Does Price Regulation Affect Competition? Evidence from Credit Card Solicitations

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We study the unintended consequences of consumer financial regulations, focusing on the CARD Act, which restricts consumer credit card issuers' ability to raise interest rates. We estimate the competitive responsiveness—the degree to which a credit card issuer changes offered interest rates in response to changes in interest rates offered by its competitors—as a measure of competition in the credit card market. Using small business card offers, which are not subject to the Act, as a control group, we find a significant decline in the competitive responsiveness after the Act. The decline in responsiveness is more pronounced for competitors' reductions, as opposed to increases, in interest rates, and is more pronounced in areas with more subprime borrowers. The reduced competition underscores the potential unintended consequence of regulating the consumer credit market and contributes toward a more comprehensive and balanced evaluation of the costs and benefits of consumer financial regulations.

1. Introduction

The subprime mortgage crisis of 2008 led to a surge of policy and legislative initiatives in regulating consumer financial products. A number of federal legislations rolled out or were under consideration to protect consumers in household finance markets. A notable example of such legislations is the Credit Card Accountability, Responsibility, and Disclosure Act of 2009 (henceforth, the CARD Act or the Act).[1] The CARD Act was enacted with the objective of protecting consumers and establishing fair and transparent practices in the credit card market. The Act restricts, among other things, consumer credit card issuers' ability to increase interest rates on outstanding balances. This restriction prompted the classic concern regarding unintended consequences of hampering competition (Joskow and Rose, 1989), since it limits issuers' feasible pricing space, making credit supply less elastic. In this paper, we investigate the effect of the CARD Act on issuers' competition.

Identifying effects on competition is challenging in part because, lacking proper instruments, it is difficult to parse out observed quantity and price changes in equilibrium into supply and demand effects. In this study, we take advantage of a unique proprietary dataset of credit card mail solicitations (compiled by Mintel/Comperemedia) that presents supply measures helpful for analyzing the dynamics of competition among credit suppliers (i.e., major credit card issuers). Direct mail marketing has been one of the most important channels through which banks market their credit card products to consumers (Grodzicki, 2014). Research demonstrates that the information contained in these mail offers can be used to infer the supply of such credit (Han et al., 2018).

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[1] Pub. L. No. 111-24, 123 Stat. 1734 (2009) (codified and scattered sections of the U.S.C.).

We focus on a particular aspect of competition, namely, the degree to which a credit card issuer reacts to recent changes by its competitors, which we refer to as the competitive responsiveness. The responsiveness of a firm to rivals' actions has been used to assess competition in other industries. For example, examining the motor vehicle industry, Doyle and Snyder (1999) find that firms adjust their planned and actual production in response to similar actions of their rivals, consistent with predictions from oligopoly competition theories (Li, 1985). We propose an intuitive and theoretically appealing indicator to measure competition in the credit card market—the degree to which a card issuer responds to earlier changes in offered interest rates of its competitors. If competition in the credit card market weakened, each issuer will dampen its responses to competitors' changes in offered interest rates.

Credit card mail solicitations are infamously complex, typically including dozens of contractual terms, many of which are presented only in the fine print. Our analysis focuses on one particular term in solicitations—the regular purchase interest rate—for three reasons. First, since the Act explicitly restricts increasing interest rates, it most directly affects card issuers' competition on interest rates.[2] Second, unlike the fine-print terms that consumers may often overlook or ignore (such as international transaction fees), the regular purchase interest rate (often referred to as the "go-to rate") is one of the top-line terms that the offers saliently highlight and it directly impacts consumers' borrowing decisions (Agarwal, Chomsisengphet, Mahoney, and Stroebel, 2015; Gabaix and Laibson, 2006). Third, extant research demonstrates that individual consumers face substantial search and switching costs (Calem and Mester, 1995; Kuchler, 2017; Pinheiro and Ronen, 2016; Stango, 2002). This potentially mutes observed manifestations of rate competition in existing credit card accounts (Stango and Zinman, 2016). In

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[2] For example, the restrictions on interest rate increases are viewed as "the core, most important provision of the CARD Act" by the credit card industry (American Bankers Association, 2013).

contrast, changes in offered interest rates in solicitations and reactions to these changes among credit card issuers better capture the dynamics of competition in the industry (Agarwal, Chomsisengphet, Liu, and Souleles, 2006).

When competitors lower offered interest rates, an issuer's optimal response must balance two countervailing forces. On one hand, if an issuer does not lower its own offered interest rates in response to competitors lowering theirs, it may lose potential customers to competitors. On the other hand, lower average rates slash future interest revenue, at least until repricing the account. Such interest revenue losses tended to be limited prior to the Act since the card issuers were subject to few restrictions on raising rates on existing accounts. Because the Act limits issuers' ability to reprice, it potentially also increases such revenue losses and thereby the cost of mimicking lower rates offered by competitors. We therefore expect an issuer's responsiveness to its competitors' changes in offered interest rates (in particular rate reductions) to become more muted after the implementation of the CARD Act, indicating a decrease in competition.

Unobservable factors present a challenge to testing our conjectures that is frequently encountered in policy evaluation exercises. These factors, rather than the Act, may have contributed to changes in issuers' responses to competitors' moves. We follow Agarwal et al. (2015) and circumvent this identification difficulty by using offers of small business credit cards, which are not subject to the provisions of the Act, as the control group. Specifically, we employ a difference-in-differences design to a sample of consumer and small business credit card offers during 2001-2016. This design enables us to compare the before- and after-Act responsiveness of issuers between consumer and small business credit card offers extended in the same local area (a county in our baseline analysis). The Mintel data we use collects detailed demographic and socioeconomic information about individual offer recipients, thereby allowing us to check the

covariate balance. We confirm that the recipients of consumer and small business card offers exhibit similar annual changes in demographic and socioeconomic characteristics, both before and after the implementation of the Act. In addition, we control for an extensive set of offer recipient characteristics and economic conditions in the local area—all potentially affect the competitive actions of issuers marketing to borrowers in a given county .

Our baseline analysis suggests that issuers' responsiveness to competitors' changes in consumer card offered interest rates weakened after the Act, relative to offers for small business cards. Our analysis indicates that, before the Act, for each one-percentage point change in the average interest rate offered by competitors to consumers in the previous year, a card issuer adjusted its own offered interest rates in the current year by about one half of a percentage point in the same direction. This competitive responsiveness decreases by about 40 percent after the implementation of the Act. We obtain similar results when focusing on counties with both consumer and small business card offers and implementing the analysis at the metropolitan statistical area (MSA) level. At the MSA level, we also study the changes in competitive responsiveness at a quarterly frequency. We continue to find robust results.

We extend our analysis in a number of directions to shed more light on the relationship between the Act and reduced competitive responsiveness. First, we exploit the feature that the Act restricts an increase but not a decrease in interest rates of existing accounts, which may lead to different competitive responsiveness changes with respect to competitors' raising versus lowering offered interest rates. We examine competitors' positive and negative changes in average interest rates offered separately and find more pronounced reduction in competitive responsiveness to competitors' decreases in offered interest rates. In other words, consumer

credit card issuers appeared to be reluctant to follow a competitor's decreases, but not increases, in offered rates.

Second, we track the more precise timing of the change in the offered-rate responsiveness and find that the weakening in responsiveness in the consumer market relative to the small business market did not take place before 2009, suggesting parallel pre-CARD Act trends of interest rate responsiveness to consumer and small business card offers. Moreover, we find that the reduction occurred in 2009, became stronger in 2010, and remained significant afterwards. These dynamics are consistent with issuers having anticipated some implications of the Act in their credit offering strategies during 2009, likely due to the Federal Reserve Board's adoption of similar credit card rules by the end of 2008 (Jambulapati and Stanvis, 2014; Zywicki, 2016), and to the subsequent resolution of uncertainty having enhanced the effects of the legislation.

Third, we test whether the reduction in the offered-rate responsiveness varies with average credit risk of consumers in a given area, measured using the share of subprime borrowers in a county. In counties with a larger share of subprime borrowers, losing the ability to reprice is likely more costly for issuers (Nelson, 2018). Consistent with this conjecture, we find a more pronounced reduction in an issuer's responsiveness to rivals' decreases in offered interest rate in such counties.

Fourth, we test if the findings are driven by the shift of consumer credit card offers towards different client pools by different issuers. In such a scenario, the changes in the credit quality of offer recipients of various card issuers may differ. For example, if the profile of offer recipients of an issuer becomes riskier after the Act, competitive responsiveness would appear to be more subdued; the opposite would be observed if the profile becomes less risky. We track the

share of subprime recipients and the average credit scores of recipients to capture changes in offer recipients' credit quality, and we find no evidence for this alternative explanation.

Fifth, we find no decline in competitive responsiveness to major credit card terms other than the interest rate, such as reward programs and annual fees.[3] The results suggest the reduced responsiveness is concentrated in interest rate competition, the term prominently regulated by the Act.

Finally, we also examine the extent to which weakened competitive responsiveness led to more dispersed interest rates and higher markups in consumer card offers. In comparison to small business cards, we find that the dispersion in consumer card offered rates and the spread of these rates over two-year Treasury yield have increased after the Act. The results corroborate the proposition that reduced competition led to greater price dispersion and higher prices paid by consumers (Gerardi and Shapiro, 2009; Edmond, Midrigan, and Xu, 2015).

