Minimum Payments and Debt Paydown in Consumer Credit Cards*

Benjamin J. Keys
Harris School of Public Policy
University of Chicago

Jialan Wang
Consumer Financial Protection Bureau

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Abstract

What factors impact how much consumers repay on their credit cards each month? This paper examines the drivers of payment behavior using the CFPB credit card database, which includes the monthly account activity of a large fraction of U.S. consumers from 2008–2012. We find that consumers' payment behavior is consistent and strongly bimodal. Most accounts are either paid in full or paid near the minimum amount each month, with very few intermediate payment amounts. We then evaluate the impact of two types of policy changes: 1) changes in the minimum payment formulas implemented by individual issuers, and 2) new payment disclosures mandated by the CARD Act of 2010. The formula changes led to small increases in the payments made by consumers previously paying the minimum. On average, the CARD Act disclosures increased consumer payments by $19 per month from February 2010 to December 2012. However, both the formula changes and the CARD Act's 3-year payment disclosure had the effect of *decreasing* the fraction of accounts paid in full by 1%. Our results suggest that anchoring and the salience of minimum payments play important roles in consumer decision-making in the credit card market.

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I Introduction

With roughly $700 billion in outstanding revolving debt, the credit card market represents the primary source of liquidity lending for household consumption in the United States. Although a significant amount of research has studied how households choose when and whether to borrow, relatively little evidence has been presented regarding patterns of debt repayment.[1] As credit card debt cumulates due to compound interest and exposure to fees, the path of repayment is a crucial determinant of the total cost of borrowing.

Survey and experimental evidence suggests that the presence of minimum required payments on credit card statements may affect consumer payments.[2] To our knowledge, ours is the first large-scale empirical study to analyze the role of minimum payments in repayment behavior in the United States. This paper has two main goals. First, we classify payment behavior and describe how repayment rates relate to observable borrower and account characteristics. Second, we estimate the impact of two different kinds of policy changes on borrowers' payment behavior: changes to issuers' kinked minimum payment formulas, and three new payment-related disclosures mandated by the CARD Act of 2010. The first change affects the actual required repayment amount needed for borrowers to avoid delinquency, while the second only affects the disclosed information regarding repayment. The results provide causal estimates of borrowers' responsiveness to minimum payment rules and information "nudges" (Thaler and Sunstein 2008).

Our dataset is the CFPB credit card database (CCDB), which contains the near-universe of credit card accounts for several large U.S. credit card issuers, covering the vast majority of total outstanding balances in the market.[3] The CCDB includes account-level monthly summary data

[1]Starting with the debate between Ausubel (1991) and Brito and Hartley (1995), researchers have sought to understand whether credit card borrowing choices could be interpreted as 'rational,' and, relatedly, whether the credit card market operates in a competitive environment (Knittel and Stango 2003). A more recent literature has explored whether consumers choose the right contracts (Agarwal, Chomsisengphet, Liu and Souleles 2006) and the ways in which lenders structure contracts to exploit non-sophisticated borrowers (Heidhues and Kőszegi 2010). Kuchler (2012) examines payment behavior among enrollees in an online financial management service.

[2]Stewart (2009) presents survey and experimental evidence that minimum payments significantly decrease payment size. Navarro-Martinez, Salisbury, Lemon, Stewart, Matthews and Harris (2011) find that increases in the minimum payment lead to lower average payments, and that information disclosures on interest costs do not lead to greater repayment. Hershfield and Roese (2014) find evidence that including both minimum payments and three-year payment amount disclosures leads to lower payments than presenting only one payoff scenario.

[3]The CCDB is confidential supervisory information, and the statistics in this paper are aggregated to maintain the confidentiality of both issuers and consumers in the underlying data. Confidential supervisory information has only been shared in aggregated form with Benjamin Keys.

from 2008 through 2012, and is merged to credit bureau data that provides an overview of each borrower's overall credit portfolio on a quarterly basis. This dataset is the most comprehensive source of account-level data on credit card repayments that we are aware of for the United States. In this study, we use a random sample of general-purpose credit card accounts from a subset of several issuers from the database, covering a significant fraction of the overall credit card market.

We document that most accounts exhibit consistent and strongly bimodal payment behavior. Roughly one third of accounts are paid in full every month (and thus not do not incur any interest charges), one third are repaid with close to the minimum payment, and the remainder are paid with a mixture of the full balance, the minimum, and intermediate amounts. Despite the heterogeneity in behavior, fewer than 10% of all payments fall between 20 and 99 percent of the outstanding balance.

This bimodal repayment pattern is unlikely to minimize the interest charges incurred on outstanding debt, as a standard consumer optimization plan would recommend steady debt repayment as a share of income. Surprisingly, even high-income borrowers do not always pay their credit card balance off in full, choosing instead to revolve debt at a relatively high cost (median APR=15%). FICO score appears to be the strongest correlate of payment behavior, whereas income is only weakly related to consumer payments.

One possible explanation for the observed bimodal payment behavior is that the minimum payment shown on statements, which is typically less than 10% of a consumer's balance, may serve as an "anchor" for consumer payments. Anchoring may cause consumers who would otherwise pay a higher fraction of their balance to instead pay close to the minimum amount. An alternative hypothesis is that consumers who pay the minimum are liquidity constrained, or have higher-return consumption or investment opportunities, and pay as little as possible to avoid late fees.

To explore these hypotheses, we first examine changes in issuers' minimum payment formulas. We take advantage of the fact that several issuers in the sample implemented changes to the formulas used to compute minimum payments during our sample period. The formulas are known and are based on observable characteristics of borrower accounts. Furthermore, formula changes were implemented unilaterally, so there was no selective targeting by issuers based on ex-ante consumer payment behavior.

The piecewise-linear nature of the formulas generates different changes in the required minimum payment depending on a borrower's outstanding credit card balance. Since different issuers changed their formulas in different ways over time, our main empirical approach is thus a triple-difference specification.[4] For the affected issuers, minimum payments increased by an average of \$18, or 5% of the balance, for account months with positive balances. The formula changes led to changes in payments in at least 4–6% of account-months, concentrated in shifts between full payment and near-minimum payments. The average fraction of the balance paid increased by 1% for accounts with less than \$1000 outstanding. This change is largely driven by the mechanical effect of low-balance consumers moving to the new, higher minimum amounts. This low-balance group also experienced a 1% increase in delinquencies, consistent with some consumers facing binding liquidity constraints (Gross and Souleles 2002).

More surprisingly, we find that consumers with balances over \$3000 *reduced* the average fraction of the balance they paid by roughly 2%. In contrast, the mechanical effect of the formula change was a negligible 0.3% increase in the required minimum payment as a fraction of the balance for this high-balance group. Thus, this result suggests that a subset of high-balance borrowers reacted to a small increase in their required minimum amount by significantly reducing their monthly payments. In particular, the response of these high-balance accounts is entirely driven by borrowers shifting from paying off their cards in full to paying only the minimum.

This effect is unlikely to be due to a binding liquidity constraint, since the affected borrowers were previously paying their full balances and subsequently reduce their payments. Thus, while some low-balance borrowers respond to the new minimum requirements by paying more, other borrowers with high balances respond by paying *less*. Notably, the net effect of modest increases in the minimum payment formula on issuer interest revenues is close to zero and insignificant. Because of these two countervailing effects, we find that the impact of minimum payment changes on consumers may be substantially greater than the overall impact on issuers.

Our second research strategy explores borrowers' responses to the CARD Act disclosure require-

[4] The regressions include quadratics in balance, annual percentage rate (APR), account age, credit limit, and purchases; dummies for 0% APR, round number purchase, and promotional balance; issuer fixed-effects, and loan channel fixed-effects. The controls for account characteristics are fully interacted by issuer, and the results are qualitatively robust to the inclusion of borrower fixed-effects. We intend to perform subsequent analysis using dynamic "difference in regression kink" (DIRK) and simulated instrument designs to more fully exploit the variation in minimum payment formulas.

ments. The CARD Act mandated four distinct new disclosure requirements, and we are able to separately identify the impacts of three of the four disclosures.[5] The first disclosure, mandated on two thirds of positive-balance statements, warns consumers that they can save on interest payments if they pay more than the minimum each month (without suggesting an alternative amount). The second disclosure, mandated on 55% of statements, presents a calculation of the payment needed to pay down their full balance in 3 years without additional purchases, thereby providing a new potential "anchor" in addition to the usual minimum payment shown on the statement. In contrast, paying only the minimum payment (and incurring no additional charges) generally takes about 50 months to pay off the balance. A final warning was mandated on statements that required such a low minimum payment that the loan was non-amortizing or negatively amortizing. The disclosure informed consumers that making only the minimum payments on such accounts would not keep up with the interest charged on the account, so borrowers would never be able to pay off the balance by making only minimum payments.

In contrast to the minimum formula changes, these disclosures did not change the economic incentives around credit card payments. In addition, the new disclosures presented information that was already present in or could be calculated from credit card contracts, monthly statements, and pre-existing disclosures mandated by the Federal Truth in Lending Act (TILA). Thus, their impacts represent a distinct test of the potential anchoring effects of minimum payments and of consumer understanding of credit contracts.

We estimate that the new disclosures changed consumer payments in at least 2–4% of account-months, and were associated with a $19 average increase in payments per account-month. We also find striking heterogeneity across three different combinations of disclosures. Accounts receiving the non-amortization warning and 3-year calculation increased payments by $24 per month, and had a small but insignificant increase in the average fraction paid. In contrast, those receiving the minimum payment warning and 3-year payment calculation increased payments by only $4

[5] Our analysis exploits the details of the CARD Act rules for which of the four disclosures are presented on which statements based on observable characteristics of the accounts (e.g. the amount of the minimum, and whether the consumer paid off the balance in full in prior months). These rules allow us to separately identify the impacts of three of the disclosures. A final disclosure mandated on nearly all statements warned consumers about the fees associated with late payments. By comparing across difference-in-difference versus triple-difference specifications, we are able to compare the overall impacts of the four disclosures together with the individual effects of the three payment amount disclosures.

per month. We infer that in the absence of a strongly-worded warning against non-amortizing payments, the 3-year payment calculation amount appeared to cause borrowers who were paying in full to pay less, possibly as a result of a new anchoring effect. In addition, the 3-year calculation slightly raised the payments of those who were paying low amounts and moved to the higher anchor. We document bunching in payments at the 3-year repayment amount, with the bunching greatest for borrowers in the bottom quartile of the FICO distribution. On net, the 3-year repayment disclosure led to a 0.6% overall reduction in the fraction of balances paid. Thus, the disclosure increased the interest charges incurred by borrowers, precisely the opposite intended effect of this provision of the CARD Act.

Overall, we find that small changes in incentives induce much larger and sometimes negative effects on payments for a subset of consumers, and disclosures showing previously-available information also induced changes in payments. These results suggest three key conclusions about the effects of anchoring on consumer payments. First, salient suggested payment amounts may have an anchoring effect on consumer payments. Second, anchors at low payment amounts can lead to overall reductions in consumer payments. Finally, consumers show substantial heterogeneity in their responses to the incentives and information around the minimum payment, depending on their ex ante behavior prior to the changes and the magnitude of the anchor relative to their full balance. By improving our understanding of consumer behavior, these findings have significant implications for designing optimal defaults in the credit card market (see, e.g. Carroll, Choi, Laibson, Madrian and Metrick (2009)) and for the drivers of household indebtedness.

Section II describes our monthly credit card account-level dataset and presents our descriptive analysis of consumer payments. Section III presents the analysis of the impacts of changes in minimum payment formulas and the CARD Act disclosures. Section IV provides a discussion of the potential explanations and implications for our findings, and concludes.

II Data and Descriptive Analysis

II.A CFPB Credit Card Database (CCDB)

This is the first paper to use data from the CFPB Credit Card Database (CCDB), which includes account-level data for several of the largest credit card issuers in the United States.[6] The data cover 2008 to the present, and the issuers in the dataset comprise the majority of credit card industry balances. The dataset includes monthly account-level information for the near-universe of accounts from included issuers on balances, payments, fees, interest rates, delinquency, and to a limited extent, credit profile and income. The CCDB does not contain data on individual purchase transactions. Importantly, we are also unable to link separate accounts for the same consumer or household, so we can only analyze consumer behavior at the account level.

The sample used in this analysis comes from a subset of issuers in the CCDB comprising a substantial share of the market. For each of the issuers included, we draw a roughly equally-weighted random sample of accounts of general purpose cards for the period from February 2008 to December 2012.[7] Moreover, we only use statements months with positive balances. Thus, the sample excludes all private label and business cards, as well as co-brand, oil and gas cards, affinity and student cards. Our analysis sample contains 16.4 million account-month observations.

Panel A of Table 1 presents summary statistics on the full analysis sample. Account-holders have an average income of $71,000 and average FICO score of 712.[8] The average credit limit is $9,524, and the average retail APR is 16%. Two thirds of account-months carry a revolving balance, and 57% have positive finance charges. Purchases constitute 58% of balances on average, and 56% of account-months have positive purchases. The average monthly ending balance is $3,233, and average account utilization (balance as a fraction of total credit limit) is 46%.

Borrowers pay an average of 39% of their balances per month, with an average payment amount

[6]The dataset also includes nine institutions that fall under the purview of the U.S. Office of the Comptroller of the Currency (OCC). For a description of the OCC portion of the database see Agarwal, Chomsisengphet, Mahoney and Stroebel (2013). For additional information on the CCDB, see Consumer Financial Protection Bureau (2013).

[7]The samples for some issuers begin later than February 2008 due to data availability. The samples range from between 0.1% to 5% of general-purpose cards within each issuer.

[8]To maximize the available sample size, we report incomes and FICO scores that are a combination of values at origination and updated values that are periodically recorded by issuers. These values always pre-date the statement dates, but different issuers employ different practices for whether and how often to update these values. Results are quantitatively similar when using only income and FICO at origination.

of \$538, compared to an average minimum payment of \$88. However, the average fraction paid derives from a highly skewed payment distribution. The actual payments made on the accounts are less than the minimum payment due in 10% of cases. Payments less than the minimum are considered “late,” and in nearly all of these cases borrowers are assessed late fees that typically range from \$25–\$35. Payments are exactly equal to the minimum payment due in 15% of account-months, and are within \$50 of the minimum in 35% of cases. The 20% of payments that are near but not equal to the minimum are partially due to intermediate payments for consumers with relatively low balances, but appear to be largely due to “rounding” behavior — consumers with a minimum payment of, say, \$35 may round up to \$40 or \$50. Payments are exactly equal to the outstanding balance in 33% of account-months. Thus, the remainder of payments between \$50 more than the minimum and the full amount comprise only 23% of all account-months with positive balances.

