REGULATING CONSUMER FINANCIAL PRODUCTS: EVIDENCE FROM CREDIT CARDS*

SUMIT AGARWAL
SOUPHALA CHOMSISENGPHET
NEALE MAHONEY
JOHANNES STROEBEL

We analyze the effectiveness of consumer financial regulation by considering the 2009 Credit Card Accountability Responsibility and Disclosure (CARD) Act. We use a panel data set covering 160 million credit card accounts and a difference-in-differences research design that compares changes in outcomes over time for consumer credit cards, which were subject to the regulations, to changes for small business credit cards, which the law did not cover. We estimate that regulatory limits on credit card fees reduced overall borrowing costs by an annualized 1.6% of average daily balances, with a decline of more than 5.3% for consumers with FICO scores below 660. We find no evidence of an offsetting increase in interest charges or a reduction in the volume of credit. Taken together, we estimate that the CARD Act saved consumers $11.9 billion a year. We also analyze a nudge that disclosed the interest savings from paying off balances in 36 months rather than making minimum payments. We detect a small increase in the share of accounts making the 36-month payment value but no evidence of a change in overall payments. *JEL* Codes: D0, D14, G0, G02, G21, G28, L0, L13, L15.

*We thank the editors, Lawrence Katz and Andrei Shleifer, three anonymous referees, and our discussants Effie Benmelech, Olivier de Jonghe, Brigitte Madrian, Victor Stango, Jeremy Tobacman, Jialan Wang, and Jonathan Zinman for thoughtful comments. We are grateful to John Campbell, Chris Carroll, Raj Chetty, Liran Einav, Alexander Frankel, Matthew Gentzkow, Andra Ghent, Christian Hansen, Benjamin Keys, Theresa Kuchler, Andres Liberman, Monika Piazzesi, Jesse Shapiro, Richard Thaler, Alessandra Voena, and Glen Weyl, and seminar participants at the University of Chicago, New York University, Harvard University, Harvard Business School, Duke University, Arizona State University, the University of Michigan, Texas A&M, the Philadelphia Fed, the NBER meetings in Industrial Organization, Corporate Finance, Law & Economics, and Household Finance, the Boston Fed Conference on Payment Systems, the Empirical Macro Workshop in New Orleans, the Sloan Conference on Benefit-Cost Analysis of Financial Regulation, the Bonn/Bundesbank conference for Regulating Financial Intermediaries, the CFPB, the OCC, the FDIC, Kansas University, University of Virginia, Johns Hopkins University, and the College of William and Mary for helpful comments. We thank Regina Villasmil for truly outstanding and dedicated research assistance. Mahoney and Stroebel thank the Fama-Miller Center at Chicago Booth for financial support. The views expressed are those of the authors alone and do not necessarily reflect those of the Office of the Comptroller of the Currency.

The Quarterly Journal of Economics (2015), 111–164. doi:10.1093/qje/qju037.
Advance Access publication on November 25, 2014.

I. 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 Protection Bureau to monitor and regulate mortgages, student loans, credit cards, and other consumer 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 can protect less sophisticated consumers and reduce aggregate borrowing costs.

Critics have expressed skepticism about the effectiveness of consumer financial regulations. While limits on hidden fees, for example, can shift surplus from more sophisticated 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 restrict the supply of credit (American Bankers Association 2013). 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."

This article aims to advance this debate in the context of the 2009 Credit Card Accountability Responsibility and Disclosure (CARD) Act in the United States. We analyze the effectiveness

1. Senator Chris Dodd, lead sponsor of the CARD Act in the Senate, has noted, "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).

of two key aspects of the CARD Act: (i) regulatory limits on certain types of credit card fees, which became effective in February and August 2010, and (ii) attempts to affect consumers' repayment behavior by requiring that monthly credit card statements provide clear information on the costs of making only 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 panel data set on the 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), provide 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 fees and late fees. Our data cover 160 million consumer and small business accounts and a significant share of total industry assets during our period of study.

We estimate the intended and possible unintended consequences of the CARD Act by using a difference-in-differences research design that compares changes in outcomes over time for consumer credit cards, which were subject to the new regulations, to changes in outcomes for small business credit cards, which the law did not cover. Our strategy expands on the Consumer Financial Protection Bureau's (2013a) analysis that also compares average outcomes for consumer and small business credit cards but does not conduct a formal difference-in-differences analysis. The identifying assumption is that in the absence of the CARD Act, outcomes for consumer and small business accounts would have maintained parallel trends.

To argue that our identifying assumption is valid, we show that outcomes for consumer and small business credit cards move together in the pre–CARD Act period, with parallel trends in fees, interest charges, and measures of credit volume such as average daily balances (ADBs), credit limits, and the number of new accounts. This is consistent with a high degree of institutional similarity between consumer and small business cards. Both types of cards are guaranteed by the personal financial assets of the account holder, and applicants for both types of cards are screened on their personal FICO scores. The main difference is that small business account holders must claim to use their cards for business purposes only. Banks in most circumstances do not monitor this behavior, and survey evidence indicates that a

significant percentage of charges are used for personal expenditure (Federal Reserve Board of Governors 2010).

Using this difference-in-differences strategy, we find that regulations to reduce fees were highly effective. For borrowers with a FICO score below 660, total fees declined by 5.3 percentage points of ADB, or $57.69 per account per year, led by a large decline in over-limit fees (3.3 percentage points) and a smaller decline in late fees (1.5 percentage points). Account holders with a FICO score above 660 had lower pre–CARD Act fee levels, and experienced a qualitatively similar but smaller decline in fees (0.5 percentage point of ADB, or $7.59 per account, per year). Combined across the low and high FICO score accounts, the CARD Act reduced overall fees by an annualized 1.6% of borrowing volume, or $22.58 per account each year.[2] Extrapolating this number to the total outstanding credit card balances of $744 billion in the first quarter of 2010 (Federal Reserve Bank of New York 2013) yields annual cost savings for U.S. credit card users of $11.9 billion a year.

The CARD Act also required monthly credit card statements to prominently display the cost of repaying the balance when only making minimum payments and compare this to the cost of repaying the balance when making payments that would pay off the balance within 36 months. The aim was to nudge consumers toward paying off a larger fraction of their balances and reduce their overall interest payments (Thaler and Sunstein 2008). 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 0.4 percentage points on a base of 5.3%. Cyclical and seasonal variation make it hard to determine whether these account holders would have counterfactually been making higher or lower payments. We estimate as an upper bound that the nudge reduced aggregate interest payments by no more than 0.01% of ADB, or approximately $57 million a year.

We next examine possible unintended consequences of the CARD Act on credit card pricing and credit volume. We start by making the conceptual point that if markets are perfectly competitive, so that the aggregate price inclusive of all fees is forced

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

down to marginal cost, any regulation that reduces a certain fee will be offset by a similarly sized increase in another pricing dimension. Similarly, if all fees and prices are perfectly salient, then demand is only responsive to the aggregate price and will be unresponsive to an equally sized reduction in one fee and increase in another. This means that regulators can only be successful in lowering costs if markets are both imperfectly competitive and fees are at least partially nonsalient.

We find little offsetting response in terms of pricing. Using the same difference-in-differences approach, we find no evidence of an anticipatory increase in interest charges prior to the CARD Act, and no evidence of a sharp or gradual increase following the CARD Act implementation periods. Our point estimate for the offset is approximately zero, and we can rule out an offset of greater than 61% with 95% confidence. In addition, we find no evidence of an offsetting increase in interest charge for new accounts, for which banks are less constrained in their ability to adjust contract terms, and no evidence of an increase in other sources of credit card income (e.g., interchange fees) or a reduction in measures of costs (e.g., marketing and operational expenses).[3]

Using the same difference-in-differences design, we estimate that the CARD Act had a precise zero effect on credit limits and ADB. We also estimate a zero effect on the number of new accounts, although our standard errors are too large to prevent us from ruling out meaningful effects in either direction. 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. We think an alternative interpretation in which banks resisted raising interest rates because of concerns over future regulation is unlikely, since the industry's main lobby group was advancing the argument that the CARD Act raised interest charges and lowered access to credit (American Bankers Association 2013).

Our two years of post–CARD Act data do not allow us to investigate the longer run effects of the CARD Act on industry exit or entry, or effects on margins with multiyear contracts

3. These findings are consistent with statements by bank executives, such as J.P. Morgan CEO Jamie Diamond, who argued that the CARD Act would cost his bank up to $750 million in annual profits, and Bank of America, which said the regulations would cost it $800 million (Tse 2010).

(e.g., promotional agreements) or lumpy long-run investments (e.g., IT infrastructure and credit-scoring models). These elements are important to consider in a complete benefit-cost analysis of the regulation.

Our article contributes to a literature analyzing credit card usage and pricing (Ausubel 1991; Calem and Mester 1995; Gross and Souleles 2002; Agarwal et al. 2006, 2014a; Kuchler 2013; Stango and Zinman 2013), the debate about regulating consumer financial products (Campbell 2006; Bar-Gill and Warren 2008; Mullainathan, Barr, and Shafir 2009; Campbell et al. 2011), and a body of research that analyzes the effectiveness of nudges and default options in influencing consumer decision making (Madrian and Shea 2001; Thaler and Benartzi 2004; Choi, Laibson, and Madrian 2005; Carroll et al. 2009; Keys and Wang 2014).

We also contribute to a small literature on the CARD Act, including Debbaut, Ghent, and Kudlyak (2013), who study the restriction on lending to borrowers under age 21, and Jambulapati and Stavins (2013), who, like us, find no evidence that banks closed credit card accounts or increased interest rates in anticipation of the CARD Act. Our study complements work by Kay, Manuszak, and Vojtech (2014), who find that banks were only able to offset about 30% of the decline in revenue from the Durbin Amendment cap on debit card interchange fees.

The rest of the article proceeds as follows. Section II provides background on the U.S. credit card industry and describes the key provisions of the 2009 CARD Act. Section III describes the data, and establishes important facts about profitability in the pre–CARD Act period sample. Section IV describes our research design and approach to conducting inference. Section V analyzes the intended effects of the CARD Act, first examining the effect on fees and then turning to the effect of the disclosure nudge. Section VI examines possible unintended effects on interest charges and credit volume. Section VII concludes. All appendix material is in the Online Appendix.

II. Credit Cards and the 2009 CARD Act

II.A. A Primer on Credit Cards

Account holders use credit cards to make purchases and to borrow. When an account holder carries a balance from the

previous billing cycle, interest charges for the current cycle are given by

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

where the right-hand side is the product of the ADB, defined as the arithmetic mean of end-of-day balances over the billing cycle; the daily interest rate, defined as the annual percentage rate (APR) divided by 365; and the number of days in the billing cycle.[4] Account holders who do not carry a balance into the current period have the possibility of repaying current period purchase volume without incurring interest charges. If an account holder pays off her purchase volume completely, interest charges typically fall within a grace period and are not assessed by the bank. If the account holder does not pay her balance in full, she is charged interest starting from the date of purchase. Account holders that fall under the grace period have no ADB in our data.

Credit limits place an upper bound on consumer purchases and borrowing. Consumers who exceed their credit limit might be assessed an over-limit fee or can have transactions declined. Credit cards have a number of other fees that we discuss later. Credit card borrowing is not secured by collateral, though lenders may garnish wages or seize assets of account holders who default. Recovery rates are low, in part because credit card debt is junior to all forms of secured borrowing. To manage and price this default risk, most credit card issuers screen applicants using both FICO scores and internally generated risk measures. Credit cards are marketed to consumers through a number of channels, including direct mail and TV advertisements. Credit cards often provide consumers with cash back or reward points, which scale with purchase volume.

For some of our analysis, we compare outcomes for consumer credit cards (referred to in the industry as general purpose credit cards) and small business credit cards. These types of cards are

4. The APR measure does not account for compounding. For instance, a consumer with an APR of 15% who carries an ADB of $1,000 for 12 consecutive 30-day months would have her balance grow to $\$1{,}158 = 1{,}000 \times (\frac{0.15}{365} \times 30 + 1)^{12}$ instead of $\$1{,}150 = 1{,}000 \times (0.15 + 1)$. In the past, some credit card issuers used a method known as double-cycle billing to calculate interest payments. This method calculated ADBs 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. The CARD Act banned this practice.

institutionally similar. Like consumer credit cards, small business credit cards are guaranteed by the personal financial assets of the account holder, and applicants for both types of cards are screened on their personal FICO scores.[5] Like consumer cards, small business cards have features such as rewards and are marketed by direct mail and TV advertisements. Because of the similarities in underwriting and promotion, consumer and small business credit cards are issued by the same business units of most banks, and regulators conduct joint assessments of consumer and small business credit card lending. The main difference between consumer and small business cards is that small business account holders must claim to use their cards for business and commercial purposes only. Banks in most circumstances do not monitor this behavior, and survey evidence indicates that a significant percentage of charges are used for personal expenditure (Federal Reserve Board of Governors 2010).

II.B. The 2009 CARD Act

The CARD Act of 2009, was introduced in the 111th U.S. Congress (H.R. 627).[6] On April 30, 2009, it passed the House with a majority vote of 357 to 70. The Senate passed an amended version of the bill on May 19, 2009, also with an overwhelming majority (90 to 5). President Barack Obama signed the bill into law on May 22, 2009.

The CARD Act primarily amended the Truth in Lending Act and instituted a number of new consumer protection and disclosure requirements for consumer credit cards. The regulation excluded small business credits cards.[7] The provisions of the CARD Act were scheduled to take effect in three phases between August 20, 2009, and August 22, 2010.

5. Small business cards are also secured by firm assets. However, for many small business account holders, personal assets such as home and vehicle equity tend to be much more important than business assets.

6. Congress had previously drafted consumer financial regulation that included many of the same provisions as the CARD Act. The most recent attempt was known as the Credit Cardholders' Bill of Rights Act of 2008 and was introduced in the 110th Congress as H.R. 5244. The bill passed by a 312 to 112 vote in the House but was never given a vote in the Senate.