Our analysis demonstrates that interest rate regulations intended for consumer protection changed the competitive landscape of the regulated industry, informing the current debate on the consequences of regulating consumer financial products (Campbell et al., 2011; Chatterji and Seamans, 2012). The Dodd-Frank Wall Street Reform and Consumer Protection Act of 2010 stiffened the regulations of a wide range of consumer products (e.g., mortgages, student loans, and credit cards). The change in regulatory regime calls for more research to understand the benefits and costs of regulating consumer products (Posner and Weyl, 2013), taking into account both the regulations' intended and unintended effects. In the extant literature, cost-and-benefit analysis of the CARD Act yielded mixed evidence. On one hand, several studies document its

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[3] Although some provisions of the Act pertain to over-limit and late fees (see details in Section 2.1 below), the implications of these provisions for issuer competition are not as straightforward as interest rate related provisions. Moreover, Agarwal, Chomsisengphet, Mahoney, and Stroebel (2015) argue that the late and over-limit fees "are nonsalient to consumers and that consumers are only responsive to the interest rate."

intended benefits in terms of fee reductions (Agarwal et al., 2015; Bar-Gill and Bubb, 2012). On the other hand, a number of recent papers (Debbaut et al., 2016; Han et al., 2018; Jambulapati and Stavins, 2014; Levitin, 2011; Pinheiro and Ronen, 2016) suggest the Act may have limited credit supply, in particular to subprime borrowers. We show that weakened competition may add up to a yet additional cost of the Act, thereby contributing to a more comprehensive assessment of the legislation.[4]

We contribute to the industrial organization literature by proposing a new, appealing measure of competition in the credit card market—the competitive responsiveness—and shed light on the debate over the level of competition in this market (Ausubel, 1991; Brito and Hartley, 1995; Calem and Mester, 1995; Grodzicki, 2017). Our innovative use of the data also adds to the nascent literature that uses mail solicitation data to study various aspects of the credit card industry. For example, using such data, Grodzicki (2015) represents an early effort of constructing a structural model to study credit card market dynamics; Han et al. (2018) document patterns of supply of unsecured credit to bankrupt consumers; Ru and Schoar (2016) study issuers' screening of consumer behavioral biases; Firestone (2014) examines potential racial differentials in the credit card market.

The rest of the paper proceeds as follows. In Section 2, we provide an overview of the U.S. credit card market and the Credit CARD Act. In Section 3, we describe data and sample construction in detail. We present primary empirical results and robustness analysis in Section 4, and analysis on price dispersion and markups in Section 5. We conclude in Section 6.

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[4] In a recent paper, Nelson (2018) estimates the welfare effects of the CARD Act's pricing restrictions. He uses a structural model to infer dynamics of credit supply from equilibrium quantity and price data on existing credit card accounts. In contrast, our analysis employs a reduced form framework and measure credit supply using direct mail offers of credit.

2. An Overview of the Credit Card Market and the CARD Act

2.1 Landscape of the U.S. Credit Card Market

With a total outstanding balance above one trillion dollars, credit card debt represents one of the major components of U.S. household liabilities. Unlike other household credit markets such as mortgages and auto loans, the credit card industry is more concentrated, with a handful of large issuers (accounting for over 70 percent of total outstanding balances) coexisting with numerous much smaller issuers.

The industry also features several characteristics unique to the household finance market that motivate our analysis. First, credit card contracts are notoriously vague and complex compared with other household debt instruments. A typical credit card contract may include dozens of terms regarding credit limits, interest rates, fees, penalties, rewards, and their changes, and many are only presented in fine print. As a result, even financially savvy consumers frequently have to focus on only the most salient terms, such as interest rates, when choosing a product. In addition, heightened contractual complexity made borrowers vulnerable to being exploited by issuers. Second, while the direct cost of opening an account is moderate, because of the associated costs of searching, previous research has documented that the costs of switching across issuers are high for borrowers with an open account. Such high switching costs give rise to considerable market power an issuer has on its current customers but not on uncommitted consumers. Third, and relatedly, competition on new customer acquisition is intense and direct. The credit card industry is the only one that relies heavily on direct mail in customer acquisition.[5] Over 90 percent of the credit mail offer data we use are credit card offers.

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[5] More recently, credit card issuers also increased solicitation volume through email and social media platforms.

The unique structure and features of the industry prompted a long stream of research on the competitiveness of the credit card market. In a seminal paper, Ausubel (1991) documents that interest rates in this market are high and sticky, suggesting the market is not competitive. In contrast, Brito and Hartley (1995) and Calem and Mester (1995) argues that competition is not inconsistent with high and sticky interest rates. More recently, Grodzicki (2015) establishes how the classical indicia characterizing a failure of competition in credit card lending during the 1980s were largely reversed in the decades that followed. Specifically, since 1990, issuers' markups decreased substantially, prices have become responsive to underlying costs, and profits have shrunk, notwithstanding increased market concentration in the same era.

2.1 The CARD Act

As noted above, the unique opaqueness and complexity of credit card contracts and lending practice made borrowers vulnerable to being exploited by issuers. As a response to such concerns, the Credit Card Accountability Responsibility and Disclosure Act (the CARD Act) was signed into law on May 22, 2009. The Act regulates disclosures to consumers of contractual and related information and restricts the changing of interest rates. The Act restricts interest rate increases on new transactions within the first year of opening the account and on existing balances except when the prior rate was an introductory rate, or the minimum payment has not been received for 60 days. Interest rate increases after the first year must be periodically re-evaluated.[6]

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[6] Section 101(c) of the CARD Act requires card issuers that increase an annual percentage rate applicable to a credit card account, based on the credit risk of the consumer, market conditions, or other factors, to periodically (no less frequently than once every six months) consider changes in such factors and determine whether to reduce the annual percentage rate. Card issuers are required to reduce the annual percentage rate that was previously increased if a reduction is "indicated" by the review. However, the statute expressly provides that no specific amount of reduction in the rate is required.

The Act also regulates the charging of credit card fees. A card issuer cannot impose fees on consumers making a transaction over an account's credit limit unless the cardholder explicitly "opts in" for the issuer to charge such a fee. Furthermore, an over-limit fee could be charged only once when the limit is exceeded, and over-limit fees are capped at the actual over-limit amount. A card issuer cannot impose a late fee of more than $25 unless one of the previous six payments was also late, and the late fee cannot be greater than the minimum payment.

The CARD Act prompted an active line of research on its effectiveness and broader impact on the credit card market. In the theoretical domain, Pinheiro and Ronen (2016) and Tam (2011) show that the Act's restrictions reduce consumer welfare by, among other things, increasing average interest rates, hence resulting in lower levels of households borrowing. The empirical findings of the Act's cost-and-benefit analysis are somewhat mixed. On one hand, Bar-Gill and Bubb (2012), using data ending in 2011, report substantially reduced fees regulated by the Act with little change in purchase interest rates consistent with issuers having market power before the Act. More recently, Agarwal et al. (2015) estimate that limits on fees saved consumers about $12 billion per year by 2011, also without a significant increase in interest rates. On the other hand, Han et al. (2018) show the CARD Act reduced credit supply to subprime borrowers; and Nelson (2018) finds that the Act may have exacerbated the adverse retention among existing account holders, both underscoring the additional social cost of the Act arising from its unintended consequences.

Our analysis speaks to the intersection of the literature of credit card market competitiveness and the CARD Act policy evaluation. We present novel evidence on how

interest rate competition evolved in the post-Act era, which represents an important factor to consider in the overall assessment of the Act.

3. Data and Sample Construction

3.1 The Mintel Data

Our main data source is Mintel Comperemedia's proprietary survey of U.S. consumers.[7] Each month, Mintel randomly selects about 4,000 consumers from a pool of one million consumers that Mintel acquired from a large survey service provider. On average, about 2,500 consumers choose to participate in the Mintel survey in a given month. Each participating consumer is given a set of envelopes and asked to put the mails from an array of sectors that Mintel monitors, including credit offers, into the envelopes and send them back to Mintel weekly during the participating month. If consumers wish to respond to a credit offer, they are instructed to detach the response portion and forward Mintel the remainder of the offer materials. These consumers are offered prize raffles as a participating incentive. Our data span 2001 to 2016, covering the recent credit cycle and the enactment and implement of the CARD Act.

Once receiving envelopes from responding consumers, the Mintel database records essentially all information on the forwarded credit mail offers. This allows us to study not only whether a consumer receives any credit offers, but also terms of the contracts offered. For example, the data include information about the price of credit—the so-called "go-to" interest rate, which is the regular non-promotional interest rate for purchases. The vast majority of the mail offers collected in the Mintel survey are personal credit card offers, as the personal credit

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[7] Mintel is a consumer and marketing research company headquartered in the U.K. The data we use are collected by the company's American subsidiary, Comperemedia. For more information about the company, see http://www.comperemedia.com.

card industry exhibits the greatest reliance on direct mail in customer acquisitions. Among other types of credit, the Mintel data also include information on small business credit card offers, which we will exploit as a control group in a spirit similar to Agarwal et al. (2015) and Han et al. (2018). Since the survey is meant to make the weighted sample totals conform to population totals, each offer comes with a weight to account for panel stratification. We apply the weights provided by Mintel for all subsequent summary statistics and county-averages.

In addition to the survey on credit offers, Mintel conducts a separate survey on participating consumers to collect their demographic and socioeconomic information. This information is merged with the credit offer data. Moreover, the data include the zip code of the offer recipients, allowing us to conduct the analysis at fairly granular geographical levels.

3.2 Sample Construction

The treatment group consists of all consumer credit card offers, and the control group consists of all small business credit card offers. We focus on six largest credit card issuers of the country—Citibank, Chase, Bank of America, Capital One, Discover, and American Express. These issuers accounted for about 90% of the personal card offer mail volume in 2016. Ideally, we want to examine offer terms from the issuers to the same consumer to hold consumer attributes constant. However, the Mintel survey randomly selects consumers in each month, precluding the possibility of tracing the same set of consumers over time. We thus construct a longitudinal sample of major credit card issuers' mail volume, and average terms (i.e., interest rates, introductory rates, rewards program, annual fees, late fees and over-limit fees) of credit card offers extended to consumers in a county on a yearly basis. In order to analyze an issuer's

response to its competitors' moves, we pair issuer i's average in county c, year t with the average of the other five issuers in the same county in year $t-1$.

Table 1 details our sample selection for both consumer and small business credit cards. We first restrict our sample to counties where we observed at least one offer from an issuer in a year for at least ten of the sixteen years in the data. This yields 828,500 offers to 1,149 counties for consumer cards, and 36,200 offers to 1,013 counties for small business cards. To study the between-bank competition, we then restrict the sample to the counties where, in a given year, we observe offers extended by at least two distinct issuers. There are 823,174 consumer credit card offers extended to consumers in 965 such counties, covering most of the counties in metropolitan areas. The 823,174 offers represent about 51 billion offers in total to the U.S. population, after accounting for weights assigned by Mintel to each offer. Small business card offers are sparser; there are 28,625 small business card offers extended to owners of small businesses in about 300 counties. We use all of these offers in the baseline analysis and assess the sensitivity of our results to using only counties with both consumer and small business card offers and only counties with at least three offers in robustness tests. We also check whether the primary results are robust to constructing the sample with the unit of observations at the issuer-MSA-year and the issuer-MSA-quarter levels. While the latter allows us to examine the competitive responsiveness over a shorter window, it is infeasible for the baseline model due to insufficient number of offers at the county-level for each quarter.

