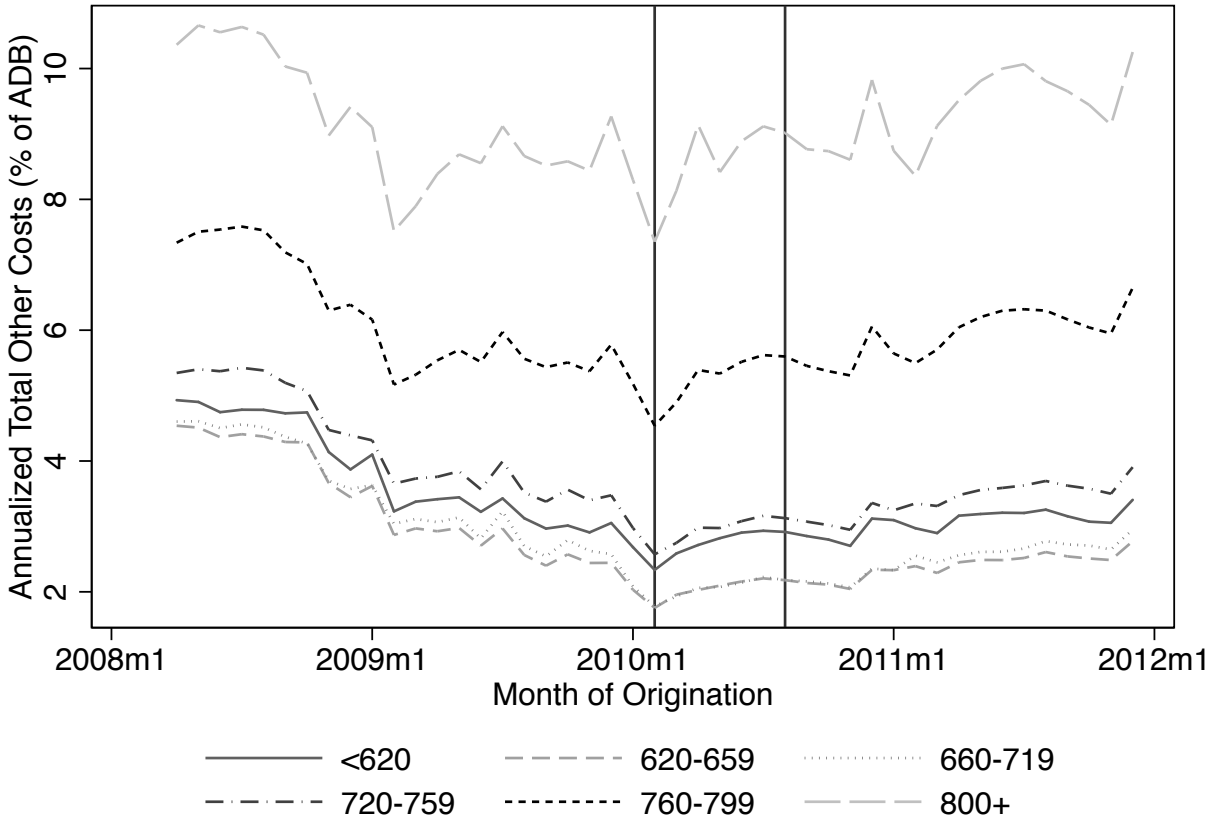
Note: Figure shows monthly average of annualized total income as a percentage of ADB over all reporting accounts, weighted by ADB. Total income is defined as sum of interest payments, total fees and interchange income. The data is split by FICO score at origination. Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates of the CARD Act.

Figure 14: Net Charge-Offs by FICO Score



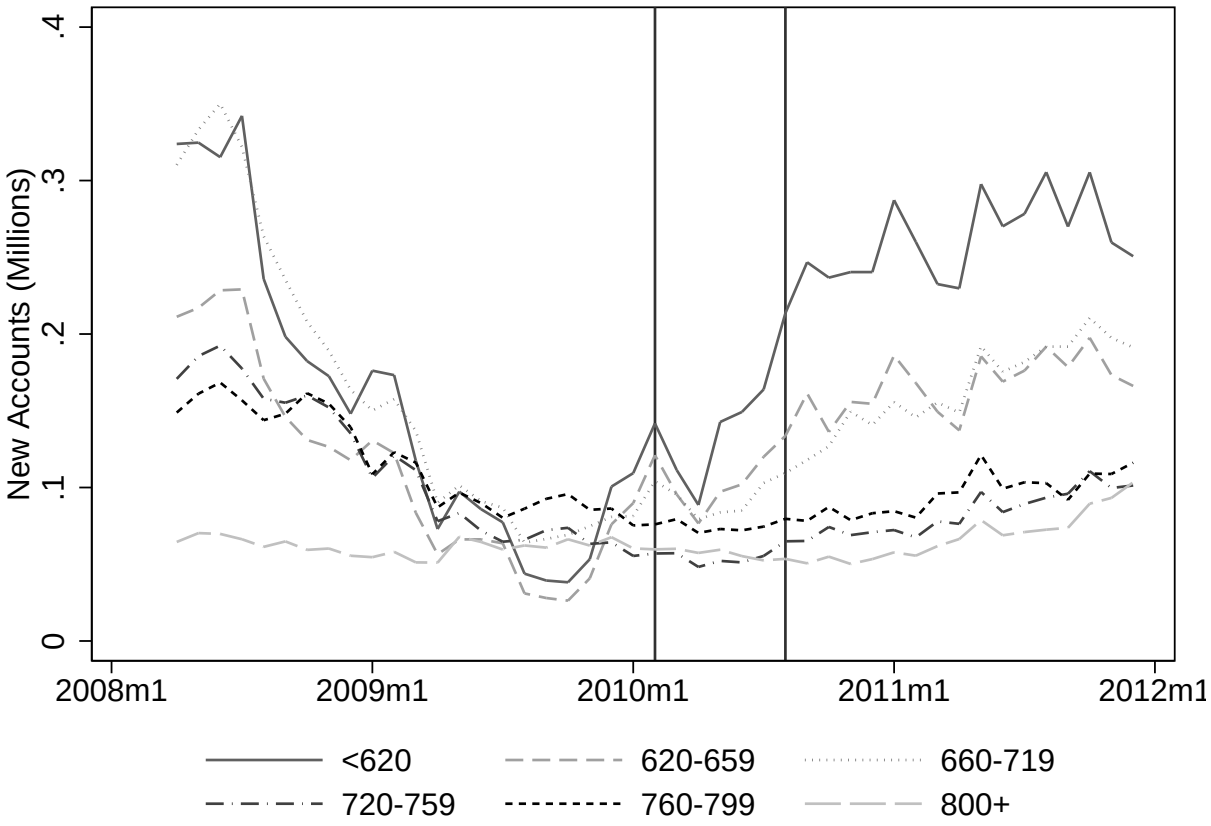
Note: Figure shows monthly average annualized net charge-off as a percentage of ADB over all reporting accounts, weighted by ADB. Net charge-off is defined as total charge-offs minus recovered amount. The data is split by FICO score at origination. Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates of the CARD Act.

Figure 15: Total Costs (Excluding Charge-Offs) by FICO Score



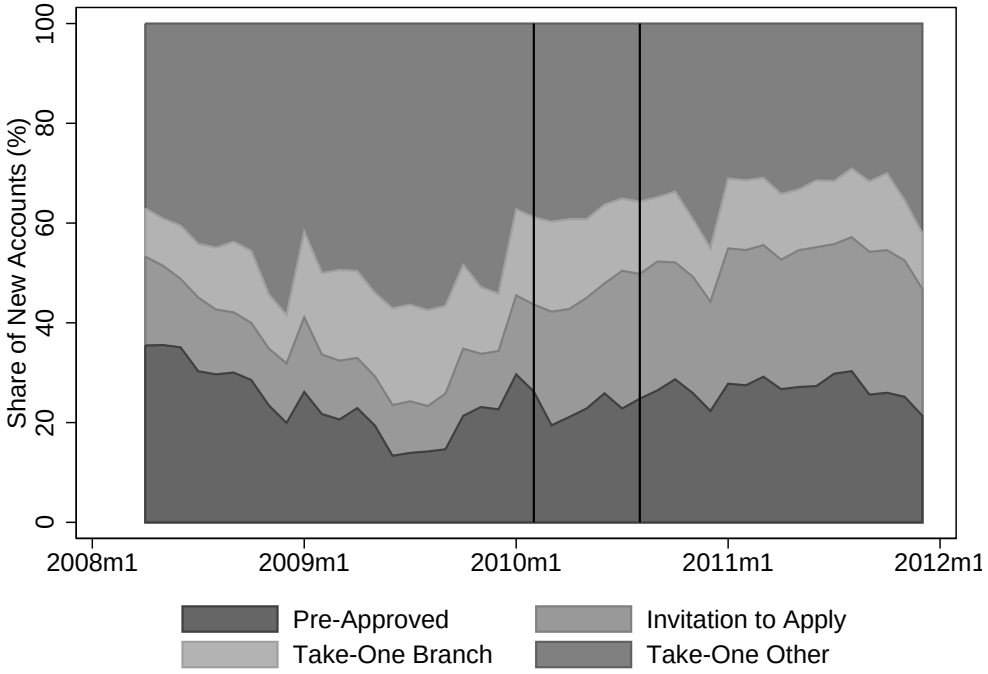
Note: Figure shows monthly average of annualized total costs excluding charge-offs as a percent of ADB over all reporting accounts, weighted by ADB. Total cost excluding charge-offs is the sum of rewards expenses, cost of funds and operational expenses. The data is split by FICO score at origination. Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates of the CARD Act.

Figure 16: New Accounts by FICO Score



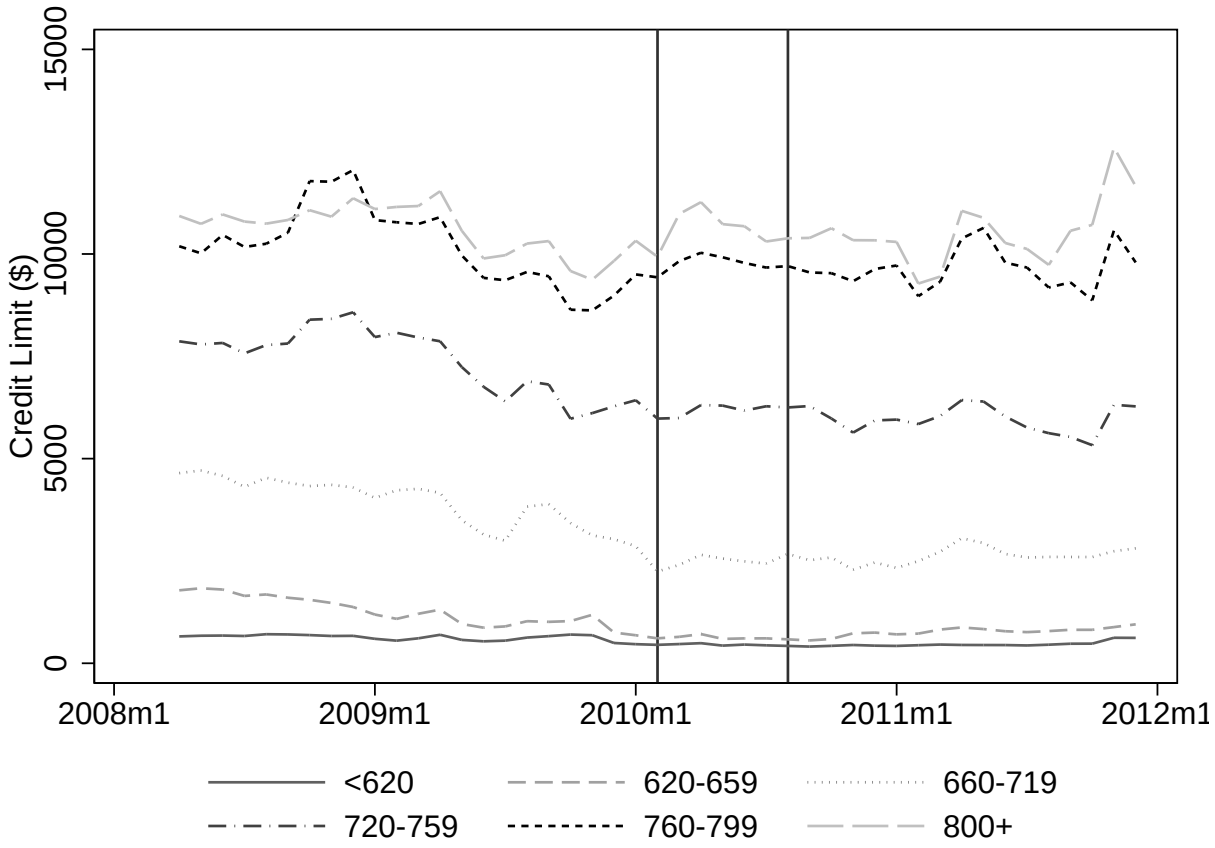
Note: Figure shows the total number of new accounts by month. The data is split by FICO score at origination. Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates of the CARD Act.