7. Legislation has recently been proposed to extend the CARD Act provisions to the small business category. The Small Business Credit Card Act of 2013 (H.R. 2419) amends the CARD Act to include small business credit cards. It was introduced in the House Financial Services Committee on June 18, 2013, but as of July 2014 had not advanced.

1. Phase 1: August 20, 2009. The first phase of the CARD Act required banks to provide consumers with 45-day advance notice of rate increases or other significant changes to terms and conditions. It also required lenders 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.

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 charge such a fee. Credit card companies could choose to either decline such transactions or process them without charging a fee. Furthermore, an over-limit fee could be imposed only once during the billing cycle in which the limit is exceeded. The CARD Act also introduced regulation detailing repayment disclosures required in monthly credit card statements. In particular, it required statements to display the following:

(i) The number of months and the total cost to the consumer (including principal and interest) that it would take to pay the outstanding balance, if the consumer pays only the required minimum payments and no further advances are made;
(ii) 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 repaying the full balance in this way.

Figure I provides an example of the way credit card statements display this information.[8]

The CARD Act also regulated the issuance of credit cards to borrowers below age 21 and included a restriction on interest rate increases for new transactions within the first year of opening the

8. 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, which means cardholders have to view a PDF copy of their full statements to see the minimum payment warnings.

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)

FIGURE I

Payoff Disclosure

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

account. Furthermore, it 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.[9]

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 previous six payments was also 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 per violation in a single billing period. The CARD Act also prohibited the charging of inactivity fees for not using the credit card for a period of time. Finally, it required lenders to reevaluate any new rate increases every six months.[10]

9. Credit card issuers are no longer allowed to set arbitrary deadlines for payments, and must accept payments received before 5 p.m. on the payment due date. 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.

10. The regulation requires, "If a creditor increases the annual percentage rate applicable to a credit card account . . . based on factors including the credit risk of the obligor, market conditions, or other factors, the creditor shall consider changes in

III. Data and Pre–CARD Act Industry Overview

III.A. Data

Our main source of data is the Credit Card Metrics (CCM) data set assembled by the OCC. The OCC supervises and regulates nationally chartered banks and federal savings associations. 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 credit cards. The purpose of the data collection was to have more timely information for bank supervision.

The CCM data set has two components. The main data set contains 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 data set contains portfolio-level information for each bank on items such as operational costs and fraud expenses for the credit card portfolio managed by the bank. Both data sets are submitted monthly. Reporting started in January 2008 and continues through the present, although the reporting in the first few months of 2008 is incomplete. Due to mergers and other reporting issues, we observe entry and exit of banks during the time period.

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 to March 2008 to December 2011. We also restrict attention to general purpose and small business credit card accounts.[11] Online Appendix Table A.I presents an overview

---

such factors in subsequently determining whether to reduce the annual percentage rate for such obligor" (12 CFR 226.59). In addition, lenders are required to "reduce the annual percentage rate previously increased when a reduction is indicated by the review." In other words, increases in APRs as a result of increases in the Federal Funds rate will have to be reversed if the Federal Funds rate subsequently declines. The regulation also requires that existing customers have interest rates adjusted to the rate that otherwise similar new customers would be assessed.

11. Our sample does not include private label cards, which can only be used at the issuing retailer's stores, but does include affinity and co-branded cards. We 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. We also drop accounts that do not report a FICO score at origination.

of our sample by reporting quarter. The sample contains data from eight banks and covers 150 million consumer accounts and 7 million small business accounts in a typically quarter.[12]

Table I shows annualized summary statistics for key account-level variables for consumer and small business accounts. For the combined sample, the average account carries an ADB of $1,347 and has an annualized purchase volume of $2,138. Multiplying by the number of accounts implies that these data account for about $210 billion in ADB, or 30% of total outstanding U.S. credit card debt over this period.[13] The average account holder pays about $168 in interest charges a year and incurs $58 in fees, of which late fees, over-limit fees, and annual fees are the largest components. Banks charge off an average $175 per account per year and recover $6 per account per year, or 3.7% of charge-offs.[14] We use the term "net charge-offs" to indicate total charge-offs minus recoveries.

Table II shows account-level averages for the variables that we construct using the portfolio data and data from other sources. (See Online Appendix A for details on these calculations.) Interchange fees are charged to merchants for processing credit card transactions and scale with purchase volume. We assess account-level interchange income as a constant 2.0% of purchase volume, or $43 per account annually. Reward and fraud expenses correspond to about 1.4% of purchase volume on average, or approximately $30 per account per year. We calculate operational costs as a percentage of ADB by month in the portfolio data and estimate account-level operational costs assuming they scale proportionally with ADB. Operational costs are $50 per account per year.[15] Banks report the total interest expenses for funding their

12. We do not restrict the analysis to a balanced panel of accounts, because doing so would require us to drop accounts, for example, that were closed in mid-sample due to delinquency, and thereby create sample selection bias.

13. ADB are somewhat higher for small business accounts than for consumer accounts, although much of this is driven by a higher average FICO score for small business accounts. Figure VII, Panel D shows that conditional on the FICO score being below 660, which composes our primary treatment sample, ADB are very similar across consumer and small business accounts.

14. "Charge-offs" refer to an expense incurred on the lender's income statement when a debt is considered long enough past due to be 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.

15. About 15% of total operational costs (an annualized 0.5% of ADB) are marketing and customer acquisition expenses. Extrapolating this to the industry level

TABLE I

SUMMARY STATISTICS USING ACCOUNT-LEVEL DATA (ANNUALIZED $ PER ACCOUNT)

	Combined sample		Consumer credit cards		Small business credit cards	
	Mean	Std. dev.	Mean	Std. dev.	Mean	Std. dev.
Average daily balance	1,346.55	2,887.52	1,319.55	2,840.56	1,922.76	3,705.39
Purchase volume	2,138.07	10,675.03	1,946.90	9,404.02	6,217.81	25,320.99
Interest charges	168.05	448.29	165.31	438.11	226.51	624.31
Total fees	57.64	230.77	57.72	229.56	55.86	255.35
Annual fee	6.47	63.95	6.58	64.32	4.20	55.57
Balance transfer	3.96	124.93	3.98	125.67	3.58	107.94
Cash advance	4.19	85.67	4.32	86.71	1.43	59.33
Debt suspension	8.10	61.94	8.37	62.82	2.15	37.97
Late fee	24.39	104.06	24.18	101.26	28.83	151.92
Not sufficient funds	0.54	18.20	0.53	17.30	0.70	31.75
Other fees	1.48	52.12	1.46	50.13	1.84	83.92
Over limit	8.51	61.68	8.29	60.01	13.13	90.13
Total charge-offs	174.82	4,619.83	167.65	4,535.38	327.88	6,150.98
Principal	144.14	4,243.99	138.06	4,099.31	273.84	6,614.69
Interest and fees	30.68	710.90	29.59	669.34	54.04	1,314.97
Recovery	6.49	469.39	6.34	453.04	9.71	736.41
Repayment[a]						
Minimum or less (%)	26.1		26.2		23.9	
Full or more (%)	30.2		29.4		43.9	

Notes. Values are calculated using all account-months in the sample period. See Online Appendix A for more details. Except for ADB and repayment statistics, values are annualized. The sample period is April 2008–December 2011. All variables are inflation-adjusted to 2012 using the CPI-U.

[a]These statistics are calculated on the sample of account-months with positive cycle-ending balances.

TABLE II
SUMMARY STATISTICS USING PORTFOLIO-LEVEL DATA (ANNUALIZED $ PER ACCOUNT)

	Mean	Note on construction
Interchange income	42.76	2% of purchase volume
Rewards + fraud expense	29.93	1.4% of purchase volume
Cost of funds	22.49	Share of ADB (time varying)
Operational costs	49.70	Share of ADB (time varying)
Collection	5.81	Share of ADB (time varying)
Marketing + acquisition	7.31	Share of ADB (time varying)
Other operational cost	36.58	Share of ADB (time varying)

Notes. Variables are constructed by combining account-level measures of ADB and purchase volume with information from the portfolio-level data. Values are calculated using all account-months in the sample period. Operational expenses include expenses for marketing and acquisition, collections, servicing, card-holder billing, processing payments, card issuing and administration. See note on construction and Online Appendix A for more details. The sample period is April 2008–December 2011. All variables are inflation-adjusted to 2012 using the CPI-U.

credit card liabilities at the portfolio level by month. These expenses scale with ADB and vary over time. Over the sample period, funding the average account's credit card receivables for one year costs banks $22.

III.B. Pre–CARD Act Industry Overview

In this section we analyze data on average credit card issuer income, costs, and profits across the FICO score distribution for the pre–CARD Act period (April 2008 to January 2010). Table III shows key summary statistics on account-level credit card utilization and profitability, grouped by FICO score at account origination.[16] About 29.9% of accounts have FICO scores below 660, and 26.8% of accounts have FICO scores of 760 or higher.

Table III, Panel A describes credit card capacity and utilization. Credit limits increase from $2,025 for account holders with FICO scores below 620 to $12,400 for borrowers in the 760–799 range, and then tail off moderately. ADB are hump-shaped in

suggests total industry advertising spending of about $3.75 billion. This level of spending is consistent with numbers reported in Consumer Financial Protection Bureau (2013b).

16. We use FICO score at account origination to avoid the reverse causality 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 score at origination introduces some measurement error if the object of interest is profitability by contemporaneous FICO score.

TABLE III

PRE-CARD UTILIZATION AND REALIZED PROFITS BY FICO SCORE

	Total	FICO score range <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 (annualized $ per account)							
Credit limit	8,042	2,025	3,546	7,781	11,156	12,400	11,390
ADB	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 (% of ADB)							
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
Collection	0.4	0.4	0.4	0.4	0.4	0.4	0.4
Marketing + acquisition	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Other operational cost	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Realized profit	1.6	7.9	1.3	−1.6	−0.2	1.5	3.1

Notes. Table shows income and cost components for consumer accounts during the pre–CARD Act period, defined as April 2008–January 2010. The first column shows averages over all accounts; the other columns show averages by FICO score at account origination. Net charge-offs are the sum of principal and interest/fees charge-offs minus recoveries. Panel B shows values as annualized percent of average daily balances. All dollar variables are inflation-adjusted to 2012 using the CPI-U.

FICO score, rising from $804 for borrowers with FICO scores below 620 to $2,029 for borrowers in the 660–719 range, before falling to $1,110 or less for account holders with FICO scores above 760. 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 facilitate transactions is declining in FICO score.

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

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

For an account holder with a constant interest rate, interest charges as an annualized percentage of ADB is simply the interest rate. Our measure can thus be interpreted as an interest rate equivalent for different components of income and costs.[17]

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.

Table III, Panel B examines the components of profits as a percentage 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 by FICO score; total fees decline precipitously. Interchange income is not quantitatively important, except for the highest FICO score borrowers, who generate interchange income of more

17. We use ADB as the common denominator to normalize outcomes across accounts with different levels of activity. An alternative approach would be to normalize outcomes as an annualized percent of purchase volume. Because interchange income scales with purchase volume, the resulting measure could be interpreted as converting our outcomes into interchange income equivalents. This approach seems less natural, because interchange income makes up only a small fraction of total revenue. In addition, our results that low FICO score account holders pay large fees would be even more extreme if we normalized by purchase volume instead of ADB.

than 9.5% of ADB.[18] Figure II, Panels A and B show plots of interest charges and fees by FICO score.

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, and account holders with FICO scores of 760 and above incurred net charge-offs of less than 6.3%. Similar to interchange income, rewards and fraud costs as a share of ADB are larger for higher FICO account holders, who generate more purchase volume per unit of borrowing. The cost of funds as a share of ADB is relatively low, at about 2.3%. Figure II, Panels C and D show plots of net charge-offs and interchange income net of rewards expenses by FICO score.[19]

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 accounts with the highest FICO scores. Figure II, Panels E and F plot realized profits and the number of accounts by FICO score.

Although realized profits do not account for ex ante risk, and we have insufficient time-series data to estimate risk premia across the FICO distribution, the data suggest that credit cards were a very profitable segment of the banking industry. Table III shows that across all FICO scores, realized profits averaged 1.6% of ADB in the pre–CARD Act period. Adjusting for taxes and bank leverage, this translates into a return on equity in excess of 10%, more than five times larger than the average financial sector return on equity during this time period. (See Online Appendix A.1.4 for details.) Indeed, at the same time that bank divisions making subprime home loans were losing large amounts of

18. 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.