II.B Descriptive Analysis

In this section, we present a taxonomy of consumer payment behavior and the correlations between consumer characteristics and payment behavior. As noted above, consumer payments appear to be strongly bimodal, and consumers who pay low amounts exhibit rounding behavior around the minimum payment. To analyze whether these patterns are consistent over time within a given account, we categorize accounts by whether they pay in full (full payers), pay the minimum (min exact payers), or pay within \$50 of the minimum (min + 50 payers) for at least 50% of positive-balance months.

Figure 1 presents the composition of consumers and account-months based on this taxonomy. Panel A shows that the majority of accounts exhibit persistent payment behavior over time. Thirty-one percent of accounts are paid in full at least half the time, 11% are paid with exactly the minimum, and 23% are paid within \$50 of the minimum. The remaining 35% of accounts, which we term mixed payers, pay a mixture of the full amount, minimum, and intermediate amounts.

Panel B shows that payment behavior is largely consistent within each payer type. Full payers pay in full 90% of the time, and minimum exact payers pay exactly or close to the minimum 86% of the time. Minimum+\$50 and mixed payers exhibit more heterogeneous behavior than full and minimum exact payers. Mixed payers have high likelihoods of delinquency, with 18% of all statement months being delinquent. The consistency of payment behaviors may be due to features such as automatic payments tied to bank accounts, but may also reflect both the active choices and potential biases of consumers.[9] Nonetheless, each payer type pays both the full and minimum amounts at least 1% of the time. Panels B–D of Table 1 present summary statistics for the major payer types (minimum exact and minimum+$50 payers are combined).

Figure 2 describes the distribution of payments within each payer type. The figure presents additional evidence for bimodality in payment amounts. Across all payer types, very few payments range from 20% to 99% of the full balance, but every payer type has a significant fraction of payments between 0–5% of the balance and at 100% of the balance. Seventy-five percent of payments made by minimum payers (including both min exact and min+50) are between 0–5% of their balance, and 90% of payments made by full payers are at 100% of their balance. Despite their alternative classification, it is notable that payments by mixed payers are qualitatively similar to those of min payers. They pay between 0–5% of the balance 44% of the time, and 70% of all of their payments are less than 20% of the balance.

Figures 3–5 present the composition of payments and account-months by balance, income, and FICO. Panel A of Figure 3 shows that the bimodality of payments spans the balance spectrum. Payments as a fraction of the balance decrease as balances increase. While the majority of accounts with less than $500 are paid in full, starting around $1,500 in balance, the majority of payments range from 0–10% of the balance. This pattern results from a combination of two effects: 1) greater cashflows are needed to pay off the large purchases that generate higher balance amounts and 2) high balances arise endogenously due to low prior payments.

Panel B shows the distribution of payer types by balance. Full payers cluster at low balances. Thirty-five percent of account-months with positive balances have balances less than $250, and 77% have balances less than $1,000. The distribution of payer minimum and mixed payers are similar by balance. Forty-six percent of minimum payers and 44% of mixed payers have balances less than $1,000, and the remainder are fairly evenly distributed across higher balance amounts.

Figure 4 shows the composition of payments and distribution of accounts by income. Panel A shows that payment fractions increase monotonically by income, but substantial fractions of

[9] For instance, the lack of consistency among mixed payers may be related to their high rates of delinquency, since non-standard payment amounts may induce higher likelihoods of forgetfulness about due dates.

consumers of both low and high incomes make both low and full payments. Consumers making less than $50,000 per year pay less than 10% of their balances more than half of the time and their full balances about 30% of the time. Consumers making more than $250,000 per year pay in full about half the time, and pay less than 10% of their balances about 40% of the time. Panel B confirms the weak relationship between income and payment behavior, showing similar income distributions for all three payer types.

Figure 5 shows that consumer payments vary much more dramatically by FICO than by income. Panel A shows that consumers with FICO scores less than 700 consistently make low payments, paying less than 10% of their balances at least 70% of the time. However, typical payment behavior shifts dramatically in the 700–800 FICO range. Consumers with FICO scores above 800 typically pay in full in at least 80% of their positive-balance months. However, some consumers with very high FICO scores display low-payment behavior, which may be due to "rate surfing" or exploitation of promotional offers, behaviors we attempt to control for in the analysis that follows.

Consistent with Panel A, Panel B shows that full payers are clustered at FICO scores between 700–850, while min and mixed payers span a greater range of FICOs, with min payers having lower scores on average than mixed payers. The patterns by FICO score should be interpreted with caution, because consumer credit card payment behavior is a component used in determining FICO scores. While we again note that consumer scores always lag the statement dates used in the analysis, the observed persistence in payment behavior nonetheless generates a mechanical relationship between consumer payments and FICO score.

III Impacts of Policy Changes

III.A Impact of Changes to Minimum Payment Formulas

In this section, we present regression analysis that exploits changes in minimum payment formulas made by issuers. Minimum payments are the amounts stated on credit card statements that borrowers must pay by the due date in order to avoid incurring late fees. The formulas used for determining minimum payment amounts are disclosed on issuer websites and in credit card contracts, and issuers have some discretion to set their own formulas in compliance with the guidance of bank regulators.

III.A.1 Description of Minimum Payment Formulas

Minimum payment formulas used in the industry generally follow a fairly consistent recipe, with a flat "floor" region for lower balances and sloped regions that are a percentage of the balance and interest charges for higher balances. Figure 6 shows a stylized version of a typical minimum payment formula and the impact of a change in the floor. In the figure, the formula consists of

$$minimum = \max\{floor, 1\% \cdot balance + interest + fees, 2\% \cdot balance + fees\} \quad (1)$$

where $floor = \$20$ in the left panel and $floor = \$60$ in the right panel. As in the stylized formula, typical formulas consist of the maximum of the floor and two other values that are increasing in the balance, interest charges, and fees.

The sloped part of the formula is typically lower for "transactors," or borrowers who pay their balances in full and hence incur no interest charges. In the stylized formula, the transactor region consists of $2\% \cdot balance + fees$. Because monthly interest rates are typically greater than 1%, the minimum payment in the "revolver" region $1\% \cdot balance + interest + fees$ is generally greater than the transactor region. In the figure, the interest rate for revolvers is assumed to be 16% APR. In addition, the figure only shows the formula values for $fees = 0$.

For the parameters in the stylized formula, the kink in the formula between the floor and sloped regions occurs at \$1,000 for $floor = \$20$ and \$3,000 for $floor = \$60$. Importantly for our regression framework, the increase in the floor affects borrowers in three different formula regions differently. Borrowers with less than \$1,000 balance experience only a levels change in the minimum payment. Borrowers with between \$1,000 and \$3,000 balance experience both a level and slope change in the minimum payment formula. And borrowers with greater than \$3,000 balance experience no change in the minimum payment.

In our analysis, we exploit changes in minimum payment formula for several of the issuers in our sample. All of the changes during our sample period represented increases in the required minimum payments. These changes were made by issuers at discrete points in time and affected the vast majority of all general-purpose cards in their portfolios. Because these formula changes affect borrowers with different formulas differently, our main regression approach is a triple-difference framework that estimates the impacts of the change within the same issuers portfolio across different balances over time.[10]

We do not know the exact reasons why issuers made these formula changes. Because issuers face different regulatory regimes under different regulators, banks that change regulators may be required to change their formulas based on regulator guidance. No regulators changed their guidance on minimum formulas during the sample period. Issuers may also change their formulas in anticipation of future regulatory action. Because the CARD Act and regulatory trends suggest increasing scrutiny on low minimum payments, issuers with low initial payment formulas may decide to increase the required payments to pre-empt regulator action and attention.

Finally, issuers may have business reasons to increase their formulas. The CARD Act changed the payment hierarchy and so that balances with the highest interest rate must be paid off first, <u>except</u> for the minimum payment. Thus, increasing required minimums may yield higher interest revenue for some issuers. Increasing the minimum could also help issuers mitigate default risk. Regardless of the reasons for the formula changes, our empirical strategy exploits the fact that issuers implemented these changes sharply starting in a given calendar month, and these changes were implemented consistently across their entire portfolios consisting of borrowers with many different payment profiles. By controlling for issuer fixed-effects, calendar-month effects, and both fixed and dynamic borrower characteristics in the specifications we describe in more detail below, we seek to mitigate the endogenous selection and timing of the formula changes.

III.A.2 Response to Changes in Minimum Payment Formulas

We begin by presenting simple graphs of the minimum and actual payments as a fraction of the balance for the "control" versus "treated" samples. The control sample includes both issuers that did not change their formulas during the sample period and the pre-change observations for issuers that did change their formulas. Panel A of Figure 7 shows the minimum payment fraction. Because nearly all of the formula changes occur due to increases in floor amounts, only low-balance accounts

[10] In future analysis, we will exploit the kinked nature of the formulas with a regression kink methodology.

experienced significant increases in the fraction of the balance they were required to pay.

Panel B shows the impact of the minimum payment changes on actual consumer payments. The figure shows a roughly parallel increase in payments for low-balance accounts under $1,000. For accounts between $1,000 and $3,000, the slope of payment fraction relative to balance becomes visibly steeper after the formula change, with payments still being higher for treated accounts. For accounts with greater than $3,000 balance, the graph shows that treated accounts make slightly lower payments.

The remainder of this section describes the impacts of the formula changes in a triple-difference regression framework. The regressions include the following controls: quadratics in balance, APR, account age, credit limit, and purchases; dummies for 0% APR, round number purchase, and promotional balance; calendar-month fixed effects; issuer fixed-effects, and loan channel fixed-effects. The controls for account characteristics are fully interacted by issuer. The results are qualitatively robust to inclusion of account fixed-effects, but the results are less precisely estimated. All specifications cluster standard errors at the level of the issuer-month. Appendix figures A-1 and A-2 present results for difference-in-difference specifications that do not interact the effect by balance.

Panel A of Figure 8 presents the impact of the formula changes on the dollar amount of the minimum payment and on actual consumer payments. Table 3 presents the associated regression estimates. The formula change affected increased the minimum payment by between $13 and $20 for all three balance categories. As shown in Appendix Table A-1, the average payment increased by $18.

The monthly dollar payment amounts are not precisely estimated, and none of the coefficients are significant. Nonetheless, the point estimates are close to zero and much smaller than the change in the minimum payment. The null result on payment amounts is surprising since Section II.B showed that a large fraction of consumers pay only the minimum each month, and would hence be affected by the formula change. Thus, these results suggest that countervailing effects may mitigate the impact of the minimum formula change. In addition, the small effect on overall consumer payments suggests that the overall impact of the formula changes on issuer profits may be small.

Panel B shows the impact of the formula changes on indicators for consumer payments relative to the minimum payment and full balance. The first set of columns shows results for paying less than the minimum, or delinquency, as the dependent variable. The results show that delinquencies increased by 1% for low-balance consumers. This is consistent with a small fraction of low-balance consumers facing liquidity constraints, so that even a relatively small dollar increase in the minimum pushes them into delinquency.

The effects on delinquency for consumers with greater than $1,000 are small and insignificant. This pattern of results suggests that lower-balance consumers are more likely to experience liquidity constraints, since they are also disproportionately likely to have lower credit limits. We also note that delinquency demonstrates a relatively extreme form of liquidity constraints, since consumers must pay late fees for failing to pay the minimum that may be even higher than the minimum itself.

The second set of columns shows that the fraction of consumers paying exactly the minimum increased by about 2% for all three groups. This result is largely due to a mechanical effect of the change, since consumers who were previously paying a small amount more than the minimum are now pushed to the new minimum amount. Consistent with this effect, the increase in payments within $50 of the minimum is significantly lower than the increase in those paying exactly the minimum.

The last two sets of columns show that low-balance and high-balance consumers responded very differently to the formula when it came to the propensity to pay in full. Those with balances less than $1,000 had a 1% higher likelihood of paying in full. However, this result is driven entirely by the mechanical effect of the new minimum amounts being equal to their full balance. Thus, the increase in full payments is accompanied by a decrease in those paying between the minimum and full. Surprisingly, accounts with balances greater than $3,000 were 2% *less* likely to pay in full after minimum payments were increased. As we show in the next set of results, this does not result from any mechanical effect of the minimum formula change.

Panel A of Figure 9 shows the impacts of the minimum formula change on the distribution of minimum payments as a fraction of the total balance. As a summary measure, the first set of columns shows the change in the average minimum payment fraction. The results show that the average minimum payment increased by 10% of the total balance for low-balance consumers. But the minimum fraction increased by only 0.8% for those with balances between $1,000 and $3,000, and by only 0.3% for those with balances greater than $3,000.

Consistent with the mechanical impact of the formula change for low-balance consumers described above, the fraction of minimum payments that constituted the full balance increased by 4% for this group. The changes in the minimum fraction are very small throughout the distribution for both higher-balance groups. If all groups reacted consistently to the minimum formula change, we would expect to see a similar pattern of effects on the actual payments, scaled by the fraction of consumers who pay the minimum.

Panel B shows that the pattern of impacts on actual payments as a fraction of the balance contrasts starkly with the changes in the minimum. While the pattern looks qualitatively similar for low-balance consumers, both higher-balance consumer groups exhibit much larger responses in payment fractions than the actual formula change itself. In particular, consumers with balances greater than $3,000 decrease their average payments by 2% of their balance. This effect is driven entirely by a decrease in those paying in full. Payments that were previously the full balance move to the lower part of the payment distribution, concentrated between 0–30% of the balance.

III.B Impact of Changes to Disclosure Requirements

This section describes the payment disclosures implemented by the Credit CARD Act of 2010 and their impacts on consumer payments.