We use an array of location-specific economic indicators as control variables. Unemployment rates and house price appreciation at the county level are sourced from the Bureau of Labor Statistics and CoreLogic Real Estate Data, respectively. To measure the average credit risk of the consumers in a county, we calculate the share of consumers with subprime

credit scores using the Federal Reserve Bank of New York Consumer Credit Panel/Equifax (the Equifax data). We compute both the level of and the annual change in the share of subprime consumers within a county during our sample period (2001-2016). The demographic and socioeconomic information of participating consumers in Mintel's survey for each issuer is also aggregated each year to the county-level for the consumer and small business card offers separately (i.e., the share of high school graduates, people with some college education, people with college degrees, white, homeowners and married people, and average household income). Since our interest is the response coefficient on changes in offer terms, we take first-differences for all aggregated demographic and socioeconomic characteristics.

3.3. Descriptive Statistics

We begin by calculating annual changes in the county-level average credit card terms offered by each issuer. The mean and standard deviation for the level of (change in) each term are presented in Table 2 Panel A (B). There are 24,565 (1,008) and 18,046 (890) issuer-county-year observations for consumer (small business) cards before and after the CARD Act. The relative sizes of consumer and small business card offer samples are largely consistent with those in Agarwal et al 2015.[8] On average, an issuer's annual interest rates of consumer credit card offers are 11.495% pre-CARD Act, and 14.852% post-CARD Act. The average annual change in interest rate is 0.197% pre-CARD Act and 0.443% post-CARD Act. We also break down the changes into positive and negative rate changes. The standard deviations of the annual changes in interest rates offered are similar to those of the levels of interest rates offered. A similar pattern is also observed for small business card offers.

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[8] The data Agarwal et al use include 150 million consumer credit card accounts and 7 million small business credit card accounts, an about 20-to-1 ratio.

We then examine annual changes in demographic and socioeconomic characteristics of offer recipients in the treatment and control samples to assess to what extent changes in the underlying characteristics, rather than the implementation of the CARD Act, affect the outcome of interest. Panel C of Table 2 shows means of changes in these characteristics in the pre- and post- CARD Act periods in both the treatment and control samples, along with a test of differences. Except for the average household income in the pre-period, we find no differences between treatment and control groups in annual changes to demographic and socio economic factors before and after the CARD Act. We control for changes in these factors in our regression analysis.

4. Empirical Tests and Results

In this section, we formally test the hypothesis that an issuer's response to competitors' changes in offered interest rates declines after the implementation of the CARD Act. Section 4.1 investigates the competitive responsiveness in offered interest rates, and Section 4.2 examines the responsiveness of an issuer to competitors' changes in other credit card metrics. We separate increases and decreases in competitor's offered interest rates and test the predictions derived from the main hypothesis in Section 4.3. Section 4.4 shows results from testing dynamic effects of the Act. Section 4.5 tests whether the decline in the responsiveness of an issuer to competitors' decreases in interest rates varies with the share of subprime borrowers in a county. Section 4.7 checks whether the responsiveness with respect to offer recipients' credit quality changes.

4.1. The CARD Act and Issuer Competition on Interest Rates

To illustrate our empirical design, we first estimate the following model using consumer card offers only:

$$\Delta Rate_t = \alpha + \beta_1 \Delta Rate_{t-1} + \beta_2 \Delta Rate^{C}_{t-1} + \beta_3 \Delta Rate^{C}_{t-1} \times PostCARD + \varphi PostCARD + \theta \mathbf{Z} + \varepsilon$$

$$(1)$$

where $\Delta Rate_t$, the dependent variable, is the annual change in an issuer's average interest rate offered in a county (for notational simplicity, we omit the county index), and $\Delta Rate_{t-1}$ is the one-year lag of $\Delta Rate_t$. $\Delta Rate^{C}_{t-1}$ is the lagged annual change in competitors' average interest rate offered in the same county. Using annual changes as opposed to levels of interest rates provides two advantages. First, changes better capture our underlying construct. Second, the correlation between interest rate levels of an issuer and those of its competitors in the same county can be explained by persistent county-level factors (e.g., social capital or the distance to the New York City) and thus may not capture the competitive responsiveness. The first-differences help us remove such factors. *Post CARD* is a dummy variable equal to one for the years after the implementation of the CARD Act (2010-2016) and zero for the years of 2001-2009. The vector of control variables, *Z,* contains county-level economic conditions (i.e., unemployment rate and house price appreciation), levels of and annual changes in the share of subprime consumers of the county, the annual changes in demographic and socioeconomic compositions of offer recipients (i.e., the share of high school graduates, people with some college education, people with college degrees, white, homeowners and married people, and average household income). All standard errors are clustered at the county level.

The variable of interest is $\Delta Rate^{C}_{t-1} \times Post CARD$, and β_3 reveals the differences in the competitive responsiveness of an issuer to competitors' changes in interest rates between the pre-

and post- CARD Act periods. Our hypothesis that there is a decrease in the equilibrium responsiveness with respect to competitors' changes in interest rates of consumer card offers after the CARD Act predicts a negative β_3.

Table 3 Panel A shows coefficients and t-statistics from regression estimation of equation (1) using consumer card offers only. We add each set of control variables progressively in columns (1)-(3). $\Delta Rate_{t-1}$ loads significantly negatively (two-tailed p-value < 0.01), suggesting a mean-reverting process in offered interest rates. By contrast, $\Delta Rate^C_{t-1}$ loads significantly positively (two-tailed p-value < 0.01), suggesting that before the CARD Act, when competitors introduced changes to offered interest rates, an issuer followed suit in the same direction. For the key parameter of interest, we observe a significant negative coefficient, ranging from -0.409 to -0.412 across the three specifications, on $\Delta Rate^C_{t-1} \times Post\ CARD$ (two-tailed p-value < 0.01). Thus, after the adoption of the CARD Act, issuers of consumer cards do not respond as intensely to competitors' change in offered interest rates as they did before, consistent with the notion that the regulation may have hampered competition.

This specification represents a time-series comparison, which may be confounded by events other than the Act or secular trends that influence issuer competition. We therefore introduce next our baseline model using both consumer and small business credit card offers, which takes the form:

$$\Delta Rate_t = \delta + \gamma_1 \Delta Rate_{t-1} + \gamma_2 \Delta Rate^C_{t-1} + \gamma_3 \Delta Rate^C_{t-1} \times Consumer + \gamma_4 \Delta Rate^C_{t-1} \times PostCARD + \gamma_5 \Delta Rate^C_{t-1} \times Consumer \times PostCARD + \psi Consumer + \varphi PostCARD + \lambda PostCARD \times Consumer + \theta Z + \varepsilon \quad (2)$$

Notations are defined the same as in equation (1). We introduce a new dummy variable *Consumer* that is equal to one for consumer credit card observations, and zero for small business credit card observations. All standard errors are clustered at the county level.

This specification represents a difference-in-differences research design that compares changes in the responsiveness of an issuer around the implementation of the CARD Act for consumer credit cards, which were subject to the new law, with changes in the responsiveness for small business credit cards, which the law did not cover. Similar to Agarwal et al. (2015), the identifying assumption is that, in the absence of the CARD Act, an issuer's response to competitors' changes in interest rates for consumer and small business card offers would have maintained parallel trends. We provide evidence consistent with this assumption in Section 4.4. The variable of interest is $\Delta Rate^C_{t-1} \times Consumer \times Post\ CARD$. Our hypothesis that there is a decrease in the equilibrium responsiveness with respect to competitors' changes in interest rates after the CARD Act for consumer cards predicts a negative γ_5.

Table 3 Panel B shows coefficients and t-statistics from pooled regression estimation of equation (2). We add each set of control variables progressively in columns (1)-(3). $\Delta Rate^C_{t-1} \times Consumer$ loads significantly positively (two-tailed p-value < 0.01), suggesting that before the CARD Act, compared with small business card offers, an issuer adjusts the interest rate of consumer card offers more in response to competitors' changes in interest rates. This is consistent with the literature that the "winner's curse" concern is more severe in small business lending markets (Petersen and Rajan 2002). For the key parameter of interest, we observe a significant negative coefficient (ranging from -0.380 to -0.395 across the three specifications) on $\Delta Rate^C_{t-1} \times Consumer \times Post\ CARD$ (two-tailed p-value < 0.01). This result suggests that after the adoption of the CARD Act, issuers of consumer cards do not respond as intensely to competitors' change in offered interest rates as they did before, in comparison to small business card offers, consistent with our hypothesis. Regarding the economic magnitude of coefficients before the CARD Act, applying the coefficients reported in column (3), for one percent lagged

changes in the offered interest rate by competitors to consumers, an issuer used to adjust offered interest rates in the same direction by 0.432 percent before the CARD Act. This response coefficient decreases by about 0.380 percent to essentially zero after the implementation of the Act.

To check the robustness of our results, we use four alternative ways of constructing our sample. First, as shown in Table 1, the sample of consumer card offers covers more counties than that of small business card offers. To rule out the possibility that the primary findings are driven by county differences, we restrict our sample to counties with both consumer and small business card offers from the same issuers, yielding 18,491 issuer-county-year observations. Table 4 column (1) shows the results from pooled regression estimation of equation (2) using the restricted sample. $\Delta Rate^C_{t-1} \times Post\ CARD \times Consumer$ continue to load significantly negatively (two-tailed p-value < 0.01), suggesting that the difference in county coverage is unlikely to explain our findings.

Second, to mitigate the concern that our results are sensitive to potential errors in averaging interest rates offered to a county, we exclude counties with less than three offers, yielding 34,856 issuer-county-year observations. We then estimate equation (2) using this alternative sample. As shown in Table 4 column (2), $\Delta Rate^C_{t-1} \times Post\ CARD \times Consumer$ continue to load significantly negatively (two-tailed p-value < 0.01), suggesting that potential errors in averaging interest rates offered to a county is unlikely to explain our findings.