19. We do not show the cost of funds and operational expenses because they are defined as a constant fraction of ADB.

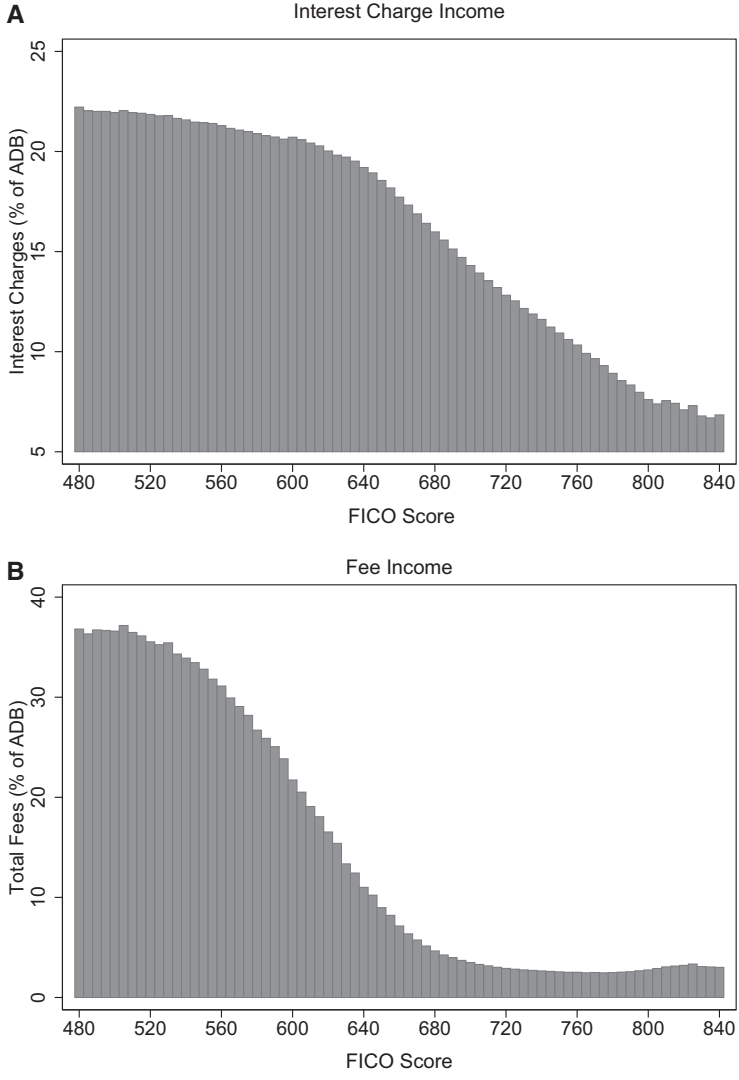
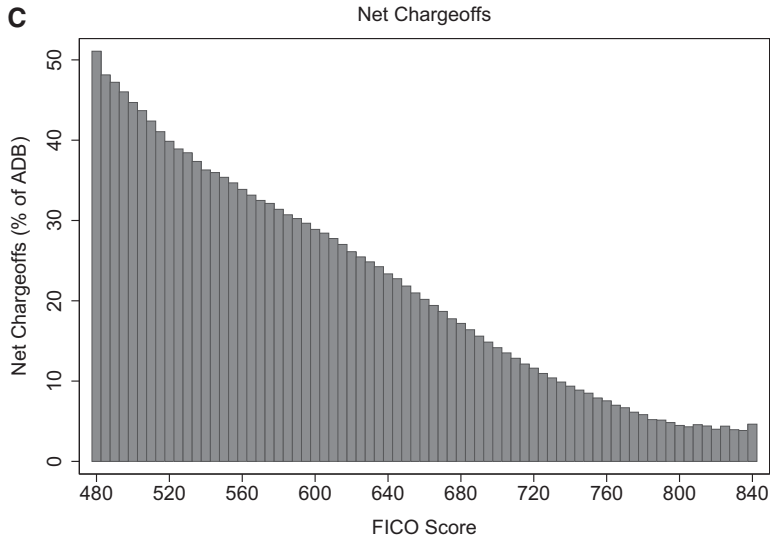


FIGURE II

Pre–CARD Act Profit Components by FICO Score

Figure shows revenue and cost components, realized profits, and number of accounts for consumer credit cards by FICO score at origination binned in groups of five. Revenue and cost components and realized profits are measured as an annualized percentage of ADB. Number of accounts are per reporting month. Realized profits are the difference between revenues (interest charges, fees, and interchange income) and costs (net charge-offs, cost of funds, operational expenses, and fraud and rewards expenses). The sample is restricted to the pre–CARD Act period, defined as April 2008–January 2010.

(continued)



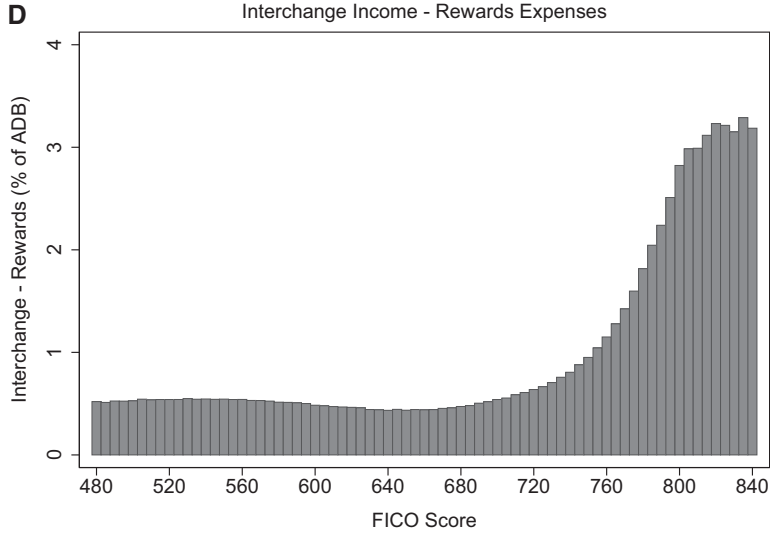


FIGURE II
(continued)

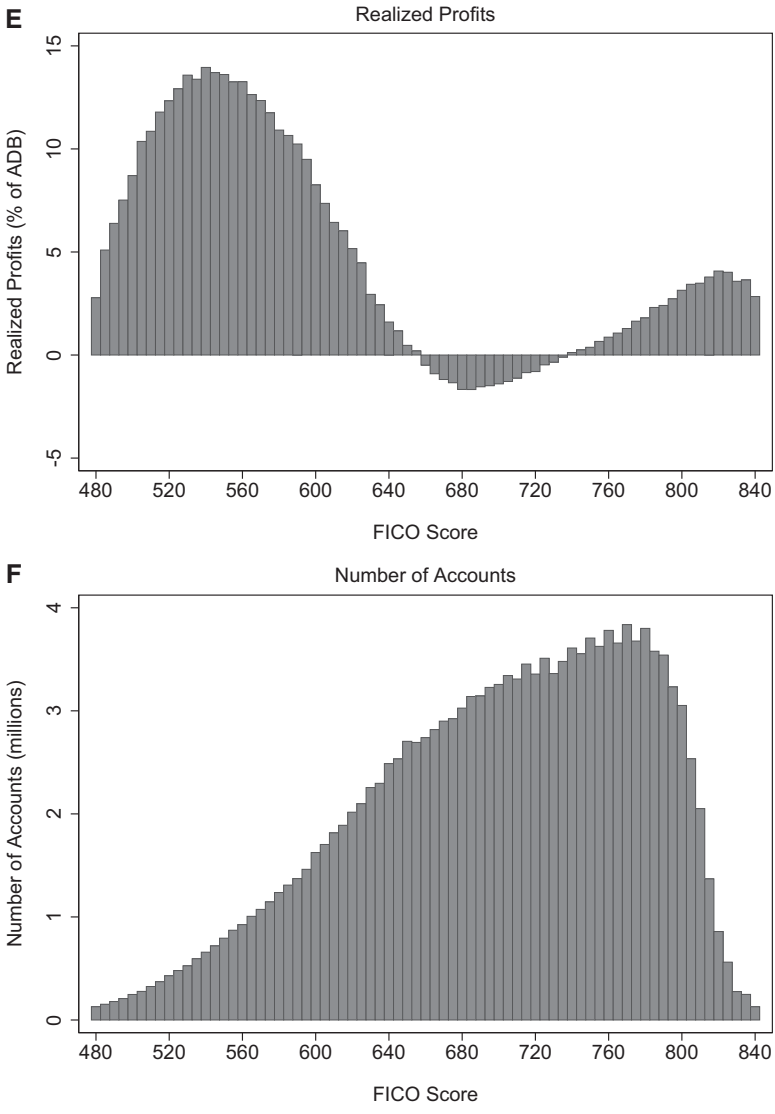


FIGURE II
(continued)

money, credit card issuers were earning their largest profits from the subprime segment of the market.[20]

IV. Research Design

Having established basic facts about the importance of fee revenue in the pre–CARD Act period, we turn to evaluating the intended and unintended consequences of the consumer protections that were implemented by the CARD Act. The empirical challenge is that the CARD Act was introduced shortly after the financial crisis, when there was much instability in the macroeconomy, which complicates the interpretation of a simple event-study analysis.

IV.A. Identification Strategy

We estimate the effects of the CARD Act using a difference-in-differences research design, where we compare outcomes for consumer credit cards (treatment group) and small business credit cards (control group) during the different phases of the CARD Act implementation. The role of the control group is to establish a counterfactual of what would have happened to consumer credit cards if the law had not been implemented. The identifying assumption is that, in the absence of the CARD Act, outcomes for consumer credit cards and small business cards would have maintained parallel trends.

We argue that the parallel trends assumption is likely to be valid for two reasons. First, we show that outcomes for consumer and small business credit cards move together in the pre–CARD Act period, with parallel trends in fees, interest charges, and measures of credit volume, such as ADB, credit limits, and the number of new accounts. We also show that conditional on FICO scores, consumer and small business accounts look similar on observable characteristics such as credit limits and interest charges.

The second reason is that consumer and small business cards are institutionally similar. As we discuss in Section II, both types

20. The data show that earnings increased substantially as the economy recovered from the Great Recession. By the end of our sample in December 2011, annualized realized profits had increased from 1.6% of ABD to 5.2% of ADB, largely due to a decline in annualized net charge-offs from a peak of 18.8% of ADB in May 2009 to 7.8% of ADB in December 2011.

of cards are guaranteed by the personal financial assets of the account holder, and applicants for both cards are screened on their personal FICO scores. Both types of cards are issued by the same business unit of most banks, and regulators conduct joint assessments of consumer and small business credit card lending. The main difference between these types of cards is that small business account holders must claim to use their cards for business purposes only, although banks in most circumstances do not monitor this behavior (Federal Reserve Board of Governors 2010).

IV.B. Econometric Model

We specify the econometric model at the account level. Since our panel data set of 160 million accounts over 45 months has more than 7 billion observations, we estimate the model on data collapsed to means for each bank $\times$ product type $\times$ FICO score group $\times$ month.[21] A product type is defined as the interaction of a consumer card indicator and whether the card is co-branded, oil and gas, affinity, student, or "other." FICO score groups are <620, 620–659, 660–719, 720–759, 760–799, and ≥ 800. We show in Online Appendix B that regressions using these collapsed data recover the parameters of interest from the account-level specification.

Our baseline econometric model is a difference-in-differences specification. Let y_{it} be an outcome for account i in month t. The regression specification is given by

$$\begin{aligned} y_{it} = {} & \alpha_t + \alpha_C \mathbb{1}_{i\in\text{Consumer}} + \beta_1 \mathbb{1}_{i\in\text{Consumer}} \cdot \mathbb{1}_{t\in\text{Phase 2}} \\ & + \beta_2 \mathbb{1}_{i\in\text{Consumer}} \cdot \mathbb{1}_{t\in\text{Phase 3}} + X'_{it}\alpha_X + \epsilon_{it}, \end{aligned} \tag{1}$$

where α_t are month fixed effects, $\mathbb{1}_{i\in\text{Consumer}}$ is a treated indicator that takes a value of 1 if the account is a consumer credit card account, X_{it} is a vector of possibly time-varying covariants, and ϵ_{it} is the error term that we assume is uncorrelated with unobserved determinants of the outcome. The indicator $\mathbb{1}_{t\in\text{Phase 2}}$ takes a value of 1 for the months between the implementation of phase 2 and

21. In the regressions, we weight the group-level observations to allow us to interpret the resulting estimates as aggregate effects. In particular, when the dependent variable is denominated as an annualized percentage of ADB (e.g., overlimit fees as an annualized percentage of ADB), we weight by total ADB in each group. For other dependent variables (e.g., credit limits), we weight by the number of accounts in each group.

the implementation of phase 3 (March 2010–August 2010), and the indicator $\mathbb{1}_{t\in\text{Phase 3}}$ takes a value of 1 for the months after the implementation of phase 3 (after August 2010).[22] The time period prior to phase 2 is the omitted group, so the coefficients can be interpreted as the differential effect relative to the preimplementation mean. For some outcome variables, we also include a consumer account × anticipation period interaction term to capture anticipatory responses that take place between the month the bill was passed and the month phase 2 came into effect (May 2009–February 2010). In these specifications, the time period prior to the passage of the law is the omitted group and the coefficients should be interpreted relative to this period.[23]

In the Online Appendix we also present results from an alternative specification, where we allow for the coefficient on the treatment group to evolve nonparametrically by month. Although this specification has less statistical power than the baseline specification, plotting the coefficients of interest over time allows us to establish whether there are spurious pretrends in the outcomes as well as examine the timing of the response to the law. The regression specification with treated × month-specific coefficients is given by

$$(2)\quad y_{it} = \alpha_t + \alpha_C \mathbb{1}_{i\in\text{Consumer}} + \sum_{t\neq\text{May 2009}} \beta_t \mathbb{1}_{i\in\text{Consumer}} + X'_{it}\alpha_X + \epsilon_{it}.$$

The coefficients of interest are the β_t's and the omitted group is May 2009, the month the CARD Act was signed. In the plots, we normalize the coefficient on May 2009 to the pre–CARD Act consumer account mean so that the effects can be interpreted relative to this baseline level.

IV.C. Inference

We conduct statistical inference using two complementary strategies. In our first approach, we construct standard errors to account for (i) serial correlation in outcomes within accounts over time and (ii) correlation in outcomes across accounts that have the same type of credit card and therefore have interest

22. We drop February 2010 and August 2010 from the sample because phase 2 and phase 3 came into effect partway through these months.

23. We do not include a dummy variable for phase 1 of the CARD Act implementation, since we do not study any of the provisions that came into effect on August 20, 2009.

rates and other contract characteristics jointly determined. We specify cluster-robust standard errors at the bank × product type level. We view this approach as conservative because many banks have multiple types of co-branded cards, for example, with contract characteristics that are adjusted individually. The number of product types varies across banks and yields no fewer than 46 clusters in the regression specifications.

Our second approach is to construct *p*-values using a permutation test where we compare our estimate of the actual CARD Act to estimates of placebo reforms specified at other periods of time (Conley and Taber 2011). To conduct inference on the over-limit fee restriction, which applied to consumer credit cards during the 22 months between February 2010 and the end of our sample, we assign placebo over-limit fee restrictions to consumer credit cards in 22 randomly selected months drawn without replacement and estimate a placebo effect on this sample. We then compare the true effect of the fee restriction to the distribution of placebo estimates derived from 1,000 randomly constructed samples. We use an analogous approach for the other dependent variables.

V. Intended Effects

In this section, we examine the intended effects of the CARD Act. We first analyze the effects of the fee regulations and then turn to considering the effects of the disclosure nudge.