III.B.1 Description of the CARD Act Disclosures

The CARD Act implemented four separate payment-related disclosures on February 22, 2010. First, a late payment warning displayed the following text: "**Late Payment Warning:** If we do not receive your minimum payment by the date listed above, you may have to pay a $35 late fee and your APRs may be increased up to the Penalty APR of 28.99%." A general minimum payment warning stated that "**Minimum Payment Warning:** If you make more than the minimum payment each period, you will pay less in interest and pay off your balance sooner."

Instead of the standard minimum payment warning, consumers whose stated minimum payments did not amortize their balance received a more drastic warning: "**Minimum Payment**

Warning: Even if you make no more charges using this card, if you make only the minimum payment each month we estimate you will never pay off the balance shown on this statement because your payment will be less than the interest charged each month." Finally, the majority of statements were also required to include a comparison between the payment duration and interest costs of paying only the minimum versus paying an amount that would amortize the loan amount without additional purchases in three years. An example of this disclosure is shown in Figure 10.

Our regression approach exploits the details of the CARD Act rules for the minimum payment warnings and 3-year payment calculation, which detail which disclosures are presented to consumers based on observable characteristics of the accounts. Specifically, consumers who paid their balances in full for two months in a row are exempt from the disclosures. The remainder receive either the standard minimum payment warning or the non-amortization warning, based on whether their payment amortizes the balance.

Among those who receive either of the minimum payment warnings, only consumers whose minimum payments are less than the 3-year payment amount receive the 3-year calculation disclosure. These rules allow us to separately identify the impacts of the three different disclosures. Furthermore, the receipt of the disclosures varies over time and across issuers depending on the consumers payment behavior and minimum payment, generating additional variation. Figure 11 shows the variation in eligibility for the different disclosures by balance.[11]

III.B.2 Response to Changes in Disclosures

Our primary specification employs a triple-difference regression framework similar to that described in Section III.A. However, Appendix Tables A-1–A-4 also present difference-in-difference results with issuer fixed-effects but no interactions by specific disclosure eligibility within issuer. Because the disclosures were implemented on the same date for all issuers, we cannot include calendar month fixed-effects in the difference-in-difference specification. Instead, the appendix results include a quadratic in calendar month.

The triple-difference framework employs the same specification as described in Section III.A, with an additional fully-interacted linear control for the minimum payment to separately identify the

[11] To preserve the confidentiality of the issuer identities included in the sample, we do not present the time series of eligibility which includes discrete changes due to changes in issuer minimum payment formulas over time.

impacts of the disclosures from the effects of changes in the minimum payment formulas described in the previous section. Because the difference-in-difference and triple-difference specifications rely on different sources of variation, the Appendix tables act as a useful robustness check for the main results. Nonetheless, as we describe next, we find starkly different results for the different disclosures, so the informativeness of the difference-in-difference specification is limited.

Panel A of Figure A-3 shows the impacts of the disclosures on the dollar amount paid and the fraction of payments relative to the minimum and full. The first set of columns indicates that consumers receiving only the minimum payment warning reduced their payments by \$6 per month. In contrast, those receiving the non-amortization warning increased payments by \$24 per month.

The second set of columns shows that delinquencies decreased after all three disclosures, by 1% for those receiving either of the minimum payment disclosures plus the 3-year payment calculation, and by 3% for those receiving the minimum payment warning only. The next two columns show that the minimum payment warning led to a 2% increase in those paying the minimum, which may largely be driven by moves away from delinquent payments. Those receiving both the non-amortization warning and the 3-year calculation had 1% decreases in their propensity to pay the minimum.

All three groups also exhibited increases in the propensity to pay between the minimum and full amounts. Those receiving only the minimum increased this type of payment by only 0.6%, but those receiving the 3-year calculation increased their payments between the minimum and the full amounts by 2–3%. The final set of columns shows the surprising result that consumers who received the 3-year payment calculation and the standard minimum payment warning *reduced* their payments of the full amount by 1.4%.

Panel B shows the impacts of the disclosures on the distribution of payments. On average, those receiving the minimum warning only increased their payments by 0.9% of the balance. Those also receiving the 3-year calculation reduced their payments by 0.6%, which is comprised of a combination of increased payments in the lower part of the distribution (largely due to a move away from minimum payments) and the decrease in full payments. Those receiving the non-amortization warning and the 3-year payment calculation had insignificant overall changes in payment fraction, but also displayed increases in payments at the bottom of the distribution, moderate increases in payments between 20–99% of the balance, and a small decrease in full payments.

Figure 12 presents estimates of changes in the payment distribution based on the number of months needed to pay off the balance in full at the given APR assuming no new purchases. Panel A shows the results focusing on a window around the 3-year amount highlighted in one of the disclosures. The figure shows a pronounced increase in payments around the 3-year amount, with a total 0.6% increase in payments between 34–36 months and a total 1.1% increase in payments between 31–39 months.

Panel B shows the changes across the entire distribution. In addition to similar effects as those described above, both the 3-year calculation and the non-amortization warning are associated with 1.3–1.5% declines in with repayment periods of greater than 75 months, and with 0.9–2.1% declines in non-amortizing or delinquent payments. Those receiving only the minimum payment warning did not reduce payments with durations greater than 75 months, but did reduce non-amortizing or delinquent payments by 2.5%.

IV Discussion and Conclusion

In this paper, we establish patterns in credit card repayment behavior from a unique sample covering a large portion of the U.S. credit card market. In our descriptive analysis, we find that payments have a bimodal distribution. Only 9% of account-months have payments between 20% and 99% of their balances. Payments are less than 20% of the balance for 58% of account-months, and the remaining third of account-months are paid in full. Furthermore, payment behavior is strongly persistent within account, so that accounts that are typically paid in full are done so 90% of the time, and those that are paid close to the minimum are done so 77% of the time. Payments are bimodal even within each account and each typical payment type, so that accounts that are typically paid in full sometimes switch to the minimum and vice versa, with very few intermediate payment amounts.

The bimodal distribution of payments is difficult to reconcile with a rational model where consumers have stable permanent income and income shocks that could lie between the minimum payment and outstanding balance. The clustering of payments below 20% of the balance suggests that the minimum payment shown on all credit card statements (which are typically below 10% of the balance) may have an anchoring effect that induces lower payments than consumers would otherwise pay.

Our findings across two different types of policy changes give credence to the anchoring hypothesis. We present evidence that in response to modest changes in both the minimum required payment and changes in the disclosed information, some consumers adjust their behavior in dramatic and potentially perverse ways.

Changes in the minimum payment formula can be interpreted as shifting an existing anchor, along with shifting an economic constraint. The introduction of a 3-year repayment calculation, on the other hand, can be interpreted as introducing a new anchor without changing the economic constraints. In response to both of these changes, borrowers become more likely to locate their payment at the newly-changed or newly-salient anchors and become less likely to pay their balances in full. We interpret our results to suggest that the existence and location of anchors impact consumer choices. Moreover, anchors at low payment amounts can have *negative* impacts on consumer payments. In sum, the formula and disclosures around the minimum payment, the most relevant default in the credit card market, have important impacts on the amount and cost of borrowing using a credit card.

By improving our understanding of consumer behavior, these findings have significant implications for designing optimal defaults in the credit card market (see, e.g. Carroll et al. (2009)). As discussed by Choi, Laibson, Madrian and Metrick (2003), defaults should be set such that they are optimal for the largest fraction of individuals possible. Although Choi et al. (2003) speculate that setting a 'bad' default may lead more agents to deviate from that default, we do not find evidence for this effect in the credit card market.

The results also call into question whether consumers are fully informed about the choices they make in repaying credit card debt (Soll, Keeney and Larrick 2013). That some consumers move to pay off their debts more slowly in response to changes to minimum payments suggests a potential role for regulation and innovation to improve disclosures and encourage faster repayment. The form that future policies would take and their ability to overcome the powerful draw of perverse anchors (or to create new personalized positive anchors) is a promising area of future research.

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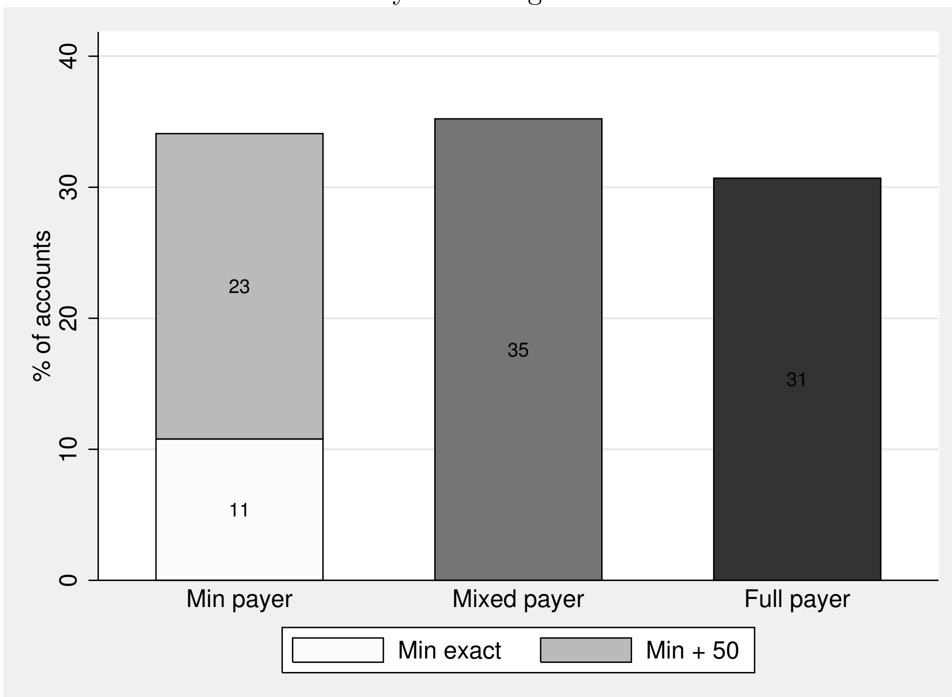
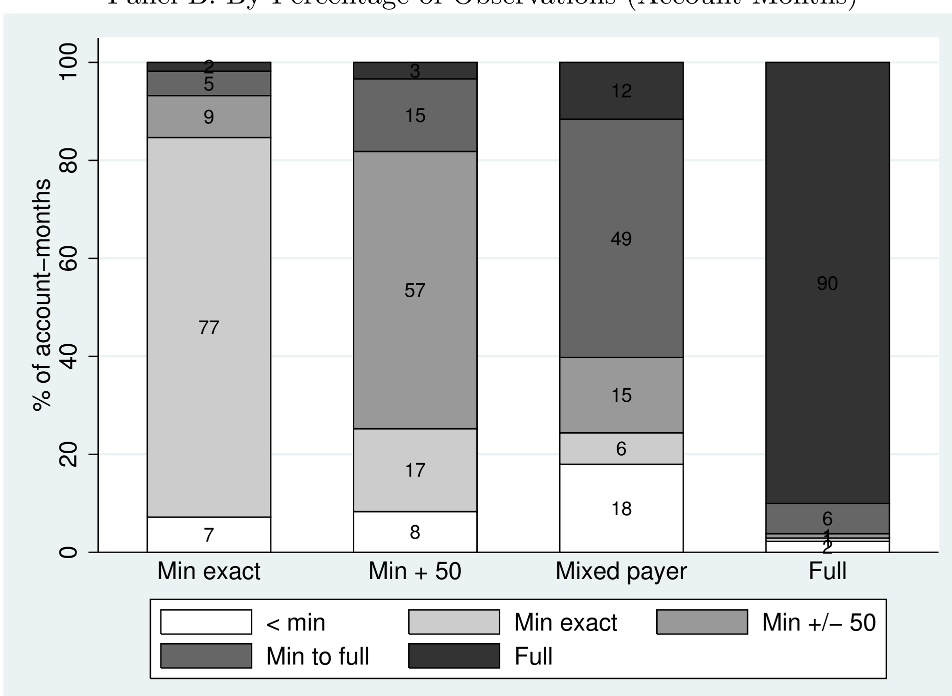
Figure 1: Composition of Payer Types

Panel A: By Percentage of Accounts

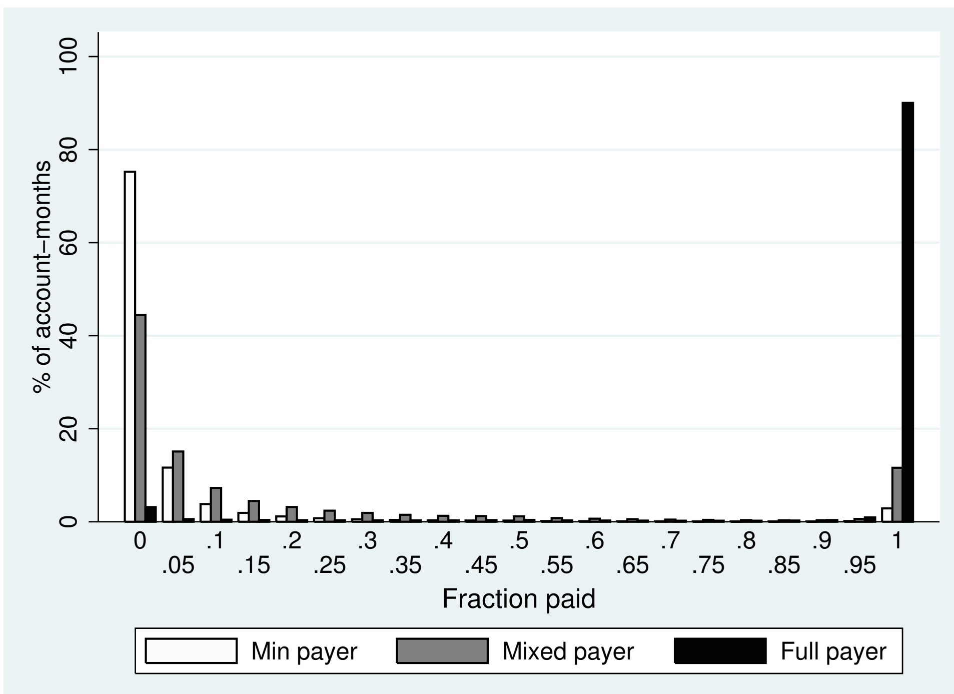


Panel B: By Percentage of Observations (Account-Months)



Note: Panel A shows the distribution of accounts by payer type, classified by whether the account was paid in full, paid based on the minimum amount, or paid within $50 of the minimum amount in at least 50% of months over which it can be observed. Accounts that do not pay either the full or minimum in at least 50% of months are classified as mixed payers. Panel B shows the composition of payments for all positive-balance account-months within each payer type relative to the minimum and full payment on each month's statement.