Figure 17: Origination Channel for New Accounts



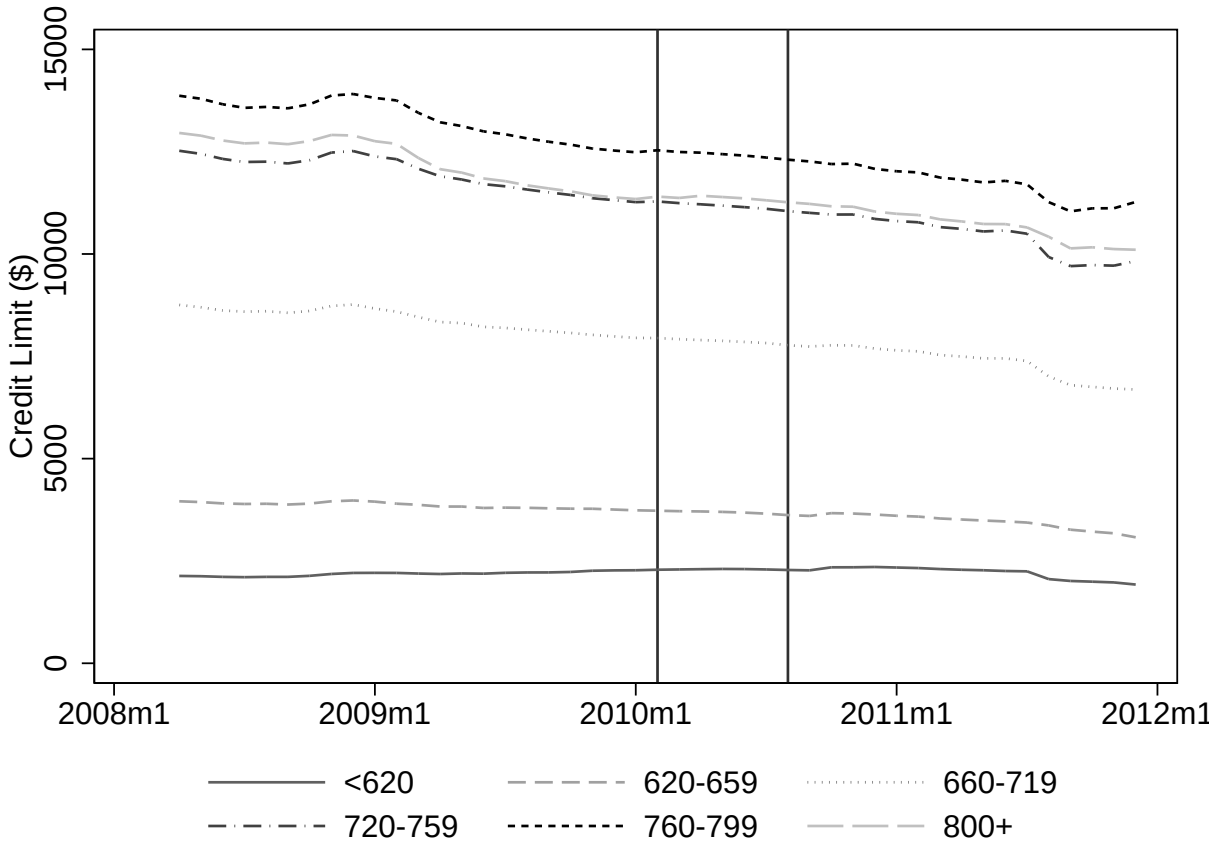
Note: Figure plots the share of new accounts originated by loan channel. Individual categories are, starting from the bottom, "Pre-Approved" (accounts originated under a program where the issuer solicits a list of potential customers to which it will make an offer of credit), "Invitation to Apply" (accounts originated based on a solicitation that required a customer to undergo a full credit review prior to approval), "Take-One Branch" (unsolicited accounts based on customer completing an application obtained at a bank) and "Take-One Other" (unsolicited accounts based on a customer completing an internet, magazine insert or event marketing application). Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates of the CARD Act.

Figure 18: Credit Limits by FICO Score for New Accounts



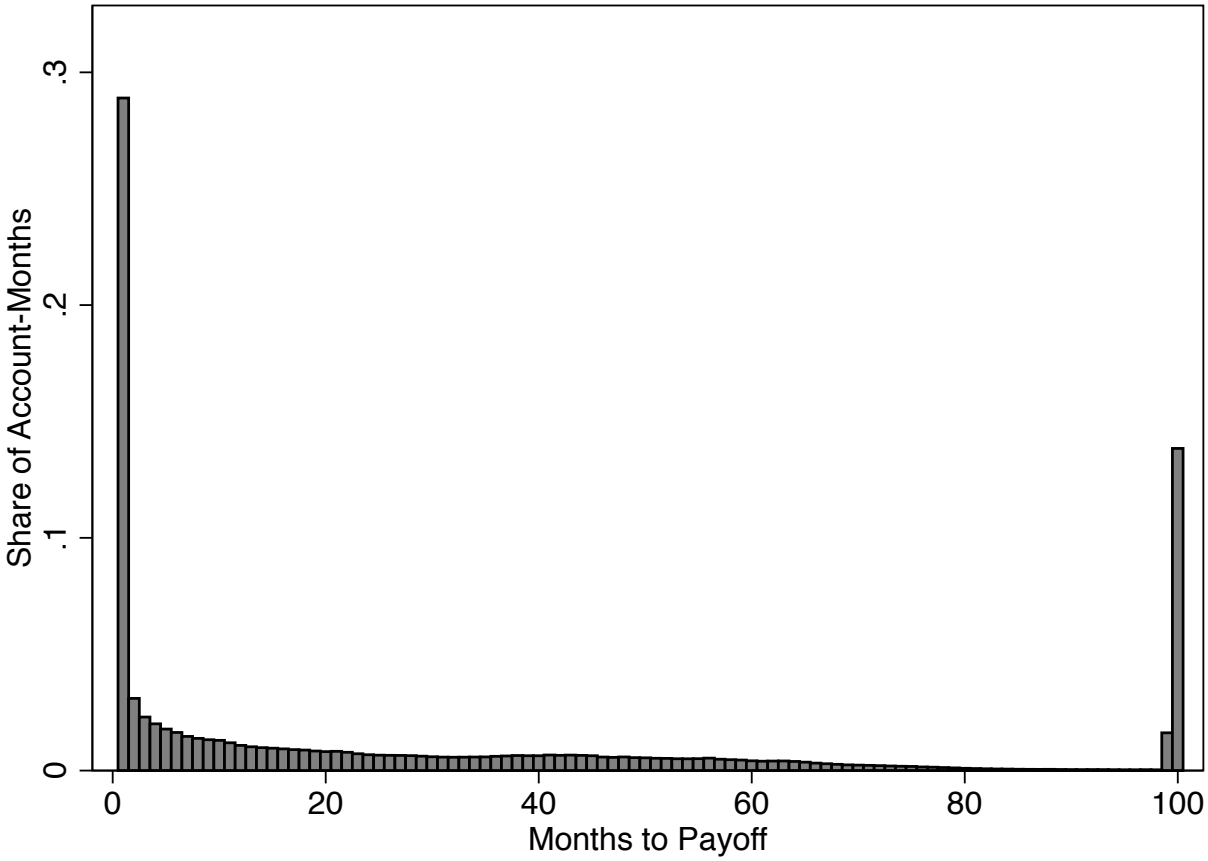
Note: Figure shows average credit limit of new accounts by month, weighted by the number of accounts. The data is split by FICO score at origination. Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates of the CARD Act.

Figure 19: Credit Limits by FICO Score for All Accounts



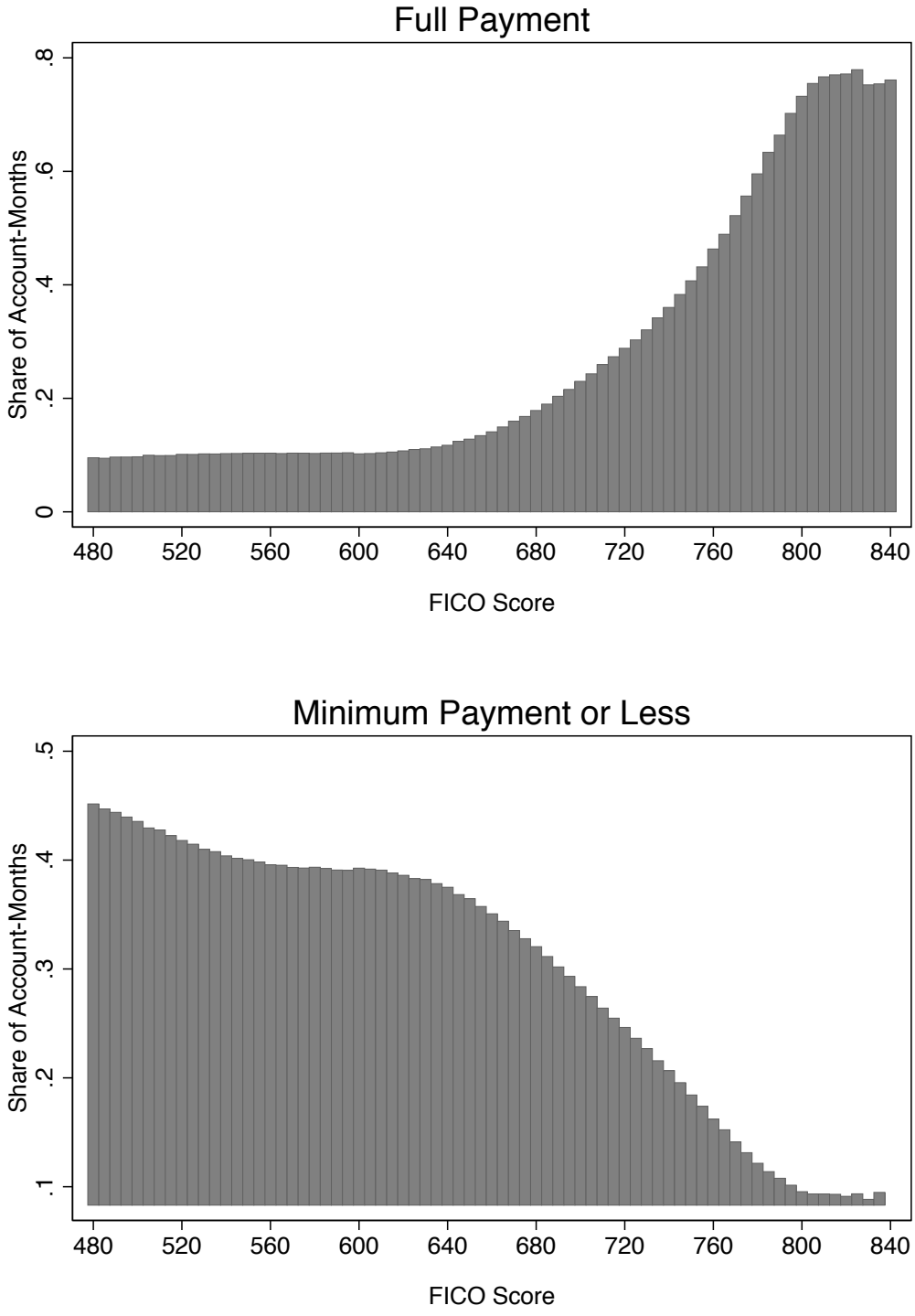
Note: Figure shows average credit limit over all accounts, weighted by the number of accounts. The data is split by FICO score at origination. Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates of the CARD Act.

Figure 20: Distribution of Months-To-Payoff (T) in Pre-CARD Act Period



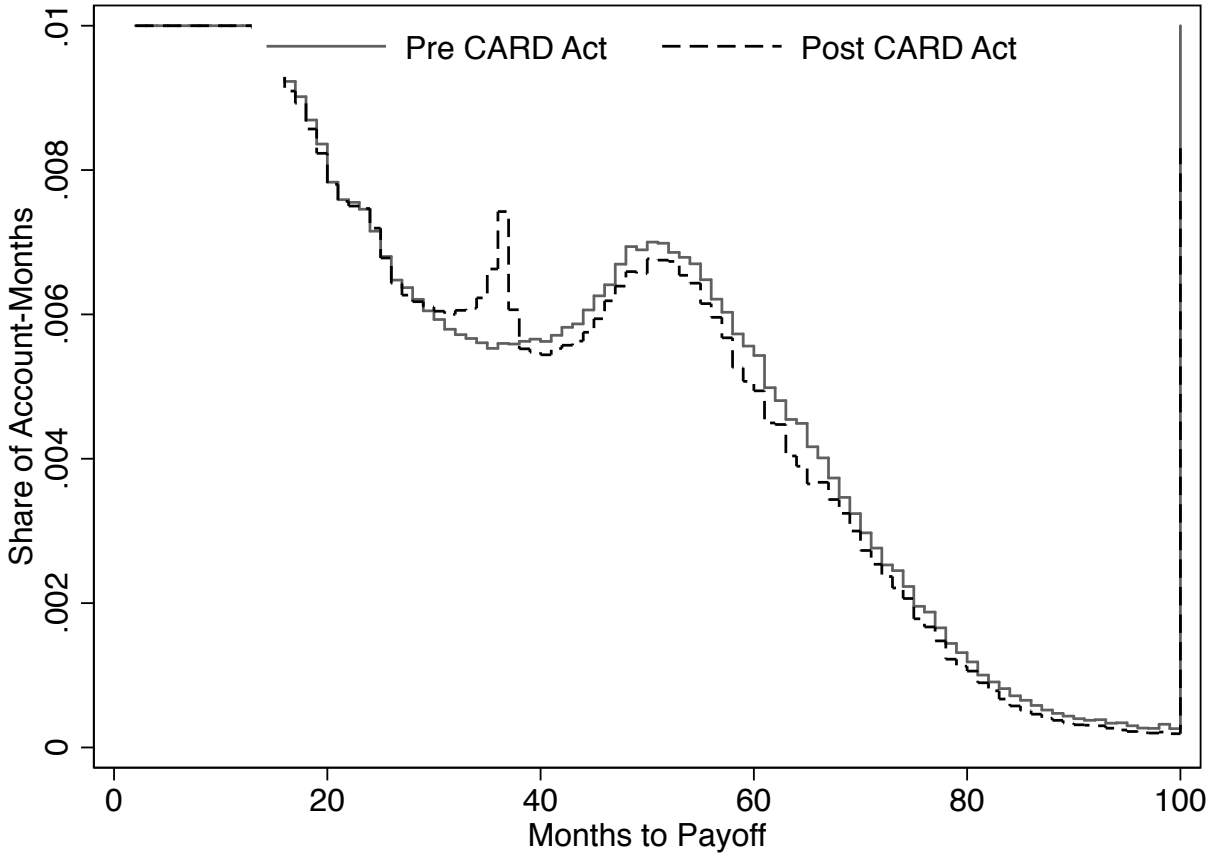
Note: Figure shows histogram of months-to-payoff (T) in the year preceding the CARD Act, defined as February 2009 to January 2010. Months-to-payoff (T) is the number of months it would take to pay off the cycle-ending balance if the account holder makes constant payments and makes no new purchases, and is calculated using Equation 7. The variable T is top-coded at 99 months with $T = 100$ denoting account holders that make no payment.