V.A. Fees

The CARD Act had two primary elements that aimed to significantly reduce over-limit fees and late fees (see Section II.B). Figure III examines the effects of these regulations by plotting average fee revenue for consumer and small business accounts over time. In each plot, the vertical axis shows mean fee revenue as an annualized percentage of ADB. The horizontal axes show months, with the vertical bars in May 2009, February 2010, and August 2010 indicating the dates when the CARD Act was signed, and when phase 2 and phase 3 of the provisions came into effect. Because fee payments vary substantially by FICO score (see Section III.B), we separately examine effects on accounts with FICO scores below and above 660 at origination, approximately the 30th percentile of the FICO score distribution in our data.

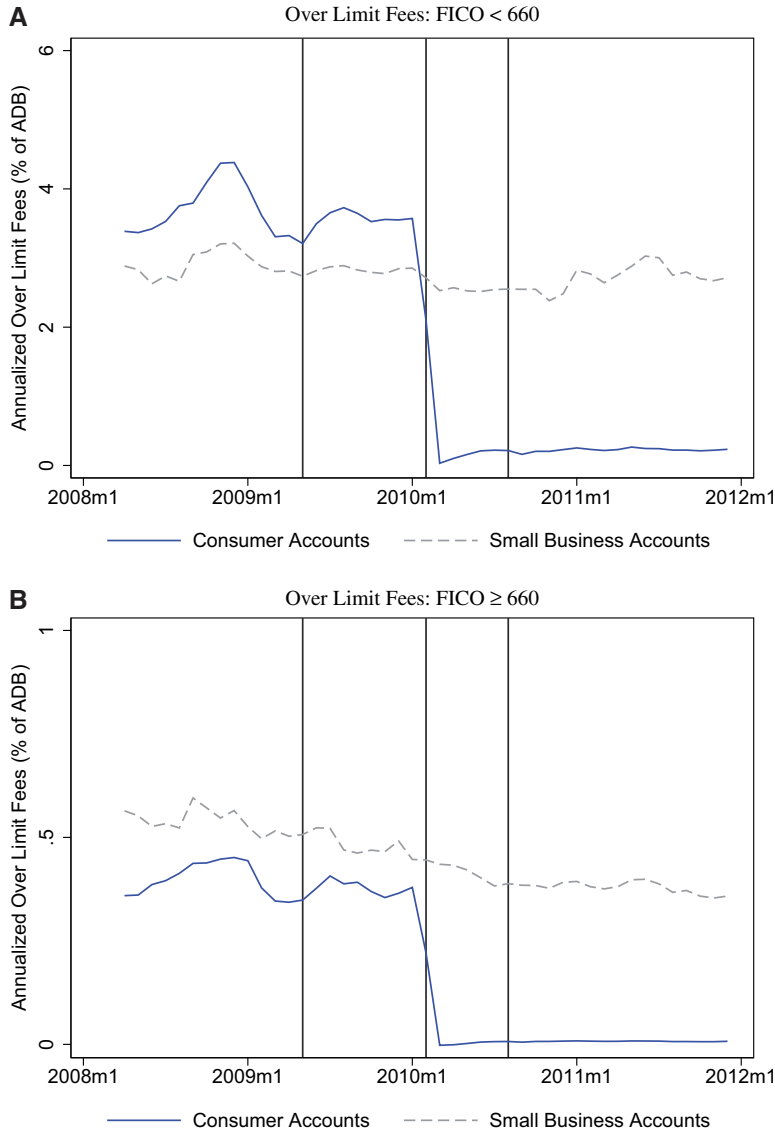


FIGURE III

Over-Limit, Late, and Total Fees

Figures show over-limit fees, late fees, and total fees as an annualized percentage of ADB for account holders with a FICO score less than 660 at origination and a FICO score of at least 660 at origination. The sample period is April 2008–December 2011. Vertical lines are plotted in May 2009, February 2010, and August 2010, the date when the bill was signed and the two key implementation dates of the CARD Act, respectively.

(continued)

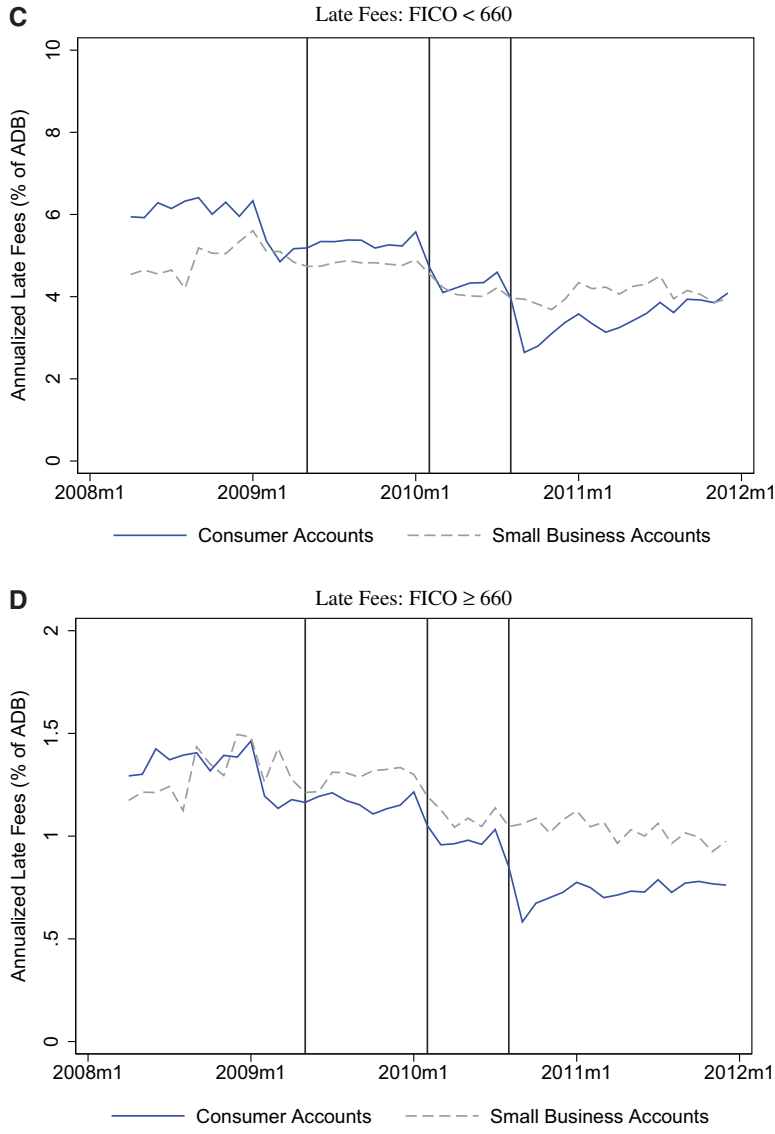


FIGURE III
(continued)

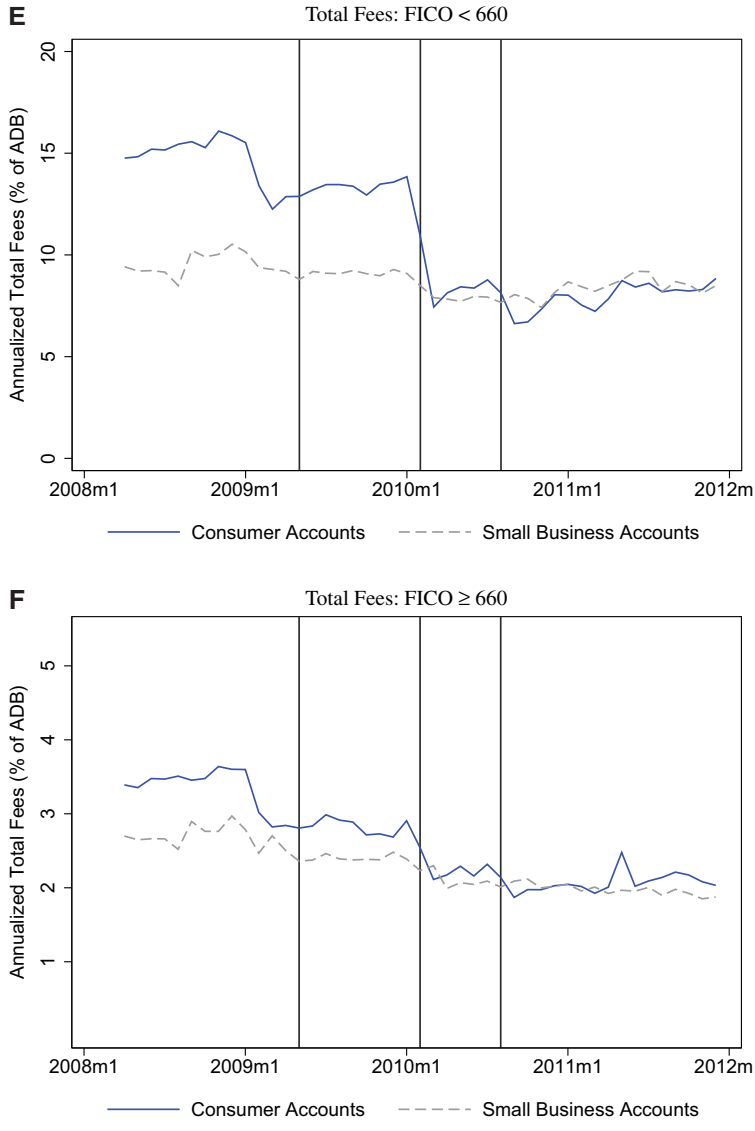


FIGURE III
(continued)

Figure III, Panels A and B examine the effects on over-limit fees. In the pre–CARD Act period, over-limit fees for consumer and small business accounts move together, confirming the parallel trends identifying assumption. In February 2010, when the law required consumer accounts to opt in to the processing of over-limit transactions, over-limit fees for consumer accounts drop to virtually zero. Over-limit fees for small business accounts, which were not affected by the CARD Act, trend smoothly through this implementation date.

Table IV shows the corresponding difference-in-differences regressions for the effect on over-limit fees. Column (1) shows the baseline specification that has consumer card by phase 2 (March 2010–August 2010) and phase 3 (after August 2010) interaction terms and consumer card and month fixed effects. The pre–February 2010 period is the omitted category, so that the effects can be interpreted relative to the outcomes prior to the implementation of the CARD Act. Column (2) adds bank $\times$ FICO score group fixed effects to this specification. Panel A shows outcomes for accounts with FICO scores below 660, and Panel B shows outcomes with FICO scores above this level. The point estimates indicate that over-limit fees fell by 3.3 percentage points and 0.3 percentage points for low and high FICO score accounts, respectively. The estimates are highly stable across specifications and statistically distinguishable from zero at conventional levels.

Figure III, Panels C and D examine the effects of the CARD Act on late fees. As with over-limit fees, there is no evidence of differential pretrends for consumer and small business accounts. Late fees for consumer accounts decline in February 2010, when restrictions on which payments could be considered late became more stringent, and drop more sharply in August 2010, when the $25 maximum for late fees came into effect. The regression estimates for late fees, shown in columns (3) and (4) of Table IV, confirm these results. For accounts with FICO scores below 660, late fees decline by 1.5 percentage points over both implementation phases, from a pre–CARD Act mean of 5.9%. The drop for high FICO score account holders is 0.3 percentage point off a pre–CARD Act mean of 1.3%.

Some industry observers conjectured that credit card issuers would respond to the loss in over-limit and late fee revenue by increasing other fees, in particular annual fees. We examine this possibility in columns (5) and (6) of Table IV by estimating

TABLE IV

FEES RESTRICTIONS: DIFFERENCE-IN-DIFFERENCES REGRESSIONS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: % of ADB							
	Over-limit fees		Late fees		Other fees		Total fees	
Panel A: FICO < 660								
Consumer × phase 2	−3.30**	−3.27**	−0.61	−0.57	−0.70	−0.62	−4.61**	−4.46**
	(1.50)	(1.52)	(0.42)	(0.38)	(0.46)	(0.41)	(2.25)	(2.22)
	[.03]	[.04]	[.15]	[.14]	[.13]	[.14]	[.05]	[.05]
Consumer × phase 3	−3.37**	−3.33**	−1.41*	−1.47**	−0.57	−0.52	−5.35**	−5.32**
	(1.52)	(1.53)	(0.76)	(0.69)	(0.45)	(0.37)	(2.67)	(2.55)
	[.03]	[.03]	[.07]	[.04]	[.21]	[.17]	[.05]	[.04]
Pre–CARD Act, consumer mean	3.77	3.77	5.85	5.85	5.05	5.05	14.68	14.68
R-squared	0.32	0.73	0.10	0.84	0.04	0.87	0.11	0.84
Number of observations	3,447	3,447	3,447	3,447	3,447	3,447	3,447	3,447
Panel B: FICO ≥ 660								
Consumer × phase 2	−0.30***	−0.30***	−0.07	−0.08	−0.08	−0.07	−0.45***	−0.45***
	(0.11)	(0.11)	(0.07)	(0.07)	(0.10)	(0.10)	(0.14)	(0.15)
	[.01]	[.01]	[.32]	[.26]	[.43]	[.49]	[.00]	[.00]
Consumer × phase 3	−0.25**	−0.26**	−0.25***	−0.30***	0.06	0.07	−0.45**	−0.49**
	(0.12)	(0.12)	(0.08)	(0.10)	(0.08)	(0.07)	(0.20)	(0.20)
	[.04]	[.04]	[.00]	[.00]	[.46]	[.32]	[.03]	[.02]
Pre–CARD Act, consumer mean	0.40	0.40	1.27	1.27	1.50	1.50	3.17	3.17
R-squared	0.23	0.69	0.11	0.73	0.19	0.52	0.16	0.72
Number of observations	6,986	6,986	6,986	6,986	6,986	6,986	6,986	6,986

TABLE IV
(CONTINUED)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: % of ADB							
	Over-limit fees		Late fees		Other fees		Total fees	
Controls: all panels								
Main effects								
Consumer card FE	X	X	X	X	X	X	X	X
Month FE	X	X	X	X	X	X	X	X
Additional covariates								
Bank FE × FICO score group FE		X		X		X		X

Note: Table shows coefficients from difference-in-differences regressions that compare fees for consumer credit cards (treatment group) and small business cards (control group) during the different phases of the CARD Act implementation. The dependent variables are shown as an annualized percent of ADB and are calculated in the same manner as the values in Panel B of Table III. We define phase 2 as March 2010–August 2010 and phase 3 as the months after August 2010. The period prior to February 2010 is the omitted group, so the coefficients can be interpreted as the differential effect relative to the preimplementation period. The sample period is April 2008–December 2011. The regressions are estimated on data aggregated to the bank × product type × FICO score group × month level, and weighted by total ADB in each group. A product type is defined as the interaction of the consumer card indicator and whether the card is co-branded, oil and gas, affinity, student, or other. FICO score groups are: <620, 620–659, 660–719, 720–759, 760–799, and ≥ 800. Standard errors clustered by bank × product type are shown in parentheses and the associated p-values are shown in brackets. There are 46 such clusters in Panel A and 47 clusters in Panel B. Significance levels: * $p < .10$, ** $p < .05$, *** $p < .01$.

difference-in-differences specifications with other fees, defined as all fees except late fees and over-limit fees, as the dependent variable. We find no evidence for an offsetting response in other fees. However, while we observe no offsetting medium-term increase in fee revenue, we cannot assess whether firms will respond by introducing novel fees in the long run, as theorized in Heidhues, Kőszegi, and Murooka (2012).