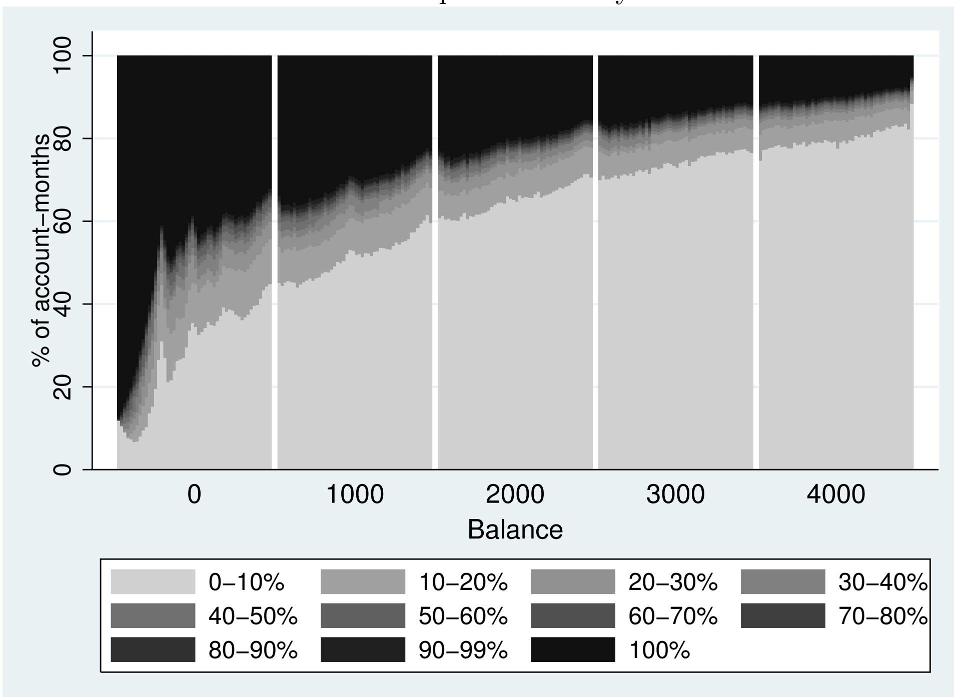
Figure 2: Distribution of Payments as Fraction of Balance



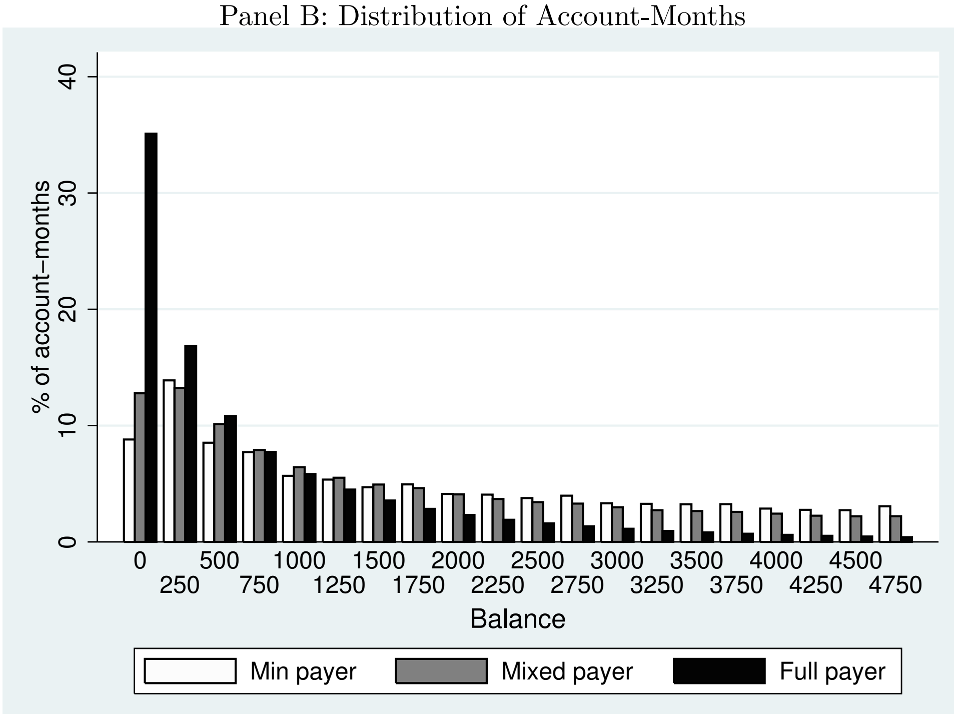
Note: The figure shows the distribution of payments as a fraction of the outstanding balance within each payer type.

Figure 3: Payments and Payer Types by Balance

Panel A: Composition of Payments



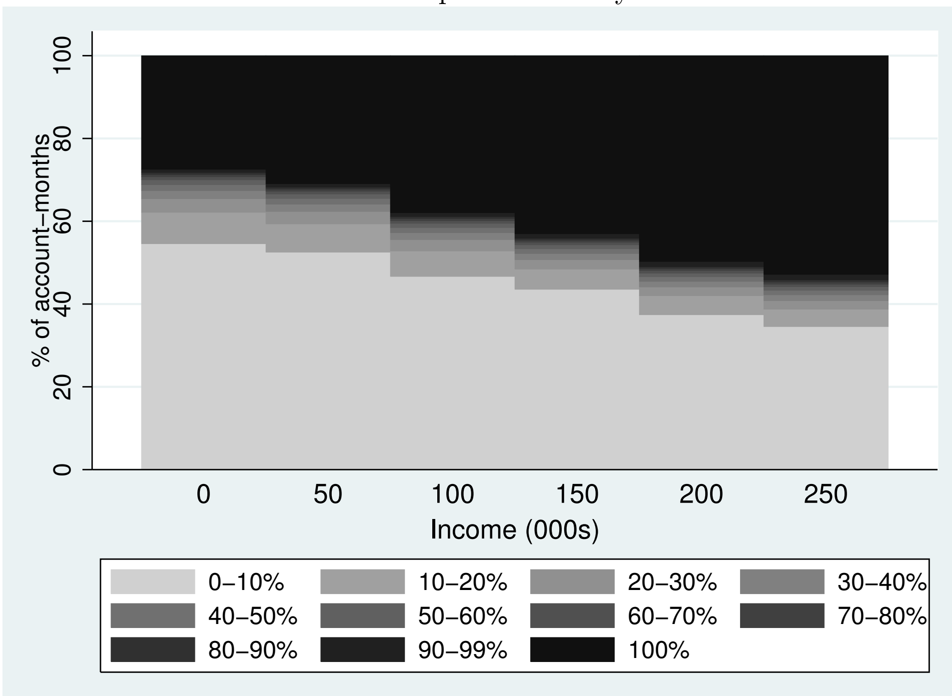
Panel B: Distribution of Account-Months



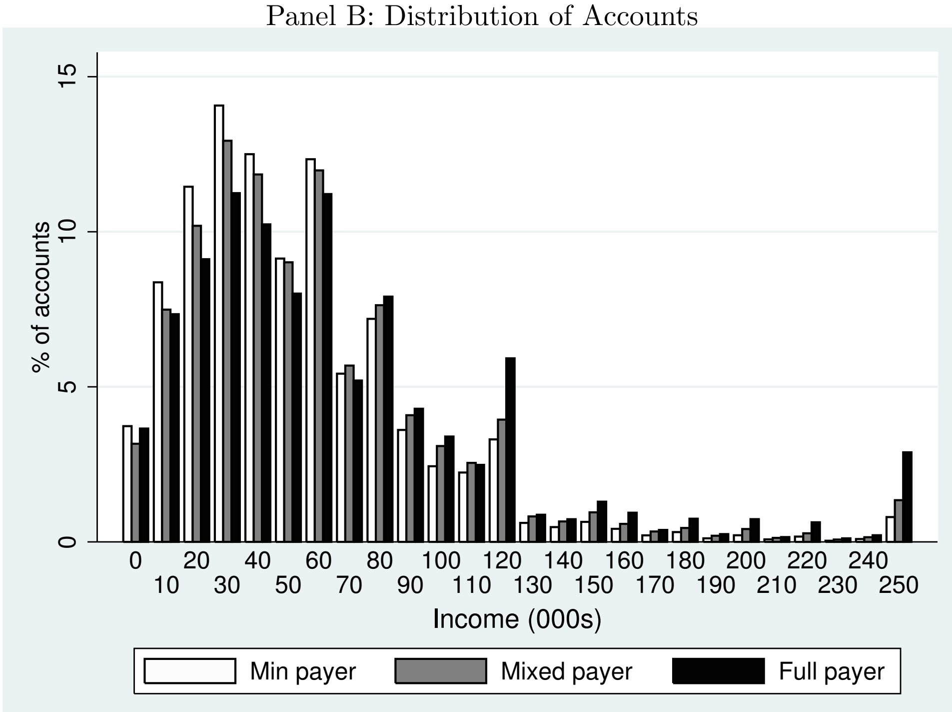
Note: Balances are grouped into $20 bins for Panel A and $250 bins for Panel B. Balances of $5,000 or above are top-coded at $4,999.

Figure 4: Payments and Payer Types by Income

Panel A: Composition of Payments



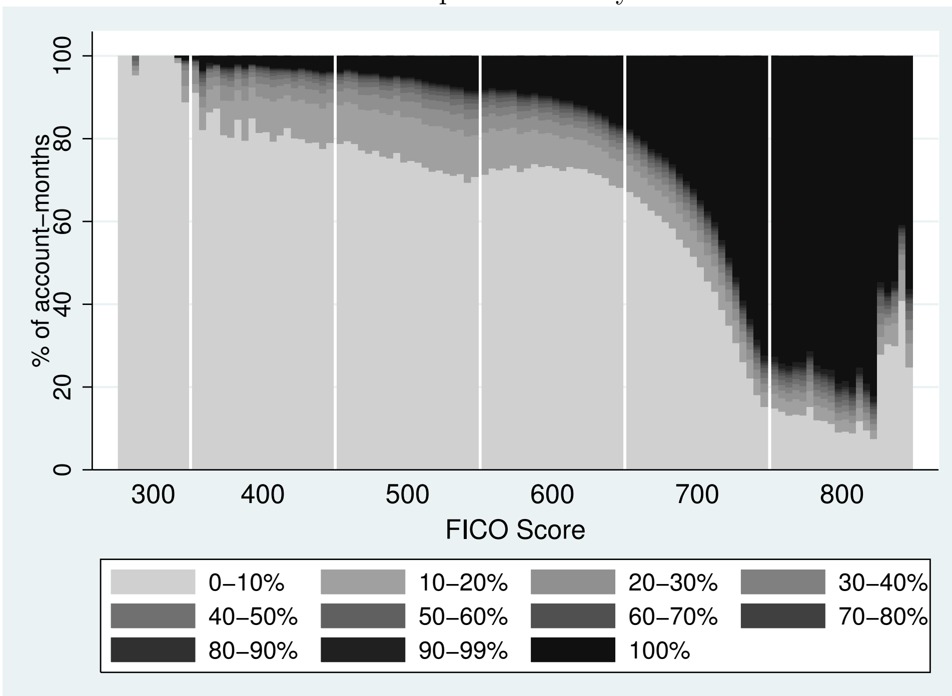
Panel B: Distribution of Accounts



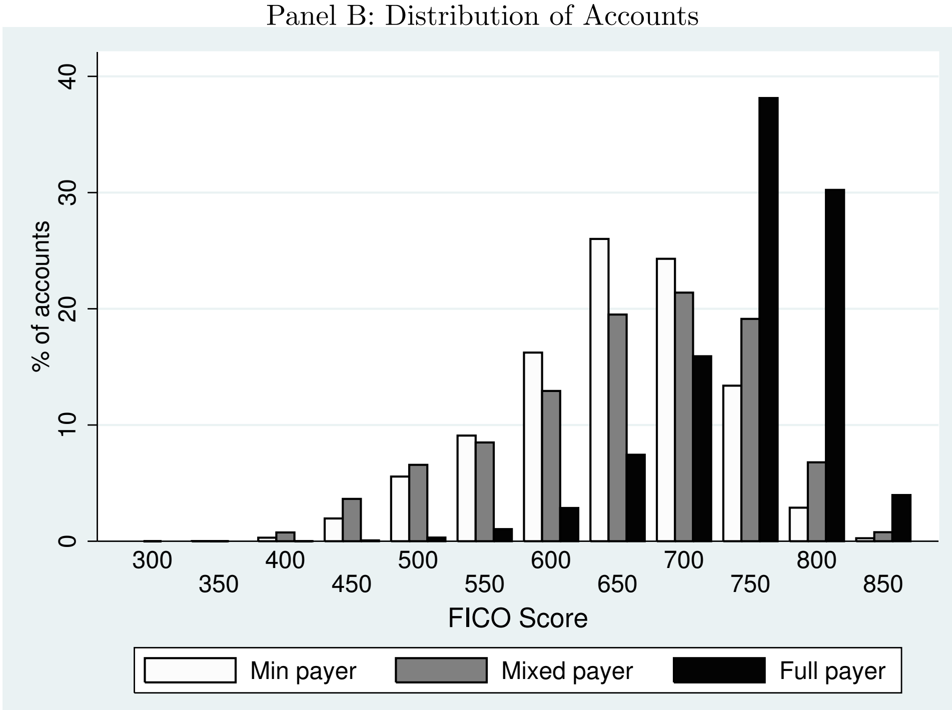
Note: Incomes above $250,000 are top-coded. Panel A is based on the latest available income for each statement-month, and Panel B is based on average income across all observations for each account.