Figure 21: Payoff Distribution by FICO Score



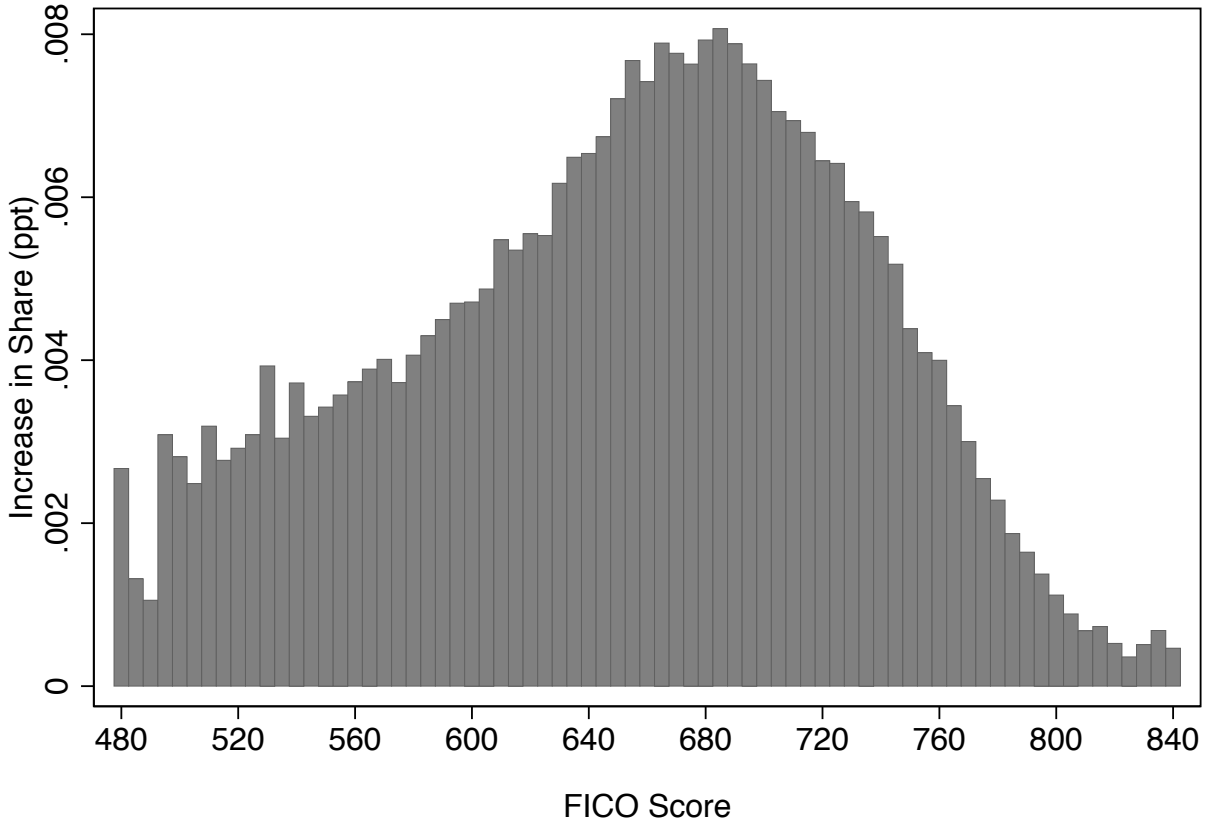
Note: Figure shows payoff behavior by FICO score at origination in the year preceding the CARD Act, defined as February 2009 to January 2010. The top panel shows the share of account-months making the full payment. The bottom panel shows the share of account-months making the minimum payment or less.

Figure 22: Distribution of Months-to-Payoff (T)



Note: Figure plots distributions of months-to-payoff (T) in the three months before (solid line) and after (dashed line) the February 2009 CARD Act implementation date. Months-to-payoff (T) is the number of months it would take to pay off the cycle-ending balance if the account holder makes constant payments and makes no new purchases, and is calculated using Equation 7. The variable T is top-coded at 99 months with $T = 100$ denoting account holders than make no payment. The "share of account-months" is top-coded at 1% in order to focus on the distribution around the CARD Act target payoff amount ($T = 36$).

Figure 23: Change in Share Making Target Payment Amount ($30 \leq T \leq 37$)



Note: Figure plots the change in the share of borrowers making the target payoff amount ($30 \leq T \leq 37$) by FICO score at origination in the three months before and after the February CARD Act implementation date. Months-to-payoff (T) is the number of months it would take to pay off the cycle-ending balance if the account holder makes constant payments and makes no new purchases, and is calculated using Equation 7.

Table 1: Sample description

Quarter	Banks	Reporting Accounts	Average Daily Balance	Annualized Purchase Volume
2008				
Q2	8	177,713,728	1,294	1,760
Q3	8	180,284,192	1,233	1,722
Q4	8	180,366,912	1,266	1,584
2009				
Q1	8	185,079,440	1,334	1,483
Q2	8	181,871,392	1,316	1,567
Q3	8	178,302,784	1,282	1,648
Q4	8	168,607,120	1,287	1,673
2010				
Q1	8	164,606,800	1,272	1,632
Q2	8	162,466,176	1,228	1,816
Q3	8	159,884,496	1,209	1,894
Q4	8	156,683,184	1,196	1,936
2011				
Q1	8	156,066,400	1,172	1,839
Q2	8	156,183,376	1,113	2,009
Q3	8	157,558,864	1,194	2,264
Q4	8	147,511,504	1,338	2,564

Note: Table shows the number of accounts, ADB, and purchase volume by quarter for the sample period, defined as Q2 2008 to Q4 2011. ADB and purchase volume are annualized averages for accounts reported on within the quarter. Values are inflation-adjusted to 2012 using the CPI-U.

Table 2: Summary Statistics

Panel A: Account-level, Annualized		
	Mean	Standard Deviation
Average Daily Balance	1,251.10	2,809.28
Purchase Volume	1,810.45	9,061.63
Interest Charges	159.14	439.30
Total Fees	53.60	221.89
Annual Fee	5.87	61.07
Balance Transfer	3.56	119.02
Cash Advance	3.92	82.36
Debt Suspension	7.93	61.73
Late Fee	22.99	99.65
Not Sufficient Funds	0.49	16.70
Other Fees	1.36	47.67
Over-Limit	7.48	57.73
Total Chargeoffs	159.14	4,402.81
Principal	130.99	3,963.38
Interest and Fees	28.14	658.79
Recovery	5.91	438.98

Panel B: Using Portfolio-level Information		
	Mean	Note on Construction
Interchange Income	36.21	2% of Purchase Volume
Rewards + Fraud Expense	25.35	1.4% of Purchase Volume
Cost of Funds	20.85	Share of ADB (Time Varying)
Operational Costs	46.14	Share of ADB (Time Varying)

Note: Panel A shows summary statistics for key variables across all reported account-months for sample period. Panel B reports additional variables that are constructed by combining account-level measures of ADB and purchase volume with information from the portfolio-level data. See note on construction and Appendix A for more details. Except for ADB, values are annualized. All variables are inflation-adjusted to 2012 using the CPI-U.

Table 3: Utilization and Profits by FICO Score

	FICO Score Range						
	Total	<620	620-659	660-719	720-759	760-799	800+
Percent of Accounts	100.0%	17.3%	12.6%	24.6%	18.6%	19.2%	7.6%
Panel A: Capacity and Utilization							
Credit Limit	8,042	2,025	3,546	7,781	11,156	12,400	11,390
Average Daily Balance	1,410	804	1,469	2,029	1,797	1,110	486
Purchase Volume	1,820	730	1,019	1,651	2,306	2,892	2,282
Panel B: Realized Profits							
Total Income	25.0%	45.7%	31.5%	21.0%	16.9%	17.1%	19.9%
Interest Charges	14.3%	20.6%	19.2%	15.2%	11.8%	9.3%	7.6%
Total Fees	7.6%	23.3%	10.9%	4.1%	2.5%	2.4%	2.9%
Interchange Income	3.2%	1.8%	1.5%	1.7%	2.6%	5.4%	9.5%
Total Costs	23.4%	37.8%	30.2%	22.5%	17.2%	15.6%	16.8%
Net Charge-offs	15.6%	30.8%	23.4%	15.8%	9.7%	6.3%	4.7%
Cost of funds	2.3%	2.4%	2.3%	2.2%	2.2%	2.2%	2.2%
Rewards and Fraud	2.2%	1.3%	1.0%	1.2%	1.8%	3.7%	6.5%
Operational Costs	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%	3.4%
Realized Profit	1.6%	7.9%	1.3%	-1.6%	-0.2%	1.5%	3.1%
Panel C: Expected Profits, Q2 2008 to Q4 2011 Charge-offs							
Expected Net Charge-offs	15.2%	30.0%	22.8%	15.4%	9.5%	6.1%	4.6%
Expected Profit	2.0%	8.7%	1.9%	-1.2%	0.0%	1.6%	3.2%
Panel D: Expected Profits, Q1 1985 to Q1 2013 Charge-offs							
Expected Net Charge-offs	9.3%	18.3%	13.9%	9.4%	5.8%	3.7%	2.8%
Expected Profit	7.9%	20.4%	10.8%	4.8%	3.7%	4.0%	5.0%

Note: Table shows income and cost components for the pre-CARD Act period, defined as April 2008 to January 2010. The first column shows averages over all accounts; the other columns show averages by FICO scores at account origination. Net charge-offs are the sum of principle and interest/fees charges-offs minus recoveries. In Panel C, net charge-offs are replaced with average net charge-offs over the full Q2 2008 to Q4 2011 sample period. In Panel D, net charge-offs are scaled by (4.7%/7.9%), the ratio of net charge-off during the pre-CARD Act sample period to the long-run historical average. (See Figure A1 for these data.) Panels B, C, and D show values as annualized percent of average daily balances. All dollar variables are inflation-adjusted to 2012 using the CPI-U.

Table 4: Fees Event-Study Regressions

	Dependent Variable (%)								
	Annual Fee	Balance Transfer Fee	Cash Advance Fee	Debt Suspension Fee	Late Fee	NSF Fee	Other Fee	Over-Limit Fee	Total Fees
				Panel A					
Post February 2010	0.05**	-0.06*	-0.07***	-0.04***	-0.54***	-0.01***	-0.13***	-1.02***	-1.91***
	(0.02)	(0.03)	(0.02)	(0.01)	(0.06)	(0.00)	(0.03)	(0.25)	(0.30)
Post August 2010	0.13***	0.08**	0.02	0.01	-0.41***	-0.03***	-0.01	0.03	-0.18
	(0.04)	(0.04)	(0.01)	(0.01)	(0.08)	(0.01)	(0.03)	(0.25)	(0.31)
Bank FE	X	X	X	X	X	X	X	X	X
Month Polynomial									
Bank FE X Month Polynomial									
Sum of Effects	0.18	0.02	-0.05	-0.03	-0.95	-0.05	-0.14	-0.98	-2.08
P-value No Effect	0.00	0.60	0.01	0.05	0.00	0.00	0.00	0.00	0.00
Mean of Dep. Var.	0.47	0.29	0.31	0.64	1.86	0.04	0.11	0.60	4.41
				Panel B					
Post February 2010	-0.05	0.02	-0.02	-0.05**	-0.56***	-0.01	-0.11*	-0.99**	-1.84***
	(0.06)	(0.05)	(0.03)	(0.02)	(0.18)	(0.01)	(0.06)	(0.48)	(0.69)
Post August 2010	-0.07	0.01	-0.02	-0.04*	-0.79***	-0.04**	-0.03	-0.06	-1.07
	(0.08)	(0.05)	(0.03)	(0.02)	(0.27)	(0.02)	(0.05)	(0.43)	(0.69)
Bank FE	X	X	X	X	X	X	X	X	X
Month Polynomial	X	X	X	X	X	X	X	X	X
Bank FE X Month Polynomial									
Sum of Effects	-0.12	0.04	-0.04	-0.08	-1.35	-0.06	-0.14	-1.05	-2.91
P-value No Effect	0.26	0.57	0.38	0.00	0.00	0.01	0.11	0.13	0.01
Mean of Dep. Var.	0.47	0.29	0.31	0.64	1.86	0.04	0.11	0.60	4.41
				Panel C					
Post February 2010	-0.05	0.02	-0.02	-0.04	-0.55**	-0.01*	-0.11**	-1.00**	-1.82**
	(0.09)	(0.04)	(0.03)	(0.05)	(0.24)	(0.01)	(0.05)	(0.40)	(0.75)
Post August 2010	-0.07	0.01	-0.02	-0.03	-0.77***	-0.04***	-0.03	-0.05	-1.02**
	(0.07)	(0.03)	(0.03)	(0.04)	(0.26)	(0.01)	(0.03)	(0.16)	(0.48)
Bank FE									
Month Polynomial									
Bank FE X Month Polynomial	X	X	X	X	X	X	X	X	X
Sum of Effects	-0.12	0.03	-0.04	-0.07	-1.32	-0.05	-0.13	-1.05	-2.84
P-value No Effect	0.41	0.64	0.47	0.42	0.00	0.00	0.10	0.04	0.01
Mean of Dep. Var.	0.47	0.29	0.31	0.64	1.86	0.04	0.11	0.60	4.41

Note: Table shows estimates from event-study regressions of fees on indicators for the two key CARD Act implementation dates and controls. The dependent variables are measured as an annualized percentage of ADB. During the months of implementation, the indicator is replaced with the fraction of days the reform is in place. The unit of observation is a bank-month, with each observation weighted by mean ADB. We report heteroskedasticity-robust Newey-White standard errors allowing for 3 months of auto-correlation by bank. The first panel controls for bank fixed effects, the second panel adds a fifth-order time polynomial, and the final panel controls for a bank-specific fifth-order time polynomial.