Figure IV, Panels E and F combine the analysis of the separate fee categories by showing the effects of the CARD Act on total fees. The corresponding coefficient estimates, shown in columns (7) and (8) of Table IV, indicate that over the implementation phases, total fees dropped by 5.3 percentage points for low FICO score accounts and by 0.5 percentage points for high FICO score accounts. Both estimates are statistically distinguishable from zero with p-values of .04 and .02, respectively.

In the Online Appendix we show two additional pieces of supporting analysis. Appendix Figure A.IV plots the coefficients on consumer account $\times$ month interactions from difference-in-differences regression specifications where we allow for separate coefficients of interest by month (equation (2)). These figures confirm the lack of preexisting trends and the sharp response to the implementation of the law. In Appendix Figure A.V we show results from permutation tests where we compare our estimate of the actual effect of the CARD Act to the distribution of placebo estimates derived from 1,000 samples where "treatment" is randomly assigned (see discussion in Section IV). This alternative approach to conducting inference confirms that the drop in fee revenue was statistically significant.

The last part of this section examines the mechanisms underlying the observed drops in fee revenue. Did banks respond to the virtual elimination of over-limit fees by more frequently declining over limit transactions? Figure IV, Panel A examines this question by plotting the share of consumer and small business accounts with cycle-ending balances larger than the credit limit over time. This share of accounts declines for both types of accounts, most likely driven by the economic recovery. There is a small additional decline for consumer credit cards around the February 2010 CARD Act implementation date, suggesting that a small number of issuers chose to decline over limit transactions following the regulation. However, we continue to observe a significant number of accounts being allowed to process transactions that would take them over their credit limit.

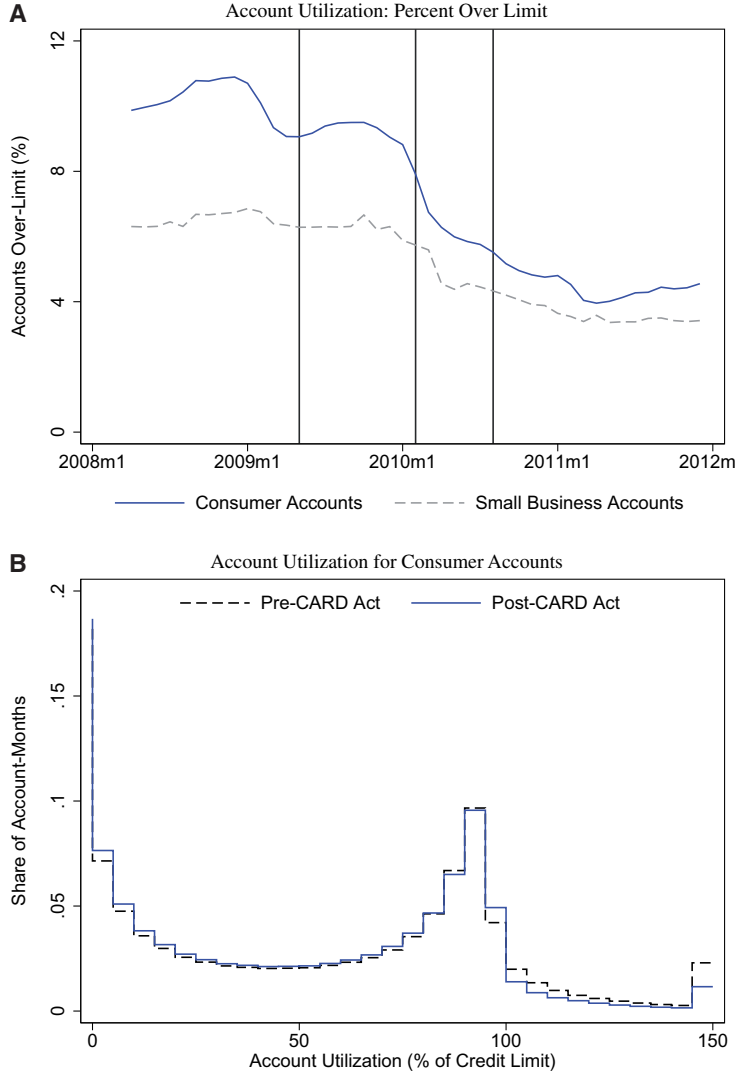


FIGURE IV

Account Utilization and Late Payments

Figures show information on account utilization and late payments. Panel A shows the percentage of consumer and small business accounts with cycle-ending balances exceeding the credit limit in each month. Panel B shows the distribution of cycle-ending balances as a share of the credit limit for consumer credit cards in the year before (dashed line) and after (solid line) the February 2010 CARD Act implementation date.

(continued)

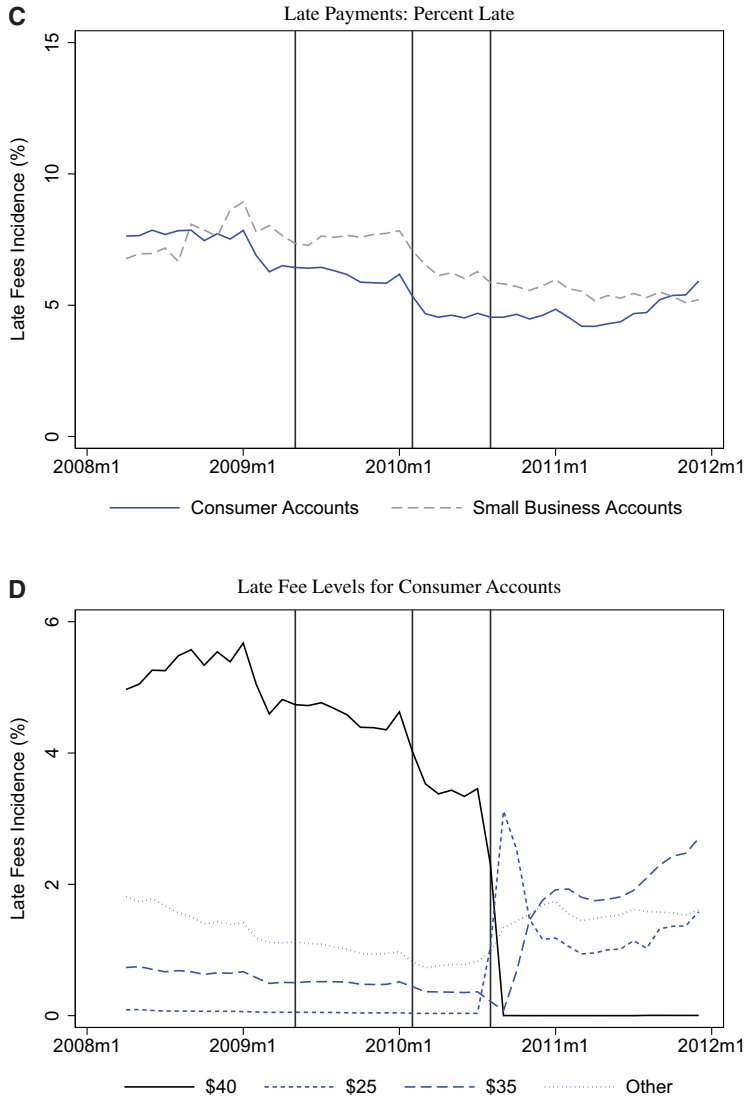


FIGURE IV

(continued)

Panel C shows the percentage of consumer and small business accounts with positive late fees in each month. Panel D shows the percent of consumer accounts with late fees of $25, $35, $45, and an "other" category that combines all other positive levels. The $25 category is defined as accounts with late fees in the $21–$25 range, the $35 category as accounts with late fees in the $31–$35 range, and the $40 category as accounts with late fees in the $36–$40 range. The sample period is April 2008–December 2011. Vertical lines are plotted in May 2009, February 2010, and August 2010, the date when the bill was signed and the two key implementation dates of the CARD Act, respectively.

Figure IV, Panel B further investigates this result by showing the distribution of account utilization, defined as the ratio of cycle-ending balances to credit limits, in the year before and after the February 2010 implementation date. Even in the post–CARD Act period, many credit card borrowers were allowed to exceed their credit limits, sometimes by substantial amounts. This evidence confirms that the vast majority of the decline in over-limit fee revenue did not come from banks no longer processing over-limit transactions, but was instead driven by banks no longer charging for processing the transaction.

Figure III shows that the decline in late fee revenue appears to diminish over time. To investigate this partial reversal, Figure IV, Panel C shows the overall incidence of late fees for consumer and small business accounts, defined as the share of accounts that incurred a late fee. In the pre–CARD Act period, about 8% of accounts experienced a late fee each month. These values drift downward over the sample period, with similar declines for consumer and small business accounts. In particular, the plot shows no effect of the August 2010 implementation date on the frequency of late payments. This suggests consumers did not respond to the reduction in the late fee "price" by increasing the frequency of late payments.

Because the data show no decline in the incidence of late payments, the drop in late fee revenue is attributable to a change in the fee amount. Figure IV, Panel D examines this price effect by plotting the frequency of late fees of different dollar amounts. Recall that the CARD Act reduced late fees to $25 unless one of the previous six payments was also late, in which case a $35 fee was allowed. The plot provides evidence of a one-for-one substitution from $40 to $25 late fees in August 2010. The plot also shows a gradual substitution from $25 to $35 late fee amounts in the months after implementation, with the frequency of $35 late fees exceeding the frequency of $25 late fees by November 2010. Banks seem to have provided account holders with a "clean slate" in August 2010 with no late payments in their six-month look-back period. Over time, as the fraction of account holders with a late payment in the previous six months rose, banks were able to increase their fees to $35 for those accounts, contributing to the observed partial reversal in late fees.

This analysis shows that the CARD Act brought about a sharp drop in fees, with drops of 5.3 percentage points of ADB for accounts with a FICO score below 660 and 0.5 percentage points of ADB for accounts with a FICO score above this level. Low and high FICO score cards make up 23.0% and 77.0% of borrowing in our data, so if we take a weighted average, we calculate a reduction of 1.6% as an annualized percentage of ADB. Given an outstanding U.S. credit card borrowing volume of $744 billion in the first quarter of 2010 (Federal Reserve Bank of New York 2013), extrapolating to the entire market suggests the CARD Act's fee regulation reduced borrowing costs by $11.9 billion a year.

V.B. Payoff Nudge

In addition to regulating the fees that banks may charge, the CARD Act introduced rules requiring repayment disclosures in monthly credit card statements. The aim of these disclosure requirements was to provide information on the cost of only making 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, 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). However, it is not obvious whether such a payoff nudge would actually lead to a change in repayment behavior, both because it is unclear if the nudge would be sufficiently powerful and because prevailing repayment levels might already have been optimal.

1. Pre–CARD Act Payoff Behavior. We begin by documenting credit card payoff behavior in the pre–CARD Act period. For this analysis, we restrict the sample to consumer credit cards with a nonzero cycle-ending balance. Figure V, Panel A shows the share of account holders making full payments by FICO score at account origination. About 10% of borrowers with a FICO score below 620 fully repay their balance at the end of the cycle. 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.

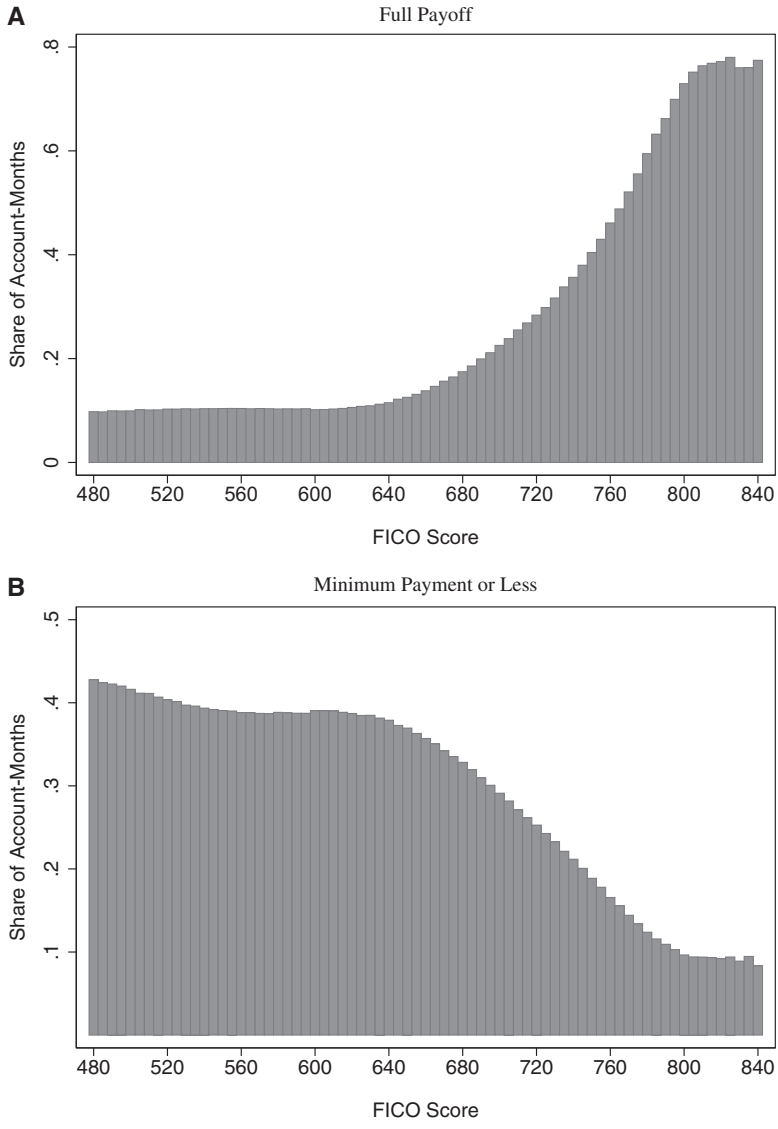


FIGURE V

Pre–CARD Act Payoff Distribution

Figure shows payoff behavior by FICO score at origination in the pre–CARD Act period, defined as April 2008–January 2010. Panel A shows the share of account-months making the full payment. Panel B shows the share of account-months making the minimum payment or less. The sample excludes accounts that have a zero cycle-ending balance.