Third, we impose a stringent data requirement, requiring a county to have both consumer and small business card offers from the same issuers and to have at least three offers. This imposition yields only 16,063 issuer-county-year observations. Nevertheless, using this smaller sample to estimate equation (2), we find that $\Delta Rate^C_{t-1} \times Post\ CARD \times Consumer$ continues to

load significantly negatively (two-tailed p-value < 0.01), as shown in Table 4 column (3). This result suggests that, despite a small sample with low statistical power, the two concerns together are unlikely to affect our findings.

Fourth, to check the robustness of our results to using county to compute the average offered rate by an issuer, we conduct our baseline analysis at the MSA level. Our sample has 24,180 issuer-MSA-year observations. As shown in Table 4 column (4), $\Delta Rate^C_{t-1} \times Post\ CARD \times Consumer$ continues to load significantly negatively (two-tailed p-value < 0.01), suggesting that measurement errors in delineating appropriate aggregation levels are unlikely to drive our findings.

Finally, to explore the competitive responsiveness over a shorter window, we aggregate the rates and recipient characteristics at the issuer-MSA-quarter level, yielding 53,224 observations. It is infeasible to do so for the baseline model due to insufficient number of offers at the county-level for each quarter. Using this alternative sample, we find that $\Delta Rate^C_{t-1} \times Post\ CARD \times Consumer$ continues to load significantly negatively (two-tailed p-value < 0.01), as shown in Table 4 column (5).

Overall, the results are robust to controlling for a battery of variables (e.g., consumer compositions) and to using alternative samples discussed above. Next, we assess to what extent our primary finding is attributable to the CARD Act rather than other concurrent events. Five sets of tests are conducted and discussed in Sections 4.2-4.6.

4.2. The CARD Act and Issuer Competition on Other Offer Terms

The CARD Act restricts issuers' ability to reprice existing credit card accounts, whereas the Act is silent or less restrictive on lending and customer acquisition practice such as

introductory interest rates, reward programs, and annual fees. Lenders' competitive

responsiveness on these metrics, therefore, is not expected to decline in the wake of the CARD

Act. We test this prediction by estimating the following model:

$$\Delta Var_t = \delta + \gamma_1 \Delta Var_{t-1} + \gamma_2 \Delta Var_{t-1}^C + \gamma_3 \Delta Var_{t-1}^C \times Consumer + \gamma_4 \Delta Rate_{t-1}^C \times PostCARD$$
$$+ \gamma_5 \Delta Rate_{t-1}^C \times Consumer \times PostCARD + \psi Consumer + \varphi PostCARD$$
$$+ \lambda PostCARD \times Consumer + \theta Z + \varepsilon \quad (3)$$

Where ΔVar_t equals the annual change in the average of any one of the five metrics—the

presence of introductory rates, the presence of rewards programs, the presence of annual fees,

and the annual fee amount—across all offers extended to a county in a year for consumer and

small business cards separately. All other variables are defined in the same fashion as in equation

(2). As shown in Table 5, $\Delta Var^C_{t-1} \times Post CARD \times Consumer$ does not load for any of these

metrics that are unrelated to issuers' repricing (two-tailed p-value > 0.1). The results, combined

with those in Table 3, suggest that the decline in issuer competition is concentrated in the interest

rate competition, mitigating the possibility that our findings are driven by omitted economic

trends and events, which tend to influence issuers' competitive responsiveness in both interest

rates and other lending and customer acquisition practices.

4.3. Responsiveness to Increases and Decreases in Competitors' Offered Interest rates

We exploit the unique feature of the Act that restricts an increase but not a decrease in the

rate of interest after a card is issued. Consequently, an issuer would be reluctant to follow a

competitor's decreases in offered interest rates but would not be reluctant to increase offered

interest rates following such a move by its competitors. Indeed, as shown in figures 1 and 2, the

decreases in competitive responsiveness of consumer credit card offers relative to small business

card offers after the CARD Act are much more pronounced for competitors' reductions of

offered interest rates (figure 1) than increases of offered interest rates (figure 2). Accordingly, we create two indicators to separate increases and decreases in offered interest rates by competitors, $\Delta^+Rate^C_{t-1}$ ($\Delta^-Rate^C_{t-1}$), which are equal to the value of $\Delta Rate^C_{t-1}$ if it is positive (negative) and zero otherwise. These two indicators are interacted with variables of interest in equation (2). The regression specification takes the form:

$$
\begin{aligned}
\Delta Rate_t = \ & \delta + \gamma_1 \Delta Rate_{t-1} \\
& + \gamma_2 \Delta^+Rate^C_{t-1} + \gamma_3 \Delta^+Rate^C_{t-1} \times Consumer + \gamma_4 \Delta^+Rate^C_{t-1} \times PostCARD \\
& + \gamma_5 \Delta^+Rate^C_{t-1} \times Consumer \times PostCARD \\
& + \gamma_6 \Delta^-Rate^C_{t-1} + \gamma_7 \Delta^-Rate^C_{t-1} \times Consumer + \gamma_8 \Delta^-Rate^C_{t-1} \times PostCARD \\
& + \gamma_9 \Delta^-Rate^C_{t-1} \times Consumer \times PostCARD \\
& + \psi Consumer + \varphi PostCARD + \lambda PostCARD \times Consumer + \theta Z + \varepsilon \quad (4)
\end{aligned}
$$

As shown in Table 6, the coefficient of $\Delta^+Rate^C_{t-1} \times Post\ CARD \times Consumer$ is not statistically distinguishable from zero, whereas the coefficient on $\Delta^-Rate^C_{t-1} \times Post\ CARD \times Consumer$ is significantly negative (-0.672, two-tailed p-value < 0.01). The sharp contrast is in line with our expectation that an issuer will reduce its responsiveness to competitors' decrease but not increase in offered interest rates after the CARD Act. Putting it in perspective, since the average of $\Delta^-Rate^C_{t-1}$ in the pre-CARD Act period is about -1.9%, our estimate suggests that an issuer's offered interest rates to consumers are about 1.3 percentage point higher (-0.672 × -1.914%) due to subdued competitive responsiveness in the post-CARD Act period, relative to rates offered to small business owners.

4.4. Dynamic Effects

To rule out the possibility that our primary results are driven by pre-existing divergent trends between consumer and small business credit cards, we examine the dynamic effects of the Act on issuer competition. Five indicators, ($Year_{2007}$, $Year_{2008}$, $Year_{2009}$, $Year_{2010}$, and $Year_{>2010}$), are created to indicate respective year and 2011-2016 for $Year_{>2010}$. We replace $Post\ CARD$ dummy in equation (4) with the five indicators and estimate the following modified regression:

$$\Delta Rate_t = \alpha + \gamma_1 \Delta Rate_{t-1}$$

$$+ \gamma_2 \Delta^+ Rate^C_{t-1} + \gamma_3 \Delta^+ Rate^C_{t-1} \times Consumer + \sum_{t=2007}^{2010^+} \gamma_4^t \Delta^+ Rate^C_{t-1} \times Year_t$$

$$+ \sum_{t=2007}^{2010^+} \gamma_5^t \Delta^+ Rate^C_{t-1} \times Year_t \times Consumer$$

$$+ \gamma_6 \Delta^- Rate^C_{t-1} + \gamma_7 \Delta^- Rate^C_{t-1} \times Consumer + \sum_{t=2007}^{2010^+} \gamma_8^t \Delta^- Rate^C_{t-1} \times Year_t$$

$$+ \sum_{t=2007}^{2010^+} \gamma_9^t \Delta^- Rate^C_{t-1} \times Year_t \times Consumer$$

$$+ \psi Consumer + \varphi PostCARD + \lambda PostCARD \times Consumer + \theta Z + \varepsilon \quad (5)$$

As shown in Table 7, neither the coefficient of $\Delta^- Rate^C_{t-1} \times Year_{2007} \times Consumer$ nor that of $\Delta^- Rate^C_{t-1} \times Year_{2008} \times Consumer$ is statistically significant, suggesting no preexisting divergent trends in the responsiveness to competitors' changes in interest rates between consumer and small business credit cards. In contrast, all three terms, $\Delta^- Rate^C_{t-1} \times Year_{2009} \times Consumer$, $\Delta^- Rate^C_{t-1} \times Year_{2010} \times Consumer$, and $\Delta^- Rate^C_{t-1} \times Year_{>2010} \times Consumer$, load significantly negatively (two-tailed p-value < 0.01). Notably, the coefficient on $\Delta^- Rate^C_{t-1} \times Year_{2010} \times Consumer$ is greater than that on $\Delta^- Rate^C_{t-1} \times Year_{2009} \times Consumer$, suggesting that card issuers had anticipated some implied change of the Act to their customer acquisition strategies during 2009, likely due to the Federal Reserve Board's earlier adoption of similar credit card rules by the end of 2008 (Jambulapati and Stanvis 2014; Zywicki 2016), and the resolution of uncertainty afterward further strengthened the effects of this legislation.

4.5. Partition by Subprime Borrower Share

We test whether the reduction in issuers' responsiveness to competitors' decreases in interest rates varies with the share of subprime borrowers in a county. In counties with a greater share of subprime borrowers, lowering offered interest rates in response to a decrease in interest

rates offered by competitors is more costly after the CARD Act, because issuers need more repricing discretion for subprime borrowers (Nelson, 2018). As a result, we expect a stronger reduction in an issuer's responsiveness with respect to rivals' decreases in offered interest rates in counties with a higher share of subprime borrowers.

We use the top and bottom quartiles of the sample based on the share of subprime borrowers in a county. Equation (4) is estimated for each subsample. As shown in Table 8, the coefficient on $\Delta^- Rate^C_{t-1} \times Post\ CARD \times Consumer$ is greater for counties with a high (above-top quartile) share of subprime borrowers, in comparison to counties with a low (below-bottom quartile) share of subprime borrowers. We implement a seemingly unrelated regression and find that these two coefficients are significantly different at the 10% level, as reported in column 3.

4.6. Responsiveness with Respect to Changes in Recipients' Credit Quality

Our last robustness analysis relates to an alternative explanation: the shift of consumer credit card originations towards different client pools after the CARD Act. Specifically, the overlap in the credit quality of target consumers between an issuer and its competitors may persist before and decline after the Act. As the offered interest rate is a monotonic function of the target consumers' creditworthiness, this decline may explain the subdued responsiveness to competitors' change in offered interest rates after the CARD Act. Our control variables that capture demographic and socioeconomic compositions of offer recipients alleviate this concern to the extent that those variables already account for changes to offer recipients' credit quality.