Figure 5: Payments and Payer Types by FICO Score

Panel A: Composition of Payments



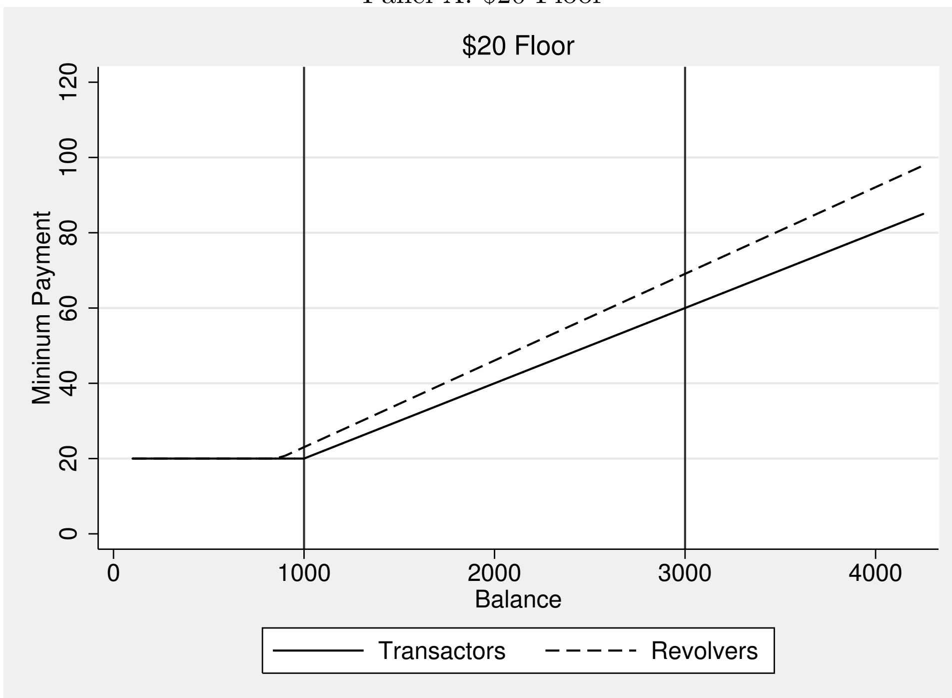
Panel B: Distribution of Accounts



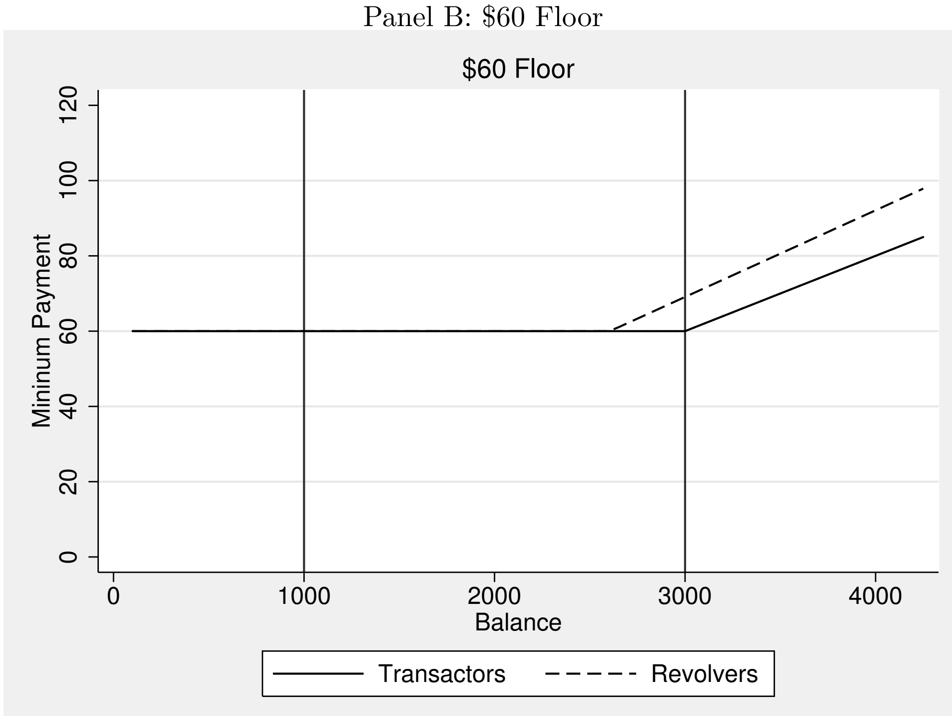
Note: FICO scores are grouped into 5-point bins for Panel A and 50-point bins for Panel B. Panel A is based on the latest available FICO score in each statement-month, and Panel B is based on average FICO across all observations for each account.

Figure 6: Stylized Minimum Payment Formula

Panel A: $20 Floor



Panel B: $60 Floor



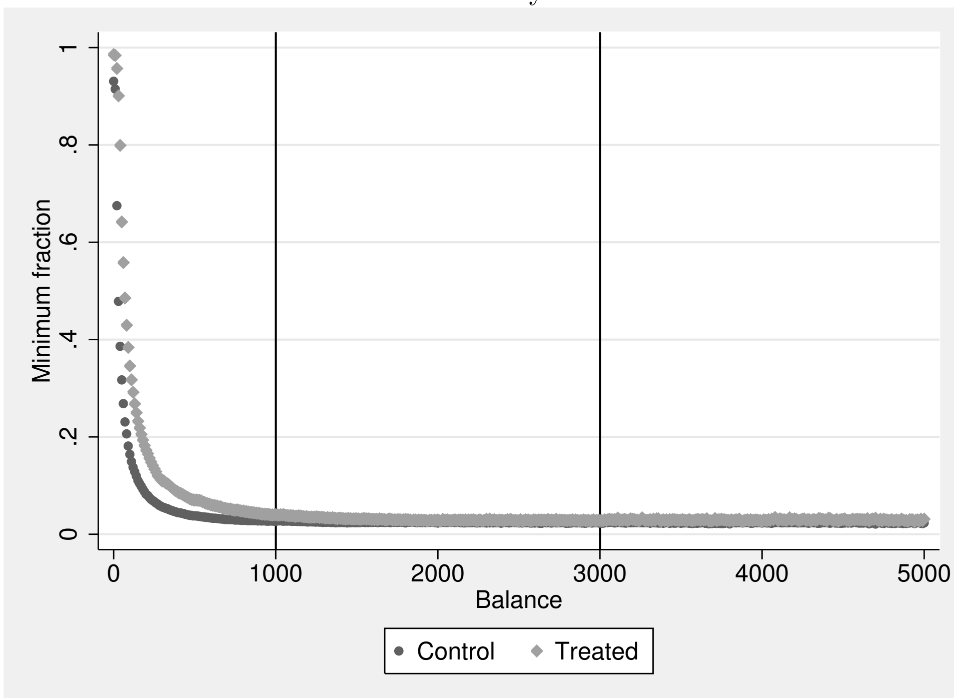
The figure presents the minimum payment as a function of balance for the following stylized minimum payment formula:

$$minimum = \max\{floor, 1\% \cdot balance + interest + fees, 2\% \cdot balance + fees\} \quad (2)$$

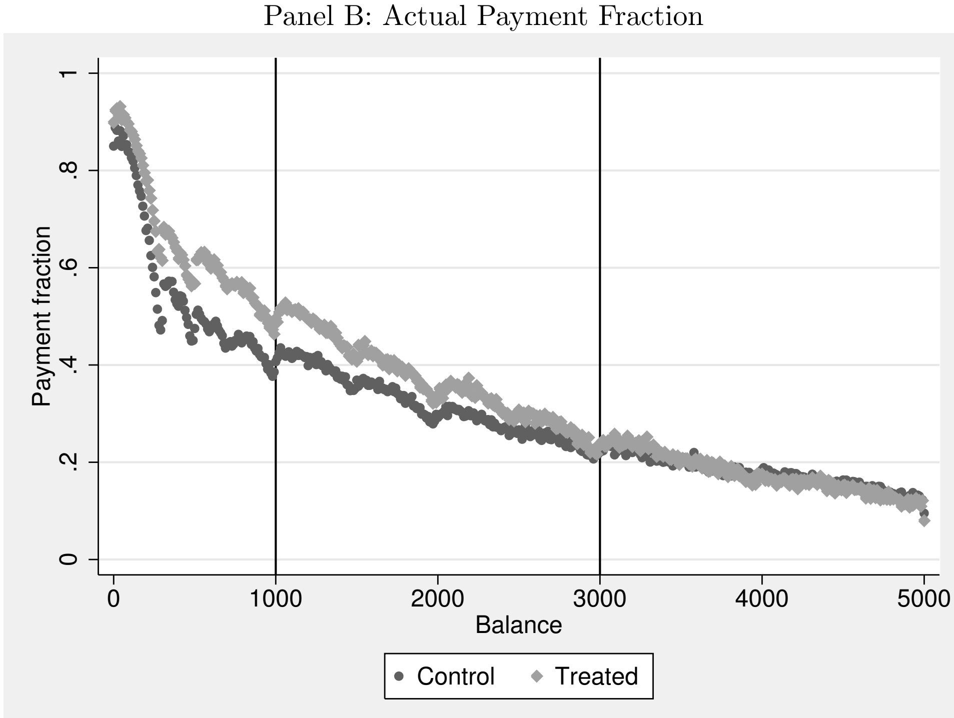
where $floor = \$20$ in the left panel and $floor = \$60$ in the right panel. The interest rate is assumed to be 16%.

Figure 7: Graphical Difference-in-Differences

Panel A: Minimum Payment Fraction



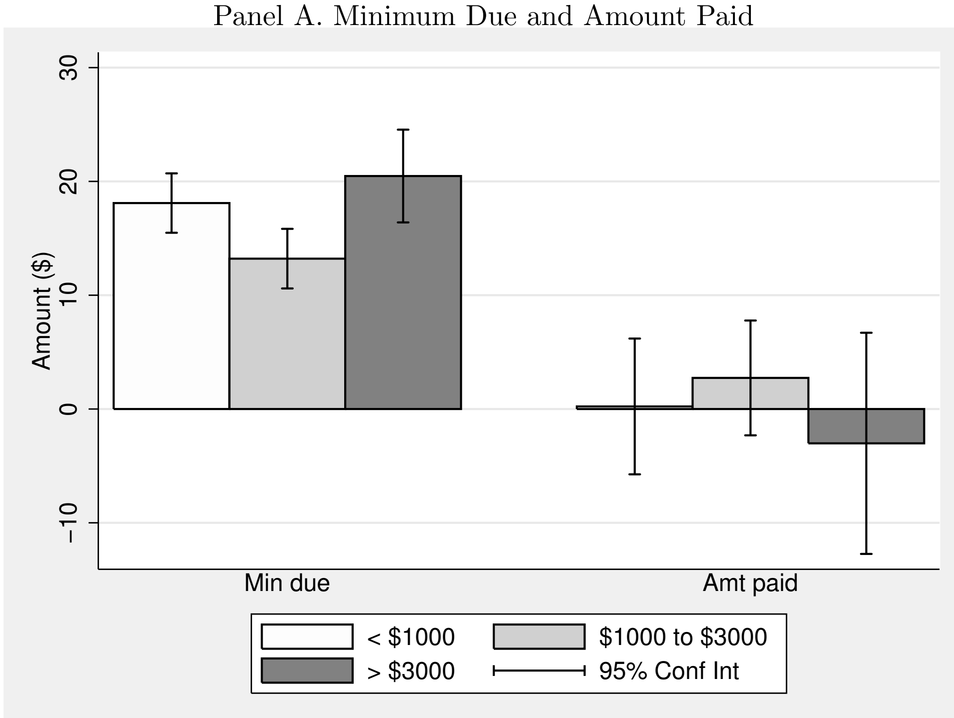
Panel B: Actual Payment Fraction



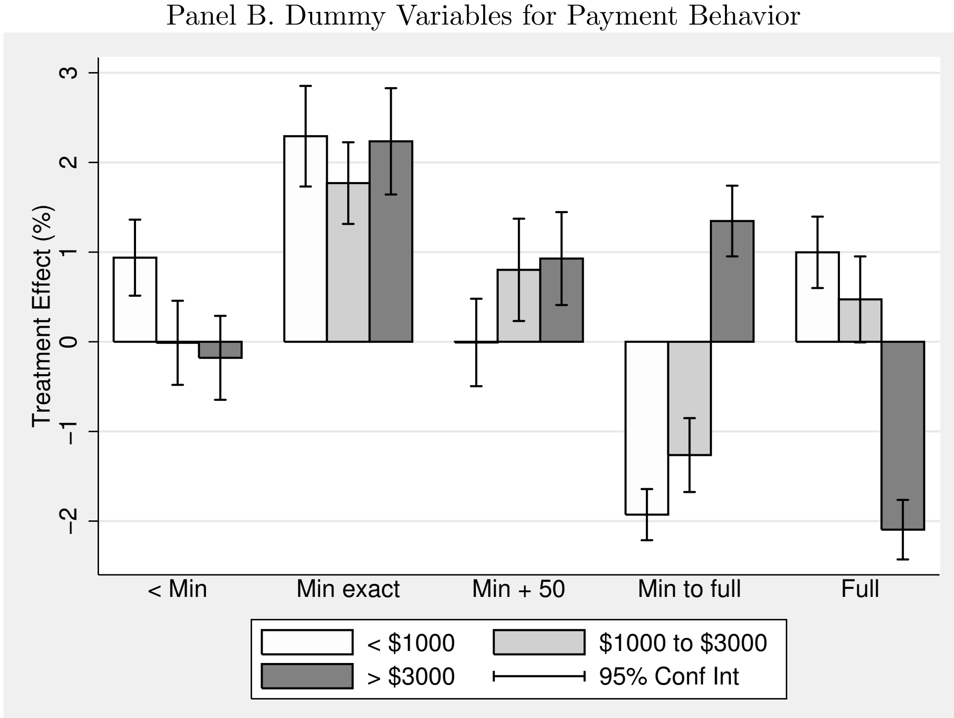
Note: The figures show the average minimum and actual payments as a fraction of the outstanding balance within $10 bins by balance. Observations in the control group include account-months prior to changes in issuer minimum payment formulas, and all account-months with issuers that did not change their formulas. Observations in the treatment group include account-months after issuers changed their formulas.