Table 5: Fees by FICO Score Event-Study Regressions

	Dependent Variable (5)								
	Late Fees			Over-Limit Fees			Total Fees		
				Panel A: <620					
Post February 2010	-2.23***	-2.34***	-2.38***	-5.41***	-5.31***	-5.33***	-9.43***	-9.92***	-9.99***
	(0.27)	(0.66)	(0.83)	(0.99)	(1.79)	(1.45)	(1.49)	(2.85)	(3.05)
Post August 2010	-1.36***	-2.97***	-3.05***	0.01	-0.21	-0.21	-0.91	-4.08	-4.22**
	(0.35)	(0.99)	(0.83)	(1.02)	(1.69)	(0.60)	(1.59)	(3.08)	(1.87)
Sum of Effects	-3.58	-5.31	-5.43	-5.40	-5.52	-5.54	-10.34	-14.00	-14.21
P-value No Effect	0.00	0.00	0.00	0.00	0.03	0.00	0.00	0.00	0.00
Mean of Dep. Var.	6.84	6.84	6.84	3.29	3.29	3.29	16.88	16.88	16.88
				Panel B: 620-659					
Post February 2010	-0.91***	-1.07***	-1.08**	-2.27***	-2.22**	-2.23***	-3.83***	-4.13***	-4.15***
	(0.10)	(0.37)	(0.45)	(0.54)	(1.05)	(0.83)	(0.69)	(1.58)	(1.57)
Post August 2010	-0.76***	-1.41***	-1.45***	-0.02	-0.08	-0.07	-0.51	-1.90	-1.95**
	(0.17)	(0.54)	(0.48)	(0.57)	(0.97)	(0.33)	(0.76)	(1.57)	(0.91)
Sum of Effects	-1.67	-2.48	-2.53	-2.29	-2.30	-2.30	-4.33	-6.03	-6.10
P-value No Effect	0.00	0.00	0.00	0.00	0.13	0.03	0.00	0.02	0.01
Mean of Dep. Var.	3.35	3.35	3.35	1.37	1.37	1.37	7.61	7.61	7.61
				Panel C: 660-720					
Post February 2010	-0.37***	-0.39***	-0.37***	-0.63***	-0.62***	-0.62***	-1.37***	-1.23***	-1.21***
	(0.05)	(0.13)	(0.12)	(0.11)	(0.23)	(0.19)	(0.14)	(0.37)	(0.33)
Post August 2010	-0.36***	-0.54***	-0.54***	0.01	-0.03	-0.02	-0.19	-0.75**	-0.73***
	(0.06)	(0.14)	(0.14)	(0.11)	(0.19)	(0.07)	(0.12)	(0.31)	(0.22)
Sum of Effects	-0.73	-0.93	-0.91	-0.61	-0.65	-0.65	-1.56	-1.97	-1.94
P-value No Effect	0.00	0.00	0.00	0.00	0.04	0.01	0.00	0.00	0.00
Mean of Dep. Var.	1.42	1.42	1.42	0.36	0.36	0.36	3.28	3.28	3.28
				Panel D: 720-759					
Post February 2010	-0.20***	-0.23***	-0.22***	-0.23***	-0.24***	-0.24***	-0.64***	-0.50***	-0.48***
	(0.05)	(0.07)	(0.03)	(0.01)	(0.04)	(0.04)	(0.12)	(0.16)	(0.10)
Post August 2010	-0.23***	-0.33***	-0.34***	0.01	-0.01	-0.01	-0.14*	-0.42***	-0.43***
	(0.04)	(0.07)	(0.05)	(0.01)	(0.03)	(0.01)	(0.08)	(0.12)	(0.09)
Sum of Effects	-0.43	-0.56	-0.56	-0.22	-0.25	-0.25	-0.79	-0.92	-0.91
P-value No Effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Dep. Var.	0.81	0.81	0.81	0.12	0.12	0.12	2.20	2.20	2.20
				Panel E: 760-799					
Post February 2010	-0.18***	-0.17**	-0.16***	-0.12***	-0.13***	-0.13***	-0.37***	-0.21	-0.19
	(0.05)	(0.08)	(0.03)	(0.00)	(0.01)	(0.01)	(0.13)	(0.18)	(0.12)
Post August 2010	-0.20***	-0.29***	-0.29***	0.00	0.00	0.00	-0.18	-0.35**	-0.35***
	(0.05)	(0.08)	(0.04)	(0.00)	(0.01)	(0.01)	(0.11)	(0.16)	(0.10)
Sum of Effects	-0.38	-0.46	-0.46	-0.12	-0.13	-0.13	-0.55	-0.57	-0.54
P-value No Effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.02	0.01
Mean of Dep. Var.	0.65	0.65	0.65	0.06	0.06	0.06	2.04	2.04	2.04
				Panel F: 800+					
Post February 2010	-0.28***	-0.18	-0.16***	-0.11***	-0.11***	-0.11***	-0.52***	0.04	0.04
	(0.07)	(0.12)	(0.06)	(0.01)	(0.02)	(0.02)	(0.12)	(0.21)	(0.15)
Post August 2010	-0.30***	-0.35***	-0.35***	0.00	-0.01	-0.01	-0.24***	-0.36**	-0.34***
	(0.07)	(0.10)	(0.06)	(0.01)	(0.02)	(0.01)	(0.08)	(0.15)	(0.12)
Sum of Effects	-0.58	-0.53	-0.51	-0.11	-0.12	-0.12	-0.75	-0.32	-0.30
P-value No Effect	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27	0.22
Mean of Dep. Var.	0.73	0.73	0.73	0.05	0.05	0.05	2.44	2.44	2.44
				Controls: All Panels					
Bank FE	X	X		X	X		X	X	
Time Polynomial		X			X			X	
Bank FE X Time Polynomail			X			X			X

Note: Table shows estimates from event-study regressions of fees on indicators for the two key CARD Act implementation dates and controls by FICO group. The dependent variables are measured as an annualized percentage of ADB. During the months of implementation, the indicator is replaced with the fraction of days the reform is in place. The unit of observation is a bank-month, with each observation weighted by mean ADB. We report heteroskedasticity-robust Newey-White standard errors allowing for 3 months of auto-correlation by bank. For each dependent variable, the first column controls for bank fixed effects, the second column adds a fifth-order time polynomial, and the third column controls for a bank-specific fifth-order time polynomial.

Table 6: Income Event-Study Regressions

	Dependent Variable (%)			
	Total Fees	Interest Charges	Interchange Income	Total Income
		Panel A		
Post February 2010	-1.91***	0.26	0.39***	-1.26***
	(0.30)	(0.49)	(0.10)	(0.40)
Post August 2010	-0.18	-1.24**	0.67***	-0.75**
	(0.31)	(0.52)	(0.13)	(0.35)
Bank FE	X	X	X	X
Month Polynomial				
Bank FE X Month Polynomial				
Sum of Effects	-2.08	-0.98	1.05	-2.01
P-value No Effect	0.00	0.01	0.00	0.00
Mean of Dep. Var.	4.41	13.52	2.94	20.87
		Panel B		
Post February 2010	-1.84***	-0.91	-0.34**	-3.10***
	(0.69)	(0.71)	(0.14)	(0.87)
Post August 2010	-1.07	-0.67	-0.34**	-2.08***
	(0.69)	(0.80)	(0.15)	(0.67)
Bank FE	X	X	X	X
Month Polynomial	X	X	X	X
Bank FE X Month Polynomial				
Sum of Effects	-2.91	-1.58	-0.69	-5.18
P-value No Effect	0.01	0.17	0.01	0.00
Mean of Dep. Var.	4.41	13.52	2.94	20.87
		Panel C		
Post February 2010	-1.82**	-0.88**	-0.35***	-3.05***
	(0.75)	(0.37)	(0.11)	(0.91)
Post August 2010	-1.02**	-0.60*	-0.36***	-1.98***
	(0.48)	(0.33)	(0.09)	(0.74)
Bank FE				
Month Polynomial				
Bank FE X Month Polynomial	X	X	X	X
Sum of Effects	-2.84	-1.48	-0.71	-5.04
P-value No Effect	0.01	0.02	0.00	0.00
Mean of Dep. Var.	4.41	13.52	2.94	20.87

Note: Table shows estimates from event-study regressions of income components on indicators for the two key CARD Act implementation dates and controls. The dependent variables are measured as an annualized percentage of ADB. During the months of implementation, the indicator is replaced with the fraction of days the reform is in place. The unit of observation is a bank-month, with each observation weighted by mean ADB. We report heteroskedasticity-robust Newey-White standard errors allowing for 3 months of auto-correlation by bank. The first panel controls for bank fixed effects, the second panel adds a fifth-order time polynomial, and the final panel controls for a bank-specific fifth-order time polynomial.

Table 7: Income by FICO Score Event-Study Regressions

	Dependent Variable (%)								
	Interest Charge			Interchange Income			Total Income		
				Panel A: <620					
Post February 2010	0.28	-1.40	-1.41***	0.33***	-0.25	-0.25*	-8.82***	-11.56***	-11.65***
	(0.58)	(1.02)	(0.54)	(0.08)	(0.16)	(0.13)	(1.10)	(2.97)	(3.41)
Post August 2010	-1.26**	-1.12	-1.16**	0.48***	-0.25*	-0.26***	-1.69	-5.46**	-5.64**
	(0.54)	(0.96)	(0.50)	(0.10)	(0.14)	(0.09)	(1.20)	(2.59)	(2.21)
Sum of Effects	-0.98	-2.52	-2.57	0.81	-0.50	-0.51	-10.51	-17.02	-17.29
P-value No Effect	0.02	0.12	0.01	0.00	0.06	0.01	0.00	0.00	0.00
Mean of Dep. Var.	19.42	19.42	19.42	2.10	2.10	2.10	38.40	38.40	38.40
				Panel B: 620-659					
Post February 2010	-0.13	-1.06	-1.05**	0.05	-0.23***	-0.23***	-3.90***	-5.42***	-5.43***
	(0.48)	(0.81)	(0.42)	(0.05)	(0.07)	(0.08)	(0.43)	(1.70)	(1.81)
Post August 2010	-1.12**	-0.75	-0.74**	0.37***	-0.18**	-0.19***	-1.25***	-2.83**	-2.88**
	(0.46)	(0.74)	(0.38)	(0.06)	(0.07)	(0.06)	(0.43)	(1.18)	(1.20)
Sum of Effects	-1.25	-1.81	-1.79	0.43	-0.40	-0.42	-5.15	-8.25	-8.31
P-value No Effect	0.00	0.15	0.02	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Dep. Var.	18.01	18.01	18.01	1.54	1.54	1.54	27.16	27.16	27.16
				Panel C: 660-720					
Post February 2010	-0.05	-1.08*	-1.05**	0.09	-0.27***	-0.26***	-1.33***	-2.58***	-2.52***
	(0.40)	(0.56)	(0.41)	(0.07)	(0.09)	(0.07)	(0.41)	(0.73)	(0.59)
Post August 2010	-1.16***	-0.69	-0.64**	0.40***	-0.22***	-0.23***	-0.95***	-1.66***	-1.61***
	(0.40)	(0.62)	(0.32)	(0.08)	(0.08)	(0.07)	(0.35)	(0.60)	(0.50)
Sum of Effects	-1.21	-1.77	-1.69	0.48	-0.49	-0.50	-2.28	-4.23	-4.12
P-value No Effect	0.00	0.05	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Mean of Dep. Var.	14.41	14.41	14.41	1.80	1.80	1.80	19.48	19.48	19.48
				Panel D: 720-759					
Post February 2010	0.74	-0.94	-0.91**	0.28***	-0.40**	-0.40***	0.38	-1.83**	-1.79***
	(0.51)	(0.68)	(0.42)	(0.11)	(0.16)	(0.12)	(0.63)	(0.86)	(0.55)
Post August 2010	-1.02**	-0.72	-0.74**	0.51***	-0.38**	-0.41***	-0.65	-1.52	-1.57***
	(0.51)	(0.84)	(0.33)	(0.12)	(0.17)	(0.10)	(0.61)	(1.00)	(0.45)
Sum of Effects	-0.27	-1.66	-1.65	0.79	-0.78	-0.81	-0.27	-3.36	-3.37
P-value No Effect	0.47	0.15	0.02	0.00	0.01	0.00	0.58	0.02	0.00
Mean of Dep. Var.	11.14	11.14	11.14	2.86	2.86	2.86	16.20	16.20	16.20
				Panel E: 760-799					
Post February 2010	0.93*	-0.52	-0.47	0.90***	-0.55	-0.59**	1.46*	-1.29	-1.25**
	(0.54)	(0.75)	(0.37)	(0.23)	(0.43)	(0.26)	(0.79)	(1.17)	(0.62)
Post August 2010	-0.93*	-0.52	-0.52*	0.84***	-0.79*	-0.85***	-0.28	-1.66	-1.71***
	(0.54)	(0.87)	(0.31)	(0.28)	(0.45)	(0.20)	(0.79)	(1.34)	(0.51)
Sum of Effects	0.00	-1.04	-0.99	1.73	-1.34	-1.44	1.18	-2.95	-2.97
P-value No Effect	0.99	0.39	0.09	0.00	0.07	0.00	0.08	0.14	0.00
Mean of Dep. Var.	8.62	8.62	8.62	5.97	5.97	5.97	16.63	16.63	16.63
				Panel F: 800+					
Post February 2010	0.27	-0.40	-0.33	1.60***	-0.26	-0.38	1.35*	-0.62	-0.67
	(0.40)	(0.60)	(0.32)	(0.38)	(0.81)	(0.50)	(0.72)	(1.27)	(0.73)
Post August 2010	-0.83**	-0.14	-0.13	0.90**	-1.12*	-1.18***	-0.16	-1.62	-1.65***
	(0.40)	(0.64)	(0.25)	(0.38)	(0.68)	(0.35)	(0.68)	(1.22)	(0.54)
Sum of Effects	-0.56	-0.54	-0.46	2.50	-1.38	-1.56	1.19	-2.24	-2.31
P-value No Effect	0.05	0.57	0.37	0.00	0.28	0.04	0.07	0.28	0.04
Mean of Dep. Var.	6.62	6.62	6.62	10.89	10.89	10.89	19.95	19.95	19.95
				Controls: All Panels					
Bank FE	X	X		X	X		X	X	
Time Polynomial		X			X			X	
Bank FE X Time Polynomail			X			X			X