To further rule out this alternative explanation, we examine directly whether the responsiveness with respect to changes in offer recipients' credit quality decreases. Mintel started to collect offer recipients' VantageScores in 2007. For each issuer in a county-year, we

use the share of subprime recipients (with VantageScores < 700) and the average credit scores of recipients to capture their credit quality for consumer and small business cards separately.[9] We then estimate equation (3), where ΔVar_t equals the annual change in one of the recipients' credit quality variables. As shown in Table 9, $\Delta Var^C_{t-1} \times Post\ CARD \times Consumer$ does not load for any of these credit quality measures (two-tailed p-value > 0.1). Thus, the shift of consumer credit card originations towards different client pools after the CARD Act is unlikely to explain our findings.

5. CARD Act, Price Dispersion and Markups

In previous subsections, we find a decreased competitive responsiveness concerning a decrease in offered interest rates. The findings suggest reduced opportunities for consumers to explore competitive interest rates. Next, we examine the extent to which such weakened competitive responsiveness led to changes to dispersion in consumer credit card offered interest rates and markups. If consumer credit card issuers do not follow competitors who offer lower interest rates, we would expect greater dispersion and markups in consumer card offers to prevail as competition weakens, in comparison to small business card offers (Gerardi and Shapiro, 2009; Edmond, Midrigan, and Xu, 2015). We calculate offered rate dispersion as the difference between the maximal and the minimal offered rates to the same consumer in a year, and average markups as the mean of interest rates offered to a county by year, minus two-year Treasury yield, for consumer credit cards and small business cards, respectively. We estimate the following model

$$Offered\ rate\ dispersion\ or\ Markups = \delta + \gamma_1 Post\ CARD + \gamma_2 Consumer$$
$$+ \gamma_3 Post\ CARD \times Consumer + \theta \mathbf{Z} + \varepsilon, \quad (6)$$

---

[9] One caveat is that the credit quality is not a linear function of credit scores.

where the dummy variables and interaction terms are defined in the same way as before. The vector X contains county-level economic conditions, levels of and annual changes in the share of subprime consumers of the county, and the annual changes in demographic and socioeconomic compositions of offer recipients, all of which are defined as before.

Table 10 shows coefficients and t-statistics from regression estimation of equation (6). We find that *Post CARD × Consumer* loads significantly positively in both columns (two-tailed p-value < 0.01), suggesting that the price dispersion and average markups in consumer card offers increase after the Act, in comparison to small business card offers. The coefficient on *Post CARD × Consumer* in Column 1 (2) suggests that the Act increases price dispersion (markups) of consumer card offers by 77.2 (69.5) basis points, in comparison to small business card offers. The increase of 69.5 basis points is economically meaningful, representing a 9 percent increase relative to the pre-CARD Act mean level of consumer card offers' markups. The results indicate that reduced competition as a result of the Act eventually led to greater price dispersion and higher prices faced by consumers.

6. Conclusion

In this paper, we examine the effects of new legislation that restricts credit card issuers' repricing ability (the CARD Act) on competition among issuers. Specifically, we study whether the restrictions dampen competition among credit card issuers. A new competition measure is introduced to capture the degree of an issuer's adjustment in offered interest rates, as a response to competitors' changes in offered rates. Using a novel data set on offer terms in mail solicitations for the entire credit card market, we conduct difference-in-differences analyses that compare changes in issuers' responsiveness around the Act for consumer credit cards, which

were subject to the new legislation, with changes in issuers' responsiveness for small business credit cards, which were not subject to the Act. We find a significant decline in the responsiveness of an issuer to competitors' changes in interest rates, but not in other credit card terms that are unrelated to repricing. Consistent with our prediction, the decline is driven by an issuer's responsiveness to competitors' decreases as opposed to increases in interest rates. The decline cannot be explained by pre-existing divergent trends and becomes stronger for counties with more subprime borrowers. The findings are resilient to using four alternative ways of constructing the sample and accounting for offer recipients' credit quality. We also show an increase in price dispersion and markups for issuances after the Act, suggesting adverse effects on consumers. Together, the results highlight an unintended consequence of the CARD Act (i.e., reduced competition among credit card issuers) and contribute toward a more comprehensive and balanced evaluation of the costs and benefits of the regulation.

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Figure 1 Responsiveness to Decreases in Offered Interest Rates
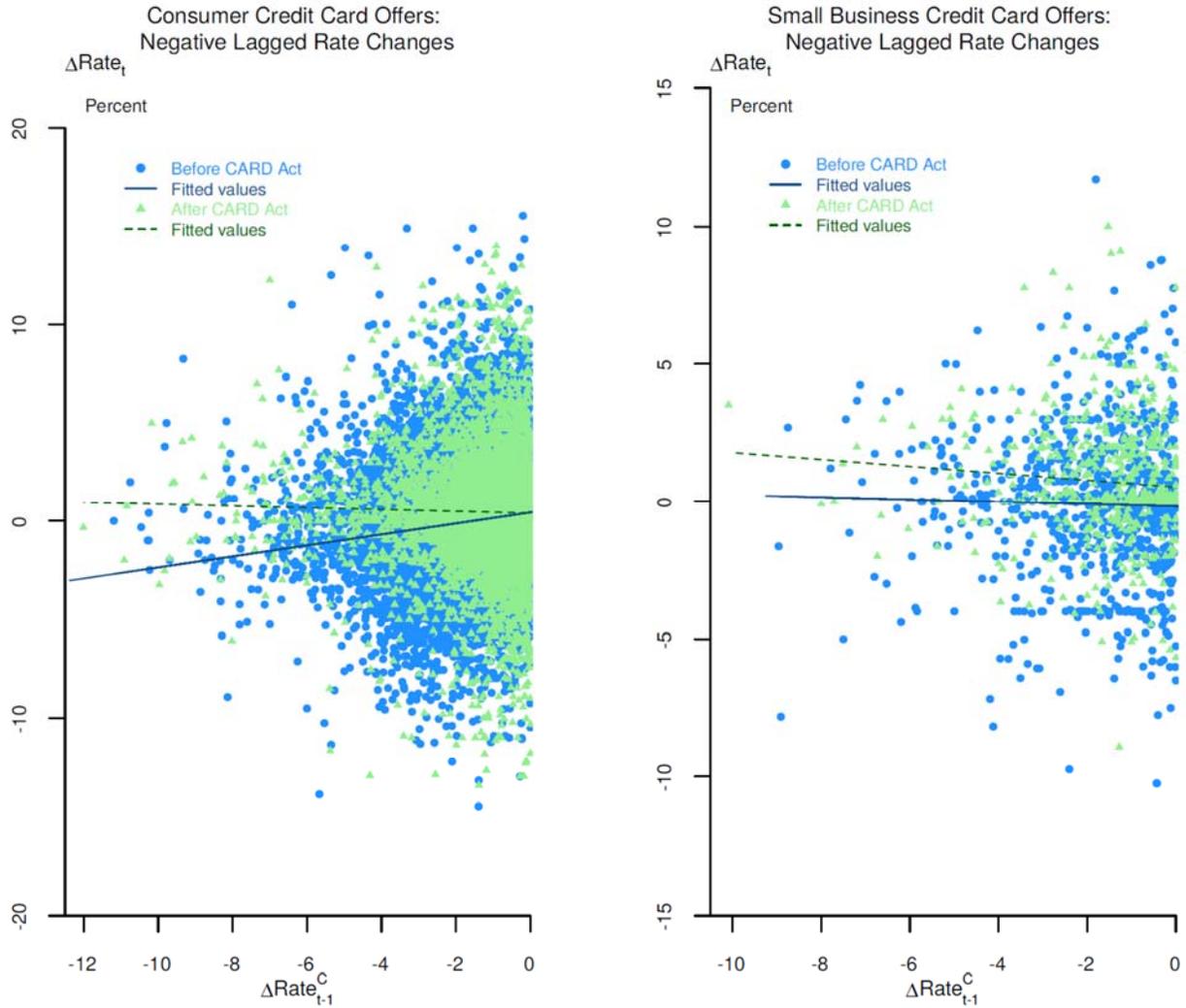
Note: The figures plot the change in an issuer's average offered rate in a county-year ($\Delta Rate_t$) against the decreases in its competitors' lagged average offered rate in the same county ($\Delta Rate^C_{t-1}$). The solid circles (triangles) represent observations before (after) the CARD Act, and the solid (dashed) lines represent their linear fitted values. Consumer credit card offers and small business credit card offers are used in the upper and lower figures, respectively.

Figure 2 Responsiveness to Increases in Offered Interest Rates
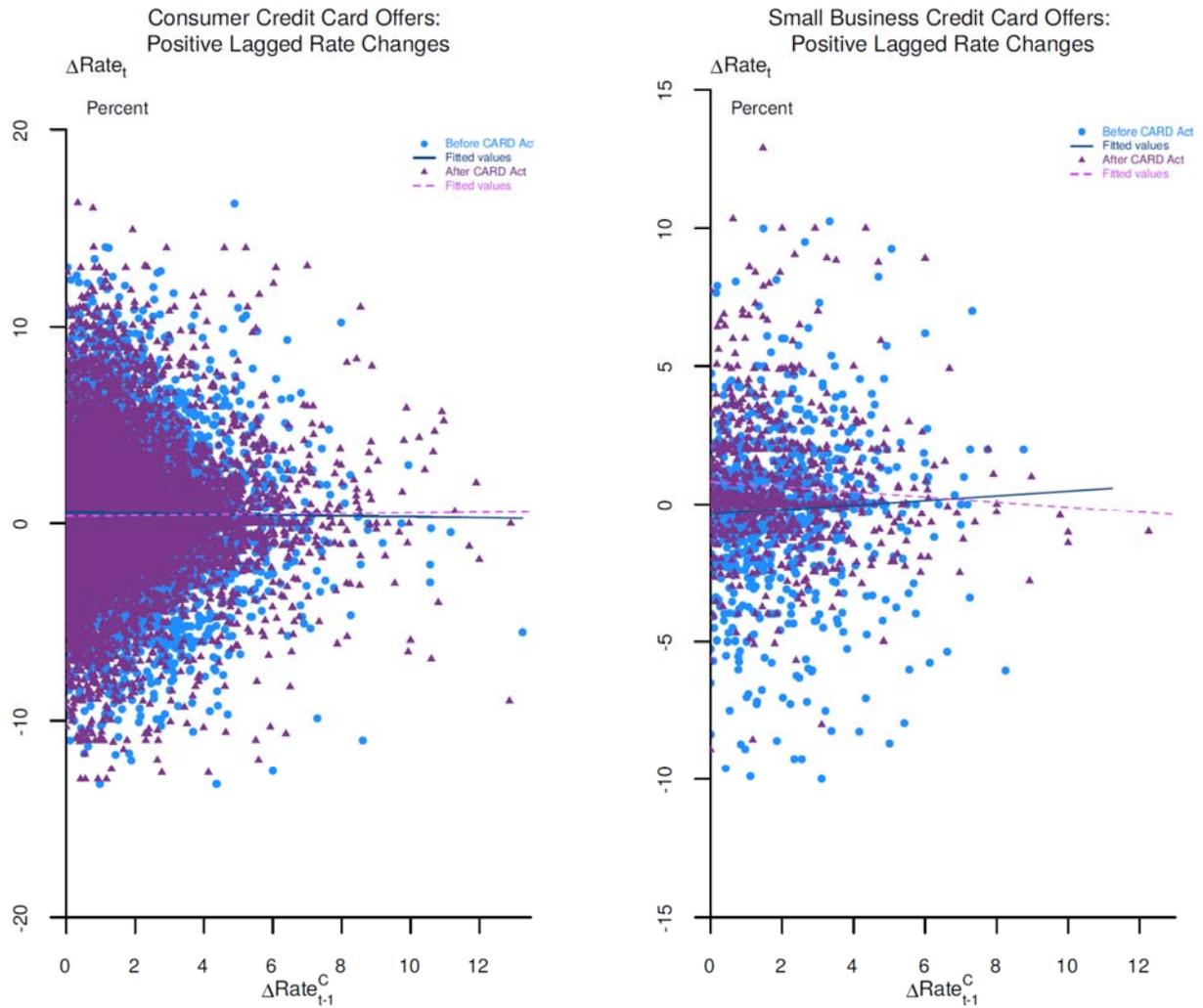
Note: The figures plot the change in an issuer's average offered rate in a county-year ($\Delta Rate_t$) against the increases in its competitors' lagged average offered rate in the same county ($\Delta Rate^C_{t-1}$). The solid circles (triangles) represent observations before (after) the CARD Act, and the solid (dashed) lines represent their linear fitted values. Consumer credit card offers and small business credit card offers are used in the upper and lower figures, respectively.

Table 1 Sample Selection

	Consumer Credit Card	Small Business Credit Card
Counties receiving offers in # of years ≥ 10		
Number of offers	828,500	36,200
Number of counties	1,149	1,013
Counties receiving offers from # of issuers ≥ 2		
Number of offers	823,174	28,625
Number of counties	965	317

Note: The table presents the numbers of offers and counties and key sample selection criteria. We focus on the six largest credit card issuers (American Express, Bank of America, Capital One, Chase, and Citigroup) and the counties where we observe credit card offers in at least ten out of the sixteen years between 2001 and 2016. We further restrict the sample to the counties where offers extended by more than one issuer were observed in at least one of these years. Source: Mintel Comperemedia, Mintel Credit Cards and Mortgage & Loan Databases.

Table 2 Descriptive Statistics

Panel A: Summary statistics of the level of offer terms

| | Consumer Credit Cards | | | | Small Business Credit Cards | | | |
| | Pre-CARD Act | | Post-CARD Act | | Pre-CARD Act | | Post-CARD Act | |
Level of …	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Interest rate (%)	11.495	2.439	14.852	2.703	11.022	2.164	13.210	2.268
Have Introductory rate? (%)	57.967	35.429	83.188	24.654	66.954	38.109	61.494	41.098
Have rewards program?	69.587	32.066	79.092	27.193	95.457	17.140	96.702	15.565
Have annual fees? (%)	11.969	22.212	12.520	22.336	17.417	28.989	37.974	41.211
Annual fee amount	58.429	24.206	85.081	34.586	89.554	53.978	99.037	49.921

Panel B: Summary statistics of the annual change in offer terms

| | Consumer Credit Cards | | | | Small Business Credit Cards | | | |
| | Pre-CARD Act | | Post-CARD Act | | Pre-CARD Act | | Post-CARD Act | |
Annual change in …	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev	Mean	Std Dev
Interest rate (%)	0.197	2.651	0.443	2.590	-0.261	2.627	0.790	2.351
Positive rate changes	2.072	1.820	1.957	1.978	1.761	1.628	2.183	1.971
Negative rate changes	-1.914	1.692	-1.672	1.850	-2.233	2.010	-1.465	1.343
Have Introductory rate? (%)	-0.178	36.362	1.813	30.379	1.045	38.944	-4.083	37.622
Have rewards program?	5.470	30.225	-1.388	28.352	2.330	21.510	0.238	20.774
Have annual fees? (%)	1.589	24.213	-1.599	25.836	2.251	31.976	2.988	38.418
Annual fee amount	-0.027	25.892	4.975	38.075	2.429	65.505	5.644	28.858

Panel C: Differences in annual changes in demographic and socioeconomic characteristics of consumer and small business credit card offer recipients

Annual Changes in …	Pre-CARD Act				Post-CARD Act			
	Consumer Credit Card	Small Business Credit Card	Diff	P-value	Consumer Credit Card	Small Business Credit Card	Diff	P-value
Share of high school graduates (%)	-0.56	-1.70	1.14	39%	-1.00	-1.20	0.19	88%
Share of people with some college education (%)	-0.03	-1.00	0.97	44%	-0.66	0.81	-1.46	22%
Share of people with college degrees (%)	0.54	1.33	-0.79	52%	-2.38	-1.19	-1.19	32%
Share of white (%)	-0.25	0.88	-1.12	22%	-4.53	-3.46	-1.07	37%
Share of homeowners (%)	0.81	1.63	-0.82	40%	-1.16	0.02	-1.18	19%
Share of married people (%)	-0.07	2.40	-2.47	11%	-3.60	-2.45	-1.15	45%
Household income ($)	952	3680	-2728	6%	-990	-2009	1019	50%

Note: Panel A of the table presents summary statistics of the level of interest rates, mail volume, and other terms for consumer and small business credit cards offered in the same county. Panel B of the table presents summary statistics of the annual change in interest rates, mail volume, and other terms for consumer and small business credit cards offered in the same county. The statistics are estimated for the periods before and after the implementation of the CARD Act, respectively. Panel C presents summary statistics of the annual change in average demographic and socioeconomic characteristics of consumer and corporate credit card offer recipients, respectively, and the differences between the two. These statistics indicate that the annual change in offer recipients' demographic and socioeconomic compositions do not show any statistically significant differences between consumer and small business card offers, either before or after the implementation of the CARD Act.

Source: Mintel Comperemedia, Mintel Credit Cards and Mortgage & Loan Databases.

Table 3 The CARD Act and Issuer Competition on Interest Rates

Panel A: Differences in competition using consumer credit card offers only

	$\Delta Rate_t$					
	(1)		(2)		(3)	
	coef	se	coef	se	coef	se
$\Delta Rate_{t-1}$	-0.372***	0.006	-0.371***	0.006	-0.367***	0.006
$\Delta Rate^C_{t-1}$	0.406***	0.012	0.406***	0.012	0.406***	0.012
$\Delta Rate^C_{t-1} \times Post\ CARD$	-0.412***	0.018	-0.411***	0.018	-0.409***	0.017
Controlling for						
Post CARD	Yes		Yes		Yes	
Local economic conditions	Yes		Yes		Yes	
Local subprime consumer share levels and changes	No		Yes		Yes	
Offer recipients' demographic and socioeconomic changes	No		No		Yes	
R-squared	0.138		0.142		0.153	
Number of observations	42,611		42,611		42,591	

Panel B: Difference in differences using small business credit card offers as the control group

	$\Delta Rate_t$					
	(1)		(2)		(3)	
	coef	se	coef	se	coef	se
$\Delta Rate_{t-1}$	-0.374***	0.006	-0.373***	0.006	-0.369***	0.006
$\Delta Rate^C_{t-1}$	-0.041	0.036	-0.030	0.036	-0.026	0.036
$\Delta Rate^C_{t-1} \times Consumer$	0.447***	0.038	0.437***	0.038	0.432***	0.038
$\Delta Rate^C_{t-1} \times Post\ CARD$	-0.018	0.046	-0.025	0.046	-0.030	0.046
$\Delta Rate^C_{t-1} \times Post\ CARD \times Consumer$	-0.395***	0.049	-0.386***	0.048	-0.380***	0.048
Controlling for						
Post CARD	Yes		Yes		Yes	
Consumer	Yes		Yes		Yes	
Post CARD × Consumer	Yes		Yes		Yes	
Local economic conditions	Yes		Yes		Yes	
Local subprime consumer share levels and changes	No		Yes		Yes	
Offer recipients' demographic and socioeconomic changes	No		No		Yes	
R-squared	0.141		0.145		0.155	
Number of observations	44,509		44,509		44,487	

Note: Panel A of the table presents differences using consumer credit card offers only, before and after the implementation of the CARD Act in how an issuer's average interest rate offered in a county changes ($\Delta Rate_t$), as a response to the lagged changes in the average interest rates offered by its competitors in the same county $\Delta Rate^C_{t-1}$. Post CARD is equal to one for years of 2010-2016, and zero for years of 2001-2009. The variable of interest is $\Delta Rate^C_{t-1} \times Post\ CARD$ and we control for the issuer's own lagged changes in the average interest rates offered in that county $\Delta Rate_{t-1}$. In column (1), we control for county-level economic conditions (i.e., unemployment rate and house price appreciation). In column (2), we add levels of and annual changes in the share of subprime consumers of the county. In column (3) we further add annual changes in demographic and socioeconomic compositions of offer recipients (i.e., the share of high school graduates, people with some college education, people with college degrees, white, homeowners and married people, and average household income). Panel B presents the difference-in-differences analysis by contrasting changes in county-level average interest rates ($\Delta Rate_t$) in response to lagged changes in competitors' county-level average interest rates $\Delta Rate^C_{t-1}$ between consumer and small business credit card offers. Consumer is equal to one for consumer credit card offers, and zero for small business credit card offers. The variable of interest is $\Delta Rate^C_{t-1} \times Post\ CARD \times Consumer$. We control for the issuer's own lagged changes in the average interest rates offered in that county $\Delta Rate_{t-1}$. In column (1), we control for county-level economic conditions (i.e., unemployment rate and house price appreciation). In column (2), we add levels of and annual changes in the share of subprime consumers of the county. In column (3) we further add annual changes in demographic and socioeconomic compositions of offer recipients (i.e., the share of high school graduates, people with some college education, people with college degrees, white, homeowners and married people, and average household income). Standard errors are clustered by county. *, (**), and [***] denote two-tailed statistical significance at 10%, (5%), and [1%] levels, respectively.

Table 4 Robustness Analyses

	Counties with both consumer and small business card offers		Counties with ≥ 3 offers		Both (1) and (2)		Issuer-MSA-year level analysis		Issuer-MSA-quarter level analysis	
	(1)		(2)		(3)		(4)		(5)	
	coef	se	coef	se	coef	se	coef	se	coef	se
$\Delta Rate_{t-1}$	-0.348***	0.010	-0.355***	0.006	-0.332***	0.010	-0.363***	0.008	-0.442***	0.005
$\Delta Rate^C_{t-1}$	-0.011	0.036	-0.004	0.051	0.022	0.051	0.096***	0.034	0.014	0.027
$\Delta Rate^C_{t-1} \times Consumer$	0.418***	0.040	0.460***	0.053	0.419***	0.056	0.362***	0.038	0.084***	0.029
$\Delta Rate^C_{t-1} \times Post\ CARD$	-0.043	0.046	-0.084	0.071	-0.106	0.071	-0.168***	0.047	0.004	0.033
$\Delta Rate^C_{t-1} \times Post\ CARD \times Consumer$	-0.372***	0.052	-0.381***	0.074	-0.343***	0.078	-0.290***	0.051	-0.090**	0.036
Controlling for										
Post CARD	Yes		Yes		Yes		Yes		Yes	
Consumer	Yes		Yes		Yes		Yes		Yes	
Post CARD × Consumer	Yes		Yes		Yes		Yes		Yes	
Local economic conditions	Yes		Yes		Yes		Yes		Yes	
Local subprime consumer share levels and changes	Yes		Yes		Yes		Yes		Yes	
Offer recipients' demographic and socioeconomic changes	Yes		Yes		Yes		Yes		Yes	
R-squared	0.150		0.168		0.153		0.157		0.208	
Number of observations	18,491		34,856		16,063		24,180		53,224	

Note: The table presents robustness tests of the difference-in-differences analysis by contrasting changes in area (county- or MSA-level) average interest rates ($\Delta Rate_t$) in response to lagged changes in competitors' area (county- or MSA-level) average interest rates ($\Delta Rate^C_{t-1}$) between consumer and small business credit card offers. *Consumer* is equal to one for consumer credit card offers, and zero for small business credit card offers. The variable of interest is $\Delta Rate^C_{t-1} \times Post\ CARD \times Consumer$. We control for the issuer's own lagged changes in the average interest rates offered in that area ($\Delta Rate_{t-1}$). We control for economic conditions (i.e., unemployment rate and house price appreciation), levels of and annual changes in the share of subprime consumers of the area, the annual changes in demographic and socioeconomic compositions of offer recipients (i.e., the share of high school graduates, people with some college education, people with college degrees, white, homeowners and married people, and average household income). In column (1), we use a subset of counties where residents received both consumer and small business credit card offers extended by the same issuers. In column (2), we use a subset of counties where residents received at least three offers. In column (3), we use a subset of counties where residents received at least three offers, and the offers consist of both consumer and small business credit card offers extended by the same issuers. In column (4), we conduct the analysis using observations at the issuer-MSA-year level (as opposed to the issuer-county-year level). In column (5), we conduct the analysis using observations at the issuer-MSA-quarter level Standard errors are clustered by county for columns (1)-(3) and by MSA for columns (4)-(5). *, (**), and [***] denote two-tailed statistical significance at 10%, (5%), and [1%] levels, respectively.

Table 5 The CARD Act and Issuer Competition on Other Offer Terms

	$\Delta Var_t =$							
	ΔHave Intro $\Delta Var_t =$		ΔHave Rewards		ΔHave Annual Fee		ΔAnnual Fee	
	coef	se	coef	se	coef	se	coef	se
ΔVar_{t-1}	-0.401***	0.004	-0.437***	0.005	-0.442***	0.006	-0.465***	0.023
ΔVar^C_{t-1}	-0.018	0.033	-0.031	0.043	-0.048	0.036	0.001	0.045
$\Delta Var^C_{t-1} \times$ Consumer	0.091***	0.035	-0.016	0.045	0.023	0.038	0.020	0.053
$\Delta Var^C_{t-1} \times$ Post CARD	0.003	0.040	0.008	0.046	0.034	0.045	0.023	0.046
$\Delta Var^C_{t-1} \times$ Consumer $\times$ Post CARD	-0.033	0.043	0.045	0.048	0.005	0.047	-0.023	0.054
Controlling for								
Post CARD	Yes		Yes		Yes		Yes	
Consumer	Yes		Yes		Yes		Yes	
Post CARD $\times$ Consumer	Yes		Yes		Yes		Yes	
Local economic conditions	Yes		Yes		Yes		Yes	
Local subprime consumer share levels and changes	Yes		Yes		Yes		Yes	
Offer recipients' demographic and socioeconomic changes	Yes		Yes		Yes		Yes	
R-squared	0.177		0.222		0.197		0.228	
Number of observations	45,267		45,096		45,267		8,771	

Note: The table presents the difference-in-differences analysis of the responsiveness with respect to changes in offer terms other than interest rates (i.e., the presence of introductory interest rates (ΔHave Intro), the presence of reward programs (ΔHave Rewards), the presence of annual fees (ΔHave Annual Fee), and the amount of annual fees (ΔAnnual Fee)), using small business credit card offers as the control group. *Post CARD* is equal to one for years of 2010-2016 and zero for years of 2001-2009. *Consumer* is equal to one for consumer credit card offers, and zero for small business credit card offers. The variable of interest is $\Delta Var^C_{t-1} \times$ *Post CARD* $\times$ *Consumer*. We control for the issuer's own lagged changes in the respective term offered in that county ΔVar_{t-1}. We control for county-level economic conditions (i.e., unemployment rate and house price appreciation), levels of and annual changes in the share of subprime consumers of the county, the annual changes in demographic and socioeconomic compositions of offer recipients (i.e., the share of high school graduates, people with some college education, people with college degrees, white, homeowners and married people, and average household income). Standard errors are clustered by county. *, (**), and [***] denote two-tailed statistical significance at 10%, (5%), and [1%] levels, respectively.

Table 6 Responsiveness to Increases and Decreases in Competitors' Offered Interest Rates

	$\Delta Rate_t$	
	coef	**se**
$\Delta Rate_{t-1}$	-0.371***	0.006
$\Delta^+ Rate^C_{t-1}$	0.052	0.086
$\Delta^+ Rate^C_{t-1} \times Consumer$	0.148*	0.088
$\Delta^+ Rate^C_{t-1} \times Post\ CARD$	-0.104	0.096
$\Delta^+ Rate^C_{t-1} \times Post\ CARD \times Consumer$	-0.066	0.100
$\Delta^- Rate^C_{t-1}$	-0.098	0.062
$\Delta^- Rate^C_{t-1} \times Consumer$	0.668***	0.066
$\Delta^- Rate^C_{t-1} \times Post\ CARD$	0.037	0.080
$\Delta^- Rate^C_{t-1} \times Post\ CARD \times Consumer$	-0.672***	0.088
Controlling for		
Post CARD	Yes	
Consumer	Yes	
Post CARD × Consumer	Yes	
Local economic conditions	Yes	
Local subprime consumer share levels and changes	Yes	
Offer recipients' demographic and socioeconomic changes	Yes	
R-squared	0.158	
Number of observations	44,487	

Note: The table presents the difference-in-differences analysis of the changes in county-level average interest rates ($\Delta Rate_t$) in response to lagged changes in competitors' average interest rates ($\Delta Rate^C_{t-1}$) between consumer and small business credit card offers. *Post CARD* is equal to one for years of 2010-2016 and zero for years of 2001-2009. *Consumer* is equal to one for consumer credit card offers, and zero for small business credit card offers. The analysis separates competitors' positive and negative lagged changes in county-level average interest rates. The variable of interest is $\Delta^+ Rate^C_{t-1} \times Post\ CARD \times Consumer$ and $\Delta^- Rate^C_{t-1} \times Post\ CARD \times Consumer$. We control for the issuer's own lagged changes in the average interest rates offered in that county ($\Delta Rate_{t-1}$). We control for county-level economic conditions (i.e., unemployment rate and house price appreciation), levels of and annual changes in the share of subprime consumers of the county, the annual changes in demographic and socioeconomic compositions of offer recipients (i.e., the share of high school graduates, people with some college education, people with college degrees, white, homeowners and married people, and average household income). Standard errors are clustered by county. *, (**), and [***] denote two-tailed statistical significance at 10%, (5%), and [1%] levels, respectively.

Table 7 Dynamic Effects

	$\Delta Rate_t$				
	coef	se		coef	se
$\Delta Rate_{t-1}$	-0.380***	0.006			
$\Delta^{+} Rate^{C}_{t-1}$	0.217	0.163	$\Delta^{-} Rate^{C}_{t-1}$	0.353**	0.177
$\Delta^{+} Rate^{C}_{t-1} \times Consumer$	0.090	0.167	$\Delta^{-} Rate^{C}_{t-1} \times Consumer$	0.437**	0.179
$\Delta^{+} Rate^{C}_{t-1} \times Year_{2007}$	-0.167	0.302	$\Delta^{-} Rate^{C}_{t-1} \times Year_{2007}$	-0.524**	0.232
$\Delta^{+} Rate^{C}_{t-1} \times Year_{2008}$	-0.260	0.194	$\Delta^{-} Rate^{C}_{t-1} \times Year_{2008}$	-0.507**	0.209
$\Delta^{+} Rate^{C}_{t-1} \times Year_{2009}$	-0.567**	0.279	$\Delta^{-} Rate^{C}_{t-1} \times Year_{2009}$	-0.374*	0.200
$\Delta^{+} Rate^{C}_{t-1} \times Year_{2010}$	-0.251	0.197	$\Delta^{-} Rate^{C}_{t-1} \times Year_{2010}$	-0.341*	0.204
$\Delta^{+} Rate^{C}_{t-1} \times Year_{>2010}$	-0.271	0.170	$\Delta^{-} Rate^{C}_{t-1} \times Year_{>2010}$	-0.468**	0.188
$\Delta^{+} Rate^{C}_{t-1} \times Year_{2007} \times Consumer$	-0.035	0.306	$\Delta^{-} Rate^{C}_{t-1} \times Year_{2007}$	-0.324	0.302
$\Delta^{+} Rate^{C}_{t-1} \times Year_{2008} \times Consumer$	-0.085	0.201	$\Delta^{-} Rate^{C}_{t-1} \times Year_{2008} \times Consumer$	-0.147	0.221
$\Delta^{+} Rate^{C}_{t-1} \times Year_{2009} \times Consumer$	0.199	0.313	$\Delta^{-} Rate^{C}_{t-1} \times Year_{2009} \times Consumer$	-0.395*	0.205
$\Delta^{+} Rate^{C}_{t-1} \times Year_{2010} \times Consumer$	-0.055	0.204	$\Delta^{-} Rate^{C}_{t-1} \times Year_{2010} \times Consumer$	-0.545**	0.226
$\Delta^{+} Rate^{C}_{t-1} \times Year_{>2010} \times Consumer$	-0.034	0.175	$\Delta^{-} Rate^{C}_{t-1} \times Year_{>2010} \times Consumer$	-0.403**	0.192
Controlling for					
Post CARD			Yes		
Consumer			Yes		
Post CARD Act × Consumer			Yes		
Local economic conditions			Yes		
Local subprime consumer share levels and changes			Yes		
Offer recipients' demographic and socioeconomic changes			Yes		
R-squared			0.225		
Number of observations			44,487		

Note: The table presents the difference-in-differences analysis of the changes in county-level average interest rates ($\Delta Rate_t$) in response to lagged changes in competitors' average interest rates ($\Delta Rate^{C}_{t-1}$) between consumer and small business credit card offers. *Consumer* is equal to one for consumer credit card offers, and zero for small business credit card offers. The analysis separates competitors' positive and negative lagged changes in average offered interest rates and also replaces *Post CARD* with an array of year dummies, $Year_t$. The key parameter of interest is $\Delta^{+} Rate^{C}_{t-1} \times Year_t \times Consumer$ and $\Delta^{-} Rate^{C}_{t-1} \times Year_t \times Consumer$. We control for the issuer's own lagged changes in the average interest rates offered in that county ($\Delta Rate_{t-1}$). We control for county-level economic conditions (i.e., unemployment rate and house price appreciation), levels of and annual changes in the share of subprime consumers of the county, the annual changes in demographic and socioeconomic compositions of offer recipients (i.e., the share of high school graduates, people with some college education, people with college degrees, white, homeowners and married people, and average household income),. Standard errors are clustered by county. *, (**), and [***] denote two-tailed statistical significance at 10%, (5%), and [1%] levels, respectively.

Table 8 Partition by Subprime Borrower Share (top vs. bottom quartiles)

	$\Delta Rate_t$				
	Low Subprime sshaShare		High Subprime		p-value
	(1)		(2)		(3)
	coef	se	coef	se	(1) = (2)
$\Delta Rate_{t-1}$	-0.372***	0.009	-0.374***	0.00	0.879
$\Delta^+ Rate^C_{t-1}$	0.144	0.112	-0.188	0.15	0.181
$\Delta^+ Rate^C_{t-1} \times Consumer$	0.042	0.118	0.379**	0.15	0.186
$\Delta^+ Rate^C_{t-1} \times Post\ CARD$	-0.192	0.153	0.105	0.19	0.292
$\Delta^+ Rate^C_{t-1} \times Post\ CARD \times Consumer$	0.051	0.161	-0.330	0.20	0.196
$\Delta^- Rate^C_{t-1}$	-0.100	0.102	-0.089	0.13	0.946
$\Delta^- Rate^C_{t-1} \times Consumer$	0.709***	0.106	0.651***	0.13	0.742
$\Delta^- Rate^C_{t-1} \times Post\ CARD$	-0.068	0.161	0.328	0.21	0.061*
$\Delta^- Rate^C_{t-1} \times Post\ CARD \times Consumer$	-0.583***	0.171	-0.971***	0.22	0.095*
Controlling for					
Post CARD	Yes		Yes		
Consumer	Yes		Yes		
Post CARD × Consumer	Yes		Yes		
Local economic conditions	Yes		Yes		
Local subprime consumer share changes	Yes		Yes		
Offer recipients' demographic and socioeconomic changes	Yes		Yes		
R-squared	0.155		0.157		
Number of observations	11,211		11,212		

Note: The table presents the difference-in-differences analysis of the changes in county-level average interest rates ($\Delta Rate_t$) in response to lagged changes in competitors' average interest rates ($\Delta Rate^C_{t-1}$) between consumer and small business credit card offers, by the share of subprime borrowers in a county. High (low) means above (below) the sample median. *Post CARD* is equal to one for years of 2010-2016, and zero for years of 2001-2009. *Consumer* is equal to one for consumer credit card offers, and zero for small business credit card offers. The analysis separates competitors' positive and negative lagged changes in county-level average interest rates. The variable of interest is $\Delta^+ Rate^C_{t-1} \times Post\ CARD \times Consumer$ and $\Delta^- Rate^C_{t-1} \times Post\ CARD \times Consumer$. We control for the issuer's own lagged changes in the average interest rates offered in that county ($\Delta Rate_{t-1}$). We control for county-level economic conditions (i.e., unemployment rate and house price appreciation), levels of and annual changes in the share of subprime consumers of the county, the annual changes in demographic and socioeconomic compositions of offer recipients (i.e., the share of high school graduates, people with some college education, people with college degrees, white, homeowners and married people, and average household income). Column 3 presents the p-values of tests of equality of columns 1 and 2 coefficients using seemingly unrelated regressions. Standard errors are clustered by county. *, (**), and [***] denote two-tailed statistical significance at 10%, (5%), and [1%] levels, respectively.

Table 9 Responsiveness with Respect to Changes in Offer Recipients' Credit Quality

	$\Delta Var_t =$			
	ΔSubprime Recipient Share		ΔAve. Recipient Score	
	coef	**se**	**coef**	**se**
ΔVar_{t-1}	-0.429***	0.009	-0.405***	0.007
ΔVar^C_{t-1}	0.004	0.058	0.015	0.055
$\Delta Var^C_{t-1} \times$ Consumer	0.016	0.067	-0.033	0.064
$\Delta Var^C_{t-1} \times$ Post CARD	0.030	0.064	-0.022	0.060
$\Delta Var^C_{t-1} \times$ Post CARD $\times$ Consumer	-0.025	0.073	0.071	0.070
Controlling for				
Post CARD	Yes		Yes	
Consumer	Yes		Yes	
Post CARD $\times$ Consumer	Yes		Yes	
Local economic conditions	Yes		Yes	
Local subprime consumer share levels and changes	Yes		Yes	
Offer recipients' demographic and socioeconomic changes	Yes		Yes	
R-squared	0.221		0.281	
Number of observations	22,346		22,346	

Note: The table presents the difference-in-differences analysis of responsiveness with respect to changes in credit quality of offer recipients (i.e., the subprime recipient share (*ΔSubprime Recipient*) and the average credit score of the recipients (*ΔRecipient Score*)), using small business credit card offers as the control group during 2007-2016. The credit scores of offer recipients are available since 2007. *Post CARD* is equal to one for years of 2010-2016 and zero for years of 2007-2009. *Consumer* is equal to one for consumer credit card offers, and zero for small business credit card offers. The variable of interest is $\Delta Var^C_{t-1} \times$ *Post CARD* $\times$ *Consumer*. We control for the issuer's own lagged changes in the respective credit quality measure of offer recipients in that county ΔVar_{t-1}. We control for county-level economic conditions (i.e., unemployment rate and house price appreciation), levels of and annual changes in the share of subprime consumers of the county, the annual changes in demographic and socioeconomic compositions of offer recipients (i.e., the share of high school graduates, people with some college education, people with college degrees, white, homeowners and married people, and average household income). Standard errors are clustered by county. *, (**), and [***] denote two-tailed statistical significance at 10%, (5%), and [1%] levels, respectively.

Table 10 Implications of Less Intense Competition

	Offered rate dispersion (1)		Markup (2)	
	coef	**se**	**coef**	**se**
Post CARD	-1.511***	0.066	4.753***	0.062
Consumer	0.391***	0.045	0.664***	0.044
Post CARD × Consumer	0.772***	0.067	0.695***	0.063
Controlling for				
Local economic conditions	Yes		Yes	
Local subprime consumer share levels and changes	Yes		Yes	
Offer recipients' demographic and socioeconomic	Yes		Yes	
R-squared	0.208		0.556	
Number of observations	260,831		64,496	

The table presents the difference-in-differences in the dispersion of offered rates and the average markup offered in a county before and after the implementation of the CARD Act between consumer and small business credit card offers. Offered rate dispersion is the difference between the maximal and the minimal offered rates to the same consumer. Markup is the average interest rates offered to a county-year minus the cost of funds. *Post CARD* is equal to one for years of 2010-2016 and zero for years of 2001-2009. *Consumer* is equal to one for consumer credit card offers, and zero for small business credit card offers. The variable of interest is *Post CARD × Consumer*. We control for county-level economic conditions (i.e., unemployment rate and house price appreciation), levels of and annual changes in the share of subprime consumers of the county, and annual changes in demographic and socioeconomic compositions of offer recipients (i.e., the share of high school graduates, people with some college education, people with college degrees, white, homeowners and married people, and average household income). Standard errors are clustered by county. *, (**), and [***] denote two-tailed statistical significance at 10%, (5%), and [1%] levels, respectively.