Figure 8: Regression Estimates of Impact of Minimum Formula Changes on Payments

Panel A. Minimum Due and Amount Paid



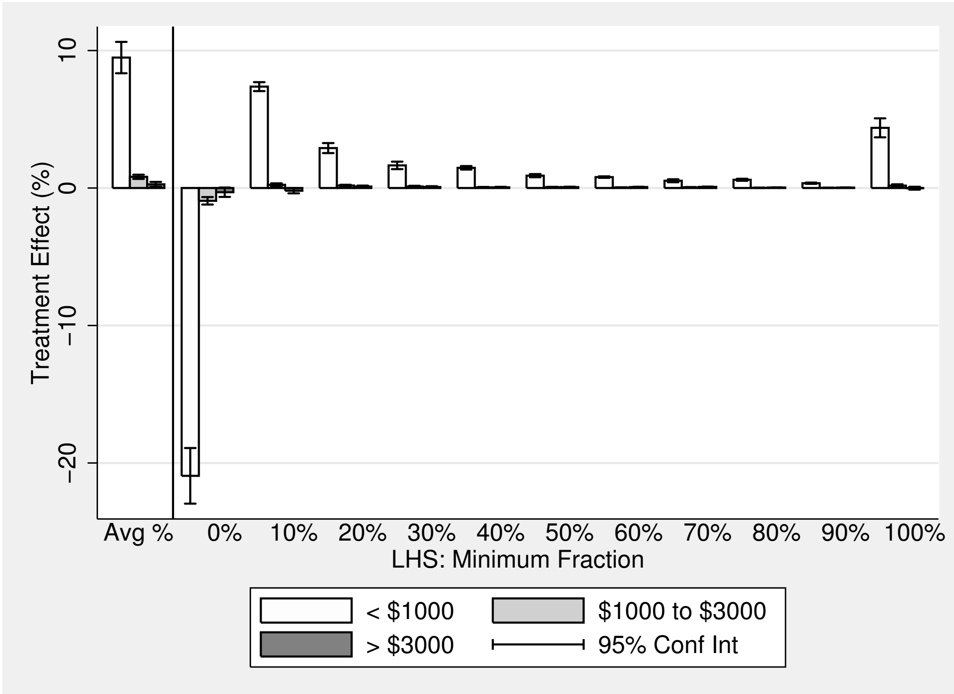
Panel B. Dummy Variables for Payment Behavior



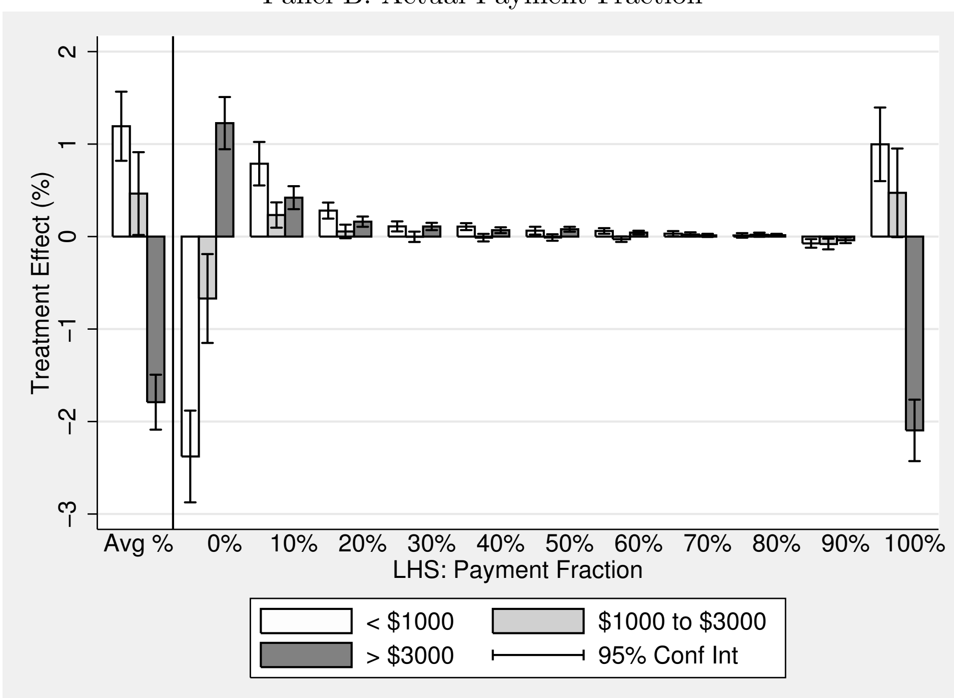
Note: The figures show triple-difference regression estimates for the effect of issuer changes in minimum payments on the required minimum payment and consumer payments. Each group of columns represent estimates from a single regression with interactions of the treatment effect with indicators for the balance amount. The dependent variables in Panel A are dollar amounts of the minimum and actual payment. The dependent variables in Panel B are dummy variables that indicate payment amounts relative to the minimum payment and full balance.

Figure 9: Regression Estimates of Impact of Minimum Formula Changes on Distribution of Payments

Panel A: Minimum Payment Fraction



Panel B: Actual Payment Fraction



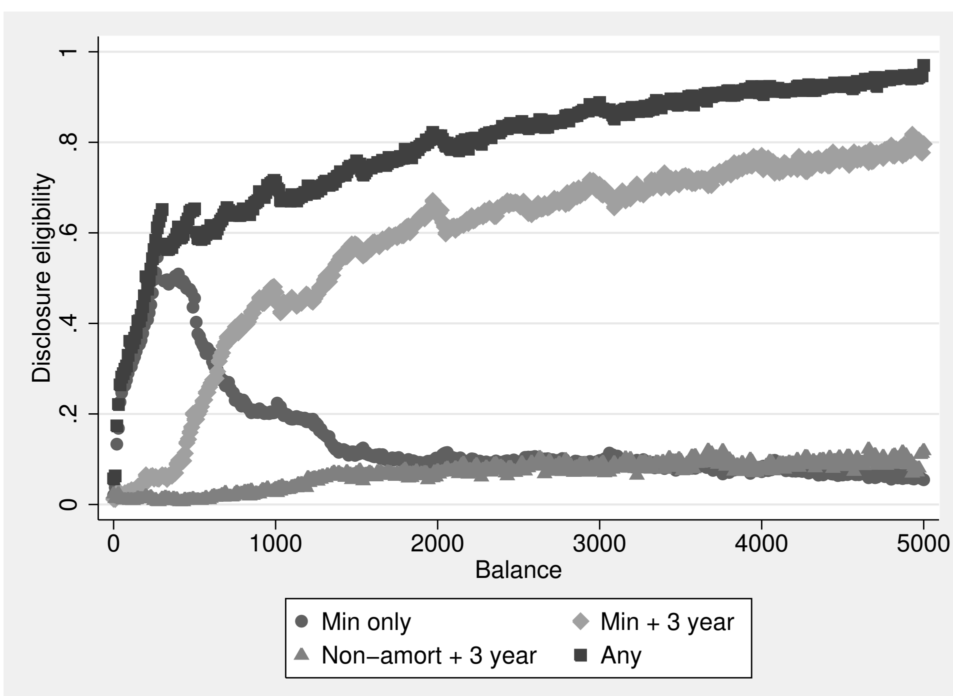
Note: The figures show triple-difference regression estimates for the effect of issuer changes in minimum payments on the distribution of required minimum payment and consumer payments as a fraction of the balance. Each group of columns represent estimates from a single regression with interactions of the treatment effect with indicators for the balance amount. The dependent variables in the first set of columns in each figure are the minimum and actual payments in a given statement-month as a fraction of the balance. The dependent variables in the remaining columns are indicators for whether the minimum and actual payments as a fraction of the balance are in one of eleven percentage bins: 0-9%, 10-19%, ..., 90-99%, and 100%.

Figure 10: Example of Three-Year Calculation Disclosure Mandated by the CARD Act

If you make no additional charges using this card and each month you pay. . .	**You will pay off the balance shown on this statement in about. . .**	**And you will end up paying an estimated total of. . .**
Only the minimum payment	11 years	$4,745
$103	3 years	$3,712 (Savings = $1,033)

Source: Federal Reserve Board:
`http://www.federalreserve.gov/consumerinfo/wyntk_creditcardrules.htm`.

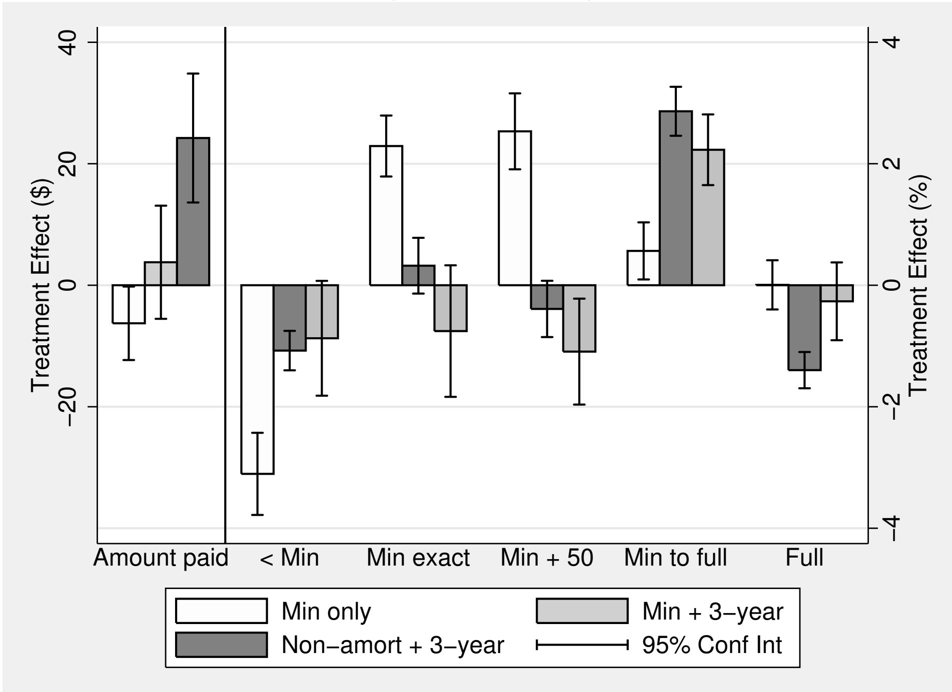
Figure 11: Eligibility for Disclosures by Balance



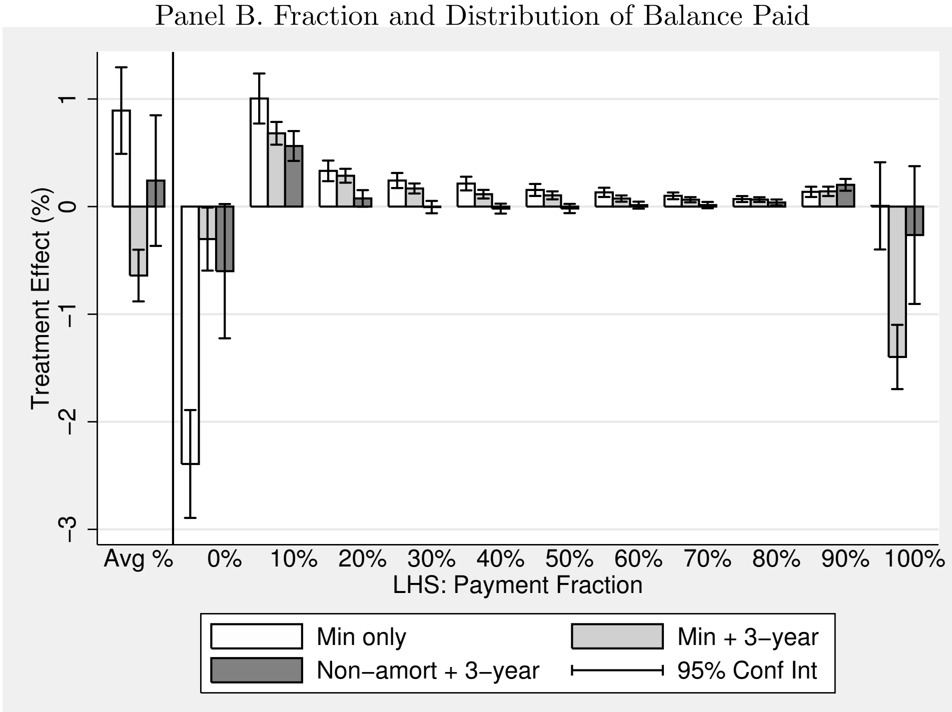
Note: The figure shows the fraction of account-months that receive each combination of CARD Act disclosures after February 22, 2010 within $10 bins by balance.