Note: Table shows estimates from event-study regressions of income components on indicators for the two key CARD Act implementation dates and controls by FICO group. The dependent variables are measured as an annualized percentage of ADB. During the months of implementation, the indicator is replaced with the fraction of days the reform is in place. The unit of observation is a bank-month, with each observation weighted by mean ADB. We report heteroskedasticity-robust Newey-White standard errors allowing for 3 months of auto-correlation by bank. For each dependent variable, the first column controls for bank fixed effects, the second column adds a fifth-order time polynomial, and the third column controls for a bank-specific fifth-order time polynomial.

Table 8: Profit by FICO Score Event-Study Regressions

	Dependent Variable								
	Net Charge-offs			Other Costs (Excluding Charge-offs)			Net Income		
				Panel A: <620					
Post February 2010	-3.24**	2.05	2.02	-1.12***	-0.23	-0.24	-4.46**	-13.39***	-13.44***
	(1.45)	(2.50)	(2.02)	(0.22)	(0.29)	(0.19)	(2.19)	(3.33)	(3.43)
Post August 2010	-11.21***	-0.16	-0.19	0.33**	-0.20	-0.23*	9.19***	-5.12**	-5.23***
	(1.69)	(2.06)	(1.65)	(0.15)	(0.21)	(0.12)	(2.25)	(2.22)	(1.84)
Sum of Effects	-14.45	1.90	1.84	-0.78	-0.43	-0.48	4.73	-18.50	-18.67
P-value No Effect	0.00	0.62	0.57	0.00	0.30	0.09	0.00	0.00	0.00
Mean of Dep. Var.	23.20	23.20	23.20	3.46	3.46	3.46	11.74	11.74	11.74
				Panel B: 620-659					
Post February 2010	0.59	1.30	1.25	-1.34***	-0.28	-0.29	-3.15**	-6.43***	-6.39***
	(1.22)	(1.56)	(1.19)	(0.22)	(0.25)	(0.18)	(1.37)	1.96	(1.91)
Post August 2010	-9.58***	0.08	-0.01	0.35**	-0.13	-0.17	7.97***	-2.82**	-2.74**
	(1.19)	(1.22)	(0.97)	(0.15)	(0.25)	(0.12)	(1.27)	(1.37)	(1.18)
Sum of Effects	-8.99	1.38	1.24	-0.98	-0.41	-0.45	4.82	-9.25	-9.14
P-value No Effect	0.00	0.54	0.52	0.00	0.31	0.10	0.00	0.00	0.00
Mean of Dep. Var.	19.11	19.11	19.11	2.90	2.90	2.90	5.15	5.15	5.15
				Panel C: 660-720					
Post February 2010	2.55**	0.12	0.12	-1.40***	-0.38	-0.38*	-2.48**	-2.31**	-2.26***
	(1.13)	(0.87)	(0.78)	(0.23)	(0.25)	(0.20)	(1.12)	(0.92)	(0.86)
Post August 2010	-7.27***	-0.31	-0.36	0.48***	-0.11	-0.12	5.84***	-1.27	-1.15
	(0.80)	(0.83)	(0.63)	(0.16)	(0.27)	(0.14)	(0.69)	(0.94)	(0.75)
Sum of Effects	-4.72	-0.19	-0.24	-0.91	-0.49	-0.50	3.35	-3.58	-3.42
P-value No Effect	0.00	0.89	0.86	0.00	0.25	0.13	0.00	0.03	0.02
Mean of Dep. Var.	14.01	14.01	14.01	2.96	2.96	2.96	2.51	2.51	2.51
				Panel D: 720-759					
Post February 2010	3.18***	-0.08	-0.05	-1.17***	-0.50*	-0.49**	-1.63**	-1.25*	-1.26*
	(0.81)	(0.69)	(0.54)	(0.24)	(0.28)	(0.20)	(0.73)	(0.68)	(0.68)
Post August 2010	-4.77***	-0.50	-0.53	0.52***	-0.26	-0.26*	3.59***	-0.78	-0.79
	(0.57)	(0.86)	(0.43)	(0.19)	(0.32)	(0.15)	(0.44)	(0.74)	(0.57)
Sum of Effects	-1.59	-0.58	-0.58	-0.65	-0.76	-0.75	1.96	-2.02	-2.05
P-value No Effect	0.05	0.66	0.51	0.00	0.12	0.02	0.01	0.12	0.07
Mean of Dep. Var.	9.10	9.10	9.10	3.77	3.77	3.77	3.33	3.33	3.33
				Panel E: 760-799					
Post February 2010	2.33***	0.02	0.07	-0.67**	-0.62	-0.61**	-0.20	-0.70	-0.71
	(0.52)	(0.59)	(0.34)	(0.30)	(0.40)	(0.24)	(0.55)	(0.71)	(0.56)
Post August 2010	-2.78***	-0.21	-0.20	0.71**	-0.59	-0.60***	1.80***	-0.88	-0.92**
	(0.37)	(0.65)	(0.24)	(0.27)	(0.49)	(0.18)	(0.41)	(0.68)	(0.45)
Sum of Effects	-0.45	-0.18	-0.14	0.04	-1.21	-1.21	1.60	-1.57	-1.63
P-value No Effect	0.39	0.86	0.79	0.90	0.10	0.00	0.00	0.18	0.08
Mean of Dep. Var.	5.76	5.76	5.76	5.95	5.95	5.95	4.92	4.92	4.92
				Panel F: 800+					
Post February 2010	1.22***	0.28	0.34	-0.19	-0.37	-0.42	0.32	-0.53	-0.59
	(0.39)	(0.39)	(0.24)	(0.37)	(0.61)	(0.36)	(0.45)	(0.76)	(0.57)
Post August 2010	-1.74***	0.20	0.16	0.75**	-0.83	-0.84***	0.82**	-1.00	-0.98**
	(0.28)	(0.44)	(0.22)	(0.33)	(0.60)	(0.26)	(0.35)	(0.61)	(0.44)
Sum of Effects	-0.52	0.48	0.50	0.56	-1.20	-1.25	1.14	-1.53	-1.58
P-value No Effect	0.14	0.49	0.22	0.12	0.23	0.02	0.01	0.19	0.09
Mean of Dep. Var.	4.00	4.00	4.00	9.16	9.16	9.16	6.79	6.79	6.79
				Controls: All Panels					
Bank FE	X	X		X	X		X	X	
Time Polynomial		X			X			X	
Bank FE X Time Polynomail			X			X			X

Note: Table shows estimates from event-study regressions of profit components on indicators for the two key CARD Act implementation dates and controls by FICO group. The dependent variables are measured as an annualized percentage of ADB. During the months of implementation, the indicator is replaced with the fraction of days the reform is in place. The unit of observation is a bank-month, with each observation weighted by mean ADB. We report heteroskedasticity-robust Newey-White standard errors allowing for 3 months of auto-correlation by bank. For each dependent variable, the first column controls for bank fixed effects, the second column adds a fifth-order time polynomial, and the third column controls for a bank-specific fifth-order time polynomial.

Table 9: Change in Payoff Behavior

	(1)	(2)	(3)	(4)	(5)	(6)
Panel A: Dep. Var.: Share Making Target Payment Amount (31 ≤T≤37)						
Post February 2010	0.303***	0.614***	0.464***	0.305***	0.632***	0.573**
	(0.08)	(0.12)	(0.15)	(0.08)	(0.12)	(0.24)
Mean of Dep. Var.	4.14	4.14	4.14	4.14	4.14	4.14
Bank FE	X	X	X	X	X	X
Second-Order Time Polynomial		X			X	
Fifth-Order Time Polynomial			X			X
Month FE				X	X	X
Panel B: Dep. Var.: Share Making Less than Target Payment Amount (T > 37)						
Post February 2010	-3.679***	-2.676***	-1.980***	-3.648***	-2.108***	-0.227
	(0.37)	(0.47)	(0.56)	(0.36)	(0.49)	(0.83)
Mean of Dep. Var.	32.75	32.75	32.75	32.75	32.75	32.75
Bank FE	X	X	X	X	X	X
Second-Order Time Polynomial		X			X	
Fifth-Order Time Polynomial			X			X
Month FE				X	X	X

Note: Table shows estimates from event-study regressions of payoff behavior on indicator for implementation of disclosure requirement. The top panel shows the percentage of account holders that make a payment corresponding to the target CARD Act payment ($31 \leq T \leq 37$). The bottom panel shows the percentage of account holders that make payments smaller than the CARD Act target amount ($T > 37$). During the month of implementation, the indicator is replaced with the fraction of days the reform is in place. The unit of observation is a bank-month, with each observation weighted by the number of accounts. We report heteroskedasticity-robust Newey-White standard errors allowing for 3 months of auto-correlation by bank. Column 1 controls for bank fixed effects, column 2 adds a second-order time polynomial, column 3 replaces the second-order polynomial with a fifth-order time polynomial. Columns 4 to 6 repeat the specifications in columns 1 to 3, including month-of-year fixed effects to control for seasonality in repayment behavior.

APPENDIX

A Data Appendix

A.1 Constructing Revenue and Cost Measures

A number of the important cost and revenue measures for credit cards are not observed at the account level, but only at the credit card portfolio level. These include the cost of funds, operational expenses, interchange income, rewards expenses, and fraud expenses. Since most of these measures broadly scale with either average daily balances (cost of funds, operational expenses) or purchase volume (interchange income, rewards, and fraud), we can use the information in the portfolio-level data to construct account-level measures of these variables. At the portfolio level, banks also report "daily average managed receivables," but not total monthly transaction volume.

A.1.1 Cost of Funds

The cost of funds is the interest rate paid by financial institutions for the funds that they deploy in their business, and is a significant component of the cost of extending credit. The cost of funds also varies across banks, depending, amongst other things, on their ability to raise funds in the interbank market. Banks report "total interest expense accrued for the month to fund credit card receivables" in the portfolio-level data. This allows us, for every bank and month, to calculate the cost of funds—that is, the annualized cost of funding credit card lending. The top panel of Figure A2 shows the average cost across banks of this cost-of-fund measure. The cost of funds declined markedly over our sample period, with particularly steep drops in 2008, as the Fed Funds Rate declined to zero. The graph also shows the 11th District Cost of Funds Index (COFI), a monthly weighted average of the interest rates paid on checking and savings accounts offered by financial institutions operating in the states of Arizona, California and Nevada. This index is widely seen as a measure of the refinancing costs of US financial institutions. Reassuringly, it moves closely with the cost-of-funds derived from the credit card portfolio data. For every account, we calculate the cost of funding that account's receivables by multiplying the average daily balances with the cost of funds for the corresponding bank and month.

A.1.2 Operational Expenses

At the portfolio level, we also observe banks reporting three other components of cost. These are *collection expenses*, which include the costs incurred to collect problem credit; *marketing/acquisition and card processing costs*, which include the costs to acquire, advertise, and promote and process credit cards; and *other expenses*, which include servicing, cardholder billing, processing interchange, processing payments, card issuing, authorizations, card administration and outside services/outsourcing expenses. We combine these three expense categories into the category "Operational Costs." For each month, we calculate the ratio of these operational costs to the average daily managed receivables. This ratio is shown in the middle panel of Figure A2. We use the smoothed version of this series to

assign a corresponding "operational cost" to every account by multiplying the average daily balances with the operational expense ratio for the corresponding month.

A.1.3 Interchange Income, Rewards and Fraud Expenses

Three other components of overall credit card profitability are also reported in the portfolio-level data. At the account level, these measures are likely to scale with total purchase volume rather than with average daily balances. Unfortunately, we do not observe a measure of total purchase volume at the portfolio level. In order to assign these costs to individual accounts, we proceed in a number of steps. We determine that while there is some heterogeneity in interchange fees, average interchange income for the issuing bank is roughly 2% of the overall volume (Government Accountability Office, 2009). Hence, we assess interchange income at the account level to be 2% of purchase volume. The portfolio-level data shows that expenditures for rewards and fraud make up about 70% of interchange income (see the bottom panel of Figure A2). Therefore, we assess reward and fraud expenses at the account level to be approximately $0.7 \times 2\% = 1.4\%$ of purchase volume.

To validate the approach of choosing interchange income as a constant fraction of purchase volume, we conduct the following analysis: First, we use the account-level data to calculate, for every month, the ratio of purchase volume to average daily balances. This is plotted in the top panel of Figure A3. Next, we combine this ratio with the portfolio-level data to impute a total purchase volume for the entire credit card portfolio. Finally, we construct the ratio of interchange income to this imputed purchase volume at the portfolio level. This is plotted in the bottom panel if Figure A3. The ratio is constant at 2% over the entire sample period.

B Fee Offset with Selection

The composition of the borrower pool may not be invariant to the prices charged, and changing the price might attract either higher or lower marginal cost consumers.[50] To allow for such adverse or advantageous selection, we allow aggregate marginal costs $c'(q)$ to depend on aggregate demand q. Adverse selection at the industry level is indicated by decreasing aggregate marginal costs $c''(q) < 0$; advantageous selection is indicated by increasing aggregate marginal costs $c''(q) > 0$.

When a single firm lowers its price, it attracts consumers that are new to the market and consumers who are already purchasing the product from competing firms. The share of consumers that firm i captures from its competitors is given by the aggregate diversion ratio: $A = -\frac{\sum_{j \neq i} \partial q_j / \partial p_i}{\partial q_i / \partial p_j}$, the sum consumers lost by firms $j \neq i$ divided by the consumers gained by firm i.[51]

We assume that the consumers acquired from competitors are not selected and have costs equal to industry average cost: $\frac{c(q)}{q}$. Marginal costs for a single firm $c_i'(q_i)$ are the weighted sum of marginal costs for consumers that are new to the market and marginal costs for consumers that are attracted

[50] Similarly, changing the price might have a direct impact on costs. For example, if high prices increase debt levels and thereby increases the probability of default.

[51] We thank Glen Weyl for suggesting this approach to modeling selection.

from other firms:

$$c_i'(q_i) = (1 - A)c'(q) + A\frac{c(q)}{q}. \tag{10}$$

It is convenient to characterize the demand curve faced by a single firm in terms of aggregate demand and the aggregate diversion ratio:

$$1 - A = 1 - \frac{\sum_{j \neq i} \partial q_j / \partial p_i}{\partial q_i / \partial p_j} = \frac{\partial q_i / \partial p_j - \sum_{j \neq i} \partial q_j / \partial p_i}{\partial q_i / \partial p_j} = \frac{q'}{q_i'} \quad \iff \quad q_i' = \frac{q'}{1 - A} \tag{11}$$

where q' is the derivative of aggregate demand with respect to the price p_1 of a single firm i.

The first order condition for p_1 is given by

$$p_1 + p_2 - c_i'(q_i) = \theta\, \mu(p_1 + \psi p_2) \tag{12}$$

with the conduct parameter $\theta \in [0, 1]$ and markup term $\mu(p_1 + \psi p_2)$ as previously defined. The second order condition for p_1 is $\theta\, \mu' + c''\, q' < 1$. We assume that at the optimal price this condition is satisfied.

For small changes in p_2 we can calculate pass-through by totally differentiating the first order condition:

$$\frac{dp_1}{dp_2} + 1 - c_i''(q_i)\, q_i' \left[\frac{dp_1}{dp_2} + \psi\right] = \theta\, \mu'(p_1 + \psi p_2) \left[\frac{dp_1}{dp_2} + \psi\right]. \tag{13}$$

Substituting $c_i'' = (1 - A)c''$ and $q_i' = \frac{q'}{1-A}$ and re-arranging gives us the pass-through formula:

$$\omega = \frac{1 - \psi\, [\theta\, \mu' + c''\, q']}{1 - [\theta\, \mu' + c''\, q']} \tag{14}$$

where we have suppressed the arguments of c, q and μ.

The offset ω is increasing in the term $c''\, q'$. With downward sloping demand $q' < 0$, this means that the offset is relatively larger when there is adverse selection ($c'' < 0$) and relatively smaller when there is advantageous selection ($c'' > 0$). The reason the offset is larger with adverse selection is that a higher p_1 brings in higher marginal cost consumers, requiring a further increase in price.

Under what conditions is the offset less than full? The second order condition $\theta\, \mu' + c''\, q' < 1$ restricts the numerator and denominator to be positive. For $\psi \in (0, 1)$, it follows that

$$\omega < 1 \iff \theta\, \mu' + c''\, q' < 0. \tag{15}$$

Under what conditions is the offset increasing in competition? Differentiating the pass-through formula yields

$$\frac{d\omega}{d\theta} = \frac{[1 - \theta\, \mu' - c''\, q'] [-\psi\, \mu'] - [1 - \psi\, \theta\, \mu' - \psi\, c''\, q'] [-\mu']}{[1 - \theta\, \mu' - c''\, q']^2} \tag{16}$$

which simplifies to

$$\frac{d\omega}{d\theta} = \frac{\mu' \left[1 - \psi\right]}{\left[1 - \theta\, \mu' - c''\, q'\right]^2} \tag{17}$$

Since the denominator is always positive, for $\psi \in (0, 1)$ we have

$$\frac{d\omega}{d\theta} < 0 \iff \mu' < 0 \tag{18}$$

where recall that increasing competition is indicated by a lower value of θ.

Under what conditions is the offset increasing in salience? Differentiating the pass-through formula gives us:

$$\frac{d\omega}{d\psi} = -\frac{\left[\theta\, \mu' + c''\, q'\right]}{1 - \left[\theta\, \mu' + c''\, q'\right]}. \tag{19}$$

Since $\theta\, \mu' + c''\, q' < 0$ is implied by the second order condition, it follows that

$$\frac{d\omega}{d\psi} > 0 \iff \theta\, \mu' + c''\, q' < 0 \tag{20}$$

We can also relate pass-through to the offset of a cost shock in settings with selection. Differentiating the first order conditions with respect to c yields the pass-through equation

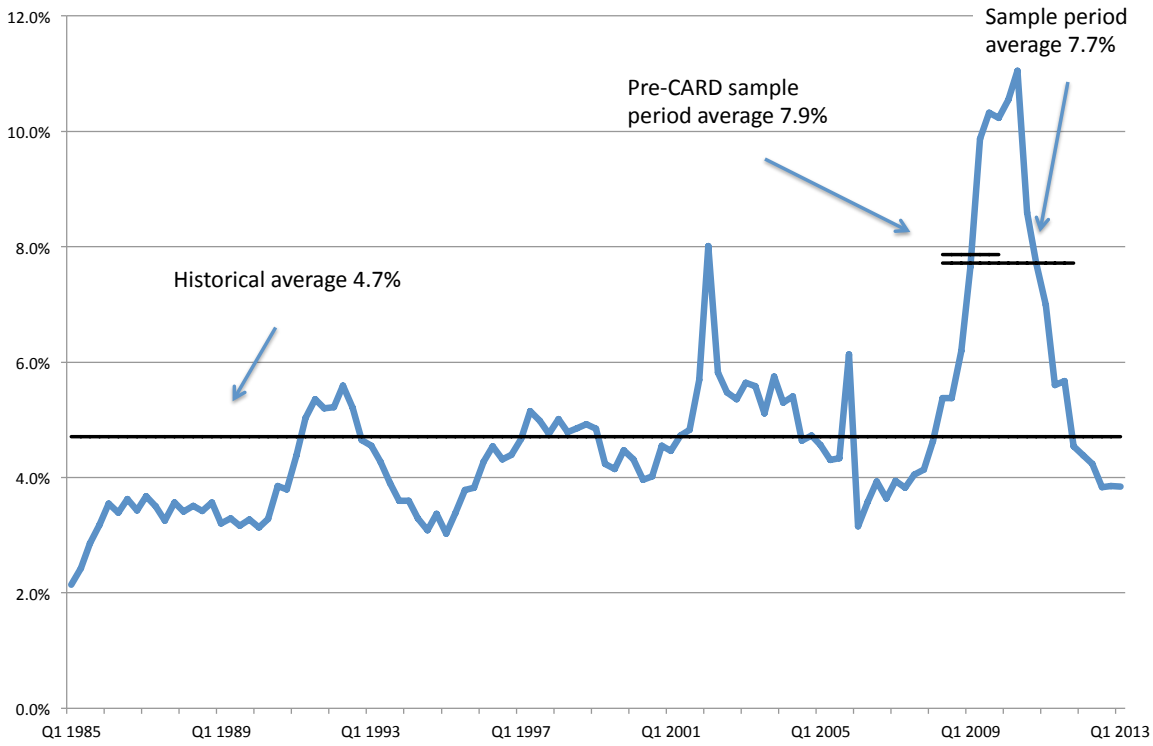
$$\rho = \frac{1}{1 - \left[\theta\, \mu' + c''\, q'\right]}. \tag{21}$$

Simple algebra allows us to write the offset as a function of the pass-through rate

$$\omega = \rho + \psi \left[1 - \rho\right] \tag{22}$$

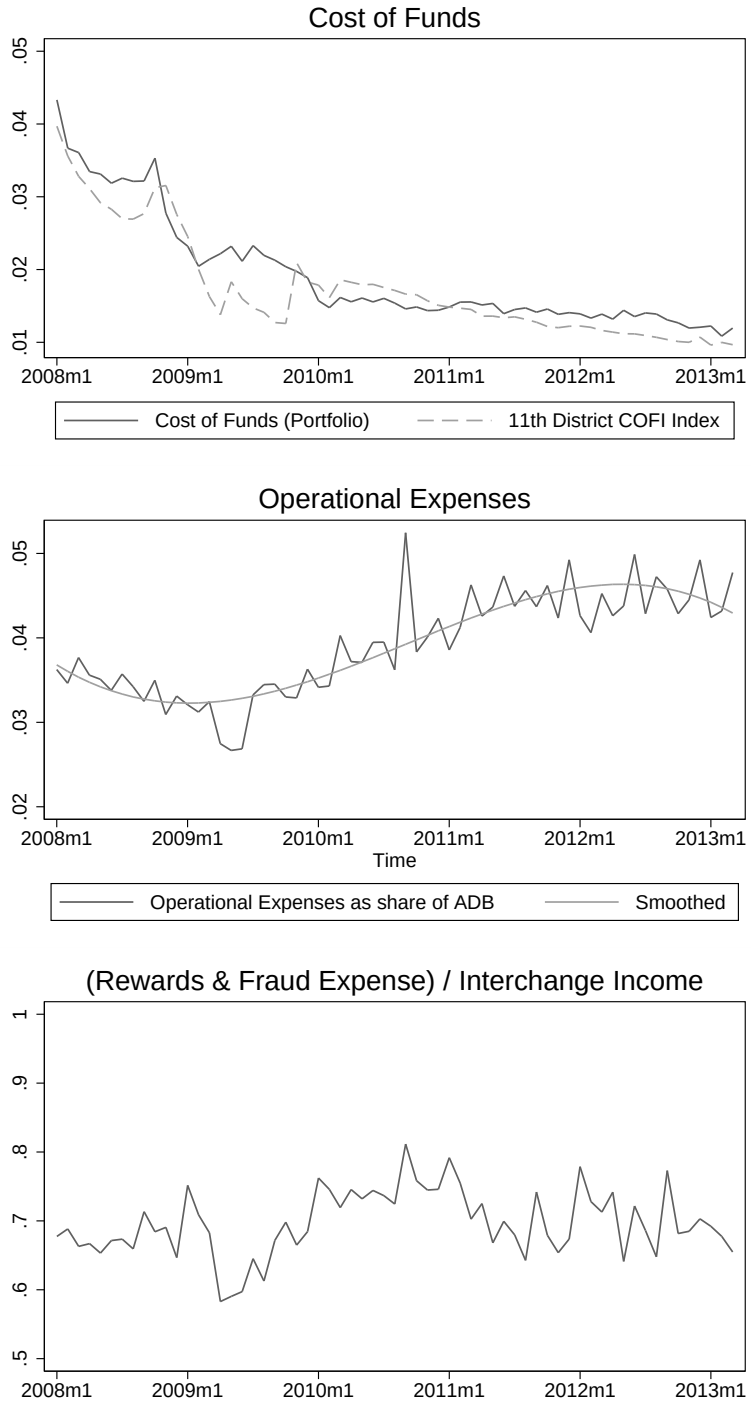
If $\psi = 0$, the offset is equal to the pass-through because a decrease in the non-salient price p_2 enters the firm's problem in the exact same manner as an increase in marginal costs c. If $\psi = 1$, then the offset is full. If $\psi \in (0, 1)$, then we have $\rho < \omega < 1$ if $\theta\, \mu' + c''\, q' < 0$ and $\rho > \omega > 1$ if $\theta\, \mu' + c''\, q' > 0$. Hence the result that the offset (ω) of a decrease in the non-salient price is weaker closer to full than the pass-through (ρ) of an increase in marginal costs.

Figure A1: Historical Charge-offs



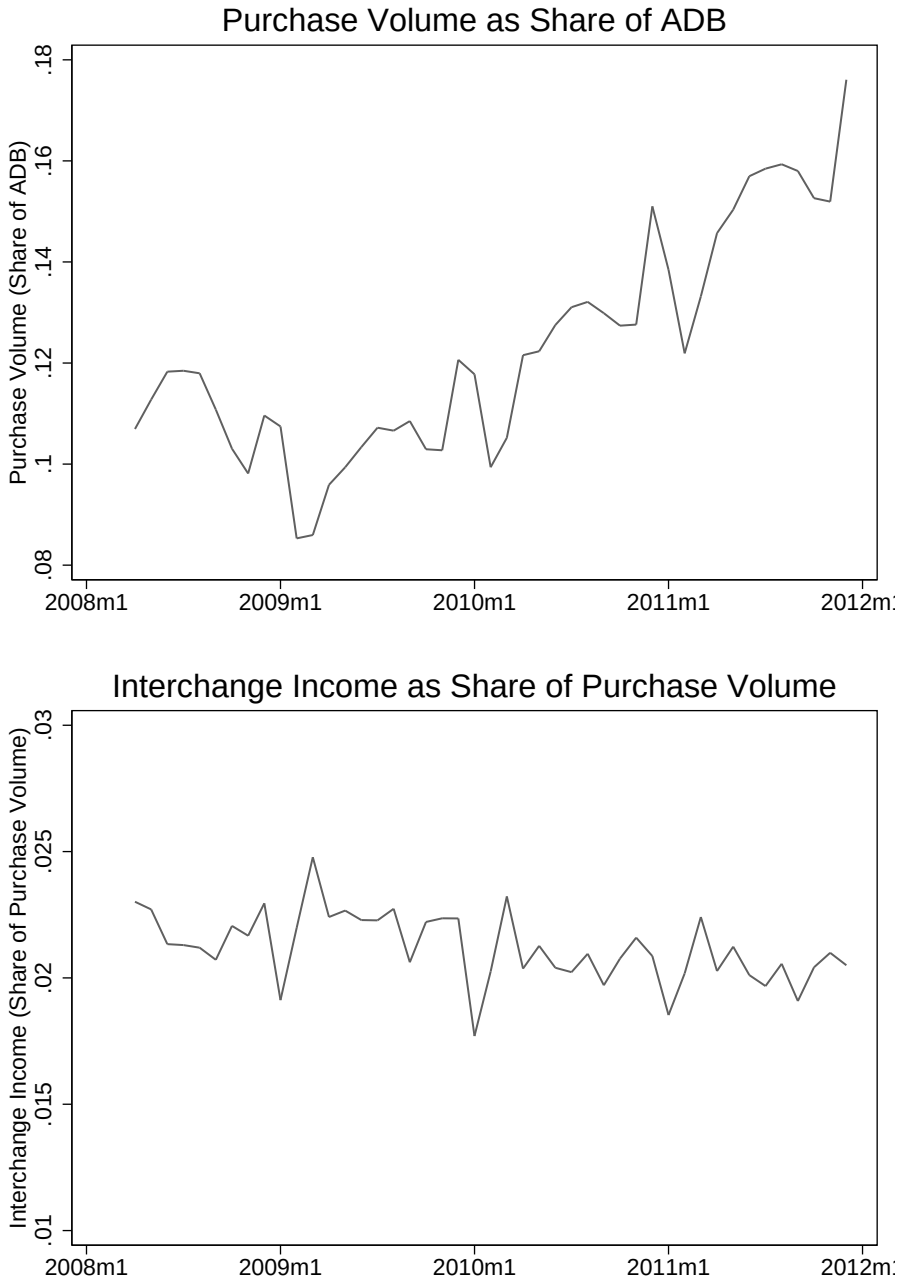
Note: Figure shows non-seasonally adjusted credit card charge-off rates for the 100 largest U.S. banks. The data is produced using Federal Financial Institutions Examination Council (FFIEC) Consolidated Reports of Condition and Income (1985-2000: FFIEC 031 through 034; 2001-Today: FFIEC 031 & 041). This data is published by the Federal Reserve Bank.

Figure A2: Portfolio Data



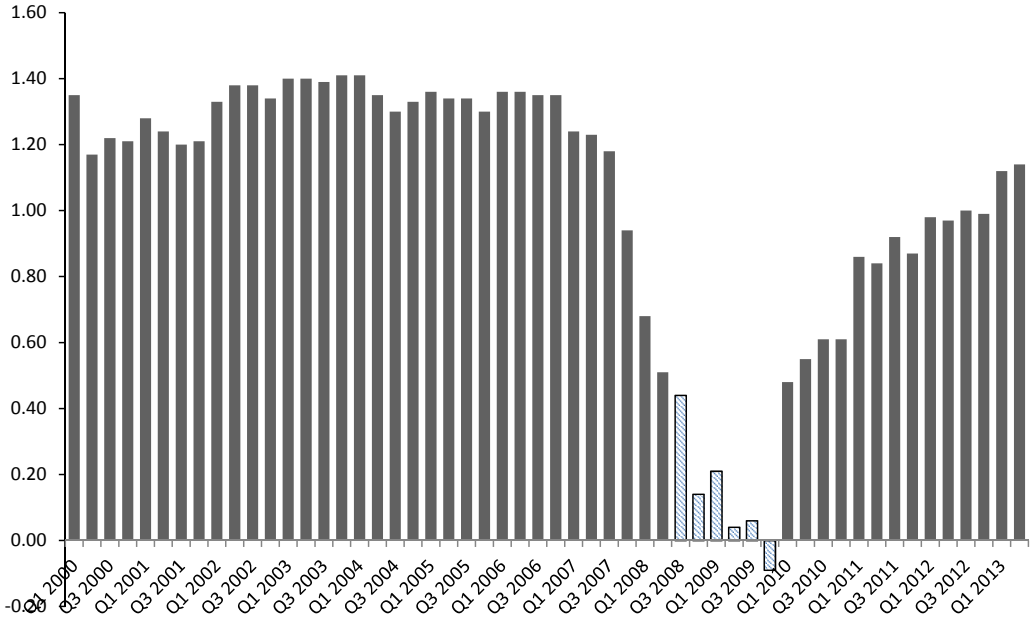
Note: Figure shows plots of cost components by month. The top panel shows the cost of funds, calculated as the annualized interest expense ("total interest expense accrued for the month to fund credit card receivables") as a share of average daily managed receivables for that month. It also shows the 11th District Cost of Funds Index (COFI). The middle panel shows the share of annualized operational expenses (including marketing and acquisition, collections, servicing, cardholder billing, processing payments, card issuing and administration) as a share of average daily managed receivables. The bottom panel shows the share of rewards and fraud expenses as a ratio of the interchange income. These figures are constructed using the monthly general purpose credit card portfolio-level data. Numbers are averages across banks.

Figure A3: Interchange Income

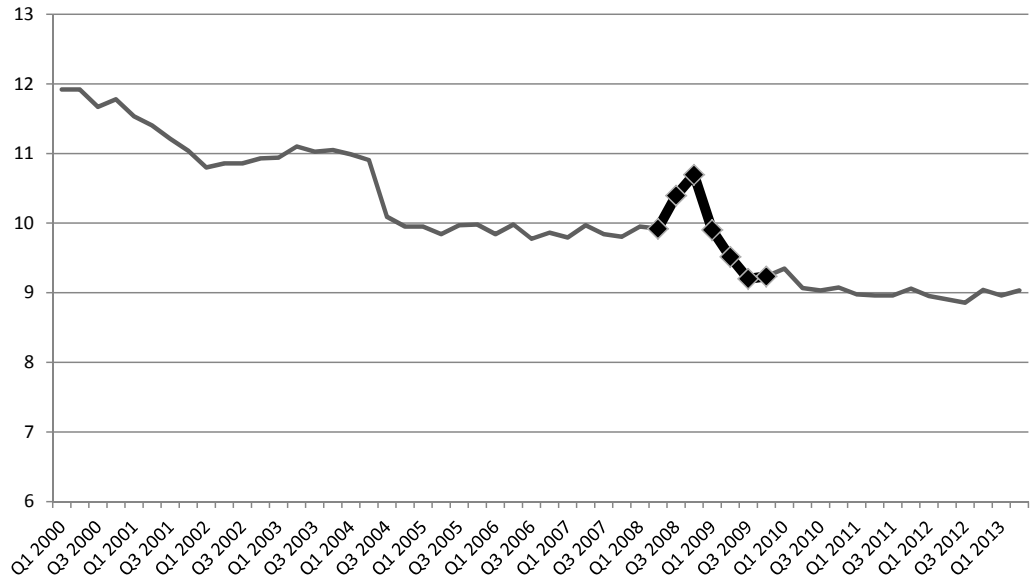


Note: Figure shows ratio of purchase volume to ADB (top panel) and share of interchange income to purchase volume (bottom panel). The top panel is constructed from account-level data. The bottom panel is constructed by taking the information from the top panel to scale the portfolio-level information on ADB to get a portfolio-level of measure of purchase volume. Total interchange income is also reported at the portfolio level.

Figure A4: U.S. Commercial Banking Sector - ROA and Leverage



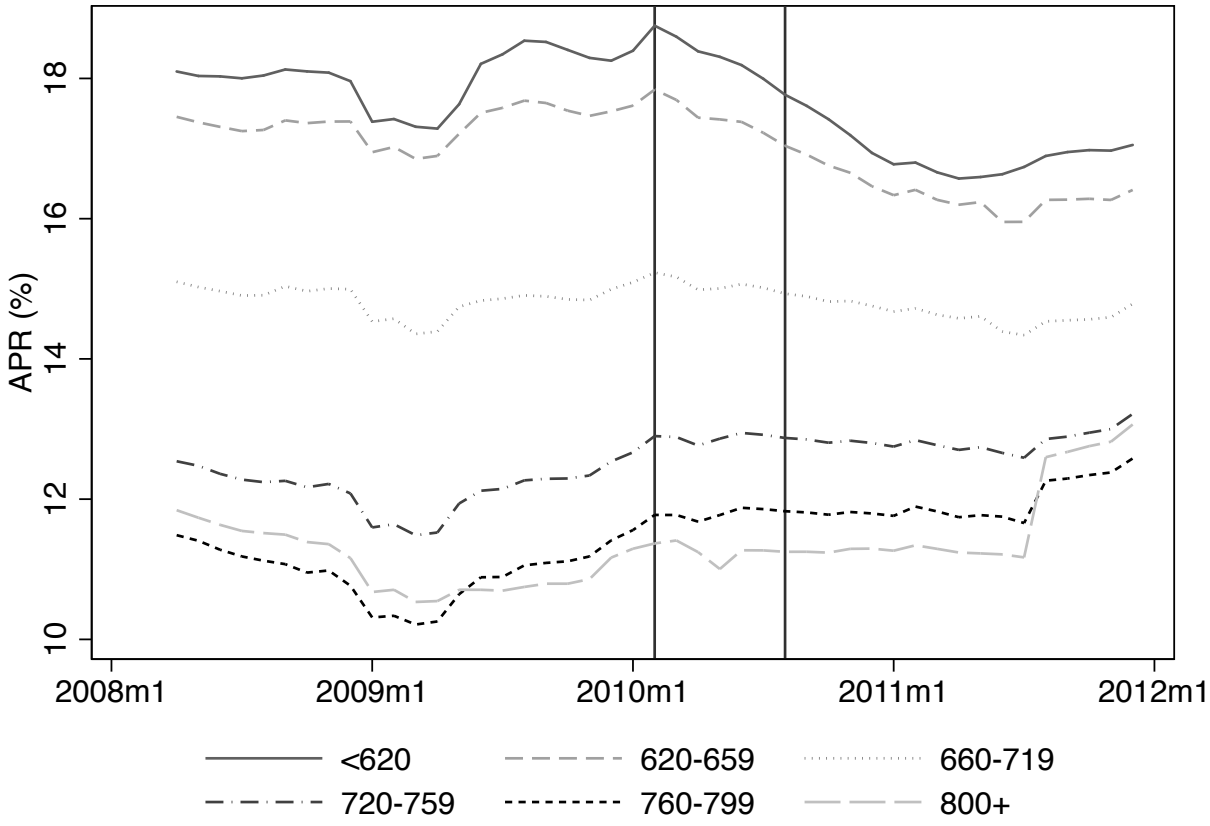
(a) Return on Assets (ROA)



(b) Leverage

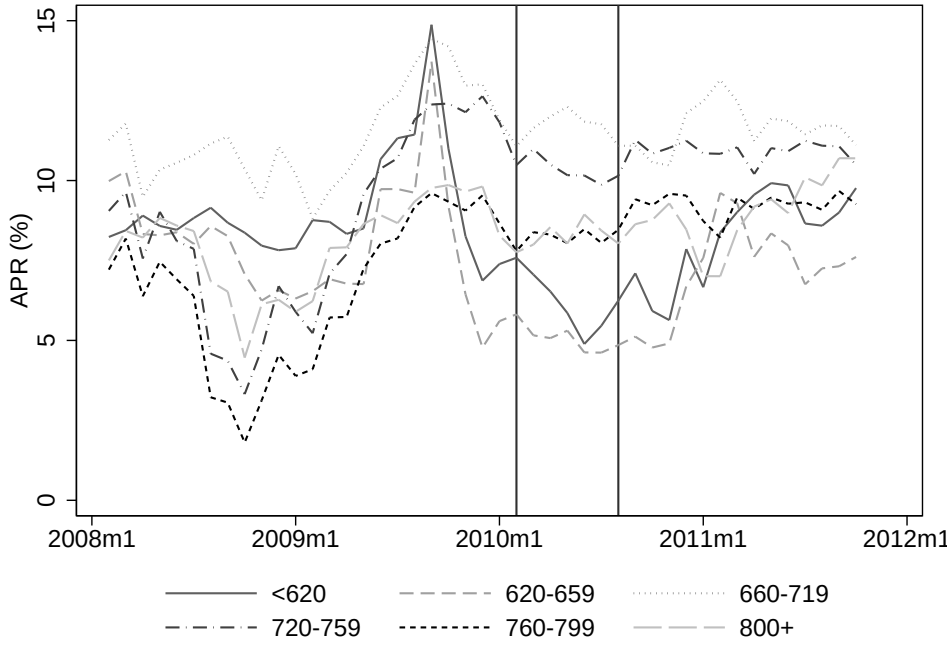
Note: Top panel shows the average Return on Assets (ROA) in percent for all insured U.S. Commercial Banks (FRED Series USROA) as reported by the Federal Financial Institutions Examination Council. The bottom panel reports the leverage (Total Assets / Total Equity) for all insured U.S. Commercial Banks (the inverse of FRED Series EQTA). The shaded bars in the top panel and bolded line in the bottom panel depict the pre-CARD Act period covered in Table 3.

Figure A5: Interest Rate for All Accounts

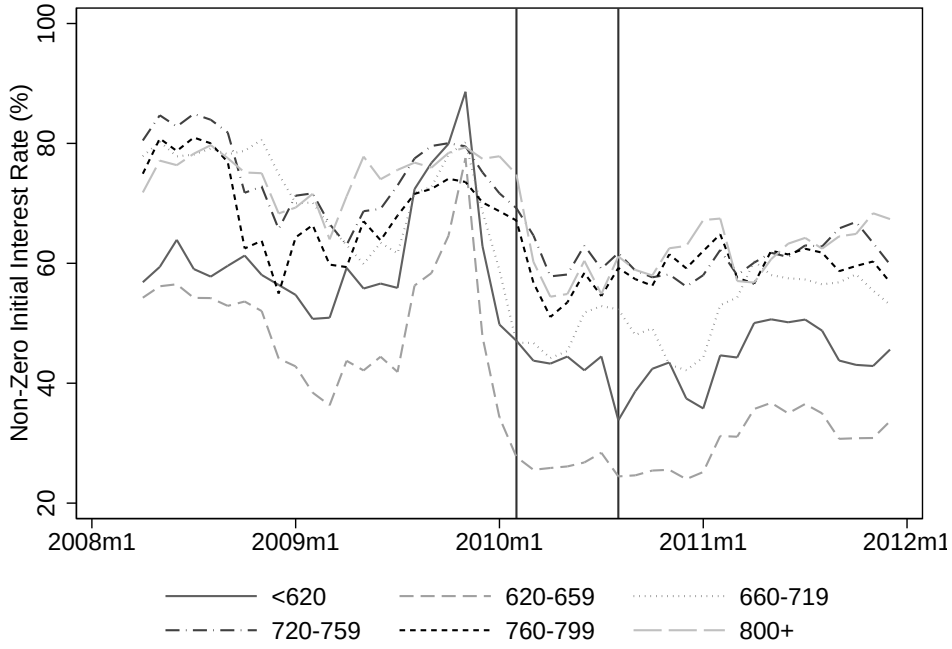


Note: Figure shows the average APR over all reporting accounts, weighted by ADB. The data is split by FICO scores at account origination. Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates for the CARD Act.

Figure A6: Interest Rates by FICO Score for New Accounts



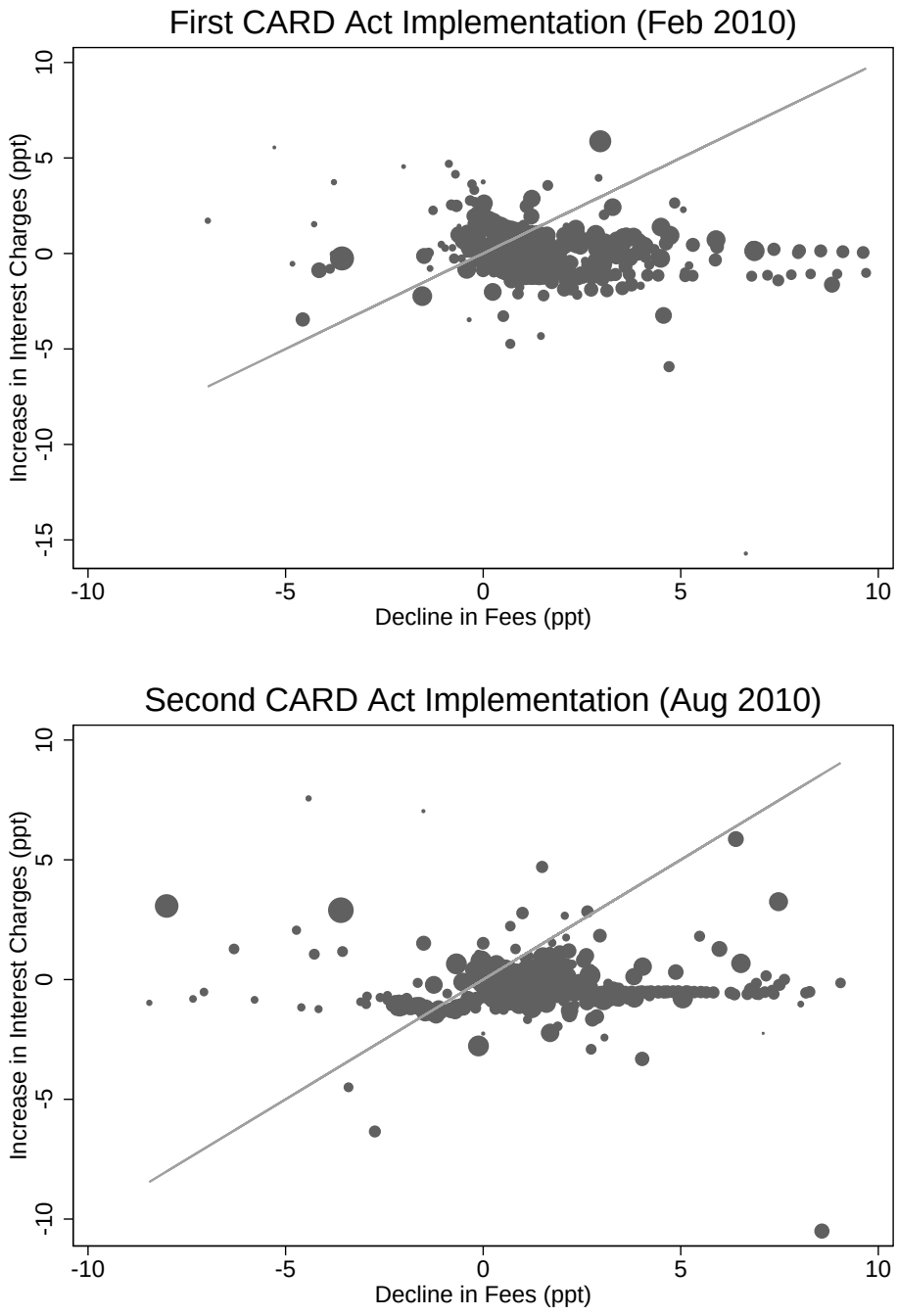
(a) Interest Rate



(b) Percent Non-Zero Initial Interest Rate

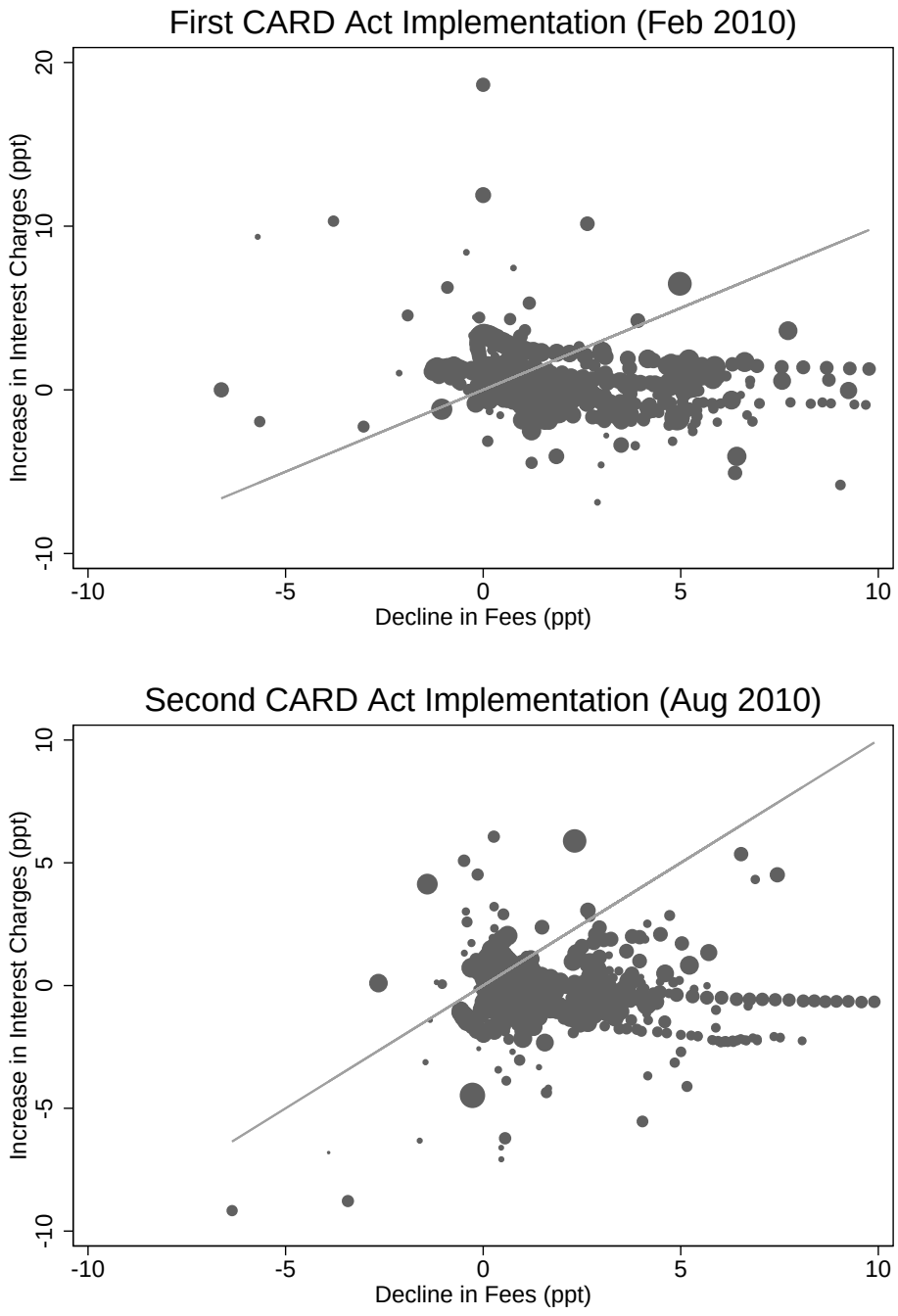
Note: The figure shows the average APR (top panel) and the share of non-zero APR (bottom panel) for new accounts, weighted by ADB. New accounts are defined as those in their first full month of account activity. The data is split by different FICO scores at account origination. Vertical bars are plotted in February 2010 and August 2010, the two key implementation dates of the CARD Act.

Figure A7: Fee Offsets by Banks



Note: Figure plots the change in interest charges (vertical axis) against the decline in fees (horizontal axis) around the two key implementation dates of the CARD Act: the two months before and after the February 2010 (top panel) and the two months before and after August 2010 (bottom panel). Each observation represents an average within a bank by FICO group cell (in steps of 5 between 450 and 890). The size of the dots is proportional to ADBs in the pre-period. FICO scores are those at account origination. Plots include the 45 degree line.

Figure A8: Fee Offset by Bank - One-year horizon



Note: Figure plots the change in interest charges (vertical axis) against the decline in fees (horizontal axis) around the two key implementation dates of the CARD Act: the twelve months before and after the February 2010 (top panel) and the twelve months before and after August 2010 (bottom panel). Each observation represents an average within a bank by FICO group cell (in steps of 5 between 450 and 890). The size of the dots is proportional to ADBs in the pre-period. FICO scores are those at account origination. Plots include the 45 degree line.