On average, 30.1% of account holders pay their cycle-ending balance in full.[24]

Figure V, Panel B shows the share of account holders making minimum payments or less by FICO score. About 40% of borrowers with a FICO score below 620 pay the minimum or less. The number of account holders making the minimum payment or less declines monotonically in FICO score, with about 27% of borrowers with a FICO score of 720 and 10% of borrowers with a FICO above 800 making payments of the minimum or less. We calculate that on average 13.0% of borrowers only make the minimum payment, and 14.7% make payments of less than the minimum amount.

2. Payoff Nudge. The CARD Act mandates the disclosure of the monthly payment that would eliminate an account holder's cycle-ending balance if the account holder makes 36 equal-sized payments and avoids new purchases (see Figure I). Let T be the number of months it would take to pay off a cycle-ending balance for a constant payment amount:[25]

$$T = 1 - \frac{\ln\left(1 - \frac{\text{APR}}{12}\frac{\text{Cycle-Ending Balance} - \text{Payment}}{\text{Payment}}\right)}{\ln\left(1 + \frac{\text{APR}}{12}\right)}. \tag{3}$$

Full repayment is indicated by $T = 1$. At the pre–CARD Act average APR 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 typical minimum payment amount 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 3.7% of the cycle-ending balance. Consumer credit accounts have a median T of 15.

24. This number is similar to estimates from other sources. For example, using data from the 1995 and 1998 Survey of Consumer Finances, Laibson, Repetto, and Tobacman (2007) calculate that 32.2% of households pay their credit card bill in full each month. Note that our data are at the account level and the survey is a household-level survey, so the numbers are not directly comparable.

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

Figure VI shows the distribution of months-to-payoff T in the year before and after the CARD Act for consumer and small business cards, focusing on values of T in the vicinity of 36.[26] Following the implementation of the CARD Act, there was a small but significant increase in the share of consumer credit card holders paying the 36-month payment amount. No such change can be detected for small business card holders, who were not shown the payoff disclosure.

We use a difference-in-differences approach to quantify the impact of the nudge, comparing the change in repayment behavior before and after the February 2010 implementation date for consumer and small business credit cards. Table V shows the results of these regressions. Columns (1) and (2) show the effect on the share of account holders making payments close to the 36-month value ($30 \leq T \leq 38$).[27] The results show that the nudge increased this share by a precisely estimated 0.4 percentage point on a base of 5.3%.[28]

26. There is seasonality in repayment behavior, so analyzing the 12 months before and after the CARD Act is more representative than analyzing the entire pre–CARD Act and post–CARD Act periods. Online Appendix Figure A.VI shows the full distribution of T in the year preceding the implementation of the CARD Act disclosure requirement, for both consumer credit cards and small business credit cards.

27. The choice of this range, which is asymmetric around the CARD Act mandated disclosure amount of $T = 36$, is motivated by an inspection of Figure VI, which shows the shift of account holders to values of T within that range. 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, whereas 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" (15 U.S. Code §1637).

28. This estimate is relatively small compared to the experimental estimates in Stewart (2009) and Navarro-Martinez et al. (2011). However, one caveat to interpreting our results is that we are unsure which credit card users actually saw the CARD Act disclosures. For example, payment disclosures are only required on monthly credit card statements, which are rarely viewed by individuals doing online banking. This means that while we pick up the full effect of the CARD Act regulation, we might understate the possible effect of a regulatory design that achieved wider awareness of the disclosures.

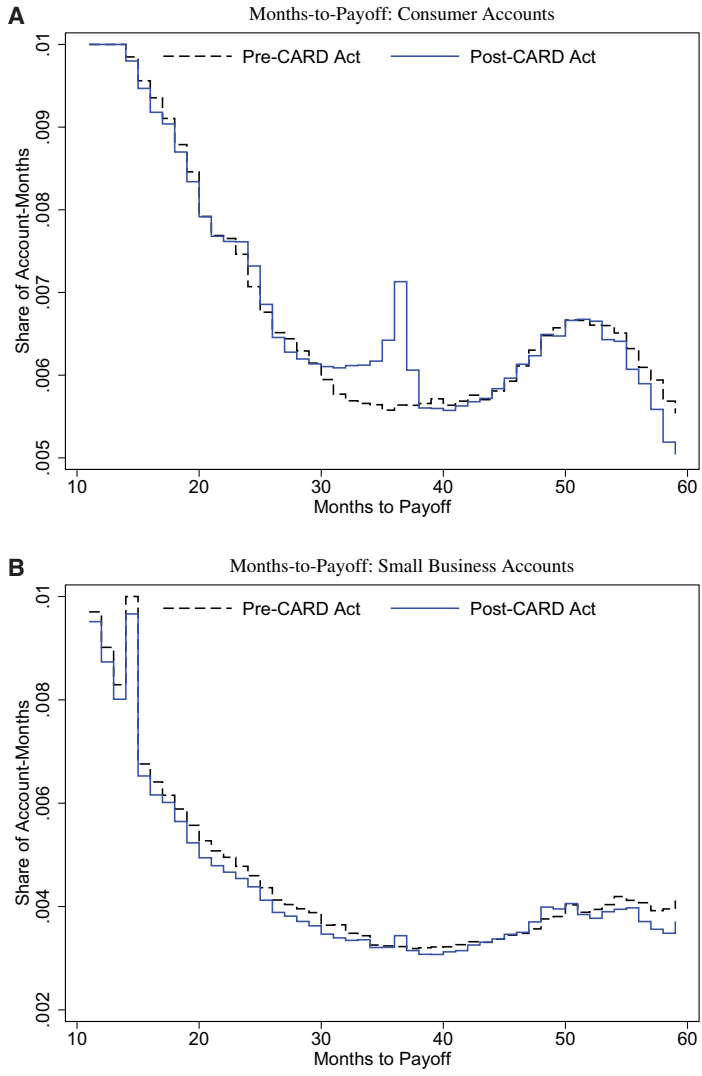


FIGURE VI

Months-to-Payoff (T)

Figure plots distributions of months-to-payoff (T) in the year before (dashed line) and after (solid line) the February 2010 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 (3). We present the distribution for T between 10 and 60. The share of account-months is top-coded at 1% to focus on the distribution around the CARD Act target payoff amount ($T = 36$). Panel A shows the distribution for consumer credit cards, Panel B for small business credit cards.

TABLE V

PAYOFF NUDGE: DIFFERENCE-IN-DIFFERENCES REGRESSIONS

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Dependent variable: percent of payments								
	Nudge range ($30 \leq T \leq 38$)			Less than nudge range ($T > 38$)			Minimum payment		
Consumer × phase 2	0.39**	0.38**	0.75**	0.03	−0.15	0.46	−0.22	−0.25	−0.35
	(0.19)	(0.17)	(0.34)	(1.23)	(1.07)	(1.29)	(0.36)	(0.40)	(0.47)
	[.05]	[.03]	[.03]	[.98]	[.89]	[.72]	[.54]	[.54]	[.46]
Controls									
Main effects									
Consumer card FE	X	X	X	X	X	X	X	X	X
Month FE	X	X	X	X	X	X	X	X	X
Additional covariates									
Bank FE × FICO score group FE		X	X		X	X		X	X
Sample restrictions									
Excluding accounts with balance < $1,000			X			X			X
Pre–CARD Act, consumer mean	5.31	5.31	7.19	35.35	35.35	47.78	12.95	12.95	14.97
R-squared	0.08	0.87	0.78	0.06	0.90	0.88	0.06	0.87	0.88
Number of observations	10,433	10,433	10,433	10,433	10,433	10,433	10,433	10,433	10,433

Notes. Table shows estimates from difference-in-differences regressions of payoff behavior for consumer credit cards (treatment group) and small business cards (control group) around the implementation of the payoff nudge. In columns (1)–(3), the dependent variable is the percent of account holders that make a payment corresponding to the target CARD Act payment nudge amount ($30 \leq T \leq 38$). In columns (4)–(6), the dependent variable is the percent of account holders that make payments smaller than the CARD Act payment nudge amount ($T > 38$). In columns (7)–(9), the dependent variable is the percent of account holders that make exactly the minimum payment. The sample period is April 2008–December 2011. The regressions are estimated on data aggregated to the bank × product type × FICO score group × month level, and weighted by the number of accounts in each group. A product type is defined as the interaction of the consumer card indicator and whether the card is co-branded, oil and gas, affinity, student, or other. FICO score groups are <620, 620–659, 660–719, 720–759, 760–799, and ≥800. In columns (3), (6), and (9), the sample is restricted to accounts with a cycle-ending balance larger than $1,000. Standard errors clustered by bank × product type are shown in parentheses and the associated p-values are shown in brackets. There are 47 such clusters in the sample. Significance levels: * $p < .10$, ** $p < .05$, *** $p < .01$.

Account holders were not shown the 36-month payment amount if this amount was lower than their minimum payment. This primarily occurred for accounts with low balances for which the minimum payment was set to a nominal lower bound. In column (3), we restrict the sample to account holders with more than $1,000 in cycle-ending balances. We find a larger response in this subsample, with about 0.8% of these accounts shifting to the 36-month payment amount.

Determining whether the nudge affected overall repayment behavior requires estimating whether the account holders who shifted to the 36-month payment amount would have counterfactually been making higher or lower payments. Estimating this effect is difficult because the 0.4% shift is small relative to cyclical and seasonal variation in repayments. Columns (4)–(6) show the effect of the CARD Act on the share of account holders making payments less than the nudge amount ($T > 38$). A precise 0.4 percentage point decline in this share would indicate that the nudge shifted account holders from lower payments to the 36-month amount. The estimates, however, are too imprecise to allow us to draw any conclusions. This is confirmed by the permutation tests presented in Online Appendix Figure A.VII, which show that the effect on the number of account holders making lower payments is small relative to normal month-on-month variation in that number.

In principle, the CARD Act could have decreased overall payments if the disclosure of the minimum payment amount had an anchoring effect and increased payments at the minimum payment level. This would be consistent with experimental evidence from Stewart (2009), who shows that presenting a minimum payment reduces overall willingness to repay. In columns (7)–(9) we test for the effect of the repayment nudge on the share of people making exactly the minimum payment. Contrary to the anchoring hypothesis, the point estimates suggest a decline of 0.2 percentage point in the share of accounts making the minimum payment on a base of 13%, but the estimates are too imprecise to allow us to draw definitive conclusions.

Although we are unable to precisely estimate the exact effect of the nudge on overall repayment behavior, we can use our estimates to construct an upper bound of the effect of the nudge on annualized interest payments. Assume that the nudge (i) shifted account holders from making no payment to paying at the 36-month value and (ii) did not affect the cycle-ending balance

of these 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 percentage of balance paid, the cycle-ending balance, and the monthly interest rate:

$$\begin{aligned}\Delta\,\text{Interest Payments} &= \Delta\,\%\ \text{of Balance Paid} \\ &\times \text{Cycle-Ending Balance} \times \frac{\text{APR}}{12}.\end{aligned} \tag{4}$$

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 (3) implies a change in the percent of balance paid from 0% to 3.7%. 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 shifted their repayment behavior in response to the nudge.

Although a reduction in interest payments of this amount would be nonnegligible for the account holders who shift their behavior, the fact that few account holders respond to the nudge leads us to estimate a small upper bound for the aggregate effect. The estimate of $24.00 annualized savings for the 0.4% of accounts that switch translates to aggregate savings of 0.0076% $\left(=\frac{0.4\% \times \$24.00}{\$1{,}251}\right)$ of total ADB. If we extrapolate these results to the $744 billion national credit card market, we estimate an upper bound for the nudge of $57 million (= $744 billion × 0.0076%) in annualized savings.

VI. Unintended Consequences

In this section, we assess possible unintended consequences of the CARD Act, focusing on whether lenders responded to the decline in fee revenue by increasing interest charges or by restricting access to credit.

From a theoretical perspective, fees will be offset if (i) markets are perfectly competitive or (ii) fees are perfectly salient. If markets are perfectly competitive, so that aggregate price inclusive of all fees is equal to marginal cost, any regulation that reduces a certain fee will be offset by 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, and

firms will adjust other prices to keep the aggregate price unchanged. This means that regulators can only be successful in lowering aggregate borrowing costs when markets are imperfectly competitive and fees are at least partially nonsalient. We present a model that formalizes this argument in Online Appendix C, and we expand on this mechanism in Agarwal et al. (2014b).

In the empirical analysis that follows, we restrict our attention to accounts with a FICO score below 660 at origination, which experienced a decline in fees of 5.3% of ADB. Since accounts with a FICO score of at least 660 only experienced a 0.5% decline in fees, we would not expect an economically significant offset for these account holders. In the Online Appendix, we replicate our analysis on the sample of accounts with a FICO score of 660 or higher.