Figure 12: Regression Estimates of Impact of CARD Act Disclosures on Consumer Payments

Panel A. Payment Summary Variables



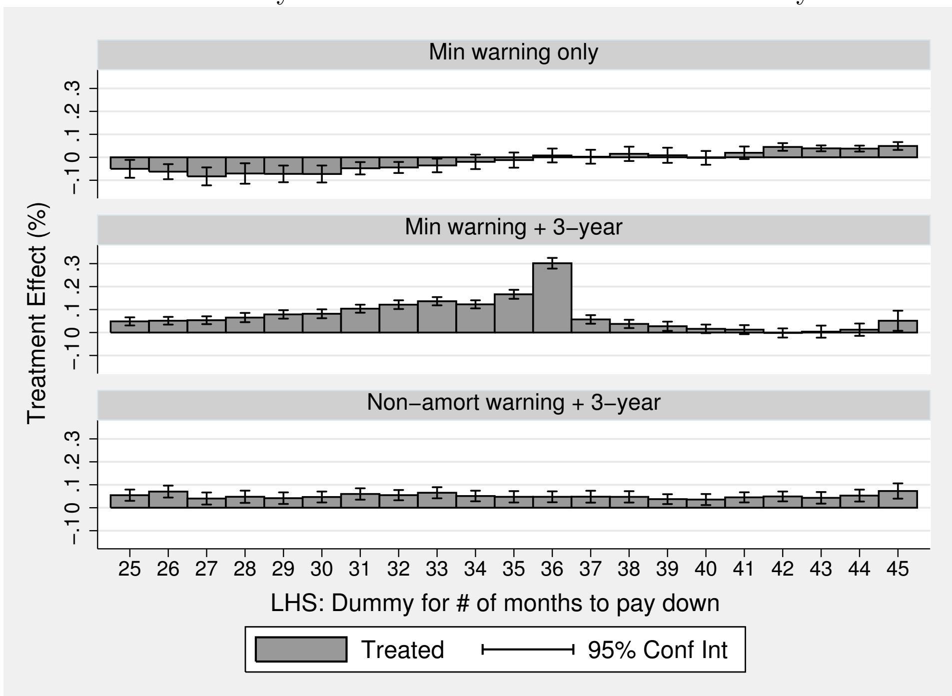
Panel B. Fraction and Distribution of Balance Paid



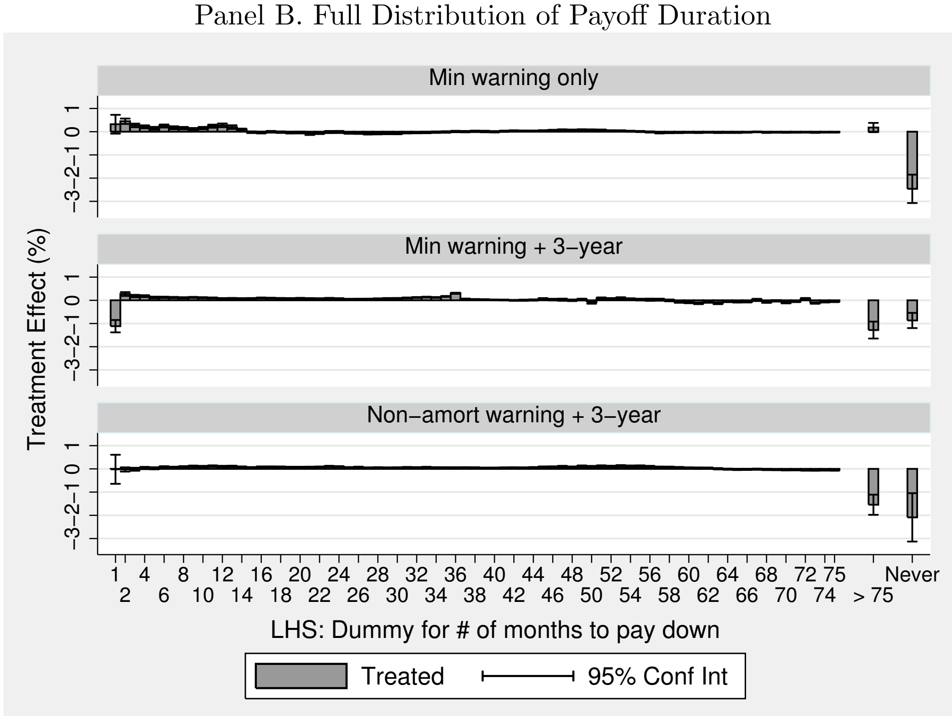
Note: The figures show triple-difference regression estimates for the effect of CARD Act disclosures on consumer payments. Each group of columns represent estimates from a single regression with interactions of the treatment effect with indicators for the combination of disclosures received. The dependent variable in the first set of columns in Panel A is the dollar amount paid. The dependent variables in the remaining columns are dummy variables that indicate payment amounts relative to the minimum payment and full balance. The dependent variable in the first set of columns in Panel B is the actual payments in a given account-month as a fraction of the balance. The dependent variables in the remaining columns are indicators for whether actual payment as a fraction of the balance is in one of eleven percentage bins: 0-9%, 10-19%, ..., 90-99%, and 100%.

Figure 13: Regression Estimates of the Impact of the CARD Act Disclosures on Consumer Payment Duration

Panel A. Payments between 25 and 45 Months to Payoff



Panel B. Full Distribution of Payoff Duration



Note: The figures show triple-difference regression estimates for the effect of CARD Act disclosures on consumer payments. Each vertical column of three estimates across the three sub-graphs represent estimates from a single regression with interactions of the treatment effect with indicators for the combination of disclosures received. The dependent variables are dummy variables that indicate the number of months it would take to amortize the full balance at the consumer's current interest rate. Panel A shows the estimates for repayment durations of 25 to 45 months, and Panel B shows estimates for the full distribution of repayment durations. The estimates in Panel A are a subset of the estimates in Panel B.

Table 1: Summary Statistics

	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.	Mean	Median	Std. Dev.
	A. All Accounts			B. Full payer			C. Min payer			D. Mixed payer		
Card and account												
Income	$71,151	$56,000	$473,245	$85,332	$62,499	$833,690	$60,436	$49,001	$202,139	$70,186	$58,500	$150,657
Fico	712	724	86	777	788	51	673	682	77	692	703	85
Account age	8.86	6	7.80	12.00	11	8.50	7.42	5	6.80	7.52	5	7.20
Original credit limit	$4,880	$4,000	$4,609	$6,781	$6,000	$5,579	$3,929	$3,000	$3,727	$4,686	$3,800	$4,420
Current credit limit	$9,524	$8,000	$8,541	$12,665	$11,350	$9,509	$7,042	$5,000	$6,727	$9,182	$7,400	$8,353
Retail APR	16.12	15	8.10	14.61	14	5.20	16.45	17	8.90	17.11	16	9.20
Multiple relationships	31%			29%			31%			33%		
Multiple cards	33%			28%			34%			35%		
Joint account	9%			16%			5%			7%		
Has annual fee	12%			11%			13%			13%		
Has debt suspension	10%			5%			12%			13%		
Revolve / Paydown Behavior												
Revolving balance > 0	67%			10%			97%			88%		
Finance charge > 0	57%			11%			78%			77%		
Purchase / Balance	58%	84%	40%	94%	100%	20%	13%	4%	20%	31%	14%	40%
Purchase > 0	56%			89%			33%			51%		
Account Behavior												
Utilization	46%	38%	40%	10%	4%	20%	70%	84%	30%	53%	55%	40%
Balance	$3,233	$1,413	$4,588	$1,071	$398	$2,272	$4,394	$2,883	$4,776	$3,994	$2,074	$5,219
Promotional	$520	$0	$2,086	$66	$0	$742	$803	$0	$2,520	$642	$0	$2,336
Cash advance	$196	$0	$1,070	$8	$0	$229	$341	$0	$1,368	$218	$0	$1,158
Penalty	$403	$0	$1,944	$57	$0	$578	$375	$0	$1,756	$731	$0	$2,690
Balance > 0	95%			90%			98%			95%		
Promotional	15%			4%			23%			18%		
Cash advance	11%			1%			19%			12%		
Penalty	12%			4%			11%			21%		
Cash Adv usage	2%			1%			2%			3%		
Bal Trans usage	0.6%			0.1%			0.7%			0.8%		
Payment and Delinquency Behavior												
Fraction paid	39%	9%	40%	94%	100%	20%	8%	3%	20%	23%	6%	30%
Minimum payment	$88	$39	$275	$32	$20	$75	$96	$51	$171	$130	$51	$420
Actual payment	$538	$147	$1,584	$1,071	$430	$2,320	$163	$67	$675	$436	$150	$1,262
Payment:												
< min	10%			2%			8%			18%		
Minimum exact	15%			1%			36%			6%		
Minimum +/- 50	35%			2%			77%			22%		
Min to full	23%			6%			12%			49%		
Full	33%			90%			3%			12%		
Charged fees:												
Late	9%			3%			9%			15%		
Overlimit	1%			0.1%			1%			3%		
NSF	0.2%			0.1%			0.2%			0.4%		
Had past due	9%			2%			8%			17%		

Table 2: Regression Estimates of Impact of Minimum Formula Changes on Payments

	A: Dollar Amounts		B: Dummy Variables for Payment Relative to Minimum and Full				
	Minimum due	Amount paid	Paid < min	Paid min. exact	Paid min. 50	Paid min to full	Paid full
Treatment	18.100	0.230	0.009	0.023	0.000	- 0.019	0.010
X < 1k	(1.320)	(3.010)	(0.002)	(0.003)	(0.003)	(0.001)	(0.002)
	[0.000]	[0.940]	[0.000]	[0.000]	[0.970]	[0.000]	[0.000]
Treatment	13.200	2.730	0.000	0.018	0.008	- 0.013	0.005
X 1k to 3k	(1.320)	(2.550)	(0.002)	(0.002)	(0.003)	(0.002)	(0.002)
	[0.000]	[0.280]	[0.960]	[0.000]	[0.006]	[0.000]	[0.052]
Treatment	20.500	- 3.020	- 0.002	0.022	0.009	0.013	- 0.021
X > 3k	(2.060)	(4.910)	(0.002)	(0.003)	(0.003)	(0.002)	(0.002)
	[0.000]	[0.540]	[0.450]	[0.000]	[0.000]	[0.000]	[0.000]
R^2	0.260	0.600	0.150	0.180	0.260	0.082	0.550

Note: The table shows triple-difference regression estimates for the effect of issuer changes in minimum payments consumer payments. Standard errors are shown in parentheses, and p-values are shown in brackets. Standard errors are clustered by issuer-month. N=16,402,335 for all regressions.

Table 3: Regression Estimates of Impact of Minimum Formula Changes on Distribution of Payments

	Fraction	0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-99%	100%
					A: Minimum as fraction of balance							
Treatment	0.095	- 0.210	0.074	0.029	0.016	0.015	0.009	0.008	0.005	0.006	0.004	0.044
X < 1k	(0.006)	(0.010)	(0.002)	(0.002)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)	(0.004)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Treatment	0.008	- 0.009	0.002	0.002	0.001	0.000	0.001	0.000	0.001	0.000	0.000	0.002
X 1k to 3k	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.000]	[0.000]	[0.000]	[0.002]	[0.000]	[0.000]
Treatment	0.003	- 0.003	- 0.002	0.001	0.001	0.001	0.001	0.001	0.001	0.000	0.000	0.000
X > 3k	(0.001)	(0.002)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)
	[0.002]	[0.075]	[0.037]	[0.002]	[0.018]	[0.002]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.780]
R^2	0.240	0.310	0.093	0.042	0.026	0.019	0.014	0.010	0.008	0.007	0.005	0.066
					B: Payment as fraction of balance							
Treatment	0.012	- 0.024	0.008	0.003	0.001	0.001	0.001	0.001	0.000	0.000	- 0.001	0.010
X < 1k	(0.002)	(0.003)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.003]	[0.000]	[0.027]	[0.320]	[0.002]	[0.000]
Treatment	0.005	- 0.007	0.002	0.001	0.000	0.000	0.000	0.000	0.000	0.000	- 0.001	0.005
X 1k to 3k	(0.002)	(0.002)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
	[0.041]	[0.006]	[0.001]	[0.140]	[0.930]	[0.560]	[0.570]	[0.056]	[0.051]	[0.082]	[0.006]	[0.052]
Treatment	- 0.018	0.012	0.004	0.002	0.001	0.001	0.001	0.000	0.000	0.000	0.000	- 0.021
X > 3k	(0.002)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.140]	[0.042]	[0.011]	[0.000]
R^2	0.630	0.550	0.027	0.011	0.007	0.005	0.005	0.003	0.003	0.003	0.009	0.550

Note: The table shows triple-difference regression estimates for the effect of issuer changes in minimum payments consumer payments. Standard errors are shown in parentheses, and p-values are shown in brackets. Standard errors are clustered by issuer-month. N=16,402,335 for all regressions.

Table 4: Regression Estimates of Impact of CARD Act Disclosures on Consumer Payments

	Dollar amount paid	Paid < min	Paid min. exact	Paid min. 50	Paid min to full	Paid full
Minimum only	- 6.260	- 0.031	0.023	0.025	0.006	0.000
	(3.050)	(0.003)	(0.003)	(0.003)	(0.002)	(0.002)
	[0.041]	[0.000]	[0.000]	[0.000]	[0.018]	[0.970]
Minimum + 3-year	3.780	- 0.011	0.003	- 0.004	0.029	- 0.014
	(4.700)	(0.002)	(0.002)	(0.002)	(0.002)	(0.002)
	[0.420]	[0.000]	[0.170]	[0.097]	[0.000]	[0.000]
Non-amort + 3-year	24.200	- 0.009	- 0.008	- 0.011	0.022	- 0.003
	(5.360)	(0.005)	(0.006)	(0.004)	(0.003)	(0.003)
	[0.000]	[0.069]	[0.170]	[0.014]	[0.000]	[0.410]
R^2	0.610	0.220	0.240	0.300	0.140	0.670

Note: The table shows triple-difference regression estimates for the effect of CARD Act disclosures on consumer payments. Standard errors are shown in parentheses, and p-values are shown in brackets. Standard errors are clustered by issuer-month. N=14,251,539 for all regressions

Table 5: Regression Estimates of the Impact of the CARD Act Disclosures on Consumer Payment Duration

A: Payment as fraction of balance

	Fraction	0-10%	10-20%	20-30%	30-40%	40-50%	50-60%	60-70%	70-80%	80-90%	90-99%	100%
Minimum	0.009	- 0.024	0.010	0.003	0.002	0.002	0.002	0.001	0.001	0.001	0.001	0.000
only	(0.002)	(0.003)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.970]
Minimum	- 0.006	- 0.003	0.007	0.003	0.002	0.001	0.001	0.001	0.001	0.001	0.001	- 0.014
+ 3-year	(0.001)	(0.002)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)
	[0.000]	[0.042]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Non-amort	0.002	- 0.006	0.006	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.002	- 0.003
+ 3-year	(0.003)	(0.003)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)
	[0.430]	[0.058]	[0.000]	[0.052]	[0.870]	[0.420]	[0.410]	[0.420]	[0.350]	[0.007]	[0.000]	[0.410]
R^2	0.710	0.560	0.054	0.026	0.016	0.011	0.009	0.006	0.004	0.004	0.010	0.670

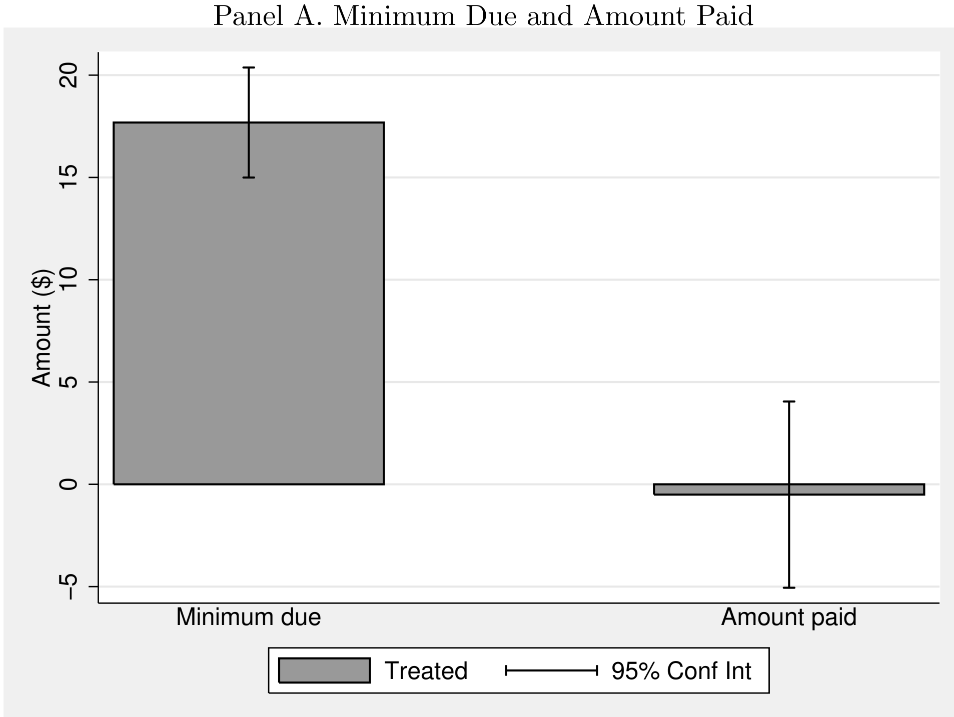
B: Months to Amortize Balance

	1	2	3	31	32	33	34	35	36	37	38	39	40	41	>75	Never
Minimum	0.003	0.005	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.002	- 0.025
only	(0.002)	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.001)	(0.003)
	[0.120]	[0.000]	[0.000]	[0.001]	[0.000]	[0.018]	[0.220]	[0.470]	[0.610]	[0.870]	[0.340]	[0.600]	[0.870]	[0.150]	[0.075]	[0.000]
Minimum	- 0.011	0.003	0.002	0.001	0.001	0.001	0.001	0.002	0.003	0.001	0.000	0.000	0.000	0.000	- 0.013	- 0.009
+ 3-year	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.002)
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.007]	[0.091]	[0.210]	[0.000]	[0.000]
Non-amort	0.000	0.000	0.000	0.001	0.001	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	- 0.015	- 0.021
+ 3-year	(0.003)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.002)	(0.005)
	[0.960]	[0.590]	[0.630]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]	[0.001]	[0.004]	[0.000]	[0.000]	[0.000]
R^2	0.670	0.023	0.018	0.003	0.003	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.190	0.380

Note: The table shows triple-difference regression estimates for the effect of CARD Act disclosures on the distribution of consumer payments as a fraction of the balance, and the distribution of repayment durations in months. Standard errors are shown in parentheses, and p-values are shown in brackets. Standard errors are clustered by issuer-month. N=14,251,539 for all regressions.

Figure A-1: Responses to Minimum Payment Changes

Panel A. Minimum Due and Amount Paid



Panel B. Dummy Variables for Payment Behavior

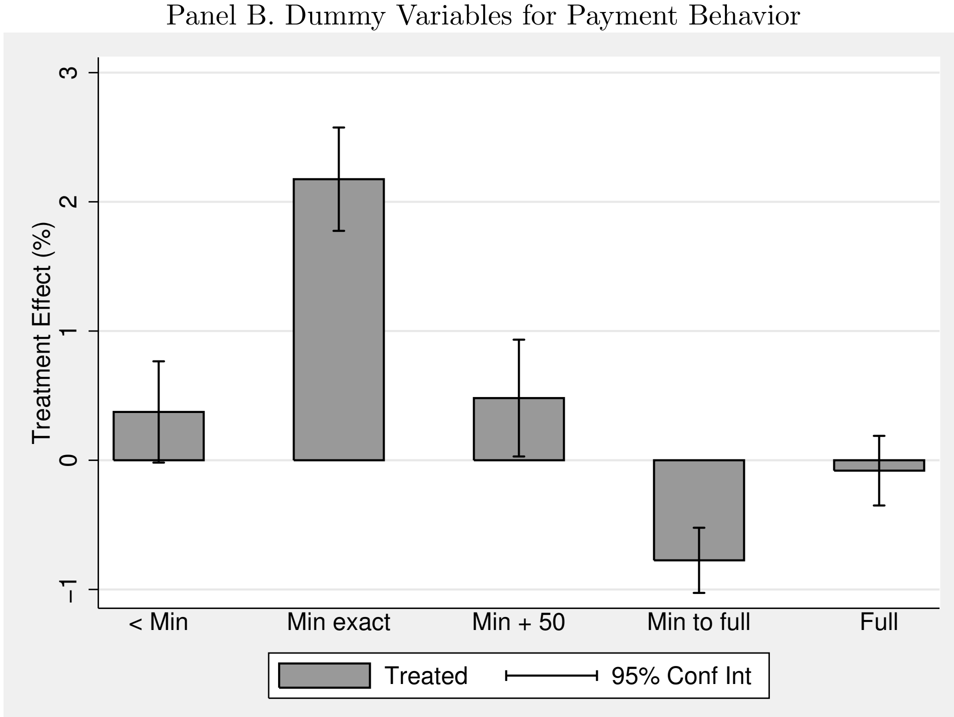
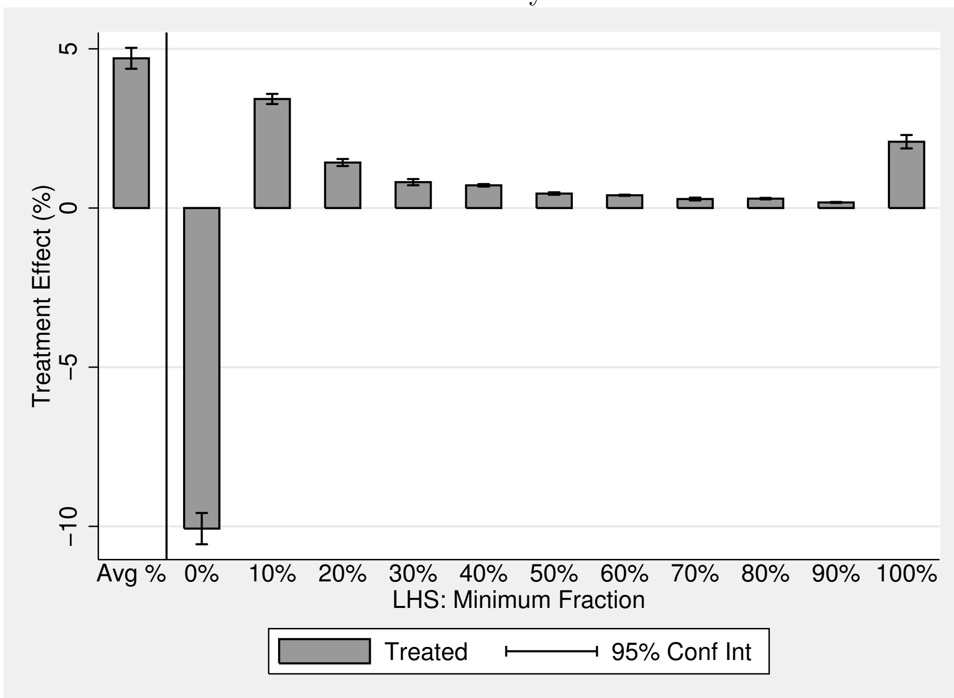


Figure A-2: Minimum Payment Changes: Difference-in-Differences Regressions, by Balance

Panel A: Minimum Payment Fraction



Panel B: Actual Payment Fraction

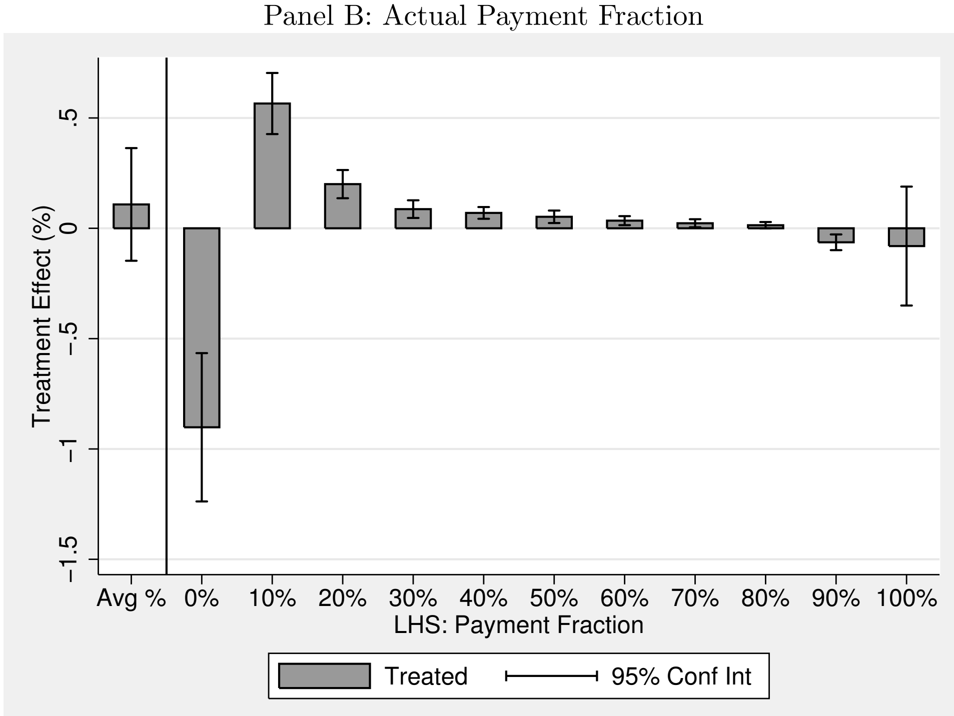
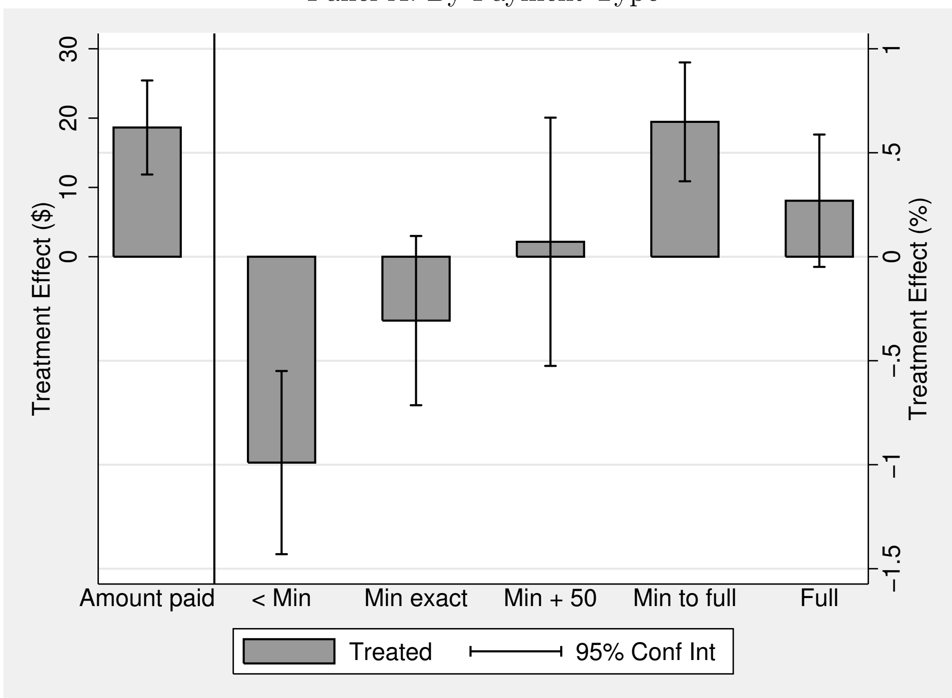


Figure A-3: Disclosure Changes: Difference-in-Differences Regressions

Panel A: By Payment Type



Panel B: By Payment Fraction

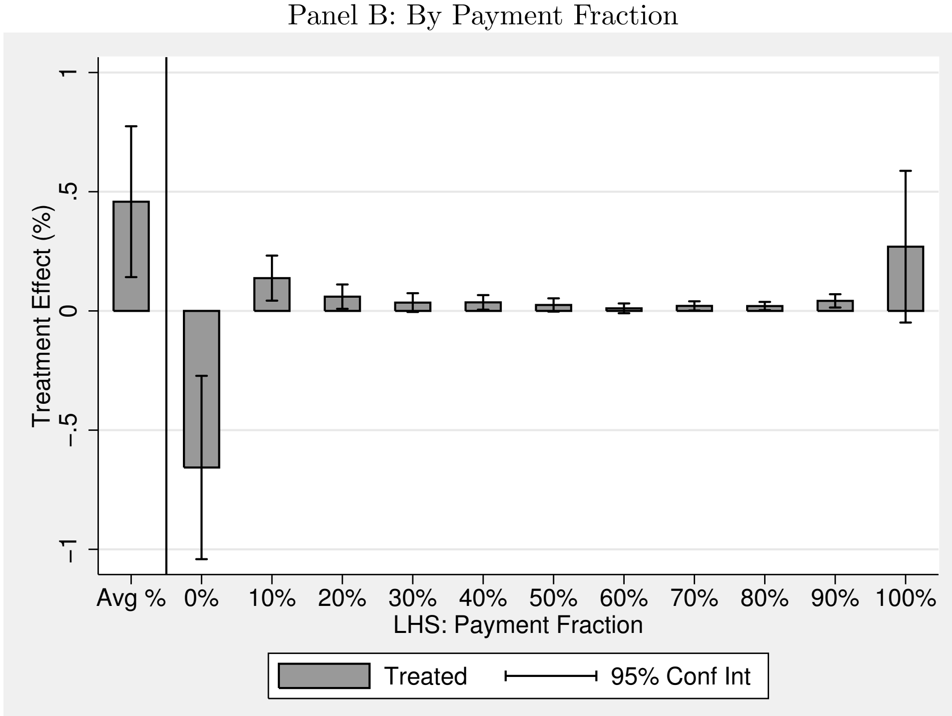


Figure A-4: Disclosure Changes: Difference-in-Differences Regressions, by Months to Pay Off Debt