VI.A. Interest Charges

Figure VII, Panel A shows mean interest charges as an annualized percent of ADB for consumer and small business accounts with a FICO score less than 660 at origination.[29] Interest charges for both types of cards move together in the pre–CARD Act period and continue to move together over the rest of the months in the data. We find no evidence of anticipatory increases for consumer accounts after the May 2009 passage date and no evidence of any increase during the implementation periods.

Table VI shows the corresponding difference-in-differences regressions. We show coefficients on consumer cards interacted with indicators for the anticipation (June 2009–January 2010), phase 2 (March 2010–August 2010), and phase 3 (after August 2010) time periods. The pre–May 2009 period is the omitted category, so that the effects can be interpreted relative to interest charges prior to the passage of the CARD Act. Column (1) shows the baseline specification with the interaction terms and consumer card and month fixed effects. Column (2) adds fixed effects for bank $\times$ FICO score groups. The regression estimates confirm

29. Interest charges are the total interest payments made by the borrower. This is a better measure for the cost of credit than APRs, because most accounts have a number of different APRs applying to different types of transactions (e.g., balance transfers, cash advances) that are in place simultaneously. Interest charges aggregate across these different APRs to provide a measure of the weighted average cost of credit.

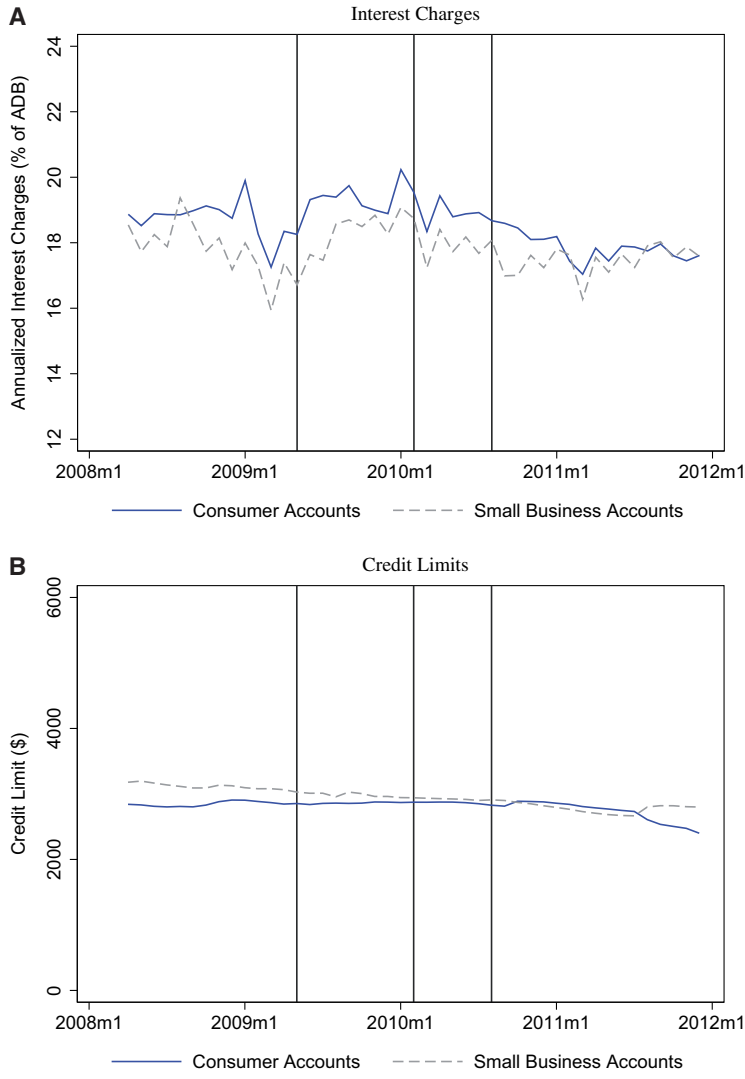


FIGURE VII

Interest Charges and Credit Volume: FICO < 660

Panel A shows interest charges as an annualized percentage of ADB. Panel B shows credit limits. Panel C shows new accounts measured as a percentage of the average total pre–CARD Act number of accounts. Panel D shows average daily balances. All panels focus on account holders with a FICO score below 660 at origination, and display monthly averages for consumer and small business credit cards. The sample period is April 2008–December 2011. Vertical lines are plotted in May 2009, February 2010, and August 2010, the date when the bill was signed and the two key implementation dates of the CARD Act, respectively.

(continued)

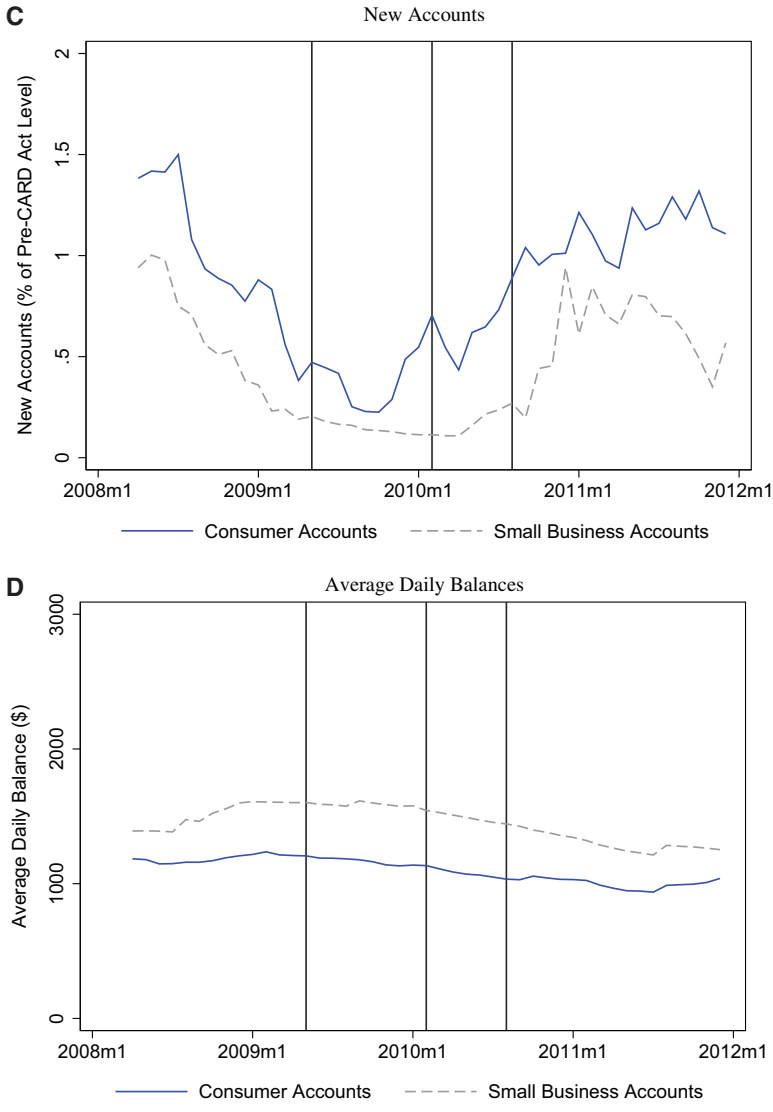


FIGURE VII
(continued)

TABLE VI

INTEREST CHARGE OFFSET: DIFFERENCE-IN-DIFFERENCES REGRESSIONS (FICO < 660)

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Dependent variable: % of ADB							
	Interest charges		Offset		Total income		Costs excluding charge-offs	
Consumer × anticipation	0.25	0.29	0.05	0.06	−0.37	0.01	−0.06	−0.05
	(1.40)	(1.40)	(0.26)	(0.26)	(1.51)	(1.47)	(0.17)	(0.15)
	[.86]	[.84]	[.86]	[.84]	[.81]	[1.00]	[.71]	[.77]
Consumer × phase 2	0.22	0.17	0.04	0.03	−4.68**	−4.41**	−0.48*	−0.50**
	(2.31)	(2.26)	(0.43)	(0.42)	(2.27)	(2.20)	(0.25)	(0.23)
	[.92]	[.94]	[.92]	[.94]	[.05]	[.05]	[.06]	[.04]
Consumer × phase 3	−0.34	−0.48	−0.06	−0.09	−6.56**	−6.47***	−0.61**	−0.66***
	(2.03)	(1.89)	(0.38)	(0.36)	(2.72)	(2.36)	(0.29)	(0.24)
	[.87]	[.80]	[.87]	[.80]	[.02]	[.01]	[.04]	[.01]
Controls								
Main effects								
Consumer card FE	X	X	X	X	X	X	X	X
Month FE	X	X	X	X	X	X	X	X
Additional covariates								
Bank FE × FICO score group FE		X		X		X		X
Pre–CARD Act, consumer mean	19.14	19.14	N/A	N/A	35.40	35.40	3.65	3.65
R-squared	0.06	0.78	N/A	N/A	0.05	0.50	0.20	0.30
Number of observations	3,447	3,447	3,447	3,447	3,447	3,447	3,447	3,447

Note: Table shows coefficients from difference-in-differences regressions that compare outcomes for consumer credit cards (treatment group) and small business cards (control group) during the different phases of the CARD Act implementation. We define the Anticipation period as the months between the passage of the bill in May 2009 and the implementation of phase 2 in February 2010. We define phase 2 as March 2010 to August 2010 and phase 3 as the months after August 2010. The period prior to April 2009 is the omitted group, so the coefficients can be interpreted as the differential effect relative to pre–CARD Act period. The sample is restricted to accounts with FICO scores below 660 at origination. The sample period is April 2008–December 2011. The regressions are estimated on data aggregated to the bank × product type × FICO score group × month level, and weighted by total ADB in each group. A product type is defined as the interaction of the consumer card indicator and whether the card is co-branded, oil and gas, affinity, student, or other. FICO score groups are <620, 620–659, 660–719, 720–759, 760–799, and ≥800. Standard errors clustered by bank × product type are shown in parentheses and the associated p-values are shown in brackets. There are 46 such clusters in the sample. Significance levels: * $p < .10$, ** $p < .05$, *** $p < .01$.

the finding that the CARD Act had at most a limited effect on interest charges, with point estimates of approximately zero across the different phases.[30]

The absence of an aggregate response does not mean that interest rates were completely unresponsive to the CARD Act. Online Appendix Figure A.VIII shows the frequency of "upward repricing" over time, where upward repricing is defined, following Consumer Financial Protection Bureau (2013a), as an APR increase of at least 1 percentage point on a base of at least 10% in the previous month, to exclude increases that occur at the end of introductory rate periods. The figure shows a small spike in the number of accounts with APR increases in the two months prior to the CARD Act. This suggests that banks were reacting to the CARD Act, but that the competitive environment and the nonsalience of fees limited the aggregate significance of the response.

Columns (3) and (4) of Table VI convert the estimates of the change in interest changes into an implied offset, which we calculate as the interest charge estimates from columns (1) and (2) divided by the phase 3 estimate of the drop in fee revenue from Table IV with the same controls.[31] The standard errors and corresponding p-values for the offset are calculated using the delta method assuming no covariance in the error terms. The phase 3 estimates provide the longest adjustment period and represent our preferred estimates of the medium-run effects of the law. The phase 3 estimate of -0.09 from column (4) allows us to rule out offset effects of greater than 0.61 with 95% confidence.[32]

Credit card issuers in principle have wide latitude to increase interest rates on account holders. The CARD Act somewhat reduced this flexibility with a set of provisions that came into effect in August 2009, which (i) required lenders to notify consumers 45 days in advance of rate changes and (ii) limited lenders' ability to

30. Online Appendix Figure A.IX, which plots the coefficients on consumer account $\times$ month interactions from a difference-in-differences specification (equation (2)), further confirms that interest charges do not rise to offset the 5.3 percentage point decline in fee revenue, shown by a horizontal line in the figure.

31. We use the phase 3 fee estimate from column (7) of Table IV to construct the offset estimates in column (3), and the phase 3 fee estimate from column (8) of Table IV to construct the estimates in column (4).

32. In Online Appendix D we provide ancillary evidence on this estimate using a restriction on the relationship between the offset and the "pass-through rate" of a cost shock that we derive from our model. This approach to estimating offsets is discussed in greater detail in Agarwal et al. (2014b).

change interest rates on existing accounts, in particular in the first year after origination. Lenders, of course, could announce rate changes 45 days in advance, so the main practical effect of this provision was to make rate increases more salient and slow down the implementation of rate increases. Nevertheless, we examine interest charges for new accounts to provide additional evidence from a setting where banks face fewer constraints in their pricing.

Online Appendix Table A.II shows difference-in-differences estimates of the effect on interest charges as a percentage of ADB for new accounts. Columns (1) and (2) repeat the estimates on the set of all accounts with FICO scores below 660 from Table VI for reference. Columns (3) and (4) show estimates for the sample of low FICO score new accounts, defined as accounts in their first full month since origination. Interest charges for new accounts are noisy because promotional rates and marketing campaigns by a single bank can have a meaningful effect on monthly outcomes. However, the estimates clearly indicate that interest charges for new accounts did not rise by the 5.3 percentage points needed to offset the reduction in fee revenue. The preferred phase 3 estimate with all controls, shown in column (4), takes on a value of 0.17, and we can reject an increase of the full 5.3 percentage point amount with a p-value below .01.

Online Appendix Figure A.X, Panel A shows interest charges as an annualized percentage of ADB for account holders with FICO scores of 660 or higher. This figure provides a placebo test for the interest charge response. Since fee revenue barely declines for high FICO score account holders, a large change in interest charges would suggest that there are other contemporaneous effects that are not being captured by the difference-in-differences specification. The plot shows no evidence of a differential effect of the CARD Act on high FICO score consumer accounts. Columns (5)–(6) of Online Appendix Table A.II show difference-in-differences regression specifications that confirm this finding.

VI.B. Total Income and Costs

The reduction in fee revenue and the lack of an offsetting interest charge response suggest that the CARD Act reduced banks' total income. Recall from Section III.B that we define total income as the sum of fee payments, interest payments,

and interchange fees. Although the evidence shows a drop in fees and no change in interest charges, the reduction in fee revenue could lead to a "waterbed effect," where credit card issuers offset the reduction in fees with higher interchange fee revenue from merchants.

Columns (5) and (6) of Table VI examine this directly by showing difference-in-differences specifications for the sample of low FICO score accounts with total income as a percentage of ADB as the dependent variable. The point estimates show a phase 3 drop in total income of 6.5 percentage points, similar to the 5.3 percentage point decline in fees. Online Appendix Figure A.II shows that interchange income as a share of purchase volume was a stable 2% over the entire time period. Thus the combination of the decline in fee revenue and flat interest charges and interchange income translates directly into a decline in total income from low FICO score account holders.

Another way banks could mitigate their exposure to the CARD Act is by reducing their spending on awards, marketing, or other credit card costs. We examine this potential response by estimating difference-in-differences specifications where the dependent variable is costs excluding charge-offs, defined using information on the cost of funds, rewards and fraud expenses, and operational costs.[33] The estimates, shown in columns (7) and (8) of Table VI, show no evidence of an economically significant decline in costs.[34] However, this does not rule out that the decline in profitability will lead to a medium-term decline in banks' investment on IT infrastructure and credit-scoring models.

VI.C. Credit Volume

In the final part of this section, we examine the effects of the CARD Act on the equilibrium volume of credit, as measured by credit limits, new accounts, and ADB. Figure VII, Panel B shows mean credit limits for consumer and small business cards with a FICO score below 660 at origination. Columns (1) and (2) of Table VII present the corresponding regressions specifications, which have credit limit as the dependent variable, and are otherwise

33. We exclude contemporaneous charge-offs because they are not controlled in the short term by actions taken by credit card issuers.

34. As an additional piece of evidence, Online Appendix Figure A.I shows that the ratio of rewards and fraud expenses to interchange income was constant over the sample and therefore that these costs were approximately constant.

identical to the interest charge regressions (columns (1) and (2) of Table VI). The plot and regressions provide clear evidence that the CARD Act did not bring about a differential reduction in credit limits for consumer accounts. The preferred phase 3 point estimate from column (2) of Table VII indicates an increase in consumer account credit limits of $114 or approximately 5% of the $2,808 pre–CARD Act mean. We can rule out a drop in credit limits of greater than than $722, or 26% of the pre–CARD Act mean, with 95% confidence.

Figure VII, Panel C shows plots for the number of new consumer and small business accounts with a FICO score below 660. The number of new accounts is measured as a percentage of the average pre–CARD Act number of accounts in the data.[35] Originations of consumer and small business accounts follow a strong U-shaped pattern over the time period. Both types of accounts drop in parallel between the start of our sample (April 2008) and the depth of the financial crisis (early 2009) before recovering over the final two years of our sample period. The month-to-month numbers exhibit considerable noise, reflecting the fact that the percentage of new accounts can be shifted by large promotional or marketing campaigns at a single bank. However, the preferred phase 3 point estimate of 0.09 from column (4) of Table VII indicates that there is virtually zero differential change in the percentage of new consumer accounts, although the standard error of 0.23 prevents us from ruling out meaningful effects in either direction.

Figure VII, Panel D shows mean ADB for consumer and small business accounts with FICO scores below 660 at origination. There is no evidence of a differential change in consumer credit card ADB. The regression estimates in columns (5) and (6) of Table VI confirm this result.

In the Online Appendix, we present three additional pieces of evidence on the volume of credit. Appendix Figure A.X plots mean credit limits, new accounts, and ADB for consumer and small business accounts with a FICO score of 660 or above. Appendix Figure A.IX plots the coefficients on the consumer account $\times$ month interactions from a difference-in-differences

35. We use the average pre–CARD Act level of accounts as the denominator, instead of the contemporaneous number of accounts, to minimize noise that arises from bank decisions to write off accounts in blocks, which makes the denominator drop in discrete increments over time.

TABLE VII

CREDIT VOLUME: DIFFERENCE-IN-DIFFERENCES REGRESSIONS (FICO < 660)

	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable:					
	Credit limits ($)		New accounts (% of pre–CARD Act level)		Average daily balances ($)	
Consumer × anticipation	124.31	40.62	−0.19	−0.17	−105.66*	−128.09**
	(153.63)	(163.42)	(0.11)	(0.11)	(59.32)	(58.28)
	[.42]	[.80]	[.09]	[.13]	[.08]	[.03]
Consumer × phase 2	229.37	101.72	0.02	0.02	−98.13	−128.14
	(285.74)	(295.80)	(0.17)	(0.12)	(142.37)	(136.72)
	[.43]	[.73]	[.90]	[.87]	[.49]	[.35]
Consumer × phase 3	291.23	113.95	0.08	0.09	9.30	−39.28
	(326.38)	(309.64)	(0.21)	(0.23)	(190.25)	(176.21)
	[.38]	[.71]	[.71]	[.70]	[.96]	[.82]
Controls						
Main effects						
Consumer card FE	X	X	X	X	X	X
Month FE	X	X	X	X	X	X
Additional covariates						
Bank FE × FICO score group FE		X		X		X
Pre–CARD Act, consumer mean	2,807.88	2,807.88	0.76	0.76	1,159.29	1,159.29
R-squared	0.00	0.74	0.04	0.24	0.03	0.79
Number of observations	3,447	3,447	3,447	3,447	3,447	3,447

Notes. Table shows coefficients from difference-in-differences regressions that compare measures of credit volume for consumer credit cards (treatment group) and small business cards (control group) during the different phases of the CARD Act implementation. Columns (1) and (2) show regressions with credit limits as the dependent variable. Columns (3) and (4) show regressions with new accounts as a percentage of the pre–CARD Act average number of accounts as the dependent variable. Columns (5) and (6) shows regressions with average daily balances as the dependent variable. We define the anticipation period as the months between the passage of the bill in May 2009 and the implementation of phase 2 in February 2010. We define phase 2 as March 2010–August 2010 and phase 3 as the months after August 2010. The period prior to April 2009 is the omitted group, so the coefficients can be interpreted as the differential effect relative to pre–CARD Act period. The sample is restricted to accounts with FICO scores below 660 at origination. The sample period is April 2008–December 2011. The regressions are estimated on data aggregated to the bank × product type × FICO score group × month level, and weighted by the number of accounts in each group. A product type is defined as the interaction of the consumer card indicator and whether the card is co-branded, oil and gas, affinity, student, or other. FICO score groups are <620, 620–659, 660–719, 720–759, 760–799, and ≥800. Standard errors clustered by bank × product type are shown in parentheses and the associated *p*-values are shown in brackets. There are 46 such clusters in the sample. Significance levels: * $p < .10$, ** $p < .05$, *** $p < .01$.

regression specification (equation (2)) for the sample of accounts with a FICO score below 660. Appendix Figure A.XI shows analogous plots for the sample of accounts with FICO scores of 660 or higher. The plots provide a more granular view of the month-to-month variation and confirm our finding of no volume response.

The nonresponse of credit volume is fully consistent with the model in Online Appendix C. The lack of price offset suggests that

fees are nonsalient to consumers and that consumers are only responsive to the interest rate. Since interest charges are unchanged, from the perspective of the borrower, the cost of borrowing does not change and there is no change in the demand for credit. Since firms continue to make money by lending to consumers, equilibrium credit volume is also unchanged.

VII. 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 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 article takes a step in this direction by providing a quantitative analysis of the impact of the CARD Act, which introduced significant changes to the regulation of credit cards. We find that the CARD Act successfully reduced 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 credit volume. In addition, we find that the disclosure requirements of the CARD Act had a small but significant impact on borrowers' repayment behavior. Our two years of post–CARD Act data do not allow us to investigate the longer run effects of the CARD Act on industry exit or entry, or effects on margins with multiyear contracts (e.g., promotional agreements) or lumpy long-run investments (e.g., IT infrastructure and credit-scoring models).

National University of Singapore
Office of the Comptroller of the Currency
University of Chicago
New York University

Supplementary Material

An Online Appendix for this article can be found at QJE online (qje.oxfordjournals.org).

REFERENCES

Agarwal, Sumit, Souphala Chomsisengphet, Chunlin Liu, and Nicholas Souleles, "Do Consumers Choose the Right Credit Contracts?," Federal Reserve Bank of Chicago Working Paper WP 2006-11. Working Paper, 2006.

Agarwal, Sumit, Souphala Chomsisengphet, Neale Mahoney, and Johannes Stroebel, "Selection and Market Power in Consumer Credit Markets," Working Paper, 2014a.

———, "A Simple Framework for Estimating the Consumer Benefits from Regulating Hidden Fees," *Journal of Legal Studies*, 43 (2014b), S239–S252.

American Bankers Association, "Response to Request for Information Regarding the Credit Card Market," 2013.

Ausubel, Lawrence M., "The Failure of Competition in the Credit Card Market," *American Economic Review*, 81 (1991), 50–81.

Bar-Gill, Oren, and Elizabeth Warren, "Making Credit Safer," *University of Pennsylvania Law Review*, 157 (2008), 1–101.

Calem, Paul S., and Loretta J. Mester, "Consumer Behavior and the Stickiness of Credit-Card Interest Rates," *American Economic Review*, 85 (1995), 1327–1336.

Campbell, John Y., "Household Finance," *Journal of Finance*, 61 (2006), 1553–1604.

Campbell, John Y., Howell E. Jackson, Brigitte C. Madrian, and Peter Tufano, "Consumer Financial Protection," *Journal of Economic Perspectives*, 25 (2011), 91–114.

Carroll, Gabriel D., James J. Choi, David Laibson, Brigitte C. Madrian, and Andrew Metrick, "Optimal Defaults and Active Decisions," *Quarterly Journal of Economics*, 124 (2009), 1639–1674.

Choi, James J., David I. Laibson, and Brigitte C. Madrian, "Are Empowerment and Education Enough? Underdiversification in 401 (k) Plans," *Brookings Papers on Economic Activity*, 2 (2005), 151–213.

Conley, Timothy G., and Christopher R. Taber, "Inference with 'Difference in Differences' with a Small Number of Policy Changes," *Review of Economics and Statistics*, 93 (2011), 113–125.

Consumer Financial Protection Bureau, "CARD Act Report," 2013a.

———, "Navigating the Market: A Comparison of Spending on Financial Education and Financial Marketing," 2013b.

Debbaut, Peter, Andra Ghent, and Marianna Kudlyak, "Are Young Borrowers Bad Borrowers? Evidence from the Credit CARD Act of 2009," Federal Reserve Bank of Richmond WP 13-09R. Working Paper, 2013.

Federal Reserve Board of Governors, "Report to the Congress on the Use of Credit Cards by Small Businesses and the Credit Card Market for Small Businesses," 2010.

Federal Reserve Bank of New York, "Quarterly Report on Household Debt and Credit, May 2013," 2013.

Gabaix, Xavier, and David Laibson, "Shrounded Attributes, Consumer Myopia, and Information Suppression in Competitive Markets," *Quarterly Journal of Economics*, 121 (2006), 505–540.

Gross, David B., and Nicholas S. Souleles, "Do Liquidity Constraints and Interest Rates Matter for Consumer Behavior? Evidence from Credit Card Data," *Quarterly Journal of Economics*, 117 (2002), 149–185.

Heidhues, Paul, Botond Kőszegi, and Takeshi Murooka, "Exploitive Innovation," UC Berkeley Working Paper, 2012.

Jambulapati, Vikram, and Joanna Stavins, "The Credit CARD Act of 2009: What Did Banks Do?," Federal Reserve Bank of Boston Working Paper 13-7, 2013.

Kay, Benjamin, Mark D. Manuszak, and Cindy M. Vojtech, "Bank Profitability and Debit Card Interchange Regulation: Bank Responses to the Durbin Amendment," Federal Reserve Board Working Paper 2014-77, 2014.

Keys, Benjamin, and Jialan Wang, "Perverse Nudges: Minimum Payments and Debt Paydown in Consumer Credit Cards," University of Chicago Working Paper, 2014.

Kuchler, Theresa, "Sticking to Your Plan: Hyperbolic Discounting and Credit Card Debt Paydown," New York University Working Paper, 2013.
Laibson, David, Andrea Repetto, and Jeremy Tobacman, "Estimating Discount Functions with Consumption Choices over the Lifecycle," NBER Working Paper, 2007.
Madrian, Brigitte C., and Dennis F. Shea, "The Power of Suggestion: Inertia in 401 (k) Participation and Savings Behavior," *Quarterly Journal of Economics*, 116 (2001), 1149–1187.
Mullainathan, Sendhil, Michael Barr, and Eldar Shafir, "The Case for Behaviorally Informed Regulation," in *New Perspectives on Regulation*, David Moss, and John Cisternino, eds. (Cambridge, MA: Tobin Project, 2009), 25–62.
Navarro-Martinez, Daniel, Linda Court Salisbury, Katherine N. Lemon, Neil Stewart, William J. Matthews, and Adam J. L. Harris, "Minimum Required Payment and Supplemental Information Disclosure Effects on Consumer Debt Repayment Decisions," *Journal of Marketing Research*, 48 (2011), S60–S77.
Posner, Eric, and E. Glen Weyl, "Benefit-Cost Analysis for Financial Regulation," *American Economic Review*, 103 (2013), 393–397.
Stango, Victor, and Jonathan Zinman, "Borrowing High vs. Borrowing Higher: Sources and Consequences of Dispersion in Individual Borrowing Costs," NBER Working Paper, 2013.
Stewart, Neil, "The Cost of Anchoring on Credit-Card Minimum Repayments," *Psychological Science*, 20 (2009), 39–41.
Thaler, Richard H., and Shlomo Benartzi, "Save More Tomorrow™: Using Behavioral Economics to Increase Employee Saving," *Journal of Political Economy*, 112 (2004), S164–S187.
Thaler, Richard H., and Cass R. Sunstein *Nudge: Improving Decisions about Health, Wealth, and Happiness* (New Haven, CT: Yale University Press, 2008).
Tse, Tomoeh Murakami, "J.P. Morgan's Dimon Says New Laws Have Hurt His Company." *The Washington Post*, April 2, 2010.
U.S. Senate, "S5314," *Congressional Record*, 155 (